



## ADAPTATION FUND

# REGIONAL PROJECT/PROGRAMME PROPOSAL

## PART I: PROJECT/PROGRAMME INFORMATION

Title of Project/Programme:	Integrated water resources management and early warning system for climate change resilience in the Lake Chad Basin
Countries:	Cameroon, Central African Rep., Chad, Niger, Nigeria
Thematic Focal Area:	Disaster risk reduction and early warning systems
Type of Implementing Entity:	Multilateral implementing entity
Implementing Entity:	World Meteorological Organization ( <b>WMO</b> )
Executing Entities:	Lake Chad Basin Commission ( <b>LCBC</b> ), Global Water Partnership Central Africa ( <b>GWP-Caf</b> )
Amount of Financing Requested:	<b>10'620'000</b> (in U.S Dollars Equivalent)

### Project overview and justification

The Lake Chad basin is one of the most vulnerable regions to climate change impacts due to its high exposure to water-related hazards, accompanied by low adaptive capacity within Lake Chad communities. Even though national level actions are being taken to decrease the negative effect of extreme events such as floods and droughts, additional efforts and regional collaboration at the transboundary scale are needed to build climate-resilient communities through more integrated water resources management and climate adaptation measures, improved policies and practices, developing an inclusive and participatory approach for end-to-end early warning systems.

Lake Chad is one of the major economic pillars of the six Lake Chad Basin Commission ([LCBC](#)) member countries. Climate change is adversely impacting the Lake Chad basin, threatening the sustainable development of local communities. It is now virtually certain that the average annual temperature in the region will be higher in the future, resulting in higher evapotranspiration and a complex range of impacts on the Lake Chad Basin production systems and economy. According to 6<sup>th</sup> Assessment Report of the Intergovernmental Panel on Climate Change ([IPCC, 2021](#)), drought frequency and intensity is expected to increase in the Central Africa region. This, in conjunction with higher temperatures and increased evaporation will very likely lead to further shrinking of the lake. Extreme events will likely increase in frequency; more frequent droughts and flooding is expected to have negative impacts on food and water security, migration, and livelihoods in the region. Quality hydrometeorological data are essential for understanding and documenting these impacts and associated vulnerabilities, as well as for the efficient management of water resources and for planning the optimal mobilization to meet all uses.

The population of the Lake Chad basin is particularly vulnerable to the impacts of climate variability and change, including extreme hydroclimatic events such as floods and droughts. This pronounced vulnerability is largely attributable to high rates of poverty, financial and technological constraints, and an economy heavily reliant on climate dependent natural resources (such as agriculture and fisheries). The population in the region is projected to double in the next thirty years, which will increase existing pressures on the water resources.

Against this backdrop, the project aims to increase the resilience of the population living in the Lake Chad Basin by strengthening the country's capacity to manage and adapt to climate-related risks through improving hydrological monitoring, data systems and service delivery, as well as raising awareness of climate-related hazards. In particular, the project will promote the integrated

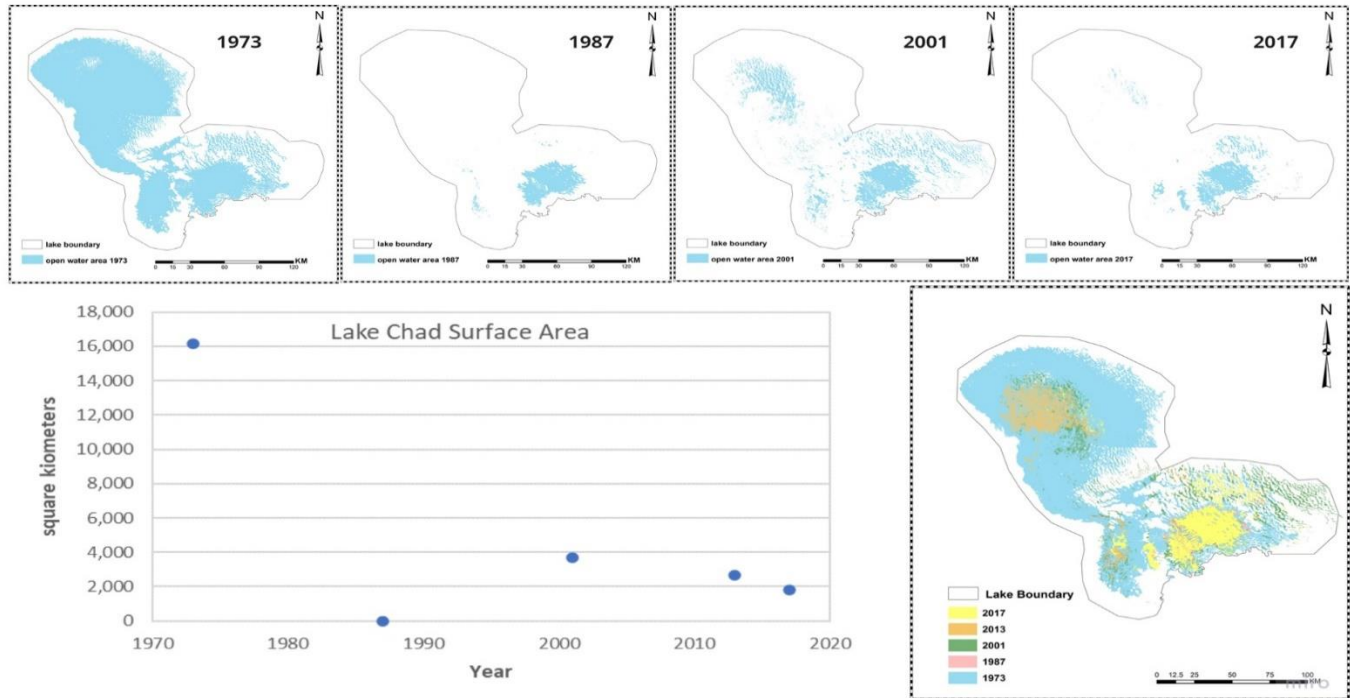
management of floods and droughts by improving the availability of hydro-climatological information through monitoring and data systems as well as forecast management and prediction systems, thus contributing to climate resilience in the region. The timely availability of reliable hydrometeorological information, as well as the capacity to analyze this data and plan and implement appropriate measures, is crucial for: i) early warnings of floods and droughts; ii) the preparation of effective climate and disaster protection/prevention measures; and iii) the implementation of adaptation measures to reduce medium and long-term hydro-climatic risks. The approach will use modern and innovative tools and methods, to cover from locale to regional level, with a focus on the "last mile" and a whole-of-society approach to ensure that the most vulnerable populations are addressed. Awareness raising and adequate communication of hydroclimatic risks at all relevant levels as well as strengthening the capacities of the regional and national agencies in this regard are therefore a central component of the project proposal.

## **I.1 - BACKGROUND**

Lake Chad, a shallow endorheic basin located in the Sahelian region of west-central Africa and on the southern fringe of the Sahara Desert, provides food and water to ~50 million people in 2020 ([Pham-Duc et al., 2020](#)) and supports unique ecosystems and biodiversity. It is estimated that Lake Chad will provide livelihoods for an estimated population of 129 million by 2050 (2.5 times more than year 2020). The countries within hydrographic catchment are: Algeria, Cameroon, Central African Republic (CAR), Chad, Libya, Niger, Nigeria, and Sudan. For thousands of years, it has been a centre of development, trade and cultural exchange between the populations of the northern Sahara and the south. As a host to migratory waterfowl, Lake Chad also plays a role in wildlife conservation. It offers very rich ecosystems in an arid environment and is therefore included in the Ramsar list of Wetlands of International Importance. However, over the last four decades, mainly due to climate change, the lake level has been steadily decreasing. Its surface area has shrunk from 25,000 km<sup>2</sup> to less than 1,500 km<sup>2</sup> and its volume decreased by almost 60% ([Lemoalle et al., 2014](#)). As a result, in addition to the emergence of tensions among riparian populations, there is widespread concern in the region that the lake could disappear.

Many studies have addressed the issue of the ongoing drying up of Lake Chad ([Olivry et al., 1996](#); [Maley, 2000](#); [Lemoalle et al., 2012](#)). The lake level has fluctuated considerably during the recent geological history (last 50,000 years), responding to changes in rainfall and temperatures caused by natural climate variability. Paleontological studies show that in the previous centuries it formed the Mega-Chad, which covered several hundred thousand square kilometres. It also dried up completely several times in the past.

At the end of the 1960s, Lake Chad had a surface area of 20,000 km<sup>2</sup> as a single water body and a water level of 282m above mean sea level ([Olivry et al., 1996](#)). The level of its water body depends closely on the climate and precipitation. Because of its large surface area, shallow depth and location at the Sahara-Sahel interface, evaporation losses are very high. In normal periods, these losses are compensated for by rainfall, but due to climate change over the last few decades, evaporation is increasing while the rainfall input is insufficient. This has led to an increasing fluctuation of the lake size and extent during the last five decades with an overall negative tendency (Fig. 1). This very high sensitivity to climatic conditions of the Lake Chad's hydrological systems makes it extremely vulnerable to climate change. Thus, already the [IPCC 2007](#) report identified the Lake Chad Basin as one of the areas most affected by climate change with severe impacts on societies, economy and ecosystems, confirmed by the most recent report ([IPCC, 2022](#)).



**Figure 1.** Changes in the surface of Lake Chad over the last five decades ([Mahamat et al. \(2021\)](#), modified).

Table 1 shows the change of hydroclimatic parameters and decline of the water level in the basin since 1970. As seen from Table 1, the shrinking of Lake Chad is explained by the significant decrease in the inflows, mainly due to a decrease in rainfall. However, higher temperatures and lower relative humidity also play a significant role. As a result, the occasional rises in the level of the lake over the last few decades followed by some major floods in the Logone and Chari rivers (1975, 1988, 1996, 2008, 2012 and 2019) are very quickly absorbed.

**Table 1. Evolution of hydrometeorological parameters in the Lake Chad basin.** The data are based on the CIMA International [report](#) (2012) (not publicly available online) on the transfer of water from the Congo basin to the Lake Chad basin.

Variable	Units	Until 1970	Since 1970	Difference
Mean level (compared to sea level)	m	282	280	-2 m
Inflow from the Chari-Logone	km <sup>3</sup> /year	47	21.7	-53.8%
Inflow from Komadugu-Yobe	km <sup>3</sup> /year	1	0.47	-53.0%
Average rainfall (Nguimi)	mm/year	240	193	-19.6%
Average rainfall (N'Djamena)	mm/year	543	465	-14.4%
Average rainfall (Sarh)	mm/year	1079	958	-11.2%
Average rainfall (Bossangoa)	mm/year	1559	1419	-10.0%
Relative humidity (N'Djamena)	%	46	43	-6.52%
Average temperatures (N'Djamena)	°C	28	28.7	+2.50%
Average temperatures (Sarh)	°C	27.6	28	+1.45%

Water withdrawals for irrigation, drinking water supply and livestock (Maga dams in Cameroon and several others in Nigeria on the Komadougou Yobe), have a minor impact. According to many studies ([UNEP, 2004](#); [Lemoalle et al., 2012](#); [Pham-Duc et al., 2020](#)), irrigation withdrawals only showed modest impacts on the Lake Chad ecosystem. However, the use of irrigation increased dramatically as a result of the observed decreases in rainfall, especially after the 1970s, which causes declines to the water supply of the lake.

The overall decline in the lake water level and the inflow from tributaries has affected economic activities in the basin, including agriculture, fishing and pastoralism. Paradoxically, certain benefits have been derived for some populations; in particular, the exposed lakebed from the shrinking of the lake has been quite favourable for agriculture and small livestock, though not offsetting overall negative impacts. Nomadic livestock breeders from the northern region have been forced by the drying

conditions to move their herds to the wetter south, which sometimes brings them into conflict with farmers. These climatic drivers of poverty and food insecurity are further exacerbated by other environmental drivers, such as the salinization of soils, the invasion of alien plant species and an increased risk of pollution resulting from the use of agricultural chemicals.

## I.2- GEOGRAPHICAL AND HYDROCLIMATIC CONTEXT

### I.2.1- Geographic and institutional context

The Lake Chad catchment is located at the southern edge of the Sahara Desert between latitudes 6 and 24 N and longitudes 7 and 24 E. The topographic basin area is nearly 2.4 million km<sup>2</sup> and 60% of which is in the arid zone (see later Fig. 3). The countries that share the Lake Chad Basin are Algeria, Cameroon, Central African Republic (CAR), Chad, Libya, Niger, Nigeria, and Sudan.

**Table 2. Area of active basin in the LCBC member countries.**  
(Source: LCBC)

Country	Basin area (km <sup>2</sup> )
Cameroon	56,800
CAR	197,800
Niger	231,375
Nigeria	205,000
Chad	361,980
Libya	5,100
<b>Total</b>	<b>1,058,055</b>

However, the area of intervention of the LCBC covers the active basin, also called the 'New Conventional Basin', which extends over an area of about 1 million km<sup>2</sup> (Table 2), between latitudes 5° and 16°N and longitudes 7° and 24°E. The project will benefit Cameroon, Central African Republic, Chad, Niger, and Nigeria, which are part of the LCBC's intervention zone. It should be noted that the Algerian part of the basin is hyper-arid and is therefore not part of the active basin. Sudan, which is part of the active basin, is not a member of the LCBC but its contribution to runoff (0.08 km<sup>3</sup>/year) is limited. Libya is a LCBC Member State, however its contribution to runoff is also very limited.

### I.2.2- Climate and environmental context

The Lake Chad Basin is situated in varied climates, from the south to the north, from the Sudanian climate with 6 months of rain per year to the desert climate with practically no rainfall. The rainy season is characterized by extreme spatio-temporal variability of rainfall, while the dry season is very clear-cut (total absence of rain). According to the amount of annual rainfall, the active basin of Lake Chad is divided into four different climatic/ecosystems zones, which are, represented (from north to south) as shown in the Table 3.

**Table 3. Climate zones and activities of the Lake Chad Basin.**

Climate zone	Average annual rainfall	Main activities
Saharan	< 200mm	Nomadic livestock farming
Sahelo-Saharan	200 – 450mm	Transhumance zone
Sahelo-Sudanian	200 – 600mm	Agriculture and livestock farming
Sudano-Sahelian	600 – 1500mm	Maize, cotton and rice are grown

Paleo-climatic studies ([Tilho, 1928](#)), show that Lake Chad has undergone significant natural fluctuations in the past. In the 11<sup>th</sup>, 12<sup>th</sup> and 17<sup>th</sup> centuries, the water level reached very high levels. In the recent quaternary it covered 340,000 km<sup>2</sup> and reached 160m in depth, but the lake also reached very low levels in the past, notably during the second half of the 15<sup>th</sup> century and at the beginning of the 20<sup>th</sup> century. The climate of the region is generally characterized by a very pronounced decadal and multidecadal natural variability in rainfall ([Lüdecke et al., 2021](#)), and climate change is aggravating the already difficult climatic conditions by increasing the frequency and magnitude of extreme events. The current and projected warming is increasing evapotranspiration whereas rainfall projections for the region are very uncertain, but suggesting that extreme rainfall will even increase when overall precipitation is decreasing and longer periods of drought are very likely ([IPCC, 2021](#)).

In recent times, and particularly since the 1970s, the Lake Chad basin has been characterized by very significant changes in the rainfall regime. In particular, the isohyets have shifted about 180km to the south over the last five decades. The result of this change is a considerable reduction in annual rainfall amounts. For example, certain areas in Bol locality in Chad close to the lake, which used to receive 300mm/year of precipitation, have experienced an annual reduction of about 100mm (-33%).

Similarly, N'Djamena, the capital of Chad, has suffered a loss of 200mm out of an annual total of 600mm. However, with a slight recovery in rainfall since the 1990s, the trend is reportedly reversing in some areas.

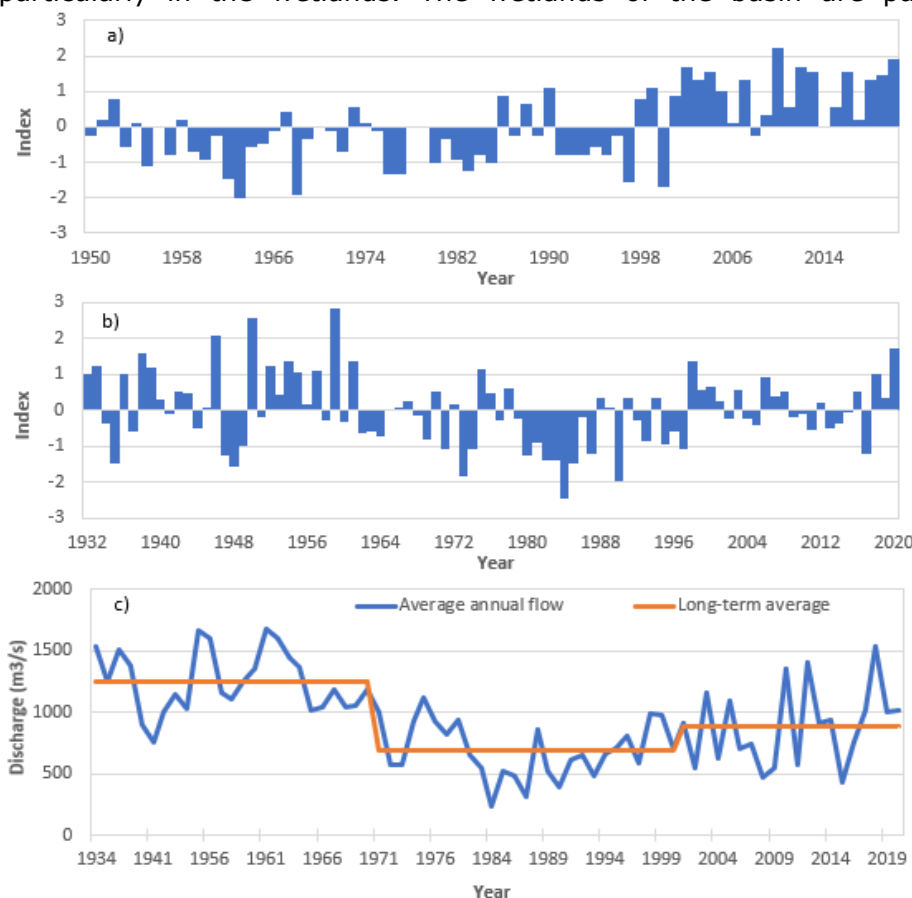
As for the other climate factors, it can be pointed out that most of the Lake Chad basin is in the Sahelian and desert zones, characterized by remarkably high temperatures, very low relative humidity, and very high evaporation rates (1500 to 2500mm on average per year). Maximum temperatures can exceed 43°C in N'Djamena in April and May, with minimums of around 12 to 13°C in January. The average annual insolation is around 3100 to 3200 hours in N'Djamena, for a total evaporation on Lake Chad evaluated between 2100 and 2300 mm/year (Olivry et al., 1996).

As elsewhere in the sub-region (Sighomnou, 2004) and in other regions of the world, the impact of climate change is reflected in an increase in temperature. Thus, the maximum temperatures recorded in N'Djamena (Fig. 2) between 2001 and 2020 have increased by an average of 1.053°C, compared to the general average for the period 1950-2020.

**Natural environment and ecosystems:** The physical environment of the Lake Chad basin varies with decreasing rainfall from South to North. Thus, one of the particularities of the basin is the great diversity of its habitats which vary between desert, shrub steppe, savannah and forest, but the environmental context of the basin is above all dominated by the presence of numerous wetlands which are recognized as hotspots of biodiversity. These various habitats are characterized by their particular fauna and flora. According to the LCBC State of the Lake Chad Basin Ecosystem Report (LCBC, 2012), depending on the country, there are between 130 and 209 species of mammals and more than 500 species of birds, hundreds of thousands of which migrate and stay there periodically, particularly in the wetlands. The wetlands of the basin are particularly distinguished by their

exceptional fishing potential, estimated at between 120 and 140 species. The Waza-Logone floodplain in Cameroon (Yaéré) alone has 56 fish species. More than 30 geographical areas have been designated as protected areas by the LCBC member States in the various national parts of the basin.

Depending on their spatial location, the wetlands of the basin are characterized by their diversity, which depends on their origin, the climatic zone in which they are located or the origin of their water supply, as well as on their duration and annual functioning, but also on their physical and chemical characteristics. These different parameters condition the installation of varied ecosystems, characterized by a significant biodiversity in their respective environmental contexts, more or less long occupied by man and integrated into local, national and regional economic



**Figure 2.** a) above: Variation of maximum temperature indices in N'Djamena (1950-2020) b) middle: Variation of precipitation indices in N'Djamena (1932-2020), c) bottom: Average annual flow of the Chari at N'Djamena 1934-2020.



activities. Like other wetlands, those of the Lake Chad Basin support and provide numerous ecosystem services, the role of which is widely recognized in the various nature protection mechanisms and by institutions working for sustainable development such as the World-Wide Fund for Nature ([WWF](#)), the International Union for Conservation of Nature ([IUCN](#)). These ecosystems are rich in natural resources and support livelihood systems that include fishing, hunting, berry picking and agriculture. An additional central role of the wetlands in the context of this project is the capacity to buffer flooding and therefore increase climate resilience.

The ecosystems of the wetlands of Lake Chad Basin are particularly sensitive to the effects of climate change, particularly those in Sahelian zones. One of the main effects is desertification, which forces populations to migrate towards watering holes. This displacement of populations combined with the high population growth results in the basin's wetlands facing increasing competition for resources between multiple stakeholders. The basin vulnerability is aggravated by the generally shallow topography of Lake Chad itself. Indeed, the variation of precipitation and evaporation (linked to temperature gradients) affects the hydrological regime and the dynamics of river floods and the ecological functioning of the Lake and the other wetlands of the basin. This variability and these environmental changes favor the development of production systems based on the mobility of resources and people, multiple economic activities within families and the multifunctionality of spaces. The complementarity between rainfed and flood recession agriculture, livestock breeding, fishing and gathering favors a relatively productive system that contributes to the resilience of populations to the impacts of climate change. However, the social and environmental changes observed in the region over the last five decades are challenging the entire system, in particular the traditional rules of access to natural resources. Other adaptation solutions are therefore necessary. They imply an analysis of the changes that requires precise knowledge of the variability and availability of resources. Therefore, better knowledge of these ecosystems and their functioning should be a priority in order to preserve them effectively and improve their management. The results of this project, together with those of many others such as UNESCO's [BIOPALT](#) project, should allow to feed the ongoing reflection on the subject, with a view to developing relevant public policy action strategies on the climate issue in a context of high climatic and geopolitical insecurity such as that of the Lake Chad basin.

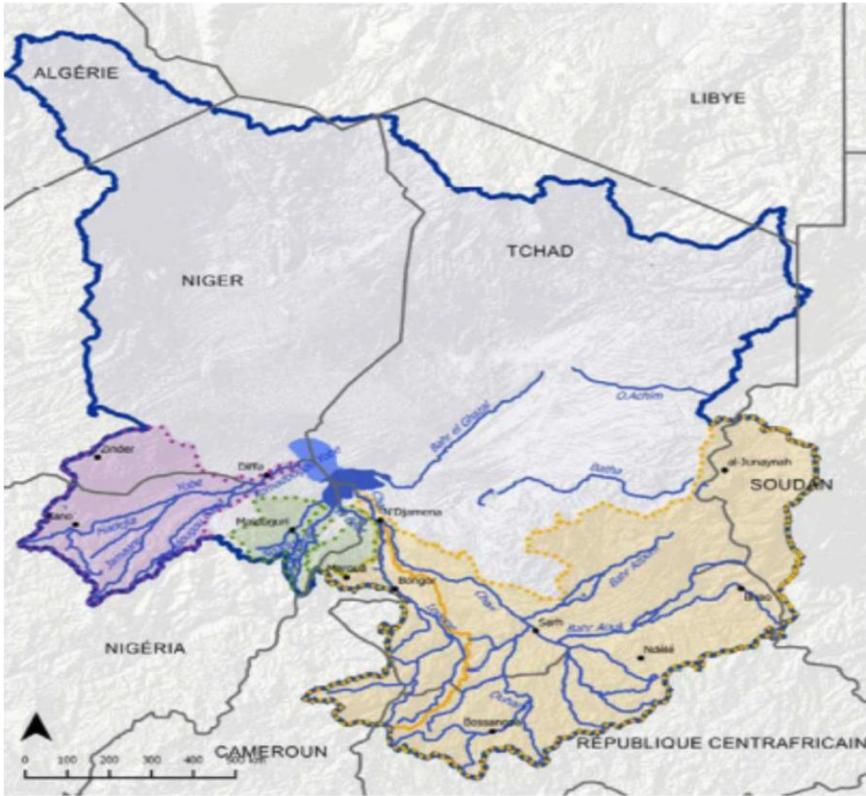
### **I.2.3- Hydrology**

The hydrographic network of the Lake Chad Basin is not very dense and includes only the lake itself and two basins, the Chari-Logone basin shared by Cameroon, Chad, CAR and the Darfur province in Sudan, and the Komadougou-Yobe basin on the Niger-Nigerian border. In addition to these systems, there are floodplains between the highlands and Lake Chad that play an environmental role of global importance, such as the Waza-Logone plain. However, two thirds of the catchment area is located in arid zones and contributes very little to the supply of Lake Chad. The hydrologically active part of the basin covers about 1,000,000 km<sup>2</sup>, of which 600,000 km<sup>2</sup> is the Chari-Logone system. Its main tributaries are the Komadougou-Yobe in the West and the Chari-Logone system in the East. The Bahr el Gazal from the north brings very little water to the lake, but it does provide an outlet for the lake's overflow in years of high hydraulicity (Fig. 3).

The natural water balance of the lake depends on the inputs that come from the Chari-Logone River system (80 to 85%), from the precipitation (between 7 and 14%) and from the small tributaries, including the El Beid and the Komadougou-Yobe, which only provide a little less than 4%. The size of the lake is therefore very largely determined by the water inflow from the Chari-Logone system, including rainfall in the mountainous regions bordering the basin in the south in the Central African Republic and Cameroon, but also by temperatures, the effects of which in terms of evaporation losses are in the order of 2 to 2.5 m/year.

### PRINCIPAUX SOUS-BASSINS DANS LE BASSIN DU LAC TCHAD

- Bassin du Chari-Logone
- Bassin du Komadougou-Yobé
- Autre bassin important: Ngadda, Yedseram, El Beid
- Bassin du lac Tchad



**Figure 3.** Lake Chad and its main tributaries.

The Chari-Logone system has a basin area of about 590,000 km<sup>2</sup>. The Chari and Logone rivers originate, respectively, in the mountainous regions of the Central African Republic and Cameroon, which receive more than 1,200mm of rainfall per year. Both rivers have a tropical regime, with a unique flooding period towards the end of the rainy season between August and November. As a result, the lake has its maximum between the end of November and the end of January and its minimum during July. All along its course, the Chari-Logone system also feeds vast wetlands, including the Yaéré floodplain, which covers up to 8,000 km<sup>2</sup> (in Chad and Cameroon) during wet years. At N'Djamena, the Logone joins the Chari, and 130km later joins Lake Chad. The changes of annual river flow since 1932 at the hydrometric station of N'Djamena TP gives a good idea of the variability of the water supply to Lake Chad (Fig. 2).

As can be seen in Figure 2, the average annual flow of the Chari at N'Djamena, which was around 1200 m<sup>3</sup>/s, fell to around 600 m<sup>3</sup>/s between the 1970s and 2000 (-50%), before rising slightly above 800 m<sup>3</sup>/s after the 2000s. This decrease, which leads to a significant variation in the surface area of the lake, is proportionally more important than the decrease in rainfall in the basin. Thus, the rivers act as amplifiers of the decrease in rainfall on the availability of water in the basin. The data in Table 4, illustrates the situation.

**Table 4.** Average rainfall in the basin and runoff of the Chari since 1950 (Lemoalle et al., 2014).

Period	Basin rainfall (mm/a)	Runoff	
		Discharge (m <sup>3</sup> /s)	Volume discharged (km <sup>3</sup> /a)
1950-59	1114	1334	42.1
1960-69	1059	1278	40.3
1970-79	929	866	27.3
1980-89	877	561	17.7
1990-99	974	688	21.7
2000-09		672	21.2

Thus, the inflow from the Chari-Logone system, which was estimated at more than 40 km<sup>3</sup>/year in the 1940s to 1970, fell to an average of around 20 km<sup>3</sup>/year after 1970. However, as can be seen from the rainfall indices time series for N'Djamena (Fig. 2), even though some years still show a large deficit, rainfall has shown an overall upward trend since the 1990s. This trend was also highlighted in the latest report of the Intergovernmental Panel on Climate Change (IPCC, 2021). It should be noted, however, that the increase in rainfall is not accompanied by a proportional improvement in water

conditions, as has already been noted in other basins ([Olivry, 1993](#)). The situation is therefore very complex and requires careful hydroclimatic monitoring for a better understanding.

#### **I.2.4- Lake Chad and its different states of variation**

Lake Chad is made up of two basins, South and North, separated by a shoal area: the "Great Barrier". Its main characteristic is its variability, both on a geological scale and on an annual and seasonal scale. This variability is directly dependent on rainfall variations in its catchment area. [Tilho \(1928\)](#) proposed a classification into three main states: Great Chad (when the annual inflow from the Chari-Logone system is greater than 43 km<sup>3</sup>), normal or average Lake Chad (when the annual inflow from the Chari-Logone system is between 34 and 43 km<sup>3</sup>) and Small Chad (when the annual inflow from the Chari-Logone system is less than 34 km<sup>3</sup>). In the wet season, the level of the Lake is high enough (altitude of 282.3m) for the Great Barrier to be permanently submerged. The Lake is then formed by a vast single body of water bordered by an archipelago on its eastern shores.

The last Great Chad stage dates from the mid-1950s ([Lemoalle et al., 2014](#)). Depending on the rainfall variations, the Normal or Great Chad sequences are interspersed with low-level phases. Three phases of Small Chad have occurred since 1900, the first (1904-1915) and the second around 1940. The third change to a Small Chad occurred in 1973, and since then the lake has been under this regime. During this drought period, the water level remained low and the resurface of the Great Barrier separates the two basins, whose levels evolve in different ways. In the context of the recent drought, a new state of the Lake has been defined, the Small Chad dry (when the inflow from the Chari-Logone system is less than 15 km<sup>3</sup>/a). In this state, the northern basin receives no recharge from the southern basin and remains dry throughout the year.

Between 1957 and 2008, the Lake was in a Small Chad or Small Chad dry state two-thirds of the time and in a Normal Chad or Great Chad state one-third of the time. The Lake still expanded to 26,000 km<sup>2</sup> in 1963, but the large inflows of the early 1960s were quickly neutralized by the drought of the 1970s-2000s.

#### **I.2.5- Groundwater**

Little is known about the availability, quality and use of groundwater in the Lake Chad basin, although there is a regional project ongoing by the Institute for Geosciences and Natural Resources, Germany ([BGR](#)). However, it is presumed to be abundant, fed by recharges through infiltration in the lakebed and the vast flood spreading areas constituted by the many wetlands of the basin. Improving the knowledge of the basin's groundwater is urgent as pressure on the resource is constantly increasing and it is the main source of water supply for the majority of the basin's population, especially in the northern Chad. Therefore, this proposed project will also focus on groundwater. Better data acquisition will improve the understanding of the hydrogeology of the whole basin, including aquifer recharge, surface and groundwater interactions, flows and water quality.

The regionally important groundwater resources in the Lake Chad Basin are represented by two aquifer systems ([Olivry et al., 1996](#)).

- The water table in the quaternary sand or sandy-clay deposits, at depths ranging from a few meters to about fifty meters. This aquifer system is about 30m thick and is hydraulically connected to Lake Chad ([Carmouze et al., 1983](#)). Its reserves are estimated at 150 km<sup>3</sup>. The quality of the water is considered satisfactory for the water supply of the population and livestock;
- The Pliocene aquifer, sometimes confined and often artesian, has only been recognized in the central part of the basin. It is about 60m thick and is found at a greater depth (sometimes between 250 and 400m). This aquifer is well exploited in Nigeria and in the far north of Cameroon, where numerous boreholes drilled in the 1960s exploit it permanently. Its waters are older and more mineralized than those of the water table.

Apart from these two aquifers, there are other artesian layers at great depths whose extent and capacity are not well known. These are generally highly mineralized fossil waters with very limited uses.

#### **I.3- SOCIO-ECONOMIC SECTORS**

Given the economic, social, and environmental role of Lake Chad, the preservation of its economic potential is highly indispensable to support the development of the riparian populations and to reduce the tensions regarding the use of water resources. Unfortunately, recent homogeneous information on these subjects is lacking. For example, due to differences in censuses in the LCBC countries, it is difficult to provide official data on the population in the Lake Chad basin. However, based on the latest official data and population growth rates provided by the [World Bank](#) the LCBC estimates the basin's



population at around 50 million in 2020. Due to its very rapid growth rate, it is estimated that the population of the basin could reach 129 million in 2050, i.e., 2.5 times more than today. The regions with the highest population densities in the basin are in Chad (N'Djamena), Nigeria (Kano and Maiduguri) and Cameroon (Maroua and Kousseri).

The figures presented in Table 5 provide some indication of the socio-economic data (development indicators, population) of the basin countries at the country level. The national portions of the basin in the different countries are essentially rural areas which are often more affected by poverty than the cities. In Niger, for example, 86% of the poor population live in rural areas (of which 36% are considered extremely poor). Inequalities are also observed, with women and children being particularly vulnerable. In 2019, all the countries in the Basin were ranked in the last performing group according to the Gender Development Index ([UNDP, 2019](#)).

**Table 5. Lake Chad Basin: Production and income per capita** (Source: [AFdB](#) and [IFPRI](#))

Country	Gross National Output (GNP) - 2017 (US\$)	Gross National Income / Inhabitant 2015 (US\$)	World Hunger Index, 2019
Cameroon	32,624	3,290	42nd
CAR	1,879	320	1st
Niger	7,384	390	17th
Nigeria	436,300,000	2,030	25th
Chad	10,111	880	3rd

### I.3.1- Economic activities

Lake Chad constitutes the economic lung for the population of the basin and the sub-region. The rich biodiversity of the lake has enabled the riparian societies to develop productive activities based on fishing, agriculture and livestock breeding, which show remarkable capacities to adapt to climatic variability. In 2014, the shores and islands of Lake Chad were home to around 2 million people ([LCBC, 2015](#)). In wet years, this area is securing food supply for a hinterland of about 13 million people, including two regional metropolises, N'Djamena, the capital of Chad, and Maiduguri, the capital of Bornou State in Nigeria. Table 6 lists the sources of household income in the basin. It should also be noted that there is a strong demand for the transport of goods and people on the Chari and Logone rivers and on Lake Chad. Navigation by heavy tonnage boats, practised in the 1960s between Bol and N'Djamena, is today only possible in years of very high-water levels. Some seasonal commercial navigation is nevertheless practised towards Moundou, Sahr and upstream on the Chari, as well as towards the localities of Pouss, Bongor and upstream on the Logone. Some sites with high tourist potential (Waza, Kalamaloué, Lake Fitri), or with plants whose products are traded (e.g., Acacia for gum) are also known in the basin. These economic activities are highly sensitive to climate change. Lake Chad and the wetlands of its basin are also an international wildlife conservation area for their rich ecosystems in the edge of the desert. As a home for migratory waterbirds, they play an important role in biodiversity conservation.

**Table 6. Sources of household income in the basin.** (Source: [www.cblt.org](#))

Activity	Revenues (\$US x 10 <sup>9</sup> )
Fishery	45.1
Rainfed and flood recession agriculture	26.6
Livestock industry	14.7
Small-scale irrigation	10.8
Large-scale irrigation	9.4

**Fishery:** Fishing is widespread in Lake Chad, the dams and on its tributaries, especially in the floodplains. The production of the floodplains depends largely on the importance and the duration of the floods, which allows the young fish to stay in a food rich environment protected from predators. It is practised as a primary, secondary or occasional activity and the most important source of household income. Whereas men are mainly involved in the sale of smoked fish, women are responsible for the fish processing and sale in small restaurants ([LCBC, 2016](#)). Annual fish production in the early 1970s was in the order of 130,000 - 141,000 tonnes, but declined due to limited flooding in the wetlands.

**Agriculture:** Agriculture is the main activity of the population in about 60% of the administrative units in the Lake Chad Basin. A distinction is made between rain-fed agriculture, flood recession agriculture and irrigated agriculture at the level of the dams in Cameroon and Nigeria. The most common crops are cotton, groundnuts, sorghum, wheat, millet, maize and rice. Both traditional and modern farming methods are used.

The irrigation potential of the conventional basin is estimated at over 1.1 million hectares, of which barely one tenth is actually irrigated. However, studies have shown that developing the entire potential of the conventional basin would require 16.53 km<sup>3</sup> of irrigation water, or about 80% of the total current inflow to the lake. Recessional agriculture takes advantage of the soil moisture that is retained in the floodplains and around the lake, which is receding every year. Indeed, while the lake is disappearing, some local people are paradoxically reluctant to see it filled, because the drying up has exposed fertile land providing income. Rainfed agriculture is practised in the Sahelo-Sudanian and Sudano-Sahelian regions where rainfall varies between 400 and 1500 mm/a.

**Livestock:** Livestock farming is extensive throughout the basin and characterized by seasonal migration. Livestock herds have grown rapidly since their decline during the droughts of the 1970s and 1980s. The routes taken by the herds are cross-border. Migrations are from north to south around Lake Chad and the floodplains during the dry season and from south to north during the rainy season. Of the Chadian population living in the basin, about 10% of the economically active population is engaged in cattle, sheep and goat rearing. Meat and live cattle are Chad's second most important export product after cotton. It has been observed that the majority of women are active in the raising of poultry and small ruminants while men are responsible for larger livestock (Annex 7).

#### **I.4- MAIN ISSUES AND CHALLENGES IN THE LAKE CHAD BASIN**

The Lake Chad Basin, which is characterized by strong demographic growth and high hydroclimatic variability, is emblematic of the challenges posed by climate change in the least developed countries. It is one of the most threatened ecosystems in Africa, combining hydroclimatic variability, ecological ecosystem richness and vulnerability, socio-economic (production of food resources and employment) and political (governance, security) issues. The prolonged drought situations since the 1970s have contributed to the degradation of its environment. This is due to several factors, in particular hydroclimatic effects of climate change, which have contributed to reducing the lake's production potential and the vulnerability of a poor rural population dependent on natural resources. For example, the increasing variability in the timing and volume of rainfall results in people not knowing what to plant and when, or when to switch from one livelihood to another.

##### **I.4.1- Challenges related to hydrometeorology and groundwater monitoring**

The hydrological observations in the Lake Chad basin started in the first half of the 20<sup>th</sup> century. The basic infrastructures were set up during the colonial era, in particular by ORSTOM (Office de la Recherche Scientifique Outre-mer, now [IRD](#), Institut de Recherche pour le Développement) in Cameroon, Central African Republic, Niger and Chad. The observation networks were gradually built up and maintained by the administrations of the various countries until the early 1980s. In Nigeria, on the other hand, there is not one National Hydrological Service (NHS), but hydrometric activities are carried out by a multitude of institutions.

Since the early 1980s, budget cuts in almost all countries have led to the abandonment of a large number of hydrometric stations. During the 1980s and 1990s, the networks were reduced to a minimum and monitoring was abandoned in some countries, or carried out in an irregular manner. Observations are sometimes resumed periodically, in the context of specific projects.

The observation stations of the National Meteorological Services (NMSs) have been reduced to a minimum and do not undergo regular maintenance. Like the NHSs, they face the problem of lack of human, financial and material resources to carry out their tasks properly.

Thus, the National Meteorological and Hydrological Services (NMHSs) of the Lake Chad Basin Commission Member States are not well equipped to document climate change impacts. The WMO has defined four categories of meteorological, climatological and hydrological services into which the NMHSs fall according to the level of services they are able to provide and the resources required to provide these services ([WMO, 2015](#)). Apart from Nigeria (Table 7), the NMHSs are mainly in category 1, i.e., providing only basic services such as data collection and archiving. Niger is classified as category 2 as also providing seasonal climate overviews and climate monitoring. The need for improving countries' ability to produce services related to water, weather and climate is evident.

**Table 7. Categorization of NMHSs in the provision of meteorological, climatological and hydrological services.**  
(Sources: [ECCAS, 2020](#) and [ECOWAS, 2018](#))

	Cameroon	CAR	Chad	Niger	Nigeria
<b>Meteorological Services</b>	Category 1 - Basic	Category 1 - Basic	Category 1 - Basic	Category 2 - Essential	Category 4 - Advanced
<b>Climatological Services</b>	Category 1 - Basic	Category 1 - Basic	Category 1 - Basic	Category 2 - Essential	Category 4 - Advanced
<b>Hydrological Services</b>	Category 1 - Basic	Category 1 - Basic	Category 1 - Basic	Category 2 - Essential	Category 3 - Full

The fact that NMHSs of the region are the least equipped and trained to document climate change is highly detrimental to good water resources management and planning for optimum mobilization of resources to satisfy all uses, as well as for the prevention of water-related risks. In particular, the period of non-observance of the hydrometric network was very detrimental to the quality of the data and especially to the calibration of the stations. Therefore, the stage-discharge relationship should be reconsidered and validated at all stations. This is particularly worrying for the Lake Chad basin, since the tributaries with torrential flows regularly silt up. Some of the rating curves currently used by the NHS for stage-discharge relations are outdated or unreliable, strongly affected by lack of measurements and resulting weaker water resources management. In changing conditions, frequent discharge measurements are needed.

**Groundwater:** Groundwater represents 80% of the basin's water resources, but its knowledge is fragmentary and its management embryonic. Water resources assessment and management, including national and regional policies and regulations, in the Lake Chad region has focused mainly on surface waters. Groundwater is the main source of drinking water in the basin and its agricultural use is increasing.

The knowledge of groundwater resources in the region is low. Many of the major aquifers are transboundary and facing the following issues:

- lowering of the water table by pumping and/or due to reduced rainfall
- pollution of groundwater by urban wastewater with a public health issue, as has been shown in some large cities in the region ([Fantong et al., 2020](#))
- the possibility of substitution of surface water by groundwater during low water periods, including to respect environmental flows in rivers.

Apart from the work carried out by the [Sahara and Sahel Observatory](#) on the shared Iullmeden aquifer, there has been no action to date to promote regional consultation (in the broad sense) on shared groundwater. However, two projects (one funded by ADB-GEF and the other by the German cooperation - BMZ) aiming at improving the knowledge of groundwater in the Lake Chad Basin, are currently being implemented by the LCBC (see table 13 below). As with the monitoring of surface waters, the efficient implementation of activities related to this component of the project will require significant technical and institutional capacity building.

Institutions that deal with groundwater in the countries are different from the NHS and are under different ministries in some countries. This situation leads to a dispersion of efforts and serious problems of operational integration and global strategy at national and regional levels. The available and exploitable data at basin level do not therefore allow a consistent assessment of the temporal evolution of groundwater quantity and quality, particularly following the drop in rainfall since the 1970s. The development and organization of the activities of the present project will have to take into account this fact.

#### **I.4.2- Challenges related to climate change and its impacts**

Climate change is a major concern in the world and will remain so. Climate change is particularly critical for lake Chad basin countries whose economies are mainly dependent on water availability. This fact is reflected in the National Adaptation Programmes of Action ([NAPA](#)) and National Adaptation Plans ([NAP](#)) of the five countries of the region and by their willingness to contribute effectively to adapt to climate change. Furthermore, the main economic activities remain associated with sectors affected by climate change such as agriculture, livestock breeding and fishing.

An assessment of the armed conflicts that currently affect large areas of the Lake Chad Basin and tens of millions of people with insecurity ([adelphi, 2019](#)), shows that they are at least exacerbated by

situations related to the effects of climate change, which will further intensify them and threaten people's lives and livelihoods. Soils are losing their fertility due to the combined effect of anthropogenic land degradation and heat-related loss of soil moisture and biomass. Under these conditions, any future planning for stabilization, peace-building and sustainable development in the region must take into account how climate change will interact with future scenarios. Furthermore, the increasing risks associated with climate change may reinforce cycles of violence and hamper prospects for stability. Efforts to support adaptation to climate change, build resilience to climate shocks and improve natural resource management can therefore be a vehicle for peacebuilding. In this context, long-term planning, based on credible and accurate scientific data, is essential for improving agricultural practices in particular and natural resource management in general, in order to prevent future disruption and potential conflict.

Globally, the Lake Chad basin is an extremely important ecosystem in a drought-prone environment located on the edge of the desert. From this point of view, it is important to study and predict the impacts of climate variability and long-term changes on water resources, including solutions adapted to modifying the natural functioning of Lake Chad, such as dams and irrigated areas.

Scientific studies have shown that climate variability is highly heterogeneous in space. However, global models are unable to simulate river system dynamics with the required accuracy over basin scale such as the Lake Chad. Understanding of climate variability and change impact on the availability of water resources in the different parts of the system requires in-depth understanding of the spatial and temporal variability of hydroclimatic regimes at the basin scale. Reliable and high-quality hydroclimatic data are a prerequisite for such an exercise. Therefore, thorough quality control, validation and data rescue work (digitizing) for all hydrometric data are needed for all participating countries. These data include water level, discharge, rating curves, precipitation and temperature.

One of the most noticeable impacts of climate change, is the shift of the isohyets of the Saharan and Sahelian climatic zones in the Lake Chad basin 180km south. This has resulted in a reduction in agricultural and pastoral areas, causing people to move southwards towards more favourable conditions. This is intensifying the pressure on resources for agriculture, fishing and livestock farming, as well as the associated conflicts. This situation reinforces the inequalities and discrimination of populations, especially at the intersection of gender and social class.

**Future climate change and its potential impacts:** Climate change is frequently invoked to explain the current state of the natural environment in the Lake Chad Basin, including impacts on people working in the agricultural sector, fishing sector, poor people living in high-risk urban areas, migration, etc., as well as the possible disappearance of the Lake. The impacts of climate change affect men and women differently as their roles differ in the society. It has been observed that climate change could increase existing gender inequalities by aggravating the vulnerability and adaptability of women to face climate change impacts. In times of drought, stress on water supplies increase the time women spent on acquiring water and fuel for cooking and subsistence, therefore limiting their availability to participate in educational opportunities or income-generating activities ([WEDO, 2007](#)).

According to the [IPCC](#) report, the Lake Chad Basin is among the regions of the world where projections of precipitation trends come with very high uncertainty and even the direction of trend is unclear ([LCBC, 2015](#)). Unfortunately, these uncertainties also prevail in the projections in the latest Assessment report of the IPCC in regard of changes to the West African monsoon system ([IPCC, 2021](#)). It is almost certain that the average temperature will be higher in the future, resulting in higher evapotranspiration and complex effects on the Lake Chad Basin production systems and economy. The Lake Chad Climate Change Development and Adaptation Plan ([GIZ, 2015](#)) predicts an increase in evaporation from Lake Chad of 0.3 to 0.6 km<sup>3</sup>/year, depending on the scenario considered (B1, global average temperature increases of 2°C or A2, increase of 4°C by the end of the century). In agriculture, such a temperature increase should result in a gradual change towards cultivated plant varieties better adapted to the new climatic conditions. The models also converge towards a negative effect of temperature on productivity in the lake area. Cultivation practices, economic, social and political conditions will also play a role in agricultural productivity.

Furthermore, even if no trend on the average can be identified, it is likely that extreme rainfall events as well as severe droughts will be more frequent ([IPCC, 2021](#)). Development policies must take this into account, as it exacerbates the effects of the basin's well-known high interannual variability. Under these conditions, improved governance of the basin's water and associated natural resources is essential to preserve its productive potential. The LCBC and its member countries must therefore develop their capacity to mobilize, analyse and disseminate environmental information in order to facilitate decision-making, steering and participation in public policies. In particular, the LCBC must be able to plan and enforce the sharing of the basin's water between member countries and between uses and users. An improvement of the hydrological model of the basin (which requires the availability



of high-quality data on hydrological cycle) is therefore essential to take into account the increase in temperature and the resulting evapotranspiration. Improvement of hydrological model will give an opportunity to refine development options like water transfer from the Congo basin.

According to LCBC figures, the population of the basin will be more than double its current population in 2050. This strong demographic growth, combined with the mobility of populations (in response to the mobility of resources) and the multifunctionality of space, leads to conflicts that result in social exclusion (young people, women and the poor excluded from the best land). These tensions could increase further if access to resources becomes increasingly difficult due to climate change. The easing of such tensions requires a better management of resources and production systems which should favour a definition of documented rules, an efficient planning and a better management of space for a more equitable access to the natural resources of the basin.

For example, the [Water Charter of the LCBC](#) defines rules for sharing water between States, upstream and downstream, sub-basins, uses and users, in order to reconcile economic development and environmental preservation. It also provides, among other things, for wetland and groundwater management rules as well as support for the processes of participation and organization of civil society around environmental issues. Its implementation is unfortunately delayed due to the non-ratification by some Member States.

In order to better document the problems and challenges outlined above and to propose solutions to prevent and cope with them, two project proposals had been developed by the LCBC and its member countries, the [Lake Chad-HYCOS project](#) in collaboration with WMO and the [Early Warning System project](#) in collaboration with GWP-CAf. In line with its strategic action plan including climate issues, the LCBC requested the two institutions to assist in developing a combined project to revive Hydromet monitoring activities for improved water management and to establish an early warning system (EWS). This collaboration between the institutions and the LCBC is a powerful alliance to promote the exchange of experiences between partners to ensure that the expected results of the present project are achieved.

#### **I.4.3- Challenges related to the knowledge and prevention of climate risks**

The Lake Chad basin is vulnerable to floods (both fluvial and flash), droughts and sandstorms. Indeed, despite the prolonged drought recently, the Lake Chad Basin has also experienced significant floods, the most well-known on the Logone and Chari rivers in: 1975, 1988, 1996, 2008, 2010, 2012 and 2019. According to information from [EM-DAT's international disaster database](#), 48 of the 314 disasters (15%) related to severe hydro-meteorological phenomena in the five project countries, concerned the Lake Chad basin in 1970-2020. During this period Lake Chad gradually dried up from 25,000 km<sup>2</sup> to about 2,500 km<sup>2</sup>. The distribution of these 48 disasters is shown in Table 8.

**Table 8. Natural disasters affecting the Lake Chad basin 1970-2020.**

<b>Nature of event</b>	<b>Number of events</b>	<b>Number of people affected</b>	<b>Number of deaths</b>
River flooding	28	3,086,625	643
Flash floods	4	362,469	107
Drought	16	27,906,308	3,001
<b>Total</b>	<b>48</b>	<b>31,355,402</b>	<b>3,751</b>

The data in the Table 8 show that two-thirds of these disasters were flood related. The number of people affected by disasters during this period is estimated at over 30 million (0.63 million/a), including nearly 4,000 deaths (75/a). Droughts affected the largest number of people (90% of the total). The impacts of these extreme events are increasingly disastrous not only because the hazard is expected to increase in frequency and intensity but also the vulnerability and the exposure in the region is growing.

However, while floods cause significant damage in the inhabited areas of the basin, particularly in urban areas (N'Djamena, Kousseri, Sarh, Moundou, Bongor), a large part of the region's rural economy depends on annual flooding in the periodically flooded plains of the Logone and Chari rivers, as well as on the banks of Lake Chad. This ambivalence of the flood situation complicates their management in the basin and makes highly necessary to have a thorough knowledge of the hydrodynamics of the rivers and hydrometeorological data.

In May-June rainy season starts in the upper basin of the Logone-Chari and raises floods to the periodically floodable plains along the two rivers in August-September, before filling of Lake Chad between October and January. The level and duration of flooding in the floodplains play a key role in their productivity and hence in the livelihoods of the people in the basin. In addition to fish production,

which is particularly dependent on the duration of flooding, the flood recession crops and the quality of dry season pastures depend on the floods in the plains of Logone and Chari rivers, which also play an important role in recharging the water table. Under these conditions, effective flood forecasting for the Lake Chad Basin is essential not only for disaster prevention but also for managing the basin's livelihoods and thus, their resilience to the impacts of climate change.

On the other hand, the droughts in the 1970s and 1980s droughts have in particular not only led to a reduction in groundwater recharge but also dramatically affected the natural environment and its entire production system. The decrease in the flow of its main tributaries has led to a significant reduction in the size of the lake to the extent that a complete disappearance is possible. It has led to a Small Chad stage (insufficient to feed the northern basin). This is particularly detrimental to the northern basin, on which the livelihoods of 500,000 people depend, and which contribute to the food security of about 4 million people. The drying up of the northern basin is also accompanied by migration towards the south, with the consequences that this implies in terms of pressure on resources and conflicts between populations.

Flash floods occur mainly in mountainous areas such as the Mandara Mountains in Cameroon, or in the arid or semi-arid areas of northern Chad. Rivers with a torrential regime (Mayo in northern Cameroon or Oueds in Chad and Niger) are dry most of the time and only flow during the rainy season or during exceptional rainfall. Effective real-time monitoring of rainfall is therefore essential to predict flash floods.

Definitively, the Lake Chad Basin ecosystem is particularly dependent on hydroclimatic conditions. Its perfect knowledge is therefore essential for the adaptation of local populations to the impacts of economic, societal and climatic changes in order to improve the quality of life of a growing basin population predicted to double in the next thirty years and with it the demand for water.

**Status of Forecasting and Early Warning Systems:** Effective civil protection systems are built around a value chain that links monitoring (data collection systems) and modelling to concrete services provided to different sectors of the economy and populations. In the LCBC member countries participating in this project, national and regional platforms/forums and multidisciplinary working groups exist but are unfortunately not very effective. The efforts made by the States have focused mainly on rescue, assistance, and rehabilitation after disasters, especially droughts and floods. Significant efforts are still needed in this area and this project aims to contribute to this. The main stakeholders include NMHSs and the service in charge of Civil Protection (for the implementation of a multi-hazard warning system), but also the services in charge of Food Security, etc. Overall, the warning procedures concerning climatic risks, notably floods, droughts, need to be developed or improved. The main difficulties are related to the lack of accurate and usable hydroclimatic information and/or problems of accessibility to decision-makers, but also the inadequacy of the relationship between hydroclimatic service providers and end-users. Limited and/or poor access to quality hydro-climatic information has contributed to increased vulnerability of local communities, especially women and children. As an example, when faced to climate extremes such as floods and droughts, factors such as social exclusion, lack of equal access to resources and lack of mobility disproportionately affect women ([Neumayer and Pluemper, 2007](#)). The most affected sectors are those of rural development, agriculture, fisheries, and livestock which constitute the economic engine of the region, but also the lack of adapted services for other sectors such as health, energy, insurance.

Under these conditions, before embarking on a programme to modernize hydro-climatic services, it is important to understand the needs and perspectives of users and beneficiaries including gender aspects. It is by providing concrete solutions to the needs of users and populations that this modernization will be effective. An Initial Gender Assessment (Annex 7) shows the gender specificities of each country and highlight the vulnerability of women to climate change. This first assessment will inform the gender approach needed to ensure total implication of all beneficiaries of the project. A detailed gender analysis to be carry out during next step of the process will enable to better understand those needs and identify gaps. This will make NMHSs more visible to decision-makers, who will then be able to finance their activities.

#### **I.4.4- Challenges related to knowledge groundwater quality**

The demographic pressure, the diversity, and the multiplicity of the sources of pollution become more and more worrying as regards the quality of water. The growing irrigated agriculture in the basin and the fact that most of the large irrigated areas are located near river axes increases the phytosanitary and nutrients pressure on water resources without the effects being known. Where there is pesticides pollution from agriculture and increasing concentration of nitrate from point source pollution was observed in the southern Lake Chad over the last 20 years due to rapid population growth and

increasing anthropogenic activities ([Bello et al., 2019](#)). In addition, there is pollution from mining, particularly in the Upper Logone basin (oil industry). The high concentration of organic matter is also detrimental to water quality in some places, and causes the proliferation of aquatic plants and plankton, making water treatment more expensive. It also reduces oxygen availability making aquatic life more difficult. Note that high fluoride level in groundwater was mentioned in groundwater of Mayo Tsanaga River Basin ([Fantong et al., 2010](#)), in the Cameroonian portion of the lake Chad basin and in groundwater of Chad formation aquifers in Borno state, Nigeria ([Bura et al., 2018](#)).

Apart from a specific and limited knowledge (in time and space) on water quality, the Lake Chad Basin countries also lack systematic monitoring of water quality and almost completely lack information on the changes of the basic physico-chemical and biological parameters. Water quality analysis laboratories exist in the countries, but the quality of equipment and the level of qualification of the staff (generally low) varies greatly from one country to another. The efficient implementation of water quality activities under this project will therefore require significant technical and material capacity building.

#### **1.4.5- Challenges related to food security**

The challenges posed by the climate crisis are numerous and linked strongly to food security. Whether it is drought that burns land and destroys crops or floods that destroy livelihoods and plunge people into mourning, these phenomena weaken living conditions and fuel social conflicts. For example, according to several media reports, in August 2021, [inter-ethnic conflicts](#) broke out in the Cameroonian area of Lake Chad basin between Choas herders and Mouzgoums fishermen related to the fishing canals. The conflict resulted in several deaths (12 to 15 according to sources), numerous injuries, 40 villages burned, and significant internal and cross-border population movements into Chad.

The Lake Chad Basin, like other African countries, have also suffered from the food price crisis. In the Lake Chad Basin, agriculture (rainfed and flood recession), livestock, fishing, mineral and vegetable harvesting, and trade in these products are the main pillars of the economy and the means of survival for the population, especially in rural areas. Each year, as the floods and recessions rise and fall (and the resources they command are located), fishermen move in search of fish, herders move in search of pastures, and farmers move in search of the best recession land. This mobility is one of the main responses of the populations of the Lake Chad basin to environmental variability.

The recurrence of droughts affecting the means of production has led some government authorities to build water retention dams (in Cameroon and Nigeria) for irrigated agriculture. These structures, with varying success, have sometimes had other negative effects on ecosystems, such as the drying up of flood plains ([Sighomnou et al., 2003](#)), and its negative effects on flood recession crops and fishing. Moreover, the significant drop in rainfall leads to a large-scale change in the lake level, which calls into question the current farming systems ([LCBC, 2015](#)). In particular, the frequent return to situations of Small Chad dry (insufficient flooding to feed the northern basin) compromises all activities in the northern basin, which contribute to the food insecurity of around 4 million people. Thus, although the region has enormous agricultural and pastoral potential, climate variability has had a significant negative impact on food availability. Socio-economic factors, such as chronic poverty, high illiteracy rates and displacement of populations further aggravate the food security situation in the region.

Low productivity combined with high levels of poverty means that household access to food is limited, both in terms of own production and the ability to buy food on the market. For example, the famine situation (according to [IFPRI](#)), was particularly critical for two countries in the basin, including the Central African Republic and Chad, which ranked first and third respectively in the 2019 World Hunger Index. Niger, Nigeria and Cameroon ranked 17th, 25th and 42nd respectively out of 117 countries with available data.

Globally, exposed to recurrent climatic hazards (floods and droughts), the agricultural production in the Lake Chad Basin is very often not sufficient to cover their needs effectively, which exposes them to food insecurity, which is the main cause of malnutrition. The availability of reliable hydrometeorological information in a timely manner is essential for the proper organization/planning of emergency interventions in the form of food aid, for example.

#### **1.5- TARGETED PROJECT AREAS AND BENEFICIARIES**

The project intervention area is the hydrologically active Lake Chad basin, also known as the "new conventional basin", which covers an area of about 1 million km<sup>2</sup> (Fig. 4). Climate change and extreme

hydrometeorological events affect populations throughout the basin. Thus, by mitigating the impact of drought and flood risks, the project will benefit the entire population of the basin. Indeed, the lack of hydrological data and information contrasts with the needs and concerns of the riparian states and the international community about the possible disappearance of Lake Chad. This situation was confirmed by clear statements from the main beneficiaries of the project in the countries on the occasion of the preparation of this document.

Ministries, public institutions, research organizations, NGOs and other national and international organizations have expressed the need for quality hydrological information and the high value they see in developing an information system on the Lake Chad Basin as well as more integrated way of managing floods and droughts. The main sectors for which requests have been identified are:



**Figure 4. The population of the Lake and its regional environment** (Lemoalle et al., 2014).

(NGOs), who will use the products and information to improve their resilience and adaptive capacity or transfer them to their partners;

- Community-based organizations, farmers', herders' and fishermen's associations, especially women's groups, who will use the new tools and methodologies to reduce their vulnerability to extreme events, and mitigate/prevent locust plague;
- Engineering firms and other technical providers, who will be able to develop contingency plans and build more resilient infrastructure;
- People in urban and rural communities, especially young people, who are increasingly familiar with information technology who will receive warning messages and eventually contribute to crowdsourcing;
- Environmental conservation stakeholders who manage the important natural heritage of the Lake Chad Basin need a thorough knowledge and regular monitoring of its water resources, which are fundamental for the sustainable management of this ecosystem;
- The other actors of the economic activities such as trade, industries, insurance, research and academics, media etc. They also need hydroclimatic data and information which are fundamental elements for decision making;
- International and regional bodies, humanitarian actors.

As can be seen on the map in Figure 4, the population of the active basin directly or indirectly benefiting from the project is estimated at 47 million inhabitants in 2014, while estimates for 2020 are 50 million.

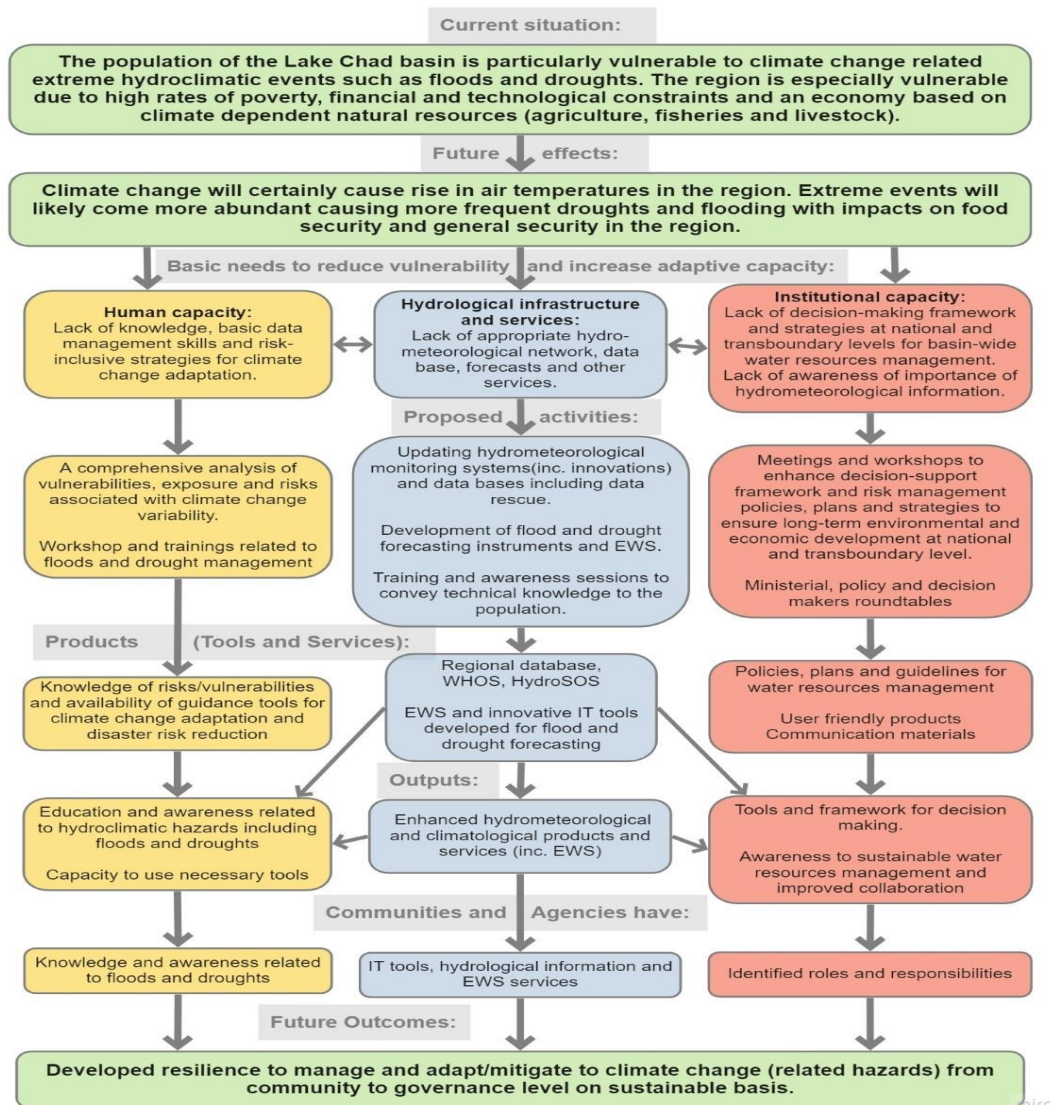


## Project Objectives

The project objective is to increase the resilience of the population living in the Lake Chad basin by enhancing the countries capability to manage and adapt to climate-related risks through improvement of hydrological monitoring, data systems and service delivery and awareness on climate-related hazards. Designed on the basis of an approach that integrates all potential beneficiaries, including women and other marginalized groups, the proposed project in Lake Chad basin also contributes to Goal 6, as well as Goal 13 and 15 of the 17 Sustainable Development Goals ([SDGs](#)) adopted by the United Nations Assembly in 2015. In addition to universal and equitable access to safe drinking water, hygiene and sanitation by 2030, this goal also aims at sustainable management of the resource, in terms of water quality, sustainable and efficient use, and protection of ecosystems. It also integrates the notion of transboundary management of the resource, which is essential for sustainable management, but also conducive to peace and cooperation. Under such conditions, proper management requires informed decisions, which must be based on reliable and timely hydrological data and information (Table 9). The project goals and activities are related to [WMO's eight long-term ambitions on hydrology](#) and will benefit from the new WMO action plan for hydrology. Project activities will build on existing data and make use of the outcomes of other completed and on-going projects in the region and will make use of technical capabilities of existing WMO programmes and initiatives such as the Global Hydrometry Support Facility ([WMO HydroHub](#)), the Global Hydrological Status and Outlook System ([HydroSOS](#)), WMO Hydrological Observing System ([WHOS](#)), WMO Integrated Global Observing System ([WIGOS](#)), WMO Information System ([WIS](#)), Climate Risk and Early Warning Systems ([CREWS](#)), as well as the project Assessment of Natural Disasters Impacts in Agriculture ([ANADIA](#)), to offer tailored, robust, innovative and sustainable solutions, both for water monitoring and for disaster risk reduction and climate change adaptation. The project will serve the participating countries as a demonstration of an end-to-end solution for service delivery responding to the needs of basin-wide end-users, in order to ensure long-term water monitoring for sustainable environmental and economic development.

As can be seen in Table 9, the specific outputs of the project are mainly aimed at (i) building an effective water information system, (ii) improving meteorological and hydrological products and services, (iii) training and informing vulnerable communities on emerging risks, (iv) strengthening the technical and institutional capacities of the national services involved in the project activities (v) dissemination and facilitation of access to relevant products, services and tools for water resources management, and their use for the protection of human lives, livelihoods and the environment from water-related hazards, and (vi) strengthening of regional and global cooperation through improved knowledge management on Lake Chad and its tributaries in order to provide appropriate climatic and hydrometeorological services.

The five-year project aims at combining global, regional, national and local information systems. Specific needs of countries and sub-national entities will be identified in the first phase of the project implementation. An illustration of the logic diagram (a theory of change diagram) of the project's contribution to solving the main problems affecting the basin is presented in Figure 5.



**Figure 5. Schematic representation of the Lake Chad project framework.**

**TABLE 9. PROJECT COMPONENTS AND FINANCING**

Each of these project components will be executed in each of the considered 5 riparian countries

Components	Expected Outcomes	Expected Concrete Outputs	(US\$)×10 <sup>3</sup>
1. Improvement of hydrological and meteorological observing systems networks	- Strengthened institutional capacity to generate and provide hydro-meteorological information contributing to reduce socioeconomic and environmental risks associated with climate related hazards	1.1. Hydromet observation network (about 50 stations for surface and groundwater and agrometeorological variables) modernized/established 1.2. Sustainable funding mechanism for water monitoring identified	2 500
2. Development of the regional hydrometeorological information system (database and data sharing mechanism)	- The database is accessible, with up-to-date information, and used and shared on a freely base by all the relevant stakeholders - WHOS is fully implemented - HydroSOS mechanism established	2.1. Development of a tailored regional database owned and managed by dedicated institutions 2.2. Appropriate data sharing agreements are in place and agreed data is shared through WHOS, and WIGOS and WIS tools are in use 2.3. Flood and drought forecasting tools and EWS within the riparian	1 000

		countries and coordination at regional level are improved 2.4. HydroSOS is ready for implementation	
3. Identification and development of hydrometeorological products and services	<ul style="list-style-type: none"> <li>- The needs and requirements of users of hydrometeorological products and services are well known: countries, end-users including minorities, considering gender and cultural aspects</li> <li>- Strengthened technical and institutional capacities of the NMHSs to monitor and stock relevant and up-to-date data, and for development of model products</li> </ul>	3.1. A concrete understanding of the knowledge and infrastructure needs on the basin, including food security and environmental services 3.2. Development of national EWS mechanisms, with LCBC providing guidance and warning advisories at the regional level 3.3. A compilation of outcomes of WMO HydroHub User-provider Workshops (bringing together NMHSs, public and private sectors in view of better understanding respective needs and requirements)	1 000
4. Training of project stakeholders and knowledge development	<ul style="list-style-type: none"> <li>- Improved collaborative interactions amongst the key stakeholders</li> <li>- Better assessment of the current situation and the capacity needs of key stakeholder groups</li> </ul>	4.1. Organizational arrangements on a national and regional level, as well as communication procedures are established 4.2. Hydromet staff is trained in installation and maintenance	1 500
5. Awareness raising with decision makers, lawmakers and water users on the importance of hydrometeorological information and services (Communication and timely diffusion of appropriate product and services to end users)	<ul style="list-style-type: none"> <li>- Sustainability of the hydrological and meteorological monitoring activities</li> <li>- Strengthened awareness to sustainable integrated approach to water resource management, including climate change issues</li> <li>- Increased interest from governments and end users</li> <li>- Minimized operation and maintenance cost of Hydromet monitoring</li> <li>- Secured continuous and efficient use of data consistently gathered in a demand-driven way</li> </ul>	5.1. Awareness raising for decision makers, lawmakers and water users 5.2. The added value of adequate hydrological services is demonstrated to users, 5.3. A communication and warning dissemination system is set up, operational and accessible to a wide audience, including vulnerable people 5.4. Warning messages are recognized and understood by users' communities in the basin, including the most vulnerable ones	1 000
6. Contingency plans (communities' response capacity)	<ul style="list-style-type: none"> <li>- Enhanced governance coherence at the basin level and increased adaptive capacity within the agricultural and natural resource sectors as well as disaster risk reduction</li> </ul>	6.1. Development and implementation of contingency plans at regional and national levels 6.2. Medium and long-term adaptation and mitigation measures are recommended in the prioritized areas	2 000
7. Project/Programme Execution cost			<b>855</b>
8. Total Project/Programme Cost			<b>9 855</b>
9. Project/Programme Cycle Management Fee charged by the Implementing Entity			<b>765</b>
<b>Amount of Financing Requested</b>			<b>10 620</b>

**Project Duration:** 5 years (60 months)

## Projected Calendar

The proposed dates for the different stages of the project are presented in the table below:

**Table 10. Project Calendar**

Milestones	Expected Dates
Start of Project/Programme Implementation	June-Dec 2023
Mid-term Review (if planned)	Nov-Dec 2025
Project/Programme Closing	June 2028
Terminal Evaluation	March-June 2028

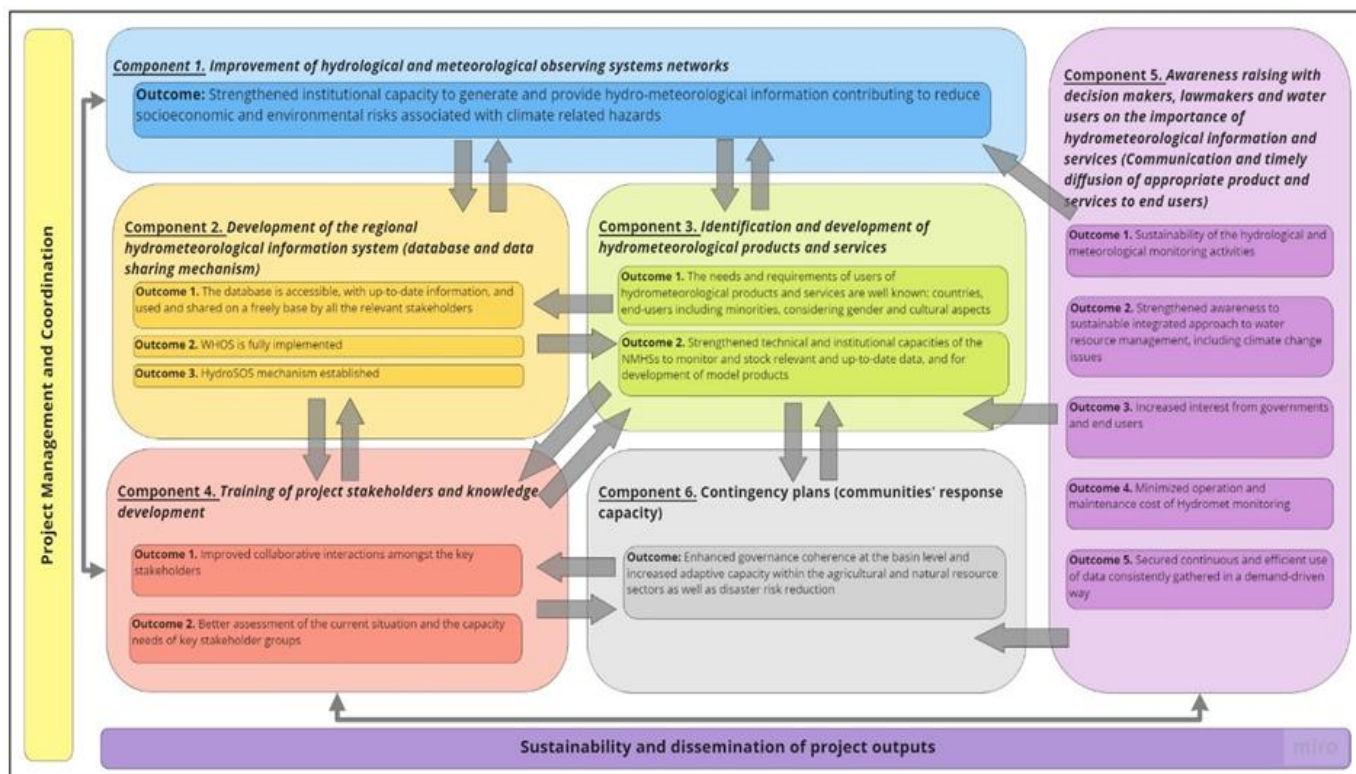
## PART II: PROJECT / PROGRAMME JUSTIFICATION

**A. Describe the project components, particularly focusing on the concrete adaptation activities, how these activities would contribute to climate resilience, and how they would build added value through the regional approach, compared to implementing similar activities in each country individually.**

The transboundary dimension of the basin makes the regional approach essential to promote collaboration and exchanges of experience between national partners and with the LCBC, ensuring, inter alia, a global analysis of the impact of climate change on the entire basin. The hydrological, social, economic and ecological interdependence in transboundary basins requires greater integration in the development and management of shared resources. Sound management of these resources requires a dynamic interrelationship between basin stakeholders and governments. They need to work together and share knowledge and experiences, including in disaster prevention, to ensure the viability of their decisions to achieve sustainable development and a good dialogue between relevant stakeholders. The regional approach is also a powerful tool for building solidarity, mutual trust and collaboration between the different technical teams in the countries. This practice, which should continue beyond the project, promotes mutual assistance between NMHSs in carrying out activities related to the knowledge and management of water resources and the EWS in the Lake Chad basin. It also strongly supports the exchange of current and historical data and information that underpins transparent decision-making critical to prevent conflicts in competitive use, namely with regard to shared resources of the transboundary basin. The main differences between the regional approach proposed by this project and the national interventions lie in the sharing of selected costs and data, and regional approach enables efficient knowledge sharing, transboundary capacity building and peer learning from neighboring countries. It also takes into account sometimes contradictory needs of the populations and water users of the whole basin, and therefore can prevent conflicts between users. The latter table in Annex 1 also highlights some differences on regional and national approach.

A schematic representation of the project components and their outcomes is presented in Figure 6; illustrating the linkages among the outcomes of components and highlighting the activities proposed in each of the components.





**Figure 6. Schematic representation of the project components and their linkages.**

The six components of the project focus on three main areas: **(i)** strengthening and updating an operational and reliable system for collecting, transmitting, processing and archiving data of water resources. These data will be both quantitative and quality aspect of surface and groundwater resources, complemented by agrometeorological data. Data will be collected and managed in a timely manner to meet the different needs of end users throughout the basin. This component will be supported by the WMO HydroHub through the uptake of appropriate innovative technologies and approaches by NMHSs. Monitoring stations will be designed for multipurpose use and to be benefiting [WMO-WIGOS](#) tools and will be ready for further developments of the Regional Basic Observing Network ([RBON](#)) and the Global Basic Observing Network ([GBON](#)) as appropriate. WMO Congress decision in October 2021 on GBON does not include hydrological variables yet (but for precipitation and soil moisture). However, new stations and related data will be fully integrated into WIGOS and WIS, and having all data into WIGOS will allow a quick integration of key stations into GBON whenever it is ready/appropriate. Data exchange will be facilitated through [WHOS](#). **(ii)** Capacity building and awareness raising will help ensuring full ownership of new generation Hydromet tools and equipment by the various actors. It will also integrate organizational and financial aspects putting a focus on the training of female and young professionals. **(iii)** Development and dissemination of products (including contingency plans) taking into account different needs and opportunities due to gender and age, to best reach different social categories and reduce inequalities, to allow facing climate hazards and promoting better resilience to climate change. The products and services developed will be adjusted to the needs of end users to enable timely decision-making and ensure the sustainability of project achievements, at both national and regional levels. The project will particularly develop and implement, through participatory approach, contingency plans at the regional and national level, to improve the communities' response capacity towards climate hazards.

Project activities will be refined after a detailed assessment of the situation on the ground (during the first year) and in particular the state of the existing observation network, needs and vulnerabilities. This preparatory phase will end with the validation of the detailed project document before the launch of the development of all project activities. Therefore, only key aspects of the main activities are presented in the following Table 11.

**Table 11. Main expected outcomes of the project and activities related.**

Outcome	Output	Activities
<b>1. Improvement of hydrological and meteorological observing systems networks</b>		
Strengthened institutional capacity to generate and provide hydro-meteorological information contributing to reduce socioeconomic and environmental risks associated with climate related hazards	1.1. Hydromet observation network (about 50 stations for surface and groundwater and agrometeorological variables), modernized/established	<p>1.1.1 Detailed analysis of the Hydromet monitoring system (including groundwater and water quality), determination of possible upgrades of the existing equipment for state-of-the-art data collection and making use of WMO HydroHub Innovations Calls</p> <p>1.1.2 Inventory of the available station equipment and determination of the complementary equipment to be acquired (by adopting innovative technologies) including specifications and tenders for the five countries of the basin</p> <p>1.1.3 Exact localization of the monitoring network stations and definition of the equipment for each station as well as the list of works and actions to be undertaken</p> <p>1.1.4 Rehabilitation and upgrading of old stations and installation of new stations including basic training</p> <p>1.1.5 Keep up active collaboration and synergies with other projects developing different monitoring methods for the local conditions (remote sensing, AI, crowdsourcing)</p>
	1.2. Sustainable funding mechanism for water monitoring identified	<p>1.2.1 Analysis of the organizational and institutional systems of the NMHSs, including the existing legal basis and funding arrangements</p> <p>1.2.2 Identify and recommend different financing models of the NMHSs - including involving private sector stakeholders - to build value chains for hydrological and meteorological information</p>
<b>2. Development of the regional hydrometeorological information system (database and data sharing mechanism)</b>		
<p>The database is accessible, with up-to-date information, and used and shared on a freely base by all the relevant stakeholders</p> <p>WHOS is fully implemented</p> <p>HydroSOS mechanism established</p>	2.1. Development of a tailored regional database owned and managed by dedicated institutions	<p>2.1.1 Inventory and digitizing of historical data that may still exist on paper, including metadata</p> <p>2.1.2 Acquisition /application of software or hardware for digitizing (if needed)</p> <p>2.1.3 Quality Assessment and Quality Control of historical data of the stations (collected and digitized) of the project monitoring network in terms of availability, quality, gaps, completeness in both the national and regional databases, transfer of any missing data to the regional database</p> <p>2.1.4 Update/define and institute procedures and routines for data acquisition, quality control, and archiving at the LCBC and in the NMHSs of the five participating countries</p> <p>2.1.5 Plan and establish a database according to WMO guidelines to meet the needs of all users (take into account gender and social aspects), including the visualization of water level and precipitation, among other variables, in real time at the key stations of the network</p> <p>2.1.6 Collaboratively agree on a MoU or similar to outline the responsibilities for database management with LCBC and the NMHSs</p>
	2.2. Appropriate data sharing agreements are in place and agreed data is shared through WHOS, and WIGOS and WIS tools are in use	<p>2.2.1 Define data transmission and reception procedures; update existing procedures, in particular in relation to new transmission methods taking into account WIGOS and WIS tools</p> <p>2.2.2 Develop data sharing agreements according to WMO new data policy to be signed by countries</p> <p>2.2.3 Develop WHOS data sharing mechanism and make use of WMO WIGOS and WIS tools, including OSCAR and Metadata registration</p>
	2.3. Flood and drought forecasting tools and EWS within the riparian countries and coordination at regional level are improved	<p>2.3.1 Detailed analysis of hydrological forecasting tools and EWS (floods and droughts) within the participating countries and at regional level, determination of possible upgrades of the existing systems and mechanism for state-of-the-art EWS</p> <p>2.3.2 Undertake the necessary data analyses for the determination of flood and drought risk thresholds for the different risk areas of the Lake Chad basin, as well as environmental thresholds based on historical events in consultation with technical services and local representatives</p> <p>2.3.3 Develop a flow forecasting information model for the Lake Chad basin</p>

	2.4. HydroSOS is ready for implementation	2.4.1 Explore product development from Hydromet information (in situ and remotely sensed) and global models to provide a comprehensive overview of the state of the basin's water resources as well as the hydrological outlook for the coming weeks and months 2.4.2 Update/set up a web portal to disseminate the HydroSOS products 2.4.3 Sensitize and train NMHSs and national and regional research institutions to use information from Lake Chad Basin water resources
<b>3. Identification and development of hydrometeorological products and services</b>		
<p>The needs and requirements of users of hydrometeorological products and services are well known: countries, end-users including minorities, considering gender and cultural aspects</p> <p>Strengthened technical and institutional capacities of the NMHSs to monitor and stock relevant and up-to-date data, and for development of model products</p>	3.1. A concrete understanding of the knowledge and infrastructure needs on the basin, including food security and environmental services	3.1.1 Conduct a detailed Climate Risk Assessment of the Lake Chad Basin, including field studies, to identify vulnerability and risk factors; disaggregate data by gender and age categories 3.1.2 Use the most representative global model outputs for the basin to develop future scenarios and test the response in the basin with the LCBC planning and allocation model 3.1.3 Disseminate information with stakeholders (community representatives, policy makers and local officials) and sensitize on climate change and future risks and to obtain additional qualitative data
	3.2. Development of a multiple EWS mechanism, with LCBC providing guidance and warning advisories at the regional level	3.2.1 Launch national consultations in the five countries to gather information on the effective coordination between national and transboundary policies in the context of flood and drought management and climate adaptation 3.2.2. Launch national consultations in the five countries to gather information on the modes of information and dissemination to the populations (taking into account gender distinctions and their different social roles), including the most vulnerable 3.2.3. Collect feedback and recommendations at national level and needs for interconnection with transboundary policies and present recommendations to policy makers in the five participating countries
	3.3 A compilation of outcomes of WMO HydroHub User-provider Workshops (bringing together NMHSs, public and private sectors in view of better understanding respective needs and requirements)	3.3.1 Organize WMO HydroHub User-provider workshops (involving NMHSs, public and private sectors) at regional level and make detailed analysis of user needs 3.3.2 Produce a compilation of the respective needs and requirements from the exchanges to improve the performance of NMHSs
<b>4. Training of project stakeholders and knowledge development</b>		
<p>Improved collaborative interactions amongst the key stakeholders to jointly support the development of services through adapted institutional agreements at national, regional and global level</p> <p>Better assessment of the current situation and the capacity needs of key stakeholder groups</p>	4.1. Organizational arrangements on a national and regional level, as well as communication procedures are established	4.1.1 Undertake an organizational assessment - including capacity needs assessments - of existing organizational arrangements for Hydromet monitoring and data sharing 4.1.2 Based on the activity above, and in collaboration with all stakeholders, develop and implement an organizational reform strategy to enhance organizational arrangements 4.1.3 Develop a needs-based training programme and action plan for all staff
	4.2. Hydromet staff is trained in installation and maintenance	4.2.1 Train/reskill relevant NMHSs and LCBC staff in various activities for installation, maintenance and management of monitoring stations, including quality assurance, quality control aspects, and maintenance of equipment according to WMO standards and safety; 4.2.2 Train/reskill LCBC and NHMS in data system installation and data management and data sharing, including WHOS, WIGOS and WIS tools 4.2.3 Reskill monitoring station observers and train in the use and maintenance of new generation hydrometeorological equipment, as well as for the prevention of vandalism and the importance of observations.
<b>5. Awareness raising with decision makers, lawmakers and water users on the importance of hydrometeorological information and services (Communication and timely diffusion of appropriate product and services to end users)</b>		
Sustainability of the hydrological and	5.1. Awareness raising for decision makers, lawmakers and water users	5.1.1 Organize awareness-raising activities for decision-makers, legislators and water users, including through the WMO HydroHub Ministerial Roundtables. Dialogues organized in the last year of the project's

<p>meteorological monitoring activities</p> <p>Strengthened awareness to sustainable integrated approach to water resource management, including climate change issues</p> <p>Increased interest from governments and end users</p> <p>Minimized operation and maintenance cost of Hydromet monitoring</p> <p>Secured continuous and efficient use of data consistently gathered in a demand-driven way</p>		<p>development, should, as far as possible, use the benefits of the project's activities as an illustration (showcase cost-benefits and added value of Hydromet network)</p> <p>5.1.2 Develop a gender-responsive stakeholder engagement strategy for continuous engagements with key stakeholders, including CSOs, private sector, government departments and local community representatives</p> <p>5.1.3 Implement the stakeholder engagement strategy and institutionalize it to ensure continued engagement beyond project implementation</p>
	5.2. The added value of adequate hydrological services is demonstrated to water users	<p>5.2.1 In close co-operation with users, develop a user feedback mechanism and identify novel and user-friendly channels that allow continuous feedback and engagement from all users of hydrological services</p> <p>5.2.2 Implement and institutionalize the user feedback mechanism to ensure continued improvement of hydrological products and services</p>
	5.3. A communication and warning dissemination system is set up, operational and accessible to a wide audience, including vulnerable people	<p>5.3.1 In close collaboration with end-users, design and implement a hydro-meteorological information system at the LCBC including regular updates of data from stations whose data is received at regional level</p> <p>5.3.2 Develop communication materials (including in local languages) for practitioners, policy makers, parliamentarians, women and youth, including videos, websites, brochures, radio announcements etc.</p> <p>5.3.3 Engage communities to develop, test and evaluate last-mile arrangements to ensure that warnings and advisories are understandable and actionable for the most vulnerable populations (including women, children and the elderly)</p>
	5.4. Warning messages are recognized and understood by all users' communities in the basin, including the most vulnerable ones	<p>5.4.1 Organize meetings and training sessions for the population of the countries on the interpretation of information disseminated through early warning systems and in communication media, ensuring equal participation of men and women</p> <p>5.4.2 Organize meetings with relevant stakeholders working on disaster risk management to select priority areas for community consultations and develop a community consultation plan that is gender-responsive and contextually-appropriate</p> <p>5.4.3 Organize and conduct local workshops in local languages to get design input from communities and collect recommendations at local level and provide input on national policy linkage needs</p>
<b>6. Contingency plans (communities' response capacity)</b>		
<p>Enhanced governance coherence at the basin level and increased adaptive capacity within the agricultural and natural resource sectors as well as disaster risk reduction</p>	6.1. Development and implementation of contingency plans at regional and national levels	<p>6.1.1 Organize and conduct national workshops to identify gaps and needs in policies and plans, and to highlight key long-term strategies for flood and drought management</p> <p>6.1.2 Based on the detailed Climate Risk Assessment developed in 3.1.1, and in conjunction with priority stakeholders, develop gender-responsive multi-hazard risk management plans - including risks from flood and droughts</p> <p>6.1.3 Institutionalize the risk management plans in major institutions in the Lake Chad Basin</p> <p>6.1.4 Organize and conduct workshops (at least one per country) on the Training Manual for Gender Mainstreaming in Flood and Drought Risk Forecasting and Management with participants from NMHSs, local decision makers, civil authorities, women and community organizations, etc.</p> <p>6.1.5 Develop policy briefs based on 6.1.1. to recommend policy amendments that enhance climate resilience</p>
	6.2. Medium and long-term adaptation and mitigation measures are recommended in the prioritized areas	<p>6.2.1 Develop a roadmap or action plan for the establishment of community-led climate change action plans, based on multi-hazard risk management plans above - including the selection of priority catchments/communities including gender, youth and other social criteria as critical to determine vulnerability for pilot implementation under this proposed project</p> <p>6.2.2 Cost potential community level adaptation measures in the Lake Chad Basin and identify potential sustainable financing strategies</p> <p>6.2.3 In priority selected catchments, develop and implement community-led and gender responsive climate change adaptation plans</p>



**B. Describe how the project /programme would promote new and innovative solutions to climate change adaptation, such as new approaches, technologies and mechanisms.**

The above-described main areas will be supported by innovative solutions, and especially using WMO HydroHub Innovation Calls to promote the uptake of innovative hydrometric solutions by NMHSs.

**The project parts related to the update of the operational data collection, processing and archiving system** will benefit from the feedback and lessons learned from previous [WMO WHYCOS](#) projects, and from activities implemented by the WMO HydroHub. The stations will be designed to comply with the requirements of the WMO Integrated Global Observing System WIGOS and, where appropriate, the Global Basic Observing Network. WMO Hydrological Observing System WHOS will be implemented for data exchange mechanism. The WMO HydroHub will support the uptake of innovative hydrometric technologies as appropriate, complementing standard measurements, and new partnerships with various sectors to take advantage of emerging regional opportunities, with a view to identify the best solutions to the issue of sustainable hydrometeorological monitoring. As regards the equipment to be acquired under the project, priority will be given to robust, low-cost, scalable, and sustainable technologies that can adequately meet the needs of users while ensuring sufficient data quality.

Feedback from other projects developing data collection has also shown that the sustainability of results depends on factors ranging from the project set-up to the development of products adapted to needs, including the development of activities in the field. Foremost is the response to the needs and requirements of the countries and end-users of the hydro-climatic products and services. This aspect must be taken care of this present project as well. It is essential to know the needs of all stakeholders and users covering different sectors, including economic and political decision-makers. The concern to provide high quality products is also an excellent stimulus for improving quality management within the NMHSs. Furthermore, the recent progress in the field of new information and communication technologies (NICTs), enables providing timely information to users via the Internet or Smartphone. Additionally, potential citizen science information and observations, will also increase the visibility of the work of NMHSs. This component will also benefit from new technology innovations, like the [SWOT](#) programme developed to use satellite altimetry for hydrological monitoring and [IRD's RainCell project](#) that uses mobile phone signal attenuation as a measure of rainfall.

The stakeholder workshop, organized in N'Djamena, Chad, in February 2022, showed that stakeholders in the lake Chad basin are aware enough of added value from Hydromet services. Therefore, organizing information and awareness workshops will be essential. The full satisfaction of users' needs within the framework of the project will contribute to their participation in the financing of hydroclimatic monitoring and consequently to the sustainability of the project's achievements for a better control of the parameters in view of resilience to the impacts of climate change.

In addition to field measurement data, satellite climate data (as well as climate scenario data), are also freely available and their use is of particular interest for identifying, locating, estimating impacts and providing risk assessments of floods and droughts, especially over transboundary basins. Applications are also available that can be used to derive even crop yield estimates. These data are freely available to all, but treatment is required to put them into usable formats. This project will identify the best available data for the Lake Chad Basin and train NMHSs and LCBC staff in their use. A good internet connection is however essential.

**The capacity building parts of the project.** One of the main innovations compared to previous projects is the consideration of institutional aspects. A detailed assessment of the institutional, legal, and budgetary situation will be carried out in the framework of the present project and, where appropriate, proposals for improvement and increased efficiency will be made. Particular attention will be paid to the following aspects:

**1. Legal basis**

- National and international legislation establishing NMHSs and their mandates/goals, missions and organization;
- National and international legislation on hydroclimatic data and information exchange;
- Proposals for improvements if required.

**2. Organization of NMHSs**

- Analysis of the current organization and relations between NHSs and NMHSs;
- Analysis of the relationships between the NMHSs and their partners, including the LCBC and other basin organizations of interest to the participating countries;

- Analysis of the relationships between NMHSs and the users of their products and services (e.g., farmers, fishers, environment, energy, civil protection, etc.);
- Proposals for improvements if required.

### **3. National budgets**

- Analysis of the current situation of the NMHSs' budgets;
- Elaboration of a business case based on the direct and indirect socio-economic benefits of hydroclimatic services;
- Proposals for financial and budgetary plans.

Regarding training, one of the main innovations will be the awareness raising of users on the added value that hydroclimatic services can bring to their activities. The lack of trained hydrological technicians in operational hydrology is also a common problem in the five countries in the project. Reflections will be undertaken within the project proposing a long-term sustainable solution to this fundamental issue, including an equitable gender and age distribution integration.

The training will also include a component on the retraining of field observers. These are people who very often belong to vulnerable groups within the communities, who generally live near the hydrometric station, and who are recruited on a voluntary basis for looking over equipment and collecting data at the monitoring station. These observers are generally not employed but receive a small fee for a daily short time they spend for observing. Their work is nonetheless fundamental for the knowledge and control of Hydromet variables. They will be also used for promoting importance of observations in the community and therefore prevent monitoring systems from vandalism. With the development of monitoring equipment, their daily work is becoming more complex nowadays, and comprehensive training including data transmission and quality aspects is needed.

In addition to the constituent elements of a hydrometric station, the training of observers will focus on a reminder of the essential principles of hydroclimatology, the mode of operation, maintenance and preservation of the equipment. Principles of data storage and transmission to NMHSs should also be addressed.

The knowledge of stakeholders will also be enhanced through capacity building at national and local level to ensure a better adoption of the innovative solutions proposed in the project. The training is aimed to local and national authorities as well as communities, taking in account gender issues. Training will develop knowledge and skills in early warning systems for flood and drought management, hydrological situation and outlooks, community-based flood and drought management, gender mainstreaming. Mobile seminars for transhumant herders and for farmers (on agrometeorology) are also planned. These trainings will be based on materials already tested and made available by WMO in the framework such as the Flood Forecasting Initiative ([FFI](#)), Associated Programme for Flood Management ([APFM](#)) or the Integrated Drought Management Programme ([IDMP](#)). All trainings in the project will benefit from capacity development programs within WMO activities. Special focus on training will be given for young professionals and females. Field experiences to learn from other countries; new staffs will learn from the trained staffs.

Workshops to build the capacity of NMHSs officers to generate and deliver climate information and forecast products and services, by developing the skills required to access forecasts and data from the Global Producing Centres for Long-Range Forecasts ([GPCLRF](#)). Further information on this topic can be found in the WMO Publication No 100, Guide to Climatological Practices ([WMO, 2018](#)).

**The knowledge product development and dissemination parts of the project.** The hydroclimatic products and services to be expected from the project fall into two categories:

- basic products, including mapping of vulnerable areas (floods and droughts), warnings of potential risk events, to be published regularly on the LCBC and NMHSs websites, on maps, in monthly bulletins and/or yearbooks. This includes information on the state of the basin's water resources as well as the hydrological outlook for the coming weeks and months from WMO HydroSOS. This also includes the information provided by EWS. Indeed, the implementation of a cross-border EWS will be one of the strong points of the project. It will, for example, enable alerts to be provided to downstream countries, based on the situation in the upstream country, as opposed to an approach based only on national data. Knowledge of the global streamflow situation will also help improve not only the governance of water resources, but also that of the basin's associated natural resources in order to preserve the productive potential of Lake Chad. For example, it will enable transhumant herders to better organize their migration across the basin in search of better pasturages;
- special products to be provided at request of the users, and made available via any appropriate means of communication they wish. A survey of potential users of this second category of products

is essential to define/precise the nature, form, timing of provision of products, and taking into account gender differences.

The integrated flood and drought early warning system will provide relevant and timely information. It will be designed on the basis of a real time value chain, which will allow the collection and transmission of local, accurate and timely data to users. It should be remembered that the processes of elaboration of the alerts will be different according to the characteristics of the hazard (flood or drought). Indeed, the two extreme hydrological phenomena differ in their spatial and temporal distribution. Floods are relatively rapid events, caused by heavy precipitation, limited in time and affecting relatively localized areas (compared to drought). Drought, on the other hand, is a slower-onset event, with an impact that is generally much more distributed in space and time. The data needed to describe the two phenomena are not identical, although they can be partly shared, such as meteorological, hydrological and agronomic parameters on the one hand; the methodology used to forecast the two phenomena varies considerably and depends on the availability of different types of meteorological forecasts (from nowcasting for short rainfall events to seasonal and sub-seasonal forecasts for the onset of drought), on the other hand. Hydrological and agronomic forecasts will be produced by a range of methods, from simple graphs using indicators (e.g., water level in the river, rainfall-river flow relationships, etc.) to more elaborate modelling (in this project these would be models already existing at the LCBC or in some NMHSs, for example). In short, the main aim is to be able to link hydrometeorological risks to their consequences in vulnerable areas from a social and environmental point of view. From this point of view, the maps of flood and drought risk areas constitute a major contribution that must be constructed and made available to communities throughout the Lake Chad basin. It will be necessary to distinguish between beneficial/wanted floods in floodplains and those that cause loss of property and life.

The products developed will be coordinated with those of the Regional Climate Outlook Forum ([RCOF](#)) for Sudano-Sahelian Africa (PRESASS) and Central Africa (PRESAC), organized by the African Centre of Meteorological Applications for Development (ACMAD) in Niamey, Niger, which covers all the countries bordering the Lake Chad Basin. These Fora bring together climate experts and sector representatives from countries in a climatologically homogenous region to provide consensus-based climate prediction and information, with significant input from global and regional producing centres and NMHSs, with the aim of gaining substantial socio-economic benefits in climate sensitive sectors.

As for information dissemination channels, in addition to the LCBC and NMHSs websites, depending on the nature of the information to be disseminated, public and private media as well as scientific journals are other means of dissemination. Furthermore, due to the development of mobile technology in the countries, the possibility of disseminating information through these means (including in local languages) will also be studied to reach the maximum number of people, particularly vulnerable communities. The possibility of providing a wider range of products on web pages or on Smartphone, will increase the visibility of NMHSs which will then be more likely financially supported. In this respect, the project will benefit from involving groups of women in the dissemination of information (e.g., community radio, direct information, videos via social networks using new technologies).

**C. Describe how the project would provide economic, social and environmental benefits, with particular reference to the most vulnerable communities, and vulnerable groups within communities, including gender considerations. Describe how the project would avoid or mitigate negative impacts, in compliance with the Environmental and Social Policy of the Adaptation Fund**

The population of the basin lives mainly in rural areas and includes vulnerable groups with a subsistence economy. The main activities that sustain the regional economy in the Lake Chad Basin are rain-fed agriculture, livestock and fisheries. The development of these activities is governed by the nature of the annual rainfall and the location of the resulting resources in the basin. Each year, with the rhythm of flooding and receding water, fishermen move in search of fish, herders in search of pasture and farmers in search of the best receding land. In wet years, migratory pressure on the lake and floodplains of the Logone-Chari system is relatively low. However, during periods of drought, which make both rainfed agriculture and pastoral livestock farming more precarious, the resources of the lake and floodplains become very attractive. This mobility of people in response to the mobility of resources, the multifunctionality of the space (fishermen, farmers and herders sharing the same wetland) leads to tensions/conflicts that result in social exclusion, especially of young people, women and the poorest who are excluded from the best land. The Annex 1 lists social, economic and environmental co-benefits of the project by each component.

Project outcomes will lead to an easing of these tensions by contributing to a better knowledge/control of resources and production systems, which should favour a definition of documented rules, an efficient organization/planning and a better management of space for a more equitable access to the natural resources of the basin. Better management of the basin's resources will foster access to social services, including water, sanitation, energy and agro-meteorological information, which is essential not only to help communities build climate resilience, but also to strengthen fractured relationships between different social groups. The information generated by the project activities will, for example, help to develop a more efficient agricultural calendar, including the determination of planting periods. It will also enable not only for a better organisation of activities in the floodplains of the basin, especially fishing which is of particular interest to women, but also for a better management of space to limit tensions between users of the various forms of use (fishing, agriculture, livestock, etc.) of these plains. An estimate of the number of beneficiaries will be provided in the full proposal. Moreover, any intervention developed under the project must be based on a detailed gender analysis to ensure that it benefits all communities. Only through a gender baseline analysis will it be possible to design suitable training and other implementation components. Women and youth must be involved in training on climate-sensitive agricultural approaches. In addition, meaningful participation of women in decision-making processes will enable them to contribute as agents of change in all circumstances, with climate change actions then benefiting from the ideas, knowledge and other resources they bring to bear in developing effective and sustainable climate change adaptation and mitigation solutions. Such meaningful participation will be ensured because the project interventions will be designed in accordance to the results of the gender baseline analysis and Key performance indicators (KPIs) will include gender and social inclusion indicators. The project will integrate women, smallholders and farming communities into the water resources management process, thereby increasing their resilience to the effects of climate change. When preparing fully developed proposal, a special focus will be given to the Gender Policy and Gender Action Plan of the Adaptation Fund.

According to the Adaptation Fund's classification, this project is expected to be Category C, and will not have negative environmental or social impacts. The necessary detailed studies will be carried out in the next phases of the development process to ensure compliance with the environmental and social policies and principles of the Adaptation Fund. Where appropriate, an environmental and social risk management plan aligned with the Adaptation Fund requirements would be developed. During project implementation, the environmental and social risk management plan would be disseminated to stakeholders, with a view to adopting appropriate measures to mitigate adverse effects of project activities, if any. A grievance mechanism would then be provided to address potential social and environmental effects during project implementation. Where appropriate, community complaints will be directly addressed.

**D. Describe or provide an analysis of the cost-effectiveness of the proposed project and explain how the regional approach would support cost-effectiveness.**

An economic analysis is necessary to estimate both the costs and benefits of the proposed project and thus justify its relevance. This involves a quantitative assessment of the costs and benefits of the activities envisaged under the project, taking into account the economic, social and political context of the five countries involved in the project. Please see Annex 1 of social, economic and environmental benefits and Annex table 2 of alternative options, rationale, benefits of the project for each output.

**Project costs**

The main differences between the regional approach proposed by this project and the national interventions lie in the sharing of certain costs and data. For example, if one assumes that the costs of project governance are equivalent at regional and country level, these costs would be divided by five under the present proposal.

One of the main conclusions of the high-level discussions of the World Meteorological Organization's Hydrology Conference, held in May 2018, recognized that the sustainability of water resources and the reduction of associated disaster risks can only be ensured by addressing the entire water data value chain, from sustainable data collection to the production of efficient hydroclimatic services, which enable informed decision-making. The assessment of the cost of the project to provide the services must therefore take into account the whole value chain. The figures provided in the table above showing the project components at a total cost of US\$ 10.62 million take into account the whole process. It is understood that in-kind contributions (staff involved in the development of activities, offices, equipment already available, historical data, etc.) made by partner countries and institutions are not taken into account in the estimates provided.

## **Hydrometeorological Monitoring Benefits**

As far as benefits are concerned, it should be recalled that hydrometeorological products and services are considered, for the most part, as public goods and as such, are considered as non-market goods. Assessing the benefits associated with such products is therefore complex and the literature provides very little direct information on their economic value. However, as with the United Nations Economic Commission for Europe (UNECE) [Policy Brief on the Benefits of Transboundary Water Cooperation](#), there are guides to estimating the expected benefits of a project such as ours. However, data and time constraints limit our ability to make such an assessment. Therefore, our assessment of benefits will be based on assumptions that will be formulated using data and information from the literature. This evaluation will concern the socio-economic benefits of hydrometeorological monitoring, including the reduction of losses generally caused by disasters related to hydroclimatic events.

Many studies have been carried out on the benefits of investing in the development of hydrometeorological infrastructure and services, including by the WMO Publication No 1153 (2015); [Kull et al. \(2021\)](#). In particular, a study by [Hallegatte \(2012\)](#) and [Gardner et al. \(2017\)](#), on the potential benefits of investing in upgrading the hydrometeorological warning and early warning information production capacities of developing countries to meet the standards of developed countries, led to benefit-cost ratios between 4 and 36. Other references in the literature cite much higher benefits in some countries. For example, early warning systems for storms, floods and droughts in Asia indicate a potential return of up to US\$ 559 per dollar invested.

These figures confirm WMO Secretary-General Jarraud's statement in 2007 that "Traditionally, the overall benefits from investments in meteorological and hydrological infrastructure have been estimated in several countries to be in the order of 10:1".

The establishment of a hydrometeorological information system and an early warning system in the Lake Chad Basin will lead to a reduction in the losses generally caused by disasters linked to violent hydroclimatic events, particularly floods and droughts. Such a system allows, for example, exposed populations to better anticipate floods (e.g., relocation of populations and assets to higher ground). The benefits resulting from the implementation of such a system represent the part of the average disaster losses avoided by the system in place. In the case of periodically flooded plains, knowledge of the nature of the floods gives an idea of the expected fishery products, the areas available for flood recession crops, the quality of dry season pastures, etc. It should also be noted that the project is developed using a co-design approach, with the aim of ensuring that users and beneficiary communities take ownership of the projects, but also contribute to the collection of data and the caretaking/protection of the facilities. The proposed project covers the whole Hydromet value chain from measurements and data to EWS and warning dissemination, products and disaster risk reduction and communication to the public, in that sense cost-benefits of the EWS is even higher than only infrastructure investments. During the fully developed proposal preparation, more specific focus will be given to the cost-benefit aspects of the project.

## **Damage and losses**

Unfortunately, there is not yet a database having information on the losses due to severe hydrometeorological events in the Lake Chad basin as a whole. However, information from the international disaster database provided by the EM-DAT (see section 1.4.5 above) shows that the basin has experienced 48 natural disasters in the last 50 years, or almost one event every year on average. Unfortunately, this database provides very little information on the estimated costs of the damage caused by these disasters. Only 10 of the 48 events (21%) recorded were the subject of an estimate. The total of these estimates is in the order of US\$400 million. Further investigations will be needed on the ground in the countries to complete this information. For example, according to information provided by the Chadian civil protection service, the damage caused by the 2012 floods was estimated at US\$24.1 million in the city of N'Djamena alone. The 2012 flooding in the Far-North Region, a total of 122 villages were affected from the Department of Logone and Chari with 9,400 houses destroyed, 40 cemeteries washed away, 42 places of worships (mosque and churches) affected, 5,023 small ruminants and 62 cattle were loss, 92 boreholes, 5 primary health care centres and 34 primary schools were also touched while 52,350 ha of arable land and 5,000 ha grazing land were all affected by the floods event. However, with an operational Flood and Drought Early Warning System, communities (farmers, herders, fisher folks etc.) and authorities would be timely informed on any foreseen drought or flood events and appropriate measures would be taking to adapt and or strengthen resilience of both the system and the population.

Based on these estimates, economic models can be used to assess the benefits of setting up a hydrometeorological information system and an early warning system. This evaluation is not yet



possible under the current conditions for the Lake Chad basin, but even if the proposed project development will not result in 100% loss reduction, it can already be deduced from the above that the cost of the project is much lower than the damage it will help to limit. Cost-benefit aspects will be looked more in detail in fully developed proposal preparation.

### **Economic, social and environmental benefits of the project**

Transboundary benefits of the project also exist and amply justify the proposed regional approach. The water balance of Lake Chad depends on the inflow from the Chari-Logone system, which provides 80 to 85% of the inflow. The size of the lake and its floodplains are therefore largely determined by the inflows from the Chari-Logone system, including rainfall in the mountainous regions bordering the basin in Central Africa and Cameroon. Under these conditions, the modernization of hydrological monitoring in Cameroon and Central Africa republic leads to an improvement in the forecasting of water inflows, not only in the bordering plains of the Chari-Logone system, but also in the Lake itself, which also benefits the riparian populations of Niger (northern basin of the Lake) and Nigeria and Chad. The same applies to the prevention of catastrophic floods in the riparian metropolises such as Kousseri and N'Djamena. A good knowledge/prediction of the water inflow in the Lake and the floodplains of the Chari-Logone system also gives an idea of the nature of the dry season pastures that benefit not only all the transhumant herds coming from all the countries of the region, but also the water birds coming from Europe in winter. By contributing to better hydrometeorological information in the basin, the project will therefore also contribute to global efforts to solve major environmental problems and thus also benefit the international community.

There are many other related, indirect and ancillary benefits to the modernization of hydrometeorological services, other than disaster prevention. These include potential consequences of the project results that are not explicitly linked to specific activities, such as the contribution to the scientific output that allows a better understanding of regional and global phenomena. However, their quantification remains difficult due to conceptual limitations or data restrictions.

These benefits also relate to the use of hydrometeorological data and information in the design of water-related development projects, including basic socio-economic infrastructure. They also concern the improvement of food security in rural areas, where the most vulnerable populations live. Indeed, the production and dissemination of agro-meteorological information to farmers should not only increase the average productivity of the agricultural sector, which is one of the main sources of employment in the region, but also make it possible to limit agricultural losses due to drought for example. In addition, the prediction of flood levels in the plains (both those around the lake and those along the rivers) allows for better organization of flood recession crops and fishing activities, as well as the quality of dry season pastures, which are of particular interest to women and the most vulnerable populations in the region. The overall benefit of the project includes, among others, reducing vulnerability and improved resilience and livelihoods of the vulnerable populations.

The project will build the capacity of flood emergency actors, but also of NMHSs and the LCBC, in the collection, processing and archiving of hydrometeorological data, as well as in the development and delivery of better-quality products and services. It will help end-users to use hydrometeorological products and services effectively. Reliable, readily available data and high-quality information products will enable all stakeholders to promote resilience to climate change, make informed decisions and develop more appropriate strategies for more appropriate adaptation to change.

### **E. Describe how the project 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. If applicable, please refer to relevant regional plans and strategies where they exist.**

The project proposal is part of the [LCBC's strategic action plan](#), developed in agreement with its member countries, based on their priorities, including national climate change adaptation plans. As such, the project will build on existing initiatives at national, regional and international levels. The project will also be in synergy with all other ongoing and planned initiatives in collaboration with other partners, including [AMCOMET](#), [ECOWAS](#) and [ECCAS](#), the African Development Bank and the World Bank's Global Facility for Disaster reduction and Recovery ([GFDRR](#)), as well as the "[Lake Chad Basin Vision 2025](#)". The above-mentioned study to assess armed conflict in the Lake Chad Basin ([adelphi, 2019](#)) shows, among other things, how climate change interacts with other elements of the crisis. Most of the 10 entry points proposed to help address this crisis will be covered/addressed in this project proposal. These include better climate and hydrological information, invest in governance and institutional development, address gender inequality and human rights violations, adapt to climate

change and manage resources, information and communication technologies, broaden access to and scope of services, etc.

Two out of the five countries participating in the project are members of the Economic Community of West African States (ECOWAS), Niger and Nigeria, while the other three are members of the Economic Community of Central African States (ECCAS), Cameroon, CAR and Chad. ECOWAS has developed and implemented strategic plans and policies in its region, including its policy on disaster risk reduction ([ECOWAS, 2006](#)) and the ECOWAS Hydromet Initiative, which is currently being finalized and which formulates a coherent regional strategy for financing hydrometric services for the benefit of member countries. The total cost of all the proposed project ideas is estimated at US\$261.5 million. This is not a project, but rather an overview of the expected investment needs at national and regional level to increase resilience to extreme weather and climate events in West Africa by strengthening the capacity of national institutions responsible for meteorology and water resources, as well as disaster response and civil protection.

With the support of the World Bank, ECCAS has assessed the NMHSs of its member states and drafted a regional framework to support the modernization of these services to improve decision-making for flood and drought management ([ECCAS, 2020](#)). The outcome of the evaluation shows that there are many challenges to the proper functioning of NMHSs in member countries. These include inadequate budgets and lack of investment, inability to recruit and retain qualified staff, outdated equipment and inadequate systems in place, which do not allow NMHSs to improve their services. These results are only one step in the process initiated by ECCAS. A guidance notes for improving early warning systems (EWS) in Central Africa will subsequently be developed to provide guidance and advocate for best practice and expertise in EWS. Workshops are also planned to develop a draft regional framework for improving Hydromet services and an action plan.

At the LCBC level, a Lake Chad Climate Change Development and Adaptation Plan ([LCBC, 2015](#)) has been developed and validated by member states, with the support of the World Bank, in coordination with the French Development Agency (AFD). The plan proposes a set of investment needs grouped into 7 major themes (one of which concerns the management and protection of the basin's water resources and the other the dissemination of information, improvement of knowledge and monitoring of the environment), for a total estimated amount of 916 million euros.

**At the level of the participating countries**, climate change, which is now a well-known phenomenon in Africa, has been integrated into environmental policies and strategies, as is the case in almost all sub-Saharan African countries. The five countries participating in the project have signed and ratified the United Nations Framework Convention on Climate Change ([UNFCCC](#)) and subsequently developed national communications on climate change in accordance with the relevant provisions of the UNFCCC. All five countries have also recently submitted an update of their Nationally Determined Contribution ([NDCs](#)), outlining greenhouse gas emission reduction targets, together with proposals for adaptation measures. This demonstrates their willingness to contribute effectively to the global effort to combat global warming, on which an important part of their economies, mainly associated with the primary sector such as agriculture, livestock and subsistence fishing, depend, especially in their various national portions of the Lake Chad Basin. In the [COP21](#), countries have also determined, each at the national level, the actions to be undertaken as part of their respective contributions to the global response to climate change. Within this framework, key national priorities have been identified and to be taken into account to the largest extent possible in this project. These priorities focus on improving the resilience of the agriculture, livestock and forestry sub-sectors, water resources, fisheries, wildlife, health, capacity building of stakeholders at all levels, especially in the regions where the respective portions of the Lake Chad Basin are located in the countries:

- The Government of **Cameroon** has developed the country's first [National Adaptation Plan \(NAP\)](#) in 2015, which is [currently under evaluation](#);
- The **Central African Republic** has recently developed its first [National Adaptation Plan \(NAP\)](#) in February 2022;
- The **Niger** [National Action Programme for Adaptation \(NAPA\)](#) developed in 2006. An integrated climate adaptation strategy specific to the rural sector ([SPN2A](#)), that is of particular interest to the national portion of the Lake Chad basin, was subsequently developed in 2020;
- The **Nigerian** National Adaptation Strategy and Plan of Action on Climate Change for Nigeria ([NASPA-CCN](#)) was developed in 2011. In December 2021, Nigeria has launched a new project to develop National Adaptation Plan, aiming to strengthen the capacity of the government to plan and budget for actions that build resilience to climate change impacts;

- As a follow-up to its national climate change adaptation programme ([PANA-TCHAD](#)), developed in 2009, the Government of **Chad** submitted its first [National Adaptation Plan \(NAP\)](#) in February 2022;

The action plans proposed in the various documents by the countries are broken down into programme/project sheets, with an order of magnitude of the financial resources needed for implementation. In addition to national budgets, it is also expected that these resources will be mobilized from partners as well as from international climate finance initiatives, including the Adaptation Fund. Overall, policies in key sectors such as agriculture, infrastructure, energy and others have only marginally reflected or made concrete programmatic adjustments in response to climate change. Concrete actions taken to date are very limited, especially in the national portions of the Lake Chad Basin.

Ultimately, the proposed project can be seen as a concretization of the wills expressed both at the country level and at the level of the regional economic institutions, but which have so far remained as project ideas not yet concretized. It therefore remains consistent with the will expressed in the regional and national adaptation programmes of action and the poverty reduction strategies.

**F. Describe how the project meets relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, etc., and complies with the Environmental and Social Policy of the Adaptation Fund.**

The Lake Chad project will be aligned with the requirements of the Adaptation Fund's Environmental and Social Policy (ESP). The Implementing Agency accredited by the Adaptation Fund, WMO, as well as the LCBC, GWP-CAf and relevant national partners, will ensure that the project follows the procedures outlined in the ESP. This includes the requirement that activities financed by the Adaptation Fund reflect local needs and circumstances and build on national actors and capacities.

National partners and stakeholders were consulted during the development of the project proposal. This consultation will be further expanded during the development of the fully developed proposal to ensure that all activities comply with relevant national standards, as well as environmental and other statutory laws and regulations of the participating countries. Where necessary, environmental impact assessments of project activities in the field will be undertaken. This document has also been submitted for validation to national stakeholders, including, inter alia, the Adaptation Fund's in-country Focal Points (Designated Authorities), the Permanent Representatives of NMHSs and other partner institutions in the implementation of the project in the participating countries.

Some of the laws and regulations of particular relevance to this proposal are listed in Table 12 below, together with their date of promulgation by country.

**Table 12. Laws and regulations in participating countries.**

<b>National laws</b>	<b>Cameroon</b>	<b>CAR</b>	<b>Niger</b>	<b>Nigeria</b>	<b>Chad</b>
Environmental legislation	N°96/12 05/8/1996	n°07-018 28/12/2007	Low 98-056 29/12/1998	NEP regulations 1991	n° 014/PR/98
Water legislation	N° 98-005 14/4/1998	n°06.001 12/4/2006	n°2010-09 1/4/2010	Water Resources Act, 1993	N°16/PR/1999
Land protection legislation	Yes	Yes	Yes	Yes	Yes
Social protection legislation	Yes	Yes	Yes	Yes	Yes
Labor legislation	Yes	Yes	Yes	Yes	Yes
Legislation on marginal groups	Yes	Yes	Yes	Yes	Yes

NEP: National Environment Protection; Yes: There are national regulations on the subject.

Additional investigations of national environmental and social assessment legislation in each country will be carried out in the next stages of the process, during the preparation of the full document and project implementation to ensure compliance and to complement the Adaptation Fund's ESP. These include laws and regulations on environmental protection and impact assessment, sustainable development, water resources management including the LCBC Water Charter, risk and crisis management, public participation, which will be inventoried and presented in the fully developed proposal. The project will apply WMO regulatory material including most recent developments on ecological impact of monitoring systems.

**G. Describe if there is duplication of project with other funding sources, if any.**

During the project preparation, the on-going projects related to the thematic area of present project have been assessed and potential synergies are identified. Several initiatives are underway or planned in the region and/or in the Lake Chad Basin, with the support of technical and financial partners such

as the World Bank, the United Nations Development Programme (UNDP), the African Development Bank (AfDB) and other development partners such as the German cooperation (GIZ, BMZ), the French Development Agency (AFD), as well as funding initiatives such as the Climate Risk and Early Warning Systems (CREWS), the Global Environment Facility (GEF), etc. These projects and programmes have been screened to avoid duplication and to develop synergies. It should be noted that most of these initiatives focus on situation assessment, sectoral monitoring or pilot sites. No mechanism has been put in place to ensure effective and sustainable knowledge for sound water resources management, disaster risk reduction or to organize actions between technical services and decision-making institutions to mitigate their impacts. The present project is designed to build on, synergize and complement the results of these activities. A joint meeting to clarify the framework for collaboration will be organized with all partners who will also be invited to the steering committees. A summary of the main projects, based on existing reports, publications and meetings with partners, is presented in Table 13.

**Table 13. Other ongoing or planned projects and programmes in the region.**

<b>Projects</b>	<b>Objectives</b>	<b>Possible synergies/ complementarities</b>
<b>CREWS Chad</b> 2019-2024 <b>CREWS Niger</b> 2017-2022 <b>CREWS West Africa</b> 2018-2023 <b>CREWS Central Africa</b> 2022-2026	These projects aim at improving the operational capacities to produce and deliver warning services. Improve the availability of, and access to, early warning systems in participant countries; develop seamless operational forecasting systems based on optimal regional cooperation (see <a href="#">CREWS Chad, Niger and West Africa</a> ). CREWS Central Africa has just recently been approved and starting in 2022.	The results achieved in Chad and Niger will be utilized in the development of this proposal. The experience gained will also be used in the other three countries in the selection of pilot sites for the project and in the dissemination of knowledge and tools to stakeholders.
Strengthening Resilience to Climate and Covid-19 shocks through Integrated Water Management on the Sudan – Chad Border area ( <b>SCCIWM</b> ) <i>(Submitted to AF in January 2021)</i>	Strengthen the regional agro-ecology and sanitation resilience to climate change and COVID-19. Focused in a small area of the Chari River basin shared by Sudan and Chad. <a href="https://pubdocs.worldbank.org/en/282721617989098376/14537-Clean-FAO-AF-SCCIWM-Regional-Project-Chad-and-Sudan-17-February-2021-MS.pdf">https://pubdocs.worldbank.org/en/282721617989098376/14537-Clean-FAO-AF-SCCIWM-Regional-Project-Chad-and-Sudan-17-February-2021-MS.pdf</a>	The project has objectives similar to those of our proposal and plans e.g., to develop integrated information systems on water resources for climate change adaptation in regional agriculture and food systems. Complementarities will be developed if it is accepted and funded.
<b>PULCI (Cameroon)</b> 2014-2019 <i>World Bank</i>	Rehabilitate hydro-agricultural infrastructure and design and implementation of an EWS including the establishment of a few Hydromet monitoring stations. <a href="https://pulci-cm.org/">https://pulci-cm.org/</a>	The Hydromet monitoring network set up within the framework of this project (mainly in Cameroon) will be taken into account and capitalized on by this proposal. These include Hydromet observation stations equipped with new generation equipment.
<b>PRESIBALT</b> 2016-2022 <i>ADF</i>	Improve the resilience of the populations in 5 LCBC member states. The acquisition of the equipment is made at the regional level, and it will benefit the 5 member countries in the spirit of solidarity and strengthening cooperation among member states. More specifically, the project activities are aimed at the acquisition and installation of <ul style="list-style-type: none"> <li>- 32 automatic controlled hydrological stations in the 5 member countries;</li> <li>- 24 automatic controlled meteorological stations</li> <li>- 30 direct reading rain gauges;</li> </ul> <a href="https://cblt.org/category/projets/">https://cblt.org/category/projets/</a>	The hydrological and meteorological monitoring network set up as part of this project will be taken into account and capitalized on in this proposal.
Lake Chad Basin Regional programme of the conservation and sustainable use of Natural Resources and energy efficiency	Preserving aquatic and agroforestry ecosystems and ensuring the sustainability of resource use; including implementation of piezometers and acquisition of piezometric recorders. More specifically, the project activities aim at	The equipment of the piezometric monitoring network set up in the framework of this project will be capitalized by the present proposal.

2019-2024 LCBC-AfdB-GEF	<ul style="list-style-type: none"> <li>- the acquisition of 500 water level gauges and 5 complete gauging equipment;</li> <li>- the construction of 60 piezometers and the rehabilitation of 40 others in the Basin</li> <li>- the acquisition of 100 piezometric recorders;</li> </ul> <a href="http://www.cbilt.org">www.cbilt.org</a>	Note that the acquisition of groundwater monitoring equipment is not foreseen in our proposition, as it will benefit from the existing piezometers provided by this project.
Sustainable management of water resources in the Lake Chad basin 2019-2022 GIZ, BMZ	<p>Improving water resource management for increasing agricultural production considering the effects of climate change, in 2 LCBC member states.</p> <p>The project aims to</p> <ul style="list-style-type: none"> <li>- a good knowledge of climate change by the local populations;</li> <li>- to strengthen the resilience of populations to climate change by pilot. projects. <a href="https://cbilt.org/category/projects/">https://cbilt.org/category/projects/</a></li> </ul>	<p>The project concerns only Cameroon and Chad.</p> <p>The experience gained in the two countries will be used in the other three countries, particularly for the dissemination of knowledge and tools to stakeholders.</p>
Sustainable groundwater management in the Lake Chad Basin 2019-2022 BGR, BMZ	<p>Support the LCBC and 2 member states (Cameroon and Chad) for sustainable groundwater management under conditions of climate change.</p> <p><a href="https://cbilt.org/category/projects/">https://cbilt.org/category/projects/</a></p>	The activities of this project concern only Cameroon and Chad, including the realization of some piezometers. The results and facilities of the project will be capitalized by this proposal.
Improving the management of Lake Chad by implementing the strategic action plan for the Lake Chad Basin through resilience to climate change and reducing pressure on ecosystems 2018-2023 LCBC-GEF	<p>Achieve ecosystem-based, integrated and resilient management through improving water quality and quantity, protect biodiversity and sustain livelihoods. The project aims at the development of a Disaster Risk Reduction and Climate Change Adaptation Strategy Framework Document in the Lake Chad region; the study on the facilitation of the harmonization of national legal, policy and financial instruments of the LCBC for the implementation of the Lake Chad Basin Water Charter and the improvement of the availability and accessibility of data and information on Lake Chad water resources and ecosystems. <a href="http://www.cbilt.org">www.cbilt.org</a></p>	The experience gained, limited to the Lake region alone, will be used in this proposal for the other regions of the basin.
Lake Chad Region Recovery and Development Project ( <b>PROLAC</b> ) Cameroon, Niger, Nigeria and Chad 2020-2025 The World Bank's International Development Association (IDA)	<p>Contribute to the recovery of the Lake Chad region by supporting crisis coordination and monitoring, connectivity and agricultural livelihoods in selected provinces of Cameroon, Niger, Nigeria and Chad.</p> <p>The project aims to establish a regional knowledge management platform to support database creation, monitoring and integration through a web-based platform; dialogue with academic and research institutions, data collection, capacity building and dissemination.</p> <p><a href="https://cbilt.org/prolac-lake-chad-region-recovery-and-development-project/">https://cbilt.org/prolac-lake-chad-region-recovery-and-development-project/</a></p>	<p>The dialogue and the Knowledge Platform set up within the framework of the project will make it possible to establish close links with the universities of the countries bordering Lake Chad. They will support the popularization of the results of this project as well as the communication and sharing of knowledge with users and the scientific community.</p> <p>The dissemination of knowledge and good practices should facilitate the replication of lessons learned by government institutions and other communities facing similar problems in other parts of the world.</p>
Regional Strategy for the Stabilization, Recovery and Resilience of Boko Haram Affected Areas of the Lake Chad Basin ( <b>RSS</b> )  Supported by the AU and UNDP	<p>The general objectives of this strategy are:</p> <ol style="list-style-type: none"> <li>1. To generate policies and programmes for the short-, medium- and long-term stabilization and development of the Lake Chad Basin region</li> <li>2. The Strategy will focus on commonalities while taking into account the particularities of each of the States concerned in the Lake Chad Basin region</li> <li>3. The Strategy will aim to address the root causes of the crisis in the Lake Chad Basin region in order to build resilience.</li> </ol> <p><a href="https://www.peaceau.org/uploads/regional-stabilisation-recovery-and-resilience-strategy-rss-.pdf">https://www.peaceau.org/uploads/regional-stabilisation-recovery-and-resilience-strategy-rss-.pdf</a></p>	The activities of this project will contribute to securing the region for the implementation of bear project activities in the basin, including this proposal.



<p>The <b>Niger-HYCOS</b> Project (part of the larger World Hydrological Cycle Observing System) 2005-2018 AFD and AWF</p>	<p>The project strengthened the capacity of the hydrological services of the four countries participating in this project (Cameroon, Niger, Nigeria and Chad), collected hydrological data and provided reliable information on water resources through improved infrastructure. It also allowed review and quality control of historical data that will be very useful for the present project. <a href="https://hydrohub.wmo.int/en/projects/Niger-HYCOS">https://hydrohub.wmo.int/en/projects/Niger-HYCOS</a></p>	<p>The feedback and achievements of this project will be used, both at the country level and at the WMO Secretariat level, to further develop the present proposal. The link with the WHYCOS system will ensure that the results of the project will be integrated into global platforms for wider availability.</p>
<p>Programme for integrated development and adaptation to climate change in the Niger Basin (<b>PIDACC</b>) 9 countries 2019-2024 USD 205 million</p>	<p>The main expected outcomes are: (a) recovery of 140 000 ha of degraded land; (b) the construction of 209 water infrastructure systems for agro-pastoral and fish farming activities; (c) the implementation of 450 sub-projects for agricultural chain development purposes and 184 youth SMEs; (d) climate change (CC) adaptation capacity building for 1,000,000 households; and (e) operationalization of a sustainable financing mechanism for sustainable natural resource management activities. <a href="https://www.greenclimate.fund/document/programme-integrated-development-and-adaptation-climate-change-niger-basin-pidacc-nb">https://www.greenclimate.fund/document/programme-integrated-development-and-adaptation-climate-change-niger-basin-pidacc-nb</a></p>	<p>The sustainable funding mechanisms, climate change adaptation and agricultural water infrastructures can have synergies with this proposal.</p>
<p>Mapping Groundwater Resources in Chad <b>ResEau</b> 2012-2022 Swiss Agency for Development and Cooperation (SDC)</p>	<p>The project goal is to increase Chad's resilience to climate variability by improving knowledge and active management of aquifers and surface water resources. The medium term outcomes are the following:</p> <ul style="list-style-type: none"> <li>- The knowledge of water resources is improved, particularly for the priority regions identified (Central and Northern Chad), thanks to the availability of new and quality data on water resources;</li> <li>- National water resource management capacities are strengthened;</li> <li>- The data and information produced are accessible and used by partners active in the sector.</li> </ul> <p><a href="http://reseau-tchad.org/">http://reseau-tchad.org/</a></p>	<p>The present project should capitalize on phase 1 of the SDC project which resulted in the set-up of a Water Resources Information System (SIRE) compiling 420 publications, 600 maps, 200 satellite images as well as 27 hydrogeological maps at 1:500,000 and 1:200,000 scale. Synergies can be sought especially in relation to information system and groundwater data. An information exchange system can be set up with this project to capitalize on the information collected in the implementation.</p>
<p>Runoff management in Sahelian Chad (GERTS) (2012 – 2022 Swiss Agency for Development and Cooperation (SDC)</p>	<p>The project aims to improve water control and erosion in the lowlands through the development of valleys with spreading sills for their agro-pastoral exploitation for the direct benefit of 350,000 people in four regions in east-central Chad. The medium-term objectives are the following:</p> <ul style="list-style-type: none"> <li>- Agricultural and livestock producers as well as local authorities ensure a sustainable and concerted management of the benefits induced by the construction of valleys managed by spreading sills</li> <li>- The populations - in particular women, youth and vulnerable people - living in the lowland areas with weirs exploit the developed spaces in a sustainable and economic way</li> <li>- The approach of developing inland valleys with weirs is known, promoted and scaled up with the support of public and private institutions and organizations.</li> </ul> <p><a href="#">Phase 3 (admin.ch)</a></p>	<p>Synergies can be developed with this project by the sharing and lessons learnt in relation to the specific needs of pastoralist communities in the areas of water management and food security.</p>
<p>World Bank</p>	<p>The assessment of Lake Chad Basin Hydromet monitoring and data systems, and assessment of water security related aspects in the region.</p>	<p>A dialogue has been started with WB experts in their assessment of investment needs in the region and their possible projects will seek synergies with this project.</p>

Regarding to groundwater monitoring stations, there are other projects (PRESIBALT, BGR) in the region making investments into piezometers and dataloggers, thus our proposed project can probably focus investments to surface water and agro-meteorological stations. This issue will be addressed in the fully-developed proposal when making funding allocations to network/stations activities.

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

The results of this project can be shared with other regions facing similar problems and for science. Various means are foreseen to ensure good coordination and wider dissemination of the project's achievements to a wider circle of institutions and communities, including the most vulnerable, women and youth.

*1) Knowledge management and experience sharing*

The activities of the project related to the operational data collection and processing system will particularly rely on WMO materials and tools such as [WMO HydroHub](#), [HydroSOS](#), [WHOS](#) and [WWDI](#). A summary of the project's know-how and best practices will be published on the web pages of the partners (WMO, LCBC, GWP and NMHSs) and in particular on the WHYCOS web page, which hydrologists regularly use to find answers to their concerns from practical experience.

The project also envisages the creation of a user community, to coordinate collaborative efforts between civil society, community groups, private companies, research institutions, international organizations and the public sector to exchange knowledge and expertise, discuss best practice and ensure the dissemination of new methods and equipment to countries. The Community of Practice which creates connections between hydrometric practitioners from around the world to share experiences in addressing the day-to-day operational challenges faced by NMHSs, including those related to new practices and technologies, but also on flood management and early warning systems.

The tools and guidelines as well as all the documentation developed within the framework of the project will remain available in the beneficiary services and communities and on the website of the partner institutions. They will be useful for the consolidation of the results and the sharing of experience. Similarly, the training organized within the framework of the project will be destined to trainers who will share it with colleagues or other communities.

*2) Dissemination to the general public*

The long-term sustainability of the project's achievements will be supported by training for NMHSs on communication and effective awareness raising on the benefits of hydrometeorological products and services especially with financial policy- and decision-makers. Appropriate means of communication (e.g., WMO, LCBC and participating NMHSs websites) will be used to publicize the results of the project to current and potential users of hydrometeorological products and services, and to promote the socio-economic benefits of sustainable Hydromet monitoring. Some products will be promoted on dedicated WMO websites, such as HydroSOS, which aims to provide information on the current state of water resources and the near future. With the support of WWDI, communication should also be directed at private sector decision-makers and policy-makers, including budget holders at the highest level of decision-making, as well as parliamentarians who vote on the state budget. Similarly, methods and tools for identifying the needs of funding partners and end-users of water information will be used. To remain credible to these users, clear communication will be provided on the uncertainties in the data and forecasts.

*3) Organization of and participation in conferences and other events*

Annual meetings of the Project Steering Committee (involving partners, key stakeholders, end-users, beneficiaries and international partners) will be organized to present the progress of the project and to refocus, where necessary, the implementation of activities to achieve the expected results. Participation in conferences and scientific meetings is also foreseen in order to present and discuss the project results. The collaboration of academics will also allow for the evaluation of the impact of the solutions proposed by the project on the effects of climate change in the region and particularly in the Lake Chad basin.

**I. Describe the consultative process, including the list of stakeholders consulted, undertaken during project preparation, with particular reference to vulnerable groups, including gender considerations, in compliance with the Environmental and Social Policy of the Adaptation Fund.**

WMO, GWP and LCBC have a long history of collaboration and have a good knowledge of the project stakeholders as well as good relationship. Furthermore, the list of beneficiaries and their needs was consolidated for the development of the pre-concept note. In accordance with one of the objectives of

its Strategic Plan validated by its Committee of Experts and the meeting of the Council of Ministers of its member countries, the LCBC had requested since 2013 the assistance of the WMO Secretariat for the development of a component of its WHYCOS programme for the Lake Chad Basin. The project document developed on a participatory basis was validated by the countries in 2015. GWP-CAf subsequently developed a project proposal on "Early Warning System (EWS) in the Lake Chad Basin" to support the LCBC and its member countries in their efforts to protect lives at risk from climate change induced disasters and help communities sustain themselves in the face of danger. The project proposal, which was to start with a pilot phase in three countries (Cameroon, Central African Republic and Chad), was validated by LCBC in 2017.

The participatory process for the development of the two projects assessed the capacity building needs of the participating countries to strengthen the data collection system and support preparedness for flood and drought management. Under the supervision of the LCBC, GWP-CAf and the WMO Secretariat, and with the support of national technical services, including NMHSs, consultations were held with institutions, users of hydrometeorological services, civil society and communities. The authorities and people consulted included mayors of cities, representatives of associations of municipalities, actors of meteorological services, institutions in charge of monitoring water resources, civil protection services and focal points for flood management and early warning systems, NGOs, universities, etc. For the EWS in particular, representatives of flood-prone vulnerable communities (women, elderly, youth) were also directly consulted by the countries' national consultants to gather the required information on flood and drought management.

Following a request from the LCBC to the WMO and GWP in 2019, the ideas contained in these two documents have been reconsidered on the basis of the modern tools currently available, for a revitalization of Hydromet monitoring and early warning activities for water-related disaster risks in the basin. An adapted and modern process was put in place to get the views and needs of the end-users of the products and services that such a project should generate, as well as those of the beneficiaries and stakeholder platforms agreed upon in the LCBC Water Charter, while taking into account current and planned innovations to better adapt them to the new context.

A participatory process was thus again set up for a new assessment of the situation, data collection and information for the update and development of a new document. A survey questionnaire was developed and submitted by email to the different stakeholders and potential beneficiaries of the project in the countries. Three different stakeholder questionnaire forms were prepared, each one for hydrological service, meteorological service and the beneficiaries of each country. The questionnaires for NMHSs included questions on institutional arrangements, human and financial resources and capacities, Hydromet networks, equipment and data collection, data systems and data sharing, service delivery and products and warnings produced. Beneficiary questionnaires were focused on receiving information on disasters, warnings on floods and droughts and stakeholder needs for that. The LCBC and GWP-CAf were the main facilitators in the field during this consultation process, working in close partnership with their Focal Points, the relevant line ministries and the WMO Permanent Representatives in the participating countries. The field activities were supported by social science experts and also drew on the role of traditional leaders and local administrations. Emphasis was placed on civil society organizations representing women, marginalized ethnic groups and vulnerable populations. In addition, stakeholders (local decision-makers, development and humanitarian agencies, private companies, etc.) from past and ongoing projects were regularly involved in consultative missions to develop necessary and sustainable synergies, assess gaps, share resources and understand the project's short and long-term impacts. In order to give all the populations of the basin, especially women and youth, the opportunity to express their views on activities and expected results, the attention of the project partners in the countries was drawn to the need to cover not only all forms of water resources use in the basin, but also to integrate/associate them in the people and groups surveyed. The same applies to the selection of participants in the regional workshop discussions. To ensure that gender issues are properly addressed, a gender expert was also involved in the formulation of some of the project activities, in addition to the AF National Designated Authorities contribution. On the basis of the data and information received from countries through the questionnaires (in addition to the questionnaires completed by the countries' technical services, about 50 questionnaires have already been completed by the potential beneficiaries of the project activities in the basin) and documentation received, a first draft of the concept note was elaborated and submitted to the stakeholders for consideration for validation prior the first regional workshop.

Organized in a hybrid format due to Covid-19, both online and face-to-face, the first regional stakeholder workshop for the preparation of the project took place on 21 and 22 February 2022 in N'Djamena, Chad. It brought together a total of seventy-five participants (25% women and 30% youth), 37 of whom were present in N'Djamena and 38 online. The participants were presenting all

five member countries and including key stakeholders of the project. The stakeholder workshop reports in English and French are available through this [link](#) and a short news coverage of the event was published at [WMO website](#) and on the [GWP website](#).

This workshop aimed at collecting additional data and sharing information on the project with the main stakeholders of the Lake Chad Basin countries, such as national Hydrological Services (NHS), National Meteorological Services (NMS), institutions in charge of disaster management, regional organizations, NGOs and communities living in the basin. This workshop also aimed to create a common understanding and full picture of the objectives of the project and the associated benefits, but also of the implementation strategy by the national and regional institutions involved. This helps to create a solid platform for the development and successful implementation of the project at regional, national and community level.

As a result of the workshop participants agreed that all project components are important and complementary, but if they were to be prioritized, Component 1 would come first because data collection infrastructure is essential to achieving the other outcomes. This would be followed by databases, data sharing and monitoring funding mechanisms; Strengthening the technical and institutional capacity of NMHSs to monitor and store relevant and up-to-date data, and to develop products and provide services; Other points that were highlighted: Involvement of users such as farmers in field data collection; Establishment of local civic environmental monitoring committees and ensuring their supervision; Going beyond data provision and offering products/services, including prevention of risks such as agricultural pests (caterpillars, locusts and migratory birds), waterborne and climate-sensitive diseases; Establish a feedback mechanism for the verification of forecasts and alerts in order to continuously evaluate the systems in place and upgrade/update them, if necessary; Communicating EWS in a simplified way that is easy to understand. For example, to install, among other things, at sensitive sites, a materialization of the alert levels on posts with coloured bands in green, yellow, orange and red, according to the nature of the danger; Taking into account civil society and water user groups and strengthening their capacities in understanding and interpreting warning messages related to climate risks; Integration of communities and vulnerable populations, including women, youth and cultural aspects, in the whole process of the project to enable them to take ownership of the project while making them understand what their benefits are, and signing of a protocol of commitment of the countries to participate in the financing of hydrometeorological activities; Use, among others, of social networks for information sharing and dissemination of warnings, including in local languages. Additionally, [a short case study](#) was made from the user need co-exploration, and lessons learned can be utilized in the further development of the project.

This process will be finalized and completed during the preparation of the fully developed proposal. This will include consultation on the selection of pilot sites for testing or demonstrating adaptation interventions; discussion on the long-term sustainability of project activities; consultation on the multi-level engagement, roles and responsibilities of potential national, sub-national and local partners working in the climate, water, ecosystems and development sector and gender aspects. In addition, close cooperation will be discussed with major projects (planned or under development in the Lake Chad Basin) to ensure feedback from the latter for the development of appropriate and sustainable synergies.

### **- The part of the project related to updating of the operational system for data collection, processing and archiving**

#### *Baseline situation (without any support from the Adaptation Fund)*

The assessment of the situation of the NMHSs revealed a critical situation with their capacity to fulfil their institutional role and respond to user demands. However, this situation is not homogeneous, both in terms of human resources and in terms of their qualification and material means, and the proportions of the basin surface in the countries sharing it are also very variable, as well as their contribution to the water supply of the Lake.

#### *Expected impact of the proposed project (with the support of the Adaptation Fund)*

An updated and reliable, basin-wide, integrated operational system for the collection, transmission, processing and archiving of data on the quantity and quality of water resources (both surface and groundwater) in a timely manner. A system serving the needs of countries and users of water information, as well as the LCBC. A focus will be on two main areas to better respond to the challenges of climate change: the rehabilitation of the observation network and the strengthening data archiving and management tools (digitization, securing, description and critical analysis of data, including rescuing historical data).

### **- The part of the project related to capacity building**

#### *Baseline situation (without any support from the Adaptation Fund)*

The main activities that support the regional economy in the Lake Chad Basin are rainfed agriculture, pastoral livestock, and fisheries. Their development is essentially dependent on hydroclimatic conditions. The hydroclimatic characteristics of the Lake Chad Basin and the projected impacts of climate change on socio-economic vulnerabilities are not well understood and have not been sufficiently taken into account and integrated into development planning and other land use practices over the years. The countries' technical services lack adequate means and information on the increasing risks related to extreme events. This leads to inadequate planning and decision-making for risk management, including floods and droughts. Under these conditions, private and public infrastructure and natural resources are continuously exposed to severe hydroclimatic events, resulting in damage and degradation of adaptive capacities.

#### *Expected impact of the proposed project (with support from the Adaptation Fund)*

The project provides for detailed assessments of capacities, vulnerabilities and exposure to floods and droughts in the basin, and the development of corresponding risk maps. It will also strengthen the technical and institutional capacities of decision-makers and stakeholders in the field of extreme hydrometeorological events and disaster risk management, including NMHSs, civil protection services, etc. The project will contribute to bridging the gaps from adaptation measures (including integrating future scenarios with current knowledge) to improve the planning and design of concrete response and adaptation measures. To this end, synergies will be developed between projects or programmes (existing or under consideration in countries and at regional level) in the field of assessment, monitoring and management of water resources for sustainable development, environmental protection, and biodiversity. Capacity building will also include organizational, legal and financial aspects. Particular emphasis will be placed on the training of women and youth.

### **- The part of the project on product development and dissemination**

#### *Baseline situation (without any support from the Adaptation Fund)*

In addition to the difficulties of NMHSs already described elsewhere, the devices required for the development of appropriate flood and drought forecasting measures do not yet exist in the Lake Chad basin. The few available facilities such as radars, other climate and hydrological sensors provide some data but there is no timely availability of flood and drought forecasts and warning information for communities prone to these risks. Existing flood and drought preparedness and response measures at local, national, and regional levels are ineffective, due to the lack of technical capacity of the national technical services in charge of the issue. Support from the Adaptation Fund will help to change this situation, which could otherwise worsen, thereby further exposing the basin's populations to the risk of disasters related to extreme hydroclimatic events and to the damage resulting from them. Furthermore, it goes without saying that local stakeholders and exposed local communities have developed traditional solutions based on their experiences (such as mobility). These practices should be considered with the necessary improvements to enable better resilience to the consequences of these and other future climate change impacts.

#### *Impact due to the proposed project (with support from the Adaptation Fund)*

The project will support the development and updating of the operational data collection, processing and archiving system and the establishment of an end-to-end early warning system for floods and droughts. This support will be translated into the development of appropriate hydro-climatic services by the appropriate technical services for the general public. This includes the development and updating of the operational data collection, processing, and archiving system as a necessary first step towards a robust and appropriate network for information and early warning. The developed system will provide results in the form of risk zoning maps, simple colour-coded graphs, etc., following a scheme that will be elaborated at a later stage. The development of contingency plans and the EWS will improve the capacity of stakeholders to make decisions and prepare to reduce impacts and, if necessary, to implement alternative practices. The effectiveness of the systems will be improved through better coordination between NMHSs and other relevant departments at local and national levels, including flood and drought prone communities. Capacity development activities, including gender mainstreaming in integrated flood and drought management, will help develop proactive approaches to resilience to climate change impacts.



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

Located in the Sahelian region at the southern edge of the Sahara Desert, Lake Chad belongs to the wetlands of the tropical world. It offers very rich ecosystems in an environment marked by aridity and is therefore included in the Ramsar list of wetlands of international importance as one of the few recognized transboundary international wetlands, where countries make a formal agreement for joint protection and management of shared aquatic ecosystems and their resources. For thousands of years, it has been a centre of development, trade, and cultural exchange between the populations of the northern Sahara and the south. Its watershed is nowadays confronted with the challenges of development, in a context of global warming and increasing demographic pressure. Indeed, climate change has severely affected the countries sharing the basin, characterized by recurrent large-scale drought, punctuated by extreme rainfall events that cause catastrophic flooding. This situation contributes to the precariousness of both rainfed crops and pastoral livestock, which are the two foundations of the regional economy. For example, the international disaster database EM-DAT indicates that over the past five decades, some fifty natural disasters linked to hydro-climatic events have occurred in the Lake Chad Basin, affecting a total of more than 30 million people, including nearly four thousand deaths, with damage estimated at several tens of billions of dollars. Based on current experience, improved multi-hazard warning systems should contribute to a considerable reduction in these losses. Faced with this situation, the governments of the riparian countries have developed and implemented various strategies and action plans to reduce the vulnerability of populations and support their adaptation/resilience to the effects of climate change, particularly the risk factors that accompany it, with the support of technical and financial partners.

The actions to be undertaken to achieve this objective are part of the improvement of the governance of the basin's water resources and associated natural resources in order to preserve its productive potential. The LCBC is in charge of monitoring the basin and develops its capacity to mobilize, analyse and disseminate environmental information to be able to plan and enforce the sharing of the basin's water resources between member countries, the policy of protecting ecosystems, to promote informed decision-making, as well as steering and participation in public and environmental policies. From this point of view, the financing of the Adaptation Fund will make it possible to develop and complete existing projects, in accordance with the priority actions envisaged by the countries in the areas concerned, but also to support the LCBC in the development of its activities. The project will establish/modernise the information system in an appropriate and methodologically consistent manner for both water resources management and EWS, as well as for resilience measures and capacities to manage and reduce vulnerability to climate risks. An effective EWS is a key element of adaptation; WMO provides solution based on the latest generation of WIS (WMO Information System) and GDPFS (Global Data-Processing and Forecasting System), thus Lake Chad would be one of the first answers to the call from UN SG on having EWS for all countries within 5 years.

The governance issues identified call for innovations and sustained efforts in their characterization for better management of water and associated natural resources at the basin level. This means improving monitoring and knowledge production systems and adequate services, but also ensuring that existing data is capitalized, mobilized and made available. For example, in order to be reliable and uncontested, the decisions to be made regarding the allocation of water resources between States, between upstream and downstream, and between uses and users, must be informed by quality data. With this in mind, the proposed project, with an estimated total budget of \$10.62 million, aims to contribute to adaptation strategies by investing in a combination of infrastructure and non-structural measures to improve preparedness, awareness of best practices and behavioural change among practitioners, policy makers and communities. It will also commit LCBC and the participating countries to long-term support and sustainability in the development of its activities, both in-country and at the regional level.

**K. Describe how the sustainability of the project outcomes has been taken into account when designing the project.**

The project proposal has been developed on a participatory basis, with the various partners and potential beneficiaries. It is in line with one of the objectives of the LCBC Strategic Plan and falls within the area of inter-state collaboration in the management of the basin resources. The participatory consultative process has ensured that the needs of the stakeholders are properly addressed. The populations of the basin including the most vulnerable communities (adults, elderly, women and youth) have been involved in identifying their expectations and contributions to implement effective flood and drought management in the basin. The project sustainability aspects were discussed and underlined during the regional stakeholder workshop in February 2022.

The Lake Chad project will contribute to a better management of the basin's water and natural resources, and hence of all the economic development factors that constitute the economic lung of the sub-region. In view of the potential impacts of climate change, which are likely to bring about irreversible changes in the basin's natural resources, it is essential to document and improve knowledge of water resources, which is inseparable from any policy aimed at sustainable management. At the end of the activities covered by the proposal, an optimum network of monitoring stations as well as up-to-date and accessible data bases and information systems will be set up and available in the countries and at the LCBC.

Moreover, a budget line has been created in the budget of the LCBC Basin Observatory Division, to support countries in the development of hydrometric activities on a minimum number of stations. In order to ensure its sustainability, the stations of the EWS network that are not yet in this minimum number will be included. The LCBC also provides technical assistance and capacity building to member countries, as needed, to strengthen monitoring activities. Details of this component of activities will be provided in the next stage of the process, in the full project document.

The training programme covering aspects such as hazard and risk mapping, water balance, hydrological outlook, community-based flood management, mobile seminars for farmers on agrometeorology, integrated drought management, end-to-end early warning systems for flood management, etc., will provide technical support and new decision support tools to the relevant services of the participating countries and those of the LCBC. Skills capable of developing adequate information products will therefore have been trained in the technical services of the participating countries and will have reached a significant level of efficiency (for at least some of them), for the management of the hydrometeorological network, the development of information products and early warnings. With the support of partners such as the WMO and GWP, lessons learned will scaling up the achievement to outside of the Lake Chad basin using the same methodology and tools.

The development of the project also builds on the lessons learned from previous projects and ongoing projects in the region. For example, feedback from projects developed under the WMO WHYCOS programme shows that after the end of project funding there is a decline in hydrological activities. Lessons will be drawn from the weaknesses of these projects to support the sustainability of the achievements of the Lake Chad project. WMO has been working within the HydroHub to build a new strategy for WHYCOS programme operation model that focuses on sustainability of hydrometeorological monitoring in countries and the sustainability of the achievements of supporting projects after their completion. This strategy that will be implemented in the development of this proposal includes, among other things, the introduction of a post-project phase in project proposals. This phase is to be funded largely by the countries (through a process to be described in the final Lake Chad project proposal), with possible external support, including from WMO for progress assessment and from the LCBC for the consolidation of the project achievements among others.

In particular, the priorities of the states and the needs of the basin's water users will be taken into account in its preparation. In addition, institutional and legal strengthening is envisaged, as well as improved national and regional coordination between the various actors. The project also includes communication activities such as

- raising the awareness of public authorities, including policy and decision makers, on the importance and economic value of hydrological monitoring for economic development and disaster protection;
- raising awareness among water resource users of the added value that hydrological monitoring can bring to their activities, in order to arouse their interest and encourage them to contribute to its financing.

These awareness-raising activities will be supported by the provision of good quality and timely hydrological products and services during and after the project. In order to better meet the needs of the users, NMHSs will develop methods and tools that will allow them to know the needs of the users and to measure, afterwards, the satisfaction of the users.

It should be noted that the LCBC, which will act as the Executing entity of the project, has a long experience in managing international projects and already has strong collaborative relationships with NMHSs in its member countries. The project design also foresees a contribution from the countries to the financing of the hydrometeorological monitoring activities and development of products. This contribution, minimal in the first year, will gradually increase until the last year of the development of the activities when it should reach, for each country, the equivalent of the annual cost of operation and development of the stations of the hydrometric network of the project located in the respective national portions of the basin. Agreement letters will be signed between the countries and the project executing agency on the subject before the effective launch of the activities on the field. Such a

contribution will ensure that follow-up activities will continue after the project on the basis of the participating countries' own funding. In addition, the consolidation of the project's achievements will be ensured in the framework of the ongoing activities of the partner organisations (LCBC, GWP-CAF and WMO) for the benefit of the countries.

The LCBC has provided an engagement to take the ownership of the project results and continue maintaining the regional data system after the project has ended. Similar engagements will be prepared with participating countries NMHSs during the fully developed proposal preparation.

All the above elements are likely to encourage the States and water users of the basin to contribute to the sustainability of the project's achievements and consequently to the perpetuation of hydro-climatological monitoring and early warnings to guard against disasters related to extreme hydro-climatic phenomena and other climate change impacts.

**L. Provide an overview of the environmental and social impacts and risks identified as being relevant to the project.**

Project activities have been screened for environmental and social risks in accordance with the 15 principles set out in the Adaptation Fund's Environmental and Social Policy. As indicated in Table 14, the principles, which will be subsequently complemented by field visits, were previously analysed with the assistance of LCBC officials and participating countries. It should also be noted that the possible triggering of a specific risk may lead to other risks. For example, the resettlement of displaced populations is a complex process involving many risks, including loss of land, employment, housing and access to common resources, economic marginalization, food insecurity, etc. This type of high-impact risk is not part of the proposed project, as the measures to be taken will focus on the principles of integrated water and environmental resource management and disaster risk reduction measures. However, the development of risk maps can alert national authorities and communities to sites potentially at-risk during floods or droughts. Public authorities may then consider relocation or resettlement of occupants, or people themselves may decide of their own accord to move to safer locations in urban or rural areas. This can be considered as primary indirect risks. In addition, secondary or dependent risks, such as competition for water, land use (e.g., between pastoralists and farmers) and natural and food resources, as well as social and cultural conflicts with people in the new location, may pose a challenge to relocating families.

Public authorities and relevant national institutions need to be sensitized to such risks and their impacts. The proposed project will raise awareness or communicate these risks and potential mitigation measures with the prior informed consent of stakeholders. The relevant national authorities will be provided with decision support tools to develop and implement a resettlement plan that respects the rights and improves, or at least restores, the standard of living of those to be resettled because of extreme weather events. For safeguard actions, a set of standards or procedures will be made available, specifying the desired outcomes and specific requirements to be achieved by means appropriate to the nature and scale of the activity and proportionate to the level of environmental and social risks and/or impacts.

By improving accessibility to early warning, capacity and the knowledge base, the AF support for this proposal will contribute to increasing the evidence base available for future initiatives to promote adaptation to climate change and improve water and environmental management, both at national and transboundary level. The environmental and social risks which will result from the Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA) studies (in line with the Environmental and Social Policy of the AF) which will be conducted during the preparation of the fully developed proposal.

**Table 14. Initial screening of the Environmental and social policy principles of the Adaptation Fund.**

<b>Checklist of environmental and social principles</b>	<b>No further assessment required for compliance</b>	<b>Potential impacts and risks – further assessment and management required for compliance</b>
Compliance with the Law	No additional assessment is required. The project will ensure that existing national and transboundary laws, policies and guidelines in the basin are respected when implementing adaptation measures or capacity development activities. The project will not require any prior legal and regulatory approvals for environmental	

	<p>and construction issues as no physical or structural construction is foreseen in the development of the activities.</p> <p>If necessary, international laws on data sharing protocol between different countries will be consulted. During the design of the project, in particular the data collection and exchange component, the attention of regional and national stakeholders was drawn to the need to implement the recommendations of the Water Charter of the LCBC on hydrological monitoring and data sharing between member countries.</p>	
Access and Equity	<p>No further assessment is required. The project will allow impartial and equitable access to the associated benefits. The project is designed to enable representatives of vulnerable groups to participate in all capacity building trainings/workshops. The selected participants will be expected to share the knowledge gained in the training with other members of the communities or organisations so that everyone has fair and equitable access to the full benefits of the project. The selection of beneficiaries will also be done in consultation with local practices and traditions. Pilot testing will ensure that all stakeholders, including vulnerable groups, are involved.</p>	<p>However, the project foresees capacity building activities in which only a small percentage of communities will be able to participate. The project will ensure that these community representatives are future trainers who disseminate information to the wider groups. In this regard, training materials must be carefully prepared for targeted audiences to facilitate community representatives disseminate information for locals.</p>
Marginalized and Vulnerable Groups	<p>No further evaluation is required. The project will contribute to the reduction of existing inequalities in EWS for floods and droughts, particularly those affecting marginalized or vulnerable groups dependent on agriculture or living in urban areas.</p> <p>Local community members will be provided with adequate information and explanation of the systems in order to use them for their own benefit. Community-based flood and drought management activities will support the participation of marginalized and vulnerable groups and their ownership of the benefits of the project.</p>	<p>There is a risk that vulnerable and marginalized groups do not have sufficient knowledge and access to technological devices such as mobile phones or lack of good telephone connection especially required for access to information.</p> <p>To avoid the exclusion of marginalized and vulnerable communities, local radio channels and traditional practices such as the 'Arabic telephone' will be implemented to reach these groups, particularly women, girls, the elderly and people with disabilities.</p>
Human Rights	<p>No further assessment is required. The proposed activities do not or will not violate any of the established human rights. Furthermore, the proposed project will promote the basic human rights of access to water, food and information.</p> <p>The project will allow each person concerned to give their opinion, perceptions and needs to develop better adaptation measures to climate change.</p>	
Gender Equity and Women's Empowerment	<p>An Initial Gender Assessment is realised in line with the Fund's Gender Policy (see Annex 7). The proposed project will improve gender equity and women's empowerment through a tool developed by WMO: Training Manual for Gender Mainstreaming in End-to-End Early Warning System for Floods and Integrated Drought Management through a Participatory Design Approach. This will increase the participation of women, girls and other vulnerable groups in flood and drought management activities and decision-making processes. Additional gender assessments will be carried out during the development of a fully developed proposal, for which a Project Formulation Grant is being requested.</p>	<p>The proposed project targets a region where men hold the majority of leadership positions. Women's participation in disaster preparedness and decision-making is often limited due to cultural and social norms. There is therefore a risk that women will not benefit equally from the proposed adaptation measures and capacity development interventions. The gender-responsive stakeholder engagement strategy included as one activity of this project will ensure that women and representatives of women's groups are fully involved.</p>

Core Labor Rights	<p>No further assessment is required. The project will be implemented and managed in accordance with the labor laws of the country concerned. No person will be employed without remuneration and remuneration will be in accordance with the country's labor legislation/laws. Child labor will be prohibited and will not be accepted from other project partner institutions.</p> <p>Local communities will be involved in the adaptation measures but will not be exposed to any risk of accidents. Core labor rights will be respected and taken into account in the design and implementation of project activities.</p>	
Indigenous People	<p>No further assessment is required. The indigenous population of the area will be consulted and involved during the design and implementation of the project activities. The traditional knowledge of indigenous people on floods and droughts will be useful in the preparation of risk maps, early warnings and dissemination of information.</p>	<p>The traditional use of natural resources, the irrigation system and land use may be challenged. Therefore, a detailed analysis will be carried out by local and national institutions in order to understand the traditional use of natural resources, especially with regard to water and land.</p>
Involuntary Resettlement	<p>The project will not create direct involuntary resettlement of communities. However, risks of population displacement after the mapping of flood and drought risk areas could be possible as some areas could be classified as high risk of loss of life. Based on scientific and factual information, the institutions will propose a new prevention plan to prohibit any future settlement in high-risk areas.</p>	<p>An integrated safeguarding approach will be defined to minimize the negative effects of involuntary settlements. In the case of involuntary resettlement, the population will be informed of their rights in a timely manner, they will be aware of grievance mechanisms, they will be consulted on their options and offered technical and economic alternatives for resettlement or fair and adequate compensation. The displaced population will face challenges in terms of acquiring resources to live on (house, food and means of subsistence) and social integration in the new communities. The project will ensure that activities, including with local government departments, provide support in terms of strategies or actions in the event of population displacement.</p>
Protection of Natural Habitats	<p>There are no potential direct risks to the protection of ecosystems, their natural habitats and biological diversity through project activities. There is a possibility of indirect risks through revised national and transboundary policies and plans that decrease the level of protection of critical habitats. Natural and nature-based solutions will be promoted using the WWF Green Flood Guide, but will not be implemented during the project as they would require a detailed ecological assessment.</p>	<p>Existing and new policies, plans and activities to protect natural habitats will be reviewed with stakeholders to ensure that critical habitats are legally protected by wetland conventions such as RAMSAR and through consultation with authoritative sources such as IUCN, UNESCO and indigenous communities. In addition, the activities concerned will take into account the characteristics of native species and critical values in defining environmental thresholds.</p>
Conservation of Biological Diversity	<p>There will be no direct risks associated with the conservation of biological diversity as the project will not involve any physical action on natural resources and will not introduce any known invasive species. Some project activities will improve the understanding of natural processes related to the water cycle. Nevertheless, the project activities could trigger changes in agricultural and irrigation practices and in the use of pesticides. Similarly, the project outputs</p>	<p>The project activities will ensure that the principles of the Convention on Biological Diversity which has been signed by the participating countries are followed and supported. In addition, the countries' national biodiversity strategy and action plan will provide valuable information and methodologies, opportunities for information dissemination and coordination at national and transboundary levels.</p>



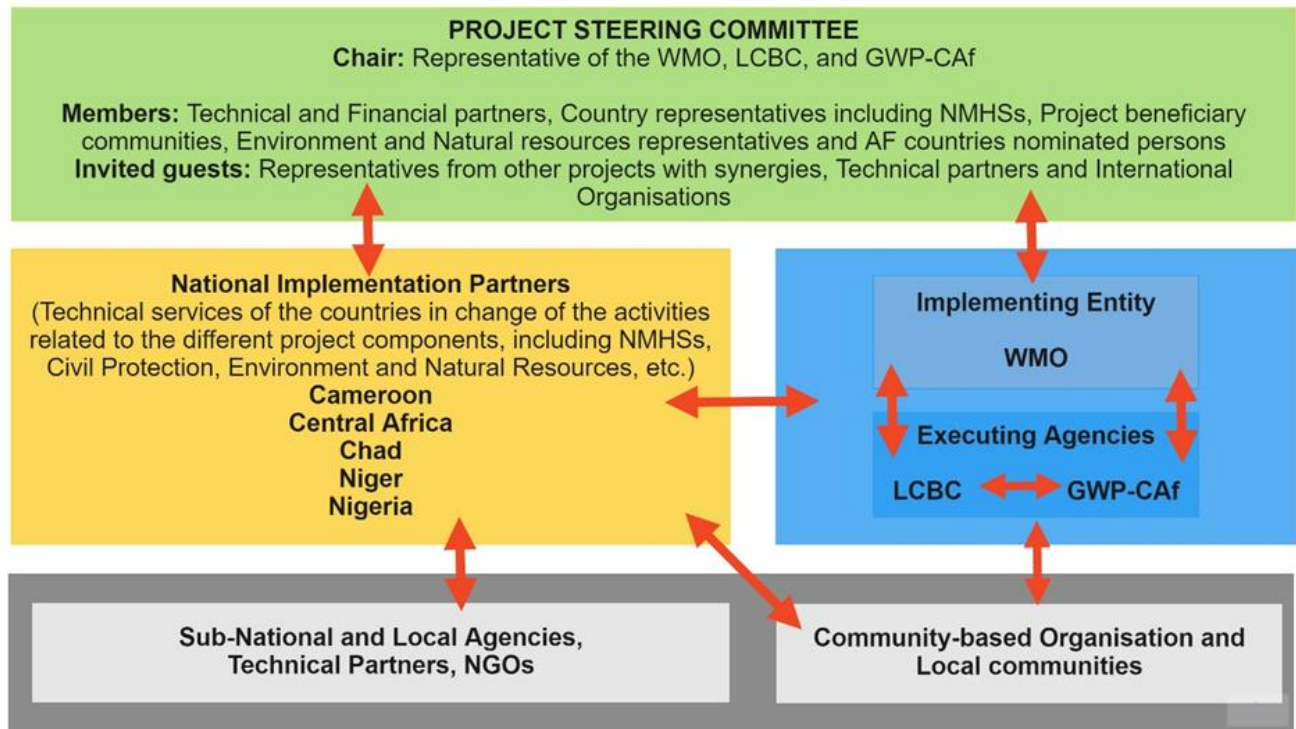
	(flood and drought risk maps, information on EWS) could lead to encroachment on protected areas, buffer zones and natural habitats.	The project will promote the planning of biodiversity conservation activities, such as reforestation, nature-based solutions, through evaluation at pilot sites with relevant national institutions. The project will promote capacity building and peer learning to strengthen the effective management of natural resources, including aquatic species, animals, and forests.
Climate Change	No further assessment is required. The project will not result in the emission of greenhouse gases into the atmosphere or deforestation, so there will be no impact on climate change. In addition, the project not only increases the flood and drought adaptive capacity and resilience of the local population, but also contributes to the development of a better governance structure, policies and plans at national and regional levels for climate change adaptation.	Actions aimed at increasing the resilience of populations should be planned at the local level (development of agricultural areas, support for disadvantaged groups in income-generating activities, etc.).
Pollution Prevention and Resource Efficiency	No further assessment is required. The project activities are not expected to result in water, air, and soil pollution.	The project will build technical and organisational capacity for water efficiency at national and transboundary levels with clear guidelines, policies, and action plans.
Public Health	No further assessment is required. The project is not expected to have a negative impact on public health. On the contrary, it will contribute to preventing the population from natural disasters, improving incomes to access health services, etc. However, in the event of a disaster, the displacement of populations can be a source of epidemics due to the lack of hygiene.	The project will identify at-risk communities that are prone to flooding and sensitize them to best practices in health security through various capacity building activities. The project will promote the planning of a health surveillance programme to cope with disasters. The project will regularly promote, inform and sensitize the population on diseases related to stagnant water (malaria, typhoid fever, amebiasis, cholera, etc.).
Physical and Cultural Heritage	No further assessment is required. The project does not affect the physical and cultural heritage. The aim of the project is to develop better management of natural resources and to have traditional and cultural integration between people.	The participatory design and mapping approach of the project will involve communities and local authorities to identify areas of physical and cultural importance and ensure that community flood and drought management activities will not have a negative impact on them.
Land and Soil Conservation	No further assessment is required. The project will promote the conservation of soil resources and land, including the selection of natural and environmentally friendly solutions.	The project will help to improve agricultural practices and build the capacity of farmers and agricultural technicians.

### PART III: IMPLEMENTATION ARRANGEMENTS

#### **A. Describe the arrangements for project management at the regional and national level, including coordination arrangements within countries and among them. Describe how the potential to partner with national institutions, and when possible, national implementing entities (NIEs), has been considered, and included in the management arrangements.**

The Adaptation Fund will provide resources to the WMO as the Project implementing entity to effectively mobilize the LCBC as the Executing agency for the activities. The LCBC will coordinate the development of the project activities through a Project Management Unit (PMU) to be established, supported by 2-3 staff to be recruited by/for the project. A steering committee will be set up to oversee and validate the implementation of the project activities in line with the expected results. It will be composed of representatives of each participating country, including representatives of NMHSs and designated national AF authorities in the countries, representatives of the LCBC, GWP-CAf, WMO,

technical and financial partners. The National technical services, in particular NMHSs and civil protection services, will ensure the effective implementation of activities on the ground, with the assistance of technical partners, including GWP-CAf and WMO's technical units. Finally, local communities will play a key role in ensuring project ownership, efficiency and demand-driven data collection. An illustration of the organization of the management structure of the project is presented in Figure 7.



**Figure 7. Organization of the management structure.**

The Lake Chad project will benefit from WMO's feedback from its WHYCOS programme and in particular the Niger and Congo-HYCOS components which have seen the participation of some Lake Chad basin countries. It will also benefit from the knowledge base and network of partners (institutions involved in environmental issues, disaster risk reduction, capacity building, community aspects and research, NGOs, national services) of the two associated WMO/GWP programmes targeting integrated flood management (APFM) and integrated drought management (IDMP). In addition to their possible contributions to the advisory committee, they will be contacted to participate in the specification of the requirements, or possibly in the development of part of the activities according to their area of expertise. Other WMO initiatives such as the Global Framework for Climate Services (GFCS), the Climate Prediction and Adaptation Service (CPAS), the Flash Flood Guidance System, the WMO HydroHub, WHOS, HydroSOS, WWDI will contribute to the activities and help to expand the scope of the project outputs.

WMO will be involved at several levels in the implementation of the activities and the supervision of the project, allowing for an international as well as a local presence. WMO Regional Office for North, Central and West Africa will support LCBC and GWP-CAf in coordination with national representatives of WMO (NMHSs) to strengthen regional co-operation. At the transboundary regional level, LCBC and GWP-CAf, alongside WMO, will ensure coordination and relations with institutions and stakeholders in the basin:

- As the regional implementing institution of the project, the LCBC will organize the development of field activities and host the regional database, through its Observatory. It will also ensure cross-border coordination of activities and links with national structures;
- The representation of the Global Water Partnership in Central Africa (GWP-CAf), through its Country Water Partnerships (CWP), will promote the integration of local communities and actors, while establishing links with national decision-makers.

The LCBC, which has a strong track record in this area, will organize the project activities at the regional level through the PMU. The PMU is the real linchpin of the coordination of the project activities carried out in and by the participating countries and in particular the NMHSs. It organizes the cooperation of NMHSs in the development of activities, centralizes the data collected by the project for the development, exchange and dissemination of regional information products. It provides technical support to NMHSs during and after the project, along the entire value chain, from data collection to the development and dissemination of information products.

The LCBC will be assisted by technical partners, including GWP-CAf and WMO's technical expertise related to hydrology, hydrogeology, climatology, and meteorology as well as gender experts, throughout the life cycle of project. Through its capillary network in the region among water practitioners, GWP-CAf will ensure a strong diversification of the partnership in the beneficiary countries and facilitate the organization of local activities. Its inclusion among the implementing entities will ensure a geographically wide distribution of project activities. GWP's network of national partners (several dozen linked to project activities) will disseminate and mainstream the project results at the local level.

At the level of the participating countries, the WMO can count on the support of the Permanent Representatives and the Hydrological Advisors, forming a technical assistance network to disseminate the project results to the Ministries in charge of Water Resources, Hydraulics, Environment and Civil Protection, but also at the international level in the 191 WMO member countries and territories.

Indeed, the achievement of the project's objectives implies actions at the level of the technical services concerned in the participating countries. The contributions of the participating countries are therefore multi-faceted and range from the provision of staff to the supply of equipment to complement that acquired under the project. On the other hand, old data records are provided by the latter. Recent baseline information will be collected by NMHSs, which have the competence and mandate to acquire, process and monitor these data. Each member country will provide the competent staff and other necessary resources required for the smooth running of the project and sustainability of the outcomes. In addition to these in-kind contributions, the project design also foresees that by the end of the implementation, countries will be in position to sustainably fund operation and maintenance through their regular budget. Such a development will also ensure that monitoring activities will continue after the project on the basis of the participating countries' own funding. Further details on the mechanism of this contribution to ensure the sustainability of the project outcomes will be provided at a later stage of the process, notably during the preparation of the detailed project document.

Details will also be provided on the relationships to be established with other institutions developing other projects with similar or complementary objectives in the region, such as the Sahara and Sahel Observatory (OSS), which facilitates partnerships around water resources management challenges, including those related to climate change in the Sahara and Sahel region. While continuing to collaborate with traditional LCBC partners such as [BGR](#), [AGRHYMET](#) and [ADB](#), in the development of activities, relations will also be established with other partners as UNESCO and the French National Research Institute for Development (IRD) who are also considering or developing other projects in the region. Information exchanges will be organized between these projects and this proposal to help identify common synergies and to develop and share resources for structural and non-structural climate change adaptation measures.

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

The framework conditions for the design of the project are based on assumptions which include the following:

1. The participating countries take ownership of the project and each accept:
  - The participating countries take ownership of the project and each accepts responsibility for the maintenance and operation of the observation stations installed on its territory, including after the end of the project funding, and support the project with the staff of the relevant national technical services;
  - to formalize in an agreement the free exchange of the data collected and the information produced.

It should be noted that the Water Charter of the LCBC, already ratified by the majority of the member countries, provides that each country should ensure the collection and sharing of data on its national portion of the basin. Given that the project development process is being launched following a request from the LCBC and the countries concerned, it can be said that this condition will be met;

2. The funds made available by the financial partners in the framework of the project represent only a one-off support for the development of hydro-climatic monitoring and risk prevention

activities, and the participating countries must make complementary financial contributions and ensure the consolidation/perpetuation of the achievements. The governments of the five countries will commit themselves to sustaining the financing of monitoring and risk prevention after the project. The choice of monitoring stations for the project is made in collaboration with NMHSs and users of hydro-climatic products and services. On the other hand, due to the increasingly visible impacts of climate change, policy makers in countries as well as private development actors are becoming more sensitive to environmental monitoring issues. This proposal is designed to serve as a demonstration of the importance of state-of-the-art hydroclimatic monitoring for socio-economic development projects, risk prevention and resilience to the effects of climate change. In addition, funds will be allocated in the project budget for awareness-raising activities among water stakeholders on these different topics to meet this requirement;

3. The LCBC, which will coordinate the development of the project's activities in the field, has a long experience in managing international projects and already has a strong and effective collaborative relationship with the participating countries. In addition, LCBC staff will benefit from the training organized under the project. The lessons learned by these staff will be used to help the country consolidate and sustain the achievements of the project. Under these conditions, it is logical to assume that this condition will also be met;
4. The representatives of the state technical services and in particular of the NMHSs who will have benefited from training within the framework of the project will be maintained in their posts throughout the duration of the project and afterwards to contribute to the development of activities in their respective countries. The existing institutional, legal and policy framework of NMHSs and the main challenges and gaps they face will be highlighted and will form the basis for the institutional capacity building actions recommended for the project, suggesting that this condition will also be met.

The WMO and its advisory group (Task Team and Hydrological Coordination Panel (HCP) working groups) will provide support to the project team and the LCBC to carry out regular risk monitoring. Similarly, project activities and recorded results will be monitored, evaluated and reported in the WMO internal monitoring system. Financial and project risk measures will be assessed as a continuous process throughout the development of the project activities. The potential risks identified are listed in Table 15.

**Table 15. Risks and possible mitigation**

<b>Risks</b>	<b>Mitigation actions</b>
Challenges faced by national partners and LCBC in the area of institutional management	Assess gaps and needs in the institutional, policy and legal framework and provide relevant support. Assess training needs and ensure targeted skills development; define a national and regional capacity building strategy. The LCBC has extensive experience in managing projects of this nature. The project will also recruit additional staff and use consultants to carry out some of the project's activities.
Insufficient national funding available for implementation and delays in external resource mobilization	Engage relevant government funding entities early on; identify synergies and linkages with planned and ongoing related programmes and engage potential funding entities early on in project formulation. Build awareness on the economic benefits of efficient monitoring and information delivery. It should also be noted that the LCBC Water Charter requires countries to monitor the water resources of the basin in their national portion of the basin and exchange data with the LCBC. The project therefore supports them in meeting these obligations.
NMHSs may not have the resources and skills to install and maintain the equipment, especially new generation equipment	Identify the difficulties of NMHSs and put in place the necessary technical assistance (LCBC expert or external consultant) to ensure support in the development of activities; Plan an appropriate training programme within the framework of the project for the capacity building of the staff concerned, including innovations.
Equipment installed on the site by the project may be damaged or destroyed due to vandalism	Take this likelihood into account in the choice of equipment types and installation sites. Inform and sensitize the local population and authorities on the usefulness of this equipment for their own interests and for socio-economic development; use local observers as sentinels and as educators for local communities of importance of monitoring stations. Recruit an observer for each observation site to ensure the maintenance and guarding of the equipment. Provide for the supply of spare parts and a contingency reserve, as far as possible with local companies.
Lack of cooperation between NMHSs and the Project Executing Agency, especially regarding data	Provide for the signing of specific collaboration agreements between the Project Executing Agency and the NMHSs' supervisory ministries in the countries participating in the project activities.

sharing, as sometimes happens in this type of project.	A framework for cooperation exists between the member countries of the LCBC since its creation in 1964. Furthermore, the Water Charter of the LCBC requires each country to organize hydrological monitoring in its national part of the basin, and requires the exchange of data between countries and with the regional basin management institution, the LCBC. This is in full agreement with the WMO recommendations on the subject and in particular Resolutions 40 (Cg-XII) and 25 (Cg-XIII) on data exchange. The LCBC can build on these elements to find a solution to the problem. Promote implementation of WMO Unified Data Policy approved by Cg-Ext-2021.
The technologies developed are not accepted by all groups in the community, including gender, age or minority aspects and this hinders equality.	The project includes a socially inclusive and gender, age and minority responsive approach in all activities. Where necessary, non-technological or traditional methods will be adopted to reach and involve each group in the community.
The insecurity situation in the basin	<p>The countries concerned and the international community are working hard to find a solution to the security problems as quickly as possible. An important project on the regional strategy for the stabilization, recovery and resilience of the Lake Chad Basin areas is currently being implemented by the LCBC. It should also be noted that those in charge of the technical services implementing the activities in the countries know the terrain well and can measure the nature of the danger and, like other LCBC projects under development in the basin, finding solutions to circumvent it.</p> <p>Furthermore, the insecurity in the basin is at least partly due to tensions between communities. The easing of such tensions requires a better knowledge/control of resources and production systems which should favor a definition of documented rules, an efficient organization/planning and a better management of space for a more equitable access to the natural resources of the basin. The implementation of the present project activities will contribute to such an appeasement.</p>
A new pandemic situation or a resurgence of the current one in the world (vs. Covid-19) effecting implementation of the project	Executing entities are situated locally in the region which helps the concerns on this aspect. The use of lessons learnt during the covid-19 pandemic and use of remote meetings for steering committees in case of travels restrictions.

### **C. Describe the measures for environmental and social risk management, in line with the Environmental and Social Policy of the Adaptation Fund.**

In the preparation phase of the fully developed proposal, an Environmental Impact Assessment (EIA) and a Social Impact Assessment (SIA) will be carried out (including a baseline gender analysis), to examine the proposed project activities against the 15 principles of the Adaptation Fund's environmental and social policy. These studies will also take into account existing legislation or practices in the five countries participating in the project, as well as the cross-border provisions promoted by the LCBC on environmental and social issues, including gender.

A cross-analysis of the actions planned by the project and field surveys in the national portions of the Lake Chad Basin in the five countries will make it possible to identify the positive and negative impacts of the project. The analysis of these impacts (positive or negative) will make it possible to propose mitigation, compensation, or improvement measures according to the impact categories.

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

Monitoring and evaluation measure the progress and overall impact of project activities through key performance indicators, which will include gender equality and social inclusion KPIs. The programme of actions to be carried out within the framework of the project will include a list of indicators of achievement of these actions as well as the means of verification. The Project Management Unit (PMU) will be made available with monitoring and evaluation tools of project activities and resources. The PMU under the Implementing agencies will ensure that the Executing agencies have adequate resources and capacity to measure and monitor results at the local, national and regional level. The quarterly monitoring and annual evaluation reports of the Executing agencies along with the financial statements and resource management will be submitted to the Implementing agencies and further to the Adaptation Fund Secretariat for the review (Table 16).

**Quarterly report:** Monitoring will be carried out after each trimester and reports will be prepared with key results achieved, issues encountered or potential problems and proposed solutions.

**Annual Report:** Annual report will be prepared to monitor the progress in the time period of twelve months. This will be useful to monitor progress made in different activities. The annual report will be



presented by the programme leader to the Steering committee to assess the overall progress and provide their suggestions or feedback.

**Mid-term Assessment Report:** The project will conduct the mid-term review after two years of kick-off to get the feedback of external experts. Adjustments and/or reorientations of certain activities will then be made if necessary.

**Final Evaluation or Project Termination Report:** Two months prior to the completion of the project, an independent evaluation will be conducted to check the overall impact of the project. The final evaluation report will be developed and presented to the Adaptation Fund secretariat, project steering committee and other stakeholders.

**Table 16. Monitoring and evaluation activities** (Budget estimates will be provided in the fully developed proposal)

Monitoring & Evaluation Activity List	Calendar year																			
	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Design, development and review of Monitoring & Evaluation tools																				
Monitoring the programme activities and outputs																				
Monitoring the activities and reporting the programme outputs																				
Mid-term Evaluation																				
Improvement or additional changes in Evaluation tool																				
Final evaluation																				
Final Project Audit																				

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

The detailed project results framework, which defines the key performance indicators and means of verification for each component and its activities, will be developed in the fully developed proposal.

**F. Demonstrate how the project / programme aligns with the Results Framework of the Adaptation Fund**

The Adaptation Fund Results Framework Outcomes 1, 2,3,4,6,7,8 are covered by the project. A detailed table linking each component outcomes and outputs are found in Annex 3. The exact alignment will be developed in detail in the fully developed proposal.

**G. Include a detailed budget with budget notes, broken down by country as applicable, a budget on the Implementing Entity management fee use, and an explanation and a breakdown of the execution costs.**

The total budget of the Lake Chad project is estimated at USD 10.620 Million for the development of activities in the five participating countries, including an amount of USD 855,000 for project management and an amount of USD 765,000 to cover the expenses of the implementing entity. A detailed budget will be presented in the fully developed proposal. The disbursement schedule will be developed and presented in the fully developed proposal.

**ANNEXES:**

- 1: Table of economic, environmental, and social co-benefits of the project
- 2: Table of alternative options, rationale and benefits for each of the proposed investments and solutions
- 3: Comparison of AF Strategic Results Framework Outcomes and Outputs with proposed project Outcomes and Outputs
- 4: Section cut out from a New Strategy WHYCOS operating model for project sustainability
- 5: Regional stakeholder workshop report 21-22 Ndjama, Chad
- 6: Examples of stakeholder questionnaire forms (three different)
- 7: Initial gender assessment

## PART IV: ENDORSEMENT BY GOVERNMENTS AND CERTIFICATION BY THE IMPLEMENTING ENTITY

### A. Record of endorsement on behalf of the government<sup>1</sup>

Mr. Boris Bemokolo Head of Studies, Climate Change Innovation Fund National Climate Coordination/ Ministry of the Environment and Sustainable Development Bangui <b>CENTRAL AFRICAN REPUBLIC</b>	Date: <i>(April 11th, 2022)</i>
Mr. Porgo Hounly Focal point Adaptation Fund Ministry of the Environment, Water and Fisheries N'Djamena <b>CHAD</b>	Date: <i>(April 13th, 2022)</i>
Mr. Theophile Herve ABA'A ATEBA Sub Director for Environmental Economy Ministry of Environment, Nature Protection and Sustainable Development Yaoundé <b>CAMEROON</b>	Date: <i>(April 7th, 2022)</i>
Dr. Kamayé Maâzou Executive Secretary National Council for Environment and Sustainable Development Niamey <b>NIGER</b>	Date: <i>(April 20th, 2022)</i>
Dr. Iniobong Abiola-Awe Director Department of Climate Change Federal Ministry of Environment Abuja <b>NIGERIA</b>	Date: <i>(April 19th, 2022)</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.

## B. Implementing Entity certification

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 in Cameroon, Central African Republic, Chad, Niger and Nigeria and subject to the approval by the Adaptation Fund Board, commit to implementing the project/programme in compliance with the Environmental and Social Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.

Jean-Paul Gaudechoux  
Head, Regional Strategic Division  
Member Services and Development Department



Implementing Entity Coordinator

Date: April 27th, 2022

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REPUBLIQUE DU CAMEROUN  
Paix – Travail – Patrie

MINISTRE DE L'ENVIRONNEMENT,  
DE LA PROTECTION DE LA NATURE ET  
DU DEVELOPPEMENT DURABLE

SECRETARIAT GENERAL

DIRECTION DE LA PROMOTION DU  
DEVELOPPEMENT DURABLE



REPUBLIC OF CAMEROON  
Peace – Work – Fatherland

MINISTRY OF ENVIRONMENT,  
PROTECTION OF NATURE AND  
SUSTAINABLE DEVELOPMENT

SECRETARIAT GENERAL

DEPARTMENT OF PROMOTION OF  
SUSTAINABLE DEVELOPMENT

N° 001 /LMINEPDED/SG/DPDD/SDE/CO/PPFA

Yaounde, 07 AVR 2022

To:  
The Adaptation Fund Board  
C/o Adaptation Fund Board Secretariat  
Email: Secretariat@Adaptation-Fund.org  
Fax: 202 522 3240/5

Endorsement of the Concept Note of the Project: Integrated Water Resources Management and Early Warning System for Climate Change Resilience in the Lake Chad Basin

As Designated Authority for the Adaptation Fund in the **Republic of Cameroon**, I hereby confirm that the Concept Note of the above regional project is in accordance with the regional priorities of the Government of the Republic of Cameroon, which relates to implementing adaptation measures aimed at curbing the negative impacts and risks posed by climate change in the Republic of Cameroon and the Lake Chad Basin.

Thus, I am pleased to endorse the proposed Concept Note of this Project, submitted to the Adaptation Fund. If approved, the project will be implemented by the World Meteorological Organization (WMO) and executed by the Lake Chad Basin Commission (LCBC) and Global Water Partnership-Central Africa (GWP-CAf).

Yours Sincerely,

**Mr Theophile Hervé ABA'A ATEBA; BSc (Hons)**  
Industrial Chemical and Environmental Engineer,  
Sub Director for Environmental Economy,  
Ministry of the Environment, Nature Protection and Sustainable Development  
P.O Box 320, Yaoundé, Cameroon  
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Theophile Hervé ABA'A ATEBA  
Ingénieur du Génie de l'Environnement et Industriel



MINISTRE DE L'ENVIRONNEMENT ET  
DU DEVELOPPEMENT DURABLE

DIRECTION DE CABINET

COORDINATION NATIONALE CLIMAT

DIRECTION MOBILISATION FONDS  
INNOVANTS



République Centrafricaine  
*Unité - Dignité - Travail*

Bangui le, 11 AVR 2022

N° 001 /MEDD/DIRCAB/CNC/DMFICC.22

### Letter of Endorsement by the Government

To:  
The Adaptation Fund Board  
C/o Adaptation Fund Board Secretariat  
Email: Secretariat@Adaptation-Fund.org  
Fax: 202 522 3240/5

**Endorsement of the Concept Note of the Project: Integrated Water Resources Management and Early Warning System for Climate Change Resilience in the Lake Chad Basin**

As Designated Authority for the Adaptation Fund in the **Central African Republic**, I hereby confirm that the Concept Note of the above regional project is in accordance with the regional priorities of the Government of the Central African Republic, which relates to implementing adaptation measures aimed at curbing the negative impacts and risks posed by climate change in the Central African Republic and the Lake Chad Basin.

Thus, I am pleased to endorse the proposed Concept Note of this Project, submitted to the Adaptation Fund. If approved, the project will be implemented by the World Meteorological Organization (WMO) and executed by the Lake Chad Basin Commission (LCBC) and Global Water Partnership-Central Africa (GWP-CAf).

Yours Sincerely,

**Mr Boris Bemokolo**

Head of Studies, Climate Change Innovation Fund  
National Climate Coordination/Ministry of the Environment and Sustainable Development,  
Bangui, Central African Republic  
Tel: +236 75 09 63 25  
Email: borisbemokolo@yahoo.fr





ADAPTATION FUND

Republic of Chad  
Transitional Military Council  
Presidency of the Republic  
Prime Ministry  
Ministry of Environment, Fishery and Sustainable Development  
General Directorate of the Ministry  
National Designated Authority  
N° 003 /CMT/PR/PM/MEPDD/DGM/AND/2022

**Letter of Endorsement by the Government**

13 April 2022

To:  
The Adaptation Fund Board  
C/o Adaptation Fund Board Secretariat  
Email: [Secretariat@Adaptation-Fund.org](mailto:Secretariat@Adaptation-Fund.org)  
Fax: 202 522 3240/5

**Endorsement of the Concept Note of the Project: Integrated Water Resources Management and Early Warning System for Climate Change Resilience in the Lake Chad Basin**

As Designated Authority for the Adaptation Fund in the **Republic of Chad**, I hereby confirm that the Concept Note of the above regional project is in accordance with the regional priorities of the Government of the Republic of Chad, which relates to implementing adaptation measures aimed at curbing the negative impacts and risks posed by climate change in the Republic of Chad and the Lake Chad Basin.

Thus, I am pleased to endorse the proposed Concept Note of this Project, submitted to the Adaptation Fund. If approved, the project will be implemented by the World Meteorological Organization (WMO) and executed by the Lake Chad Basin Commission (LCBC) and Global Water Partnership-Central Africa (GWP-CAf).

Yours Sincerely,

  
**Mr Porgo Hounly**  
Focal point Adaptation Fund  
Ministry of the Environment, Water and Fisheries  
Njamena, Chad  
Tél. : +235 66 10 10 27  
Email : [porgohounly@yahoo.fr](mailto:porgohounly@yahoo.fr)





ADAPTATION FUND

REPUBLIQUE DU NIGER



*Fraternité – Travail – Progrès*

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CABINET DU PREMIER MINISTRE

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CONSEIL NATIONAL DE L'ENVIRONNEMENT POUR UN DEVELOPPEMENT DURABLE  
SECRETARIAT EXECUTIF

**Letter of Endorsement by the Government**

20 April 2022

To:  
The Adaptation Fund Board  
C/o Adaptation Fund Board Secretariat  
Email: [Secretariat@Adaptation-Fund.org](mailto:Secretariat@Adaptation-Fund.org)  
Fax: 202 522 3240/5

**Endorsement of the Concept Note of the Project: Integrated Water Resources Management and Early Warning System for Climate Change Resilience in the Lake Chad Basin**

As Designated Authority for the Adaptation Fund in the **Republic of Niger**, I hereby confirm that the Concept Note of the above regional project is in accordance with the regional priorities of the Government of the Republic of Niger, which relates to implementing adaptation measures aimed at curbing the negative impacts and risks posed by climate change in the Republic of Niger and the Lake Chad Basin.

Thus, I am pleased to endorse the proposed Concept Note of this Project, submitted to the Adaptation Fund. If approved, the project will be implemented by the World Meteorological Organization (WMO) and executed by the Lake Chad Basin Commission (LCBC) and Global Water Partnership-Central Africa (GWP-CAf).

Yours Sincerely,

**Dr Kamayé Maâzou**  
Executive Secretary,  
National Council for Environment and Sustainable Development  
P.O. Box : 10193, Niamey, Niger  
Tél : +227 20722559; Mobile : +227 96987470  
E-mail: [kamayemaazou@yahoo.fr](mailto:kamayemaazou@yahoo.fr)







# FEDERAL MINISTRY OF ENVIRONMENT

**HEADQUARTERS, MABUSHI, ABUJA.**

Letter of Endorsement by the Government

Ref: No. FMENV/DCC/ADF/003/I

Date 19<sup>th</sup> April, 2022

To:

The Adaptation Fund Board

C/o Adaptation Fund Board Secretariat

Email: Secretariat@Adaptation-Fund.org

Fax: 202 522 3240/5

**Endorsement of the Concept Note of the Project: Integrated Water Resources  
Management and Early Warning System for Climate Change Resilience in the  
Lake Chad Basin**

As Designated Authority for the Adaptation Fund in the **Federal Republic of Nigeria**, I hereby confirm that the Concept Note of the above regional project is in accordance with the regional priorities of the Government of the Federal Republic of Nigeria, which relates to implementing adaptation measures aimed at curbing the negative impacts and risks posed by climate change in the Federal Republic of Nigeria and the Lake Chad Basin.

Thus, I am pleased to endorse the proposed Concept Note of this Project, submitted to the Adaptation Fund. If approved, the project will be implemented by the World Meteorological Organization (WMO) and executed by the Lake Chad Basin Commission (LCBC) and Global Water Partnership-Central Africa (GWP-CAf).

Yours Sincerely,

①.

**Iniobong Abiola-Awe Ph.D.**

Director, Department of Climate Change

Federal Ministry of Environment

Abuja-Nigeria

Email: iniabiolawe@yahoo.co.uk

Tel: +2348034452959



## Project Formulation Grant (PFG)

Submission Date: 27 April, 2022

Adaptation Fund Project ID:

Countries:

Title of Project:

Cameroon, Central African Rep., Chad, Niger, Nigeria  
Integrated water resources management and early warning  
system for climate change resilience in the Lake Chad  
Basin

Type of IE (NIE/MIE):

Implementing Entity:

Executing Entities:

Multilateral implementing entity  
World Meteorological Organization (WMO)  
Lake Chad Basin Commission (LCBC), Global Water  
Partnership Central Africa (GWP-CAf)

### A. Project Preparation Timeframe

Start date of PFG	<b>August 2022</b>
Completion date of PFG	<b>January 2023</b>

### B. Proposed Project Preparation Activities (\$)

Describe the PFG activities and justifications:


List of Proposed Project Preparation Activities	Outputs of the PFG Activities	USD Amount
<ul style="list-style-type: none"> <li>Hire consultants to organize and conduct consultations/interviews with agencies, partners and stakeholders in the Lake Chad Basin to understand in more detail user needs for services and to create linkages with existing projects, available services and communication channels.</li> </ul>	<ul style="list-style-type: none"> <li>Meetings and consultations are successfully conducted, documented and shared with WMO and executing partners.</li> <li>User needs and communication need is better understood and incorporated in the project activities.</li> <li>Linkages and synergies with other projects are fully utilized in the fully developed proposal.</li> </ul>	20,000 USD
<ul style="list-style-type: none"> <li>Arrange at least one regional consultation workshop with project partners (executing and implementing agencies) and all five participating countries, potential new collaborators, and national beneficiaries with a possibility to have separate</li> </ul>	<ul style="list-style-type: none"> <li>Roles and responsibilities of each stakeholder well assigned/defined and timetable of activities agreed.</li> <li>Budget estimates of activities agreed.</li> </ul>	30,000 USD

consultations at national level if needed to clarify activities proposed and roles of the partners. To foster sustainability and the ownership of the project in the region.	<ul style="list-style-type: none"> <li>Partners' activities are allocated.</li> <li>Project sustainability and ownership plan is adopted with countries and partners.</li> </ul>	
<ul style="list-style-type: none"> <li>Hire consultants to contribute to the development of the environmental and social risks management plan of the Lake Chad Basin through the Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA) study aligning with the Environmental and Social Policy (ESP) of the Adaptation Fund and to fully include gender aspects in the proposal according to Adaptation Fund Gender Policy (GP) and Gender Action Plan (GAP)</li> </ul>	<ul style="list-style-type: none"> <li>EIA and SIA studies are carried out jointly with the National and Regional stakeholders and joint report is shared.</li> <li>Environmental and social risks management plan is available and included in the fully developed proposal.</li> <li>Identified gender aspects are fully included in the fully developed proposal.</li> </ul>	30,000 USD
Total Project Formulation Grant		80,000 USD *

\* : the amount is inclusive of 7% fee for the Implementing entity

### C. Implementing Entity

This request has been prepared in accordance with the Adaptation Fund Board's procedures and meets the Adaptation Fund's criteria for project identification and formulation

Implementing Entity Coordinator, IE Name	Signature	Date (Month, day, year)	Project Contact Person	Telephone	Email Address
Jean-Paul Gaudechoux		27/04/2022	Johanna Korhonen	+412273 08311	<a href="mailto:jpgaudechoux@wmo.int">jpgaudechoux@wmo.int</a>
Head Regional Strategic Division Member Services and Development Department			Scientific officer, Earth System Monitoring Division	+412273 08470	<a href="mailto:jkorhonen@wmo.int">jkorhonen@wmo.int</a>