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Report No: PAD5061

INTERNATIONAL DEVELOPMENT ASSOCIATION

PROJECT APPRAISAL DOCUMENT
ON A
PROPOSED GRANT

IN THE AMOUNT OF SDR 112.9 MILLION
(US$150.0 MILLION EQUIVALENT)

TO THE

REPUBLIC OF CHAD

FOR A

N'DJAMENA URBAN RESILIENCE PROJECT

March 9, 2023

Urban, Resilience And Land Global Practice
Western and Central Africa Region

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CURRENCY EQUIVALENTS

(Exchange Rate Effective February 28, 2023)

Currency Unit =	Franc CFA
XAF 620.2 =	US$1
SDR 0.7525 =	US$1

FISCAL YEAR
January 1 - December 31

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ABBREVIATIONS AND ACRONYMS

AAAP	Africa Adaptation Acceleration Program
AFD	*Agence Française de Développement* (French Development Agency)
AM	Accountability Mechanism
ANAM	*Agence Nationale de la Météorologie* (National Meteorological Agency)
CA	*Comités d'Assainissement* (Sanitation Committees)
CAR	Central African Republic
CCDR	Country Climate and Development Report
CDD	Community-Driven Development
CEN	Country Engagement Note
CERC	Contingent Emergency Response Component
CoC	Code of Conduct
CPF	Country Partnership Framework
CREWS	Climate Risk and Early Warning Systems
CRI	Corporate Results Indicator
CSCP	*Cellule de Suivi et de Coordination des Projects* (Project Coordination and Monitoring Unit)
CTP	*Comité Technique de Preparation* (Technical Preparation Committee)
DA	Designated Account
DRE	*Direction des Ressources en Eau* (Water Resources Directorate)
DRM	Disaster Risk Management
DTC	Data Treatment Center
E&S	Environmental and Social
EHS	Environmental Health and Safety
EU	European Union
ESCP	Environmental and Social Commitment Plan
ESIA	Environment and Social Impact Assessment
ESMF	Environmental and Social Framework
ESMP	Environmental and Social Management Plan
ESRS	Environmental and Social Review Summary
ESS	Environmental and Social Standard
EWS	Early Warning System
FCS	Fragile and Conflict-affected Situation
FCV	Fragility, Conflict, and Violence
FM	Financial Management
FMS	Financial Management Specialist
GBV	Gender-based Violence
GCA	Global Center on Adaptation
GCRF	Global Crisis Response Framework
GDP	Gross Domestic Product
GEMS	Geo-enabling Initiative for Monitoring and Supervision
GM	Grievance Mechanism

GoC	Government of Chad
GP	Global Practice
GRID+	Green, Resilient, Inclusive Development, and Competitive Cities
GRS	Grievance Redress Service
HCI	Human Capital Index
HEIS	Hands-on Expanded Implementation Support
HSE	Health, Safety, and Environment
ICR	Implementation Completion and Results Report
IDA	International Development Association
IDP	Internally Displaced Person
IFR	Interim Financial Report
IGN FI	*Institut Géographique National France International* (National Geographic Institute France International)
IOM	International Organization for Migration
IPF	Investment Project Financing
IRR	Internal Rate of Return
ISM	Implementation Support Mission
ISP	Implementation Support Plan
ITCZ	Inter-Tropical Convergence Zone
LCBC	Lake Chad Basin Commission
LMP	Labor Management Procedures
M&E	Monitoring and evaluation
MATDBG	*Ministère de l'Administration du Territoire, de la Décentralisation et de la Bonne Gouvernance* (Ministry of Territorial Administration, Decentralization and Good Governance)
MATUH	*Ministère de l'Aménagement du Territoire, de l'Urbanisme et de l'Habitat* (Ministry of Territorial Development, Urban Planning and Housing)
MEA	*Ministère de l'Eau et de l'Assainissement* (Ministry of Water and Sanitation)
MID	*Ministère des Infrastructures et du Désenclavement* (Ministry of Infrastructure and Access Improvement)
MPEPI	*Ministère de la Prospective Economique et des Partenariats Internationaux* (Ministry of Economic Forecasting and International Partnerships)
MTR	Mid-Term Review
NBS	Nature-based solution
ND-GAIN	Notre Dame Global Adaptation Initiative
NDP	National Development Plan
NGO	Non-governmental Organization
NPV	Net Present Value
O&M	Operations and Maintenance
ORSEC	*Organisation de la Réponse de Sécurité Civile* (Civil Security Disaster Response Plan)
PACAJ	*Projet d'Aménagement du Canal des Jardiniers* (Canal des Jardiniers Development Project)
PAUIN	*Projet d'Appui Urgence Inondations de N'Djaména* (N'Djamena Flood Emergency Support Project)
PDO	Project Development Objective

PEAN	*Projet de renforcement de l'accès à l'eau et à l'assainissement à N'Djamena* (Project to Strengthen Access to Water and Sanitation in N'Djamena)
PFM	Public Financial Management
PIU	Project Implementation Unit
POM	Project Operational Manual
PPA	Project Preparation Advance
PPSD	Project Procurement Strategy for Development
PR	Procurement Regulations
PRA	Prevention and Resilience Allocation
PRAMS	Procurement Risk Assessment Management System
PSC	Project Steering Committee
QII	Quality Infrastructure Investment
RAP	Resettlement Action Plan
RF	Resettlement Framework
RPF	Resettlement Policy Framework
RRA	Risk and Resilience Assessment
SCD	Systematic Country Diagnostic
SDAP	*Schéma Directeur de l'Assainissement Pluvial* (Pluvial Flood Risk Management Master Plan)
SDAPF	*Schéma Directeur de l'Assainissement Pluvial and Fluvial* (Pluvial and Fluvial Flood Risk Management Master Plan)
SEA/SH	Sexual Exploitation and Abuse / Sexual Harassment
SEP	Stakeholder Engagement Plan
SoE	Statement of Expenditures
SOP	Standard Operating Procedure
STEP	Systematic Tracking of Exchanges in Procurement
SWM	Solid Waste Management
TA	Technical Assistance
TC	Technical Committee
TOR	Terms of Reference
UNHCR	United Nations High Commissioner for Refugees
UNOPS	United Nations Office for Project Services
WA	Withdrawal Applications
WB	World Bank
WBG	World Bank Group

TABLE OF CONTENTS

DATASHEET **1**

I. STRATEGIC CONTEXT **7**

A. Country Context 7

B. Sectoral and Institutional Context 9

C. Relevance to Higher Level Objectives 14

II. PROJECT DESCRIPTION **15**

A. Project Development Objective 15

B. Project Components 15

C. Project Beneficiaries 27

D. Results Chain 28

E. Rationale for World Bank Involvement and Role of Partners 28

F. Lessons Learned and Reflected in the Project Design 29

III. IMPLEMENTATION ARRANGEMENTS **30**

A. Institutional and Implementation Arrangements 30

B. Results Monitoring and Evaluation Arrangements 32

C. Sustainability 32

IV. PROJECT APPRAISAL SUMMARY **33**

A. Technical, Economic and Financial Analysis (if applicable) 33

B. Fiduciary 34

C. Legal Operational Policies 37

D. Environmental and Social 37

V. GRIEVANCE REDRESS SERVICES **41**

VI. KEY RISKS **42**

VII. RESULTS FRAMEWORK AND MONITORING **45**

ANNEX 1: Implementation Arrangements and Support Plan **55**

ANNEX 2: Climate Co-Benefits **66**

ANNEX 3: Priority Investments under Subcomponent 1.1 ..... **73**

ANNEX 4: Solid Waste Value Chain **82**

ANNEX 5: Detailed Economic Analysis **84**

DATASHEET

BASIC INFORMATION

Country(ies)	Project Name	
Chad	N'Djamena Urban Resilience Project	
Project ID	**Financing Instrument**	**Environmental and Social Risk Classification**
P177044	Investment Project Financing	Substantial

Financing & Implementation Modalities

[ ] Multiphase Programmatic Approach (MPA)	[✓] Contingent Emergency Response Component (CERC)
[ ] Series of Projects (SOP)	[✓] Fragile State(s)
[ ] Performance-Based Conditions (PBCs)	[ ] Small State(s)
[ ] Financial Intermediaries (FI)	[ ] Fragile within a non-fragile Country
[ ] Project-Based Guarantee	[ ] Conflict
[ ] Deferred Drawdown	[ ] Responding to Natural or Man-made Disaster
[ ] Alternate Procurement Arrangements (APA)	[ ] Hands-on Enhanced Implementation Support (HEIS)

Expected Approval Date	Expected Closing Date
31-Mar-2023	31-Aug-2029

Bank/IFC Collaboration

No

Proposed Development Objective(s)

The Project Development Objective (PDO) is to reduce flood risk and strengthen climate resilient urban planning and selected flood-related services in N'Djamena.

Components

Component Name	Cost (US$, millions)

Flood protection and drainage infrastructure	90.00
Climate Resilient Urban Planning, Services and Community Investments	50.00
Project management and monitoring	10.00
Contingent Emergency Response Component	0.00

Organizations

Borrower:	Republic of Chad
Implementing Agency:	Ministry of Territorial Development, Urban Planning and Housing

PROJECT FINANCING DATA (US$, Millions)

SUMMARY

Total Project Cost	150.00
Total Financing	150.00
of which IBRD/IDA	150.00
Financing Gap	0.00

DETAILS

World Bank Group Financing

International Development Association (IDA)	150.00
IDA Grant	150.00

IDA Resources (in US$, Millions)

	Credit Amount	Grant Amount	SML Amount	Guarantee Amount	Total Amount
Chad	0.00	150.00	0.00	0.00	150.00
National Performance-Based Allocations (PBA)	0.00	150.00	0.00	0.00	150.00
Total	**0.00**	**150.00**	**0.00**	**0.00**	**150.00**

Expected Disbursements (in US$, Millions)

WB Fiscal Year	2023	2024	2025	2026	2027	2028	2029	2030
Annual	0.00	8.10	30.80	44.70	34.39	25.64	6.37	0.00
Cumulative	0.00	8.10	38.90	83.60	117.99	143.63	150.00	150.00

INSTITUTIONAL DATA

Practice Area (Lead)

Urban, Resilience and Land

Contributing Practice Areas

Environment, Natural Resources & the Blue Economy, Fragile, Conflict & Violence

Climate Change and Disaster Screening

This operation has been screened for short and long-term climate change and disaster risks

SYSTEMATIC OPERATIONS RISK-RATING TOOL (SORT)

Risk Category	Rating
1. Political and Governance	High
2. Macroeconomic	Substantial
3. Sector Strategies and Policies	Substantial
4. Technical Design of Project or Program	Substantial
5. Institutional Capacity for Implementation and Sustainability	High
6. Fiduciary	Substantial
7. Environment and Social	Substantial
8. Stakeholders	Moderate
9. Other	Substantial
10. Overall	High

COMPLIANCE

Policy

Does the project depart from the CPF in content or in other significant respects?

[ ] Yes [✓] No

Does the project require any waivers of Bank policies?

[ ] Yes [✓] No

Environmental and Social Standards Relevance Given its Context at the Time of Appraisal

E & S Standards	Relevance
Assessment and Management of Environmental and Social Risks and Impacts	Relevant
Stakeholder Engagement and Information Disclosure	Relevant
Labor and Working Conditions	Relevant
Resource Efficiency and Pollution Prevention and Management	Relevant
Community Health and Safety	Relevant
Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	Relevant
Biodiversity Conservation and Sustainable Management of Living Natural Resources	Relevant
Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	Not Currently Relevant
Cultural Heritage	Relevant
Financial Intermediaries	Not Currently Relevant

NOTE: For further information regarding the World Bank's due diligence assessment of the Project's potential environmental and social risks and impacts, please refer to the Project's Appraisal Environmental and Social Review Summary (ESRS).

Legal Covenants

Sections and Description

Financing Agreement, Schedule 2, Section I A.4: Not later than three (3) months after the Effective Date, the Recipient shall recruit a monitoring and evaluation specialist and an internal auditor, both under terms of reference and with qualifications and experience acceptable to the Association.

Sections and Description
Financing Agreement, Schedule 2, Section I, E, 1: The Recipient shall, not later than one (1) month after the Effective Date prepare and furnish to the Association for its approval, the annual work plan and budget containing all proposed activities for inclusion in the Project ("Annual Work Plan and Budget" or "AWPB")

Sections and Description
Per ESCP, the Recipient will adopt the Environmental and Social Audit (ESA) within thirty (30) days after project effectiveness and thereafter implement ESA recommendations throughout Project implementation

Sections and Description
Per ESCP, the GM that is prepared for the SEP (that shall integrate resettlement issues) shall be operational no later than ninety (90) days after the Effective Date, the same timeframe as action 10.2 of ESCP.

Sections and Description
Per ESCP, establish the grievance mechanism no later than ninety (90) days after the Effective Date and prior to the start of project activities, and thereafter maintain and operate the mechanism throughout Project implementation.

Conditions

Type	Financing source	Description
Effectiveness	IBRD/IDA	The Recipient has established the Project Implementation Unit ("PIU") in form, manner, and with terms of reference and resources, all satisfactory to the Association, and in accordance with Section I.A.3 of Schedule 2 to the Financing Agreement.
Effectiveness	IBRD/IDA	The Recipient has established a Project Steering Committee in form, manner, and with terms of reference and resources, all satisfactory to the Association, and in accordance with Section I.A.2 of Schedule 2 to the Financing Agreement
Effectiveness	IBRD/IDA	The Recipient has prepared and adopted the Project Operations Manual (POM), in form and manner satisfactory to the Association, and in accordance with Section I.B. of Schedule 2 to the Financing Agreement.
Effectiveness	IBRD/IDA	The Recipient has prepared a Security Risk Assessment and included it as an annex to the Environmental and Social Management

		Framework ("ESMF"), and disclosed the updated ESMF, all in form and manner satisfactory to the Association.
Type Disbursement	Financing source IBRD/IDA	Description Notwithstanding the provisions of Part A of this Section, no withdrawal shall be made: under Category (2), unless a Service Provider has entered into a Service Provider Agreement with a Service Provider, in accordance with Section I.C of Schedule 2 to this Agreement.

I. STRATEGIC CONTEXT

A. Country Context

1. **Chad is a landlocked, low-income country of 15.9 million people.** The country is administratively divided into 23 provinces located in three main geographical zones: a desert zone in the north, an arid Sahelian belt in the center, and a more fertile savanna zone in the south. Its gross domestic product (GDP) per capita (in constant 2010 US dollars) was US$710 in 2019, which is lower than the average in low-income countries (US$840) and in Sub-Saharan Africa (US$1,590). The annual population growth in Chad is 3.1 percent. Two-thirds of the population are under the age of 25 and 77 percent live in rural areas. Chad is the third largest country by land mass in Sub-Saharan Africa and has a relatively low population density of 13 persons per square kilometer.[1]

2. **Chad remains among the least developed countries in the world.** The economic contraction since 2015 is preventing the country from reducing poverty and improving development outcomes. While the economy grew robustly during the period of 2010–2014 (roughly 7 percent per annum), was hit hard by the collapse in oil prices in 2014–2015, which introduced a period of low and negative growth such that in real terms, GDP per capita in 2020 (US$635) was less than in 2011 (US$700).[2] The economy is dominated by agriculture and extractive industries, mainly oil. The Systemic Country Diagnostic (SCD) update has identified eight binding constraints: (i) weak human capital and slow demographic transition; (ii) low productivity in rural areas; (iii) low infrastructure investment and low access to basic services; (iv) gender inequality; and (v) weak quality of public administration services. Increasing insecurity and conflict, oil revenue volatility, inadequate macroeconomic management of economic shocks, unsustainable debt; and vulnerability to climate change are additional binding constraints. [3]

3. **Poverty, which has gradually declined since 2003, increased in 2020 due to COVID-19 and has since remained high.** Between 2003 and 2018, the monetary poverty rate fell from 54 to 42 percent together with the depth and severity of poverty. About 6.5 million people lived below the national poverty line in 2018, of whom 2.4 million were in extreme poverty. The pandemic is estimated to have pushed an additional 800,000 people into poverty in 2020.[4] Poverty and inequality vary substantially across regions, with a deep divide between rural and urban areas. Poverty is concentrated in rural areas where almost 90 percent of the poor live.

4. **The quality of public administration services in Chad is weak and has deteriorated since 2015.** Basic service delivery is limited, costly, and challenged by Chad's vast land area and its dispersed population. Government effectiveness is constrained by high staff turnover and limited public administration capacity, which hinders policy consistency, insufficient regulation, a concentration of resources and decision-making in the capital city, the failure to harness oil revenues for productive purposes, and vulnerability to shocks. These governance-related challenges underpin inequitable resource distribution and social exclusion, limit economic diversification, and stoke conflict.

5. **The country's Human Capital Index (HCI) has remained low during the last decade.** The HCI for Chad went from 0.29 in 2019 to 0.30 in 2020. Despite this small increase, Chad's HCI is lower than the average for Sub-Saharan Africa and

[1] Food and Agriculture Organization and World Bank population estimates (2021). See *https://data.worldbank.org/indicator/EN.POP.DNST?locations=TD.*
[2] World Bank (2021), World Development Indicators (database). GDP per capita (constant 2015 US$). See *https://databank.worldbank.org/reports.aspx?source=2&series=NY.GDP.MKTP.KD&country=TCD.*
[3] Tchana Tchana, Fulbert; Savadogo, Aboudrahyme; Noumedem Temgoua, Claudia. 2022. Boosting Shared Prosperity in Chad: Pathways Forward in a Landlocked Country Beset by Fragility and Conflict. Systematic Country Diagnostics. Washington, DC: World Bank. © World Bank. *https://openknowledge.worldbank.org/handle/10986/38236* License: CC BY 3.0 IGO
[4] Ibid.

for low-income countries.[5] This means that a child born in Chad today will be 30 percent as productive when she/he grows up as could be if enjoying complete education and full health. This is driven largely by the low probability of survival to age 5 (88 per 100 children born), high levels of stunting (40 percent of children), and poor enrollment and quality of education. In fact, a child in Chad can be expected to complete only 5.3 years of school by the age of 18. Factoring in the actual school curriculum, this is the equivalent of only 2.8 years of schooling. An additional reduction in years of schooling is expected given school closures during the COVID-19 pandemic.

6. **Chad is the third most vulnerable country in the world to climate change.** The country is highly vulnerable to climate-related shocks including prolonged droughts, yearly floods, wind erosion and desertification, which contribute to recurrent food crises and population displacements while at the same time displaying low levels of preparedness to prepare and respond to extreme events. Thus, Chad ranks 182 out of 182 in the Notre Dame Global Adaptation Initiative (ND-GAIN) index due to its extremely high vulnerability levels and low levels of readiness to adapt to climate change.[6] Climate change is expected to increase the mean temperatures in the Sahel between 3-6°C by 2100 while rainfall patterns showcase already high intra-annual and interdecadal variability. On average, the region will experience 60 additional days with a heat index over 35 degrees Celsius by 2060. In Chad's western, northern and eastern provinces, temperature increases are projected to be 1.5 times higher than in the rest of the world. Besides, rainfall volatility is likely to increase with climate change. In recent years, a greater share of annual precipitations has happened through extreme precipitation days in N'Djamena, but it is too early to distinguish the share of climate change and interdecadal variability behind this phenomenon. The country also faces severe environmental degradation, increased desertification, declining fish stocks, disappearance of species, and soil degradation. According to the World Bank's G5 Sahel Region Country Climate and Development Report (CCDR),[7] due to climate change as compared to a medium-growth baseline, Chadian annual GDP could be reduced by 10.5 percent under a dry-pessimistic scenario (third-worse among the G5 Sahelian countries), and 4.2 percent under a wet-pessimistic scenario (second-worse together with Niger), thus wiping out most of annual GDP and GDP per capita growth. Given this impact and the economic needs of each country in the Sahel, the report emphasizes that growth and development are the best adaptation mechanisms for these five countries. An emphasis on energy access, better management of natural capital (water, environment, and agriculture) as well as cities are highlighted in the report.

7. **Chad is classified as a fragile and conflict-affected situation (FCS) with high levels of institutional and social fragility.** Chad's fragility stems from both external and internal factors. Regional conflict spillovers from Sudan, Libya, Central African Republic (CAR), Nigeria, and Cameroon are causing chronic instability on Chad's border. Since 2015, Chad has known a significant rise in conflict and violence, mainly due to Boko Haram attacks in the Lake Chad region. These factors have caused substantial forced displacements. As of May 2022, there were 578,842 refugees (mainly from Sudan and CAR), and 381,289 internally displaced persons (IDPs).[8] Chad also has structural fragility drivers such as non-inclusive governance, weak rule of law, elite capture in the oil sector, regional imbalances between the capital and Chad's peripheral regions, as well as the political and economic exclusion of women and youth and increasing intra-communal tensions due to competition over natural resources. The level of political violence in the N'Djamena region has risen significantly since 2016. The political transition, which started in April 2021 with the sudden death of President Deby Itno who ruled Chad for 30 years, represents an opportunity to build the foundations for long-term peace, but is also fraught with challenges. The FCS in Chad is likely to further exacerbate the impacts of natural and climate-related disasters in N'Djamena by reducing the city population's coping capacity to mitigate, respond and recover from disaster events.

8. **Chad has some of the starkest gender disparities in the world.** Chad ranks 160th out of 162 countries on the

[5] World Bank Human Capital Project Report (2020).
[6] *https://gain.nd.edu/our-work/country-index/rankings*
[7] *https://openknowledge.worldbank.org/entities/publication/50936c70-3771-5618-8b3e-52e7c01be5f8*
[8] United Nations High Commissioner for Refugees (UNHCR), Operational Data Portal. See: *https://data2.unhcr.org/en/situations*.

Gender Inequality Index based on reproductive health, empowerment, and employment status and 148th out of 156 countries on the Global Gender Gap Index. Large gender gaps in agricultural productivity, enterprise performance, and employment linked to differences in endowments are also evident. Gender inequalities in education and health, land access, the use of financial services and technology, and the ability to participate in the full range of socioeconomic activities have profound consequences for household productivity, income diversification, and intergenerational economic mobility. The gender gap is larger in urban areas, where there is no agricultural sector to absorb low skilled workers.

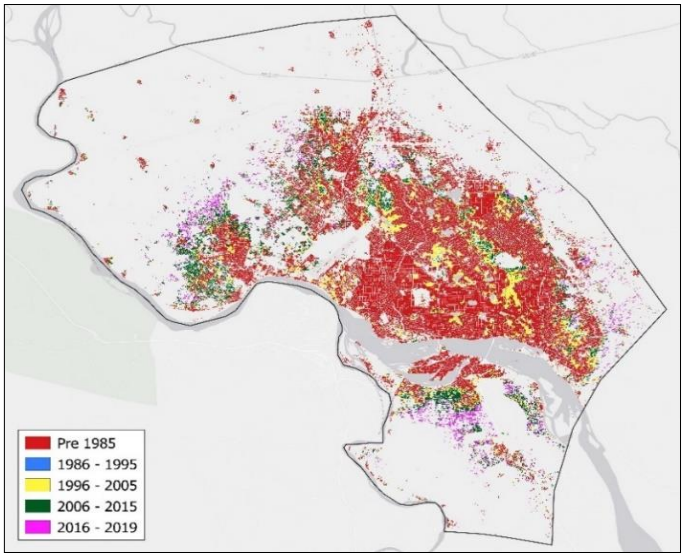
B. Sectoral and Institutional Context

9. **Chad's capital, N'Djamena, is highly exposed to climate-related risks associated with pluvial and riverine floods.** The city is located about 100 km south of Lake Chad, at the border with Cameroon, in a flat alluvial plain at the confluence of the Chari and Logone rivers. Most of the city is located on the right bank of the Chari, north of the river, with a declivity of about 4 m over 40 km, oriented towards the north rather than the natural outlet constituted by the Chari. Most of the built-up in the city is located in a flood-prone area even if alluvial deposits, consolidated as the Lake Chad receded over centuries, have provided natural dikes that have been used since the 1960s to protect the city against flooding. Floods in N'Djamena have a very specific dynamic, which evolves throughout the rainy season from predominantly pluvial to fluvial floods. N'Djamena is characterized by a monomodal wet season that lasts from May to October. As a result of this hydrological regime, coupled with the local geology and geomorphology, pluvial floods can start impacting the city early in the wet season; as river levels rise, a period of compound fluvial and pluvial flood risk generally follows in September, with the risk diminishing only when the river levels drop as the dry season settles. While the city's flood challenges can be partly attributed to the city's geological dispositions with a low water absorption capacity, other factors include weak and, in some areas, inexistant flood protection infrastructure, deficient operations and maintenance (O&M) of existing drainage systems, weak urban planning in a context of rapid urbanization, limited flood preparedness and response, as well as the accumulation of solid waste, in particular plastic, clogging drainage channels.[9]

10. **N'Djamena's population is growing rapidly in a context of a weak urban planning, which has resulted in an increase of settlements in flood-prone areas.** With a population estimated at more than 1.23 million inhabitants and growing at a rate of 4 percent to 6 percent per year (slightly above national urban growth rates), the city counts almost five times the population of Moundou, the second largest city in the country. Chad's total population is expected to double by 2030, with roughly half of this increase projected to take place in N'Djamena. Confronted with this challenge, the city's urban management and planning system currently lacks technical and human resource capacity for effective land use control that would prevent encroachment in non-constructible areas. This is largely due to outdated urban planning instruments that do not incorporate disaster and climate-risk management considerations, as well as limited human and material resources to effectively engage in land use management and urban planning. As a result, the city is suffering from uncontrolled, often informal urban sprawling in flood-prone areas in former riverbeds (see Figure 1), especially on the left bank of the Chari in the Walia-Toukra neighborhood (9th district).

[9] These challenges were identified in a World Bank (WB) Policy Note on Urban Resilience in Chad, which was finalized in September 2021 and is providing the analytical basis for the preparation of this operation.

Figure 1. Expansion of built-up areas in N'Djamena between 1985 and 2019



Source: World Settlement Footprint DLR (2021).

11. **The city has a fragmented institutional framework for urban resilience and limited capacity for flood risk management.** The Municipality of N'Djamena plays a key role in solid waste management (SWM) in the city and in the identification and prioritization of investments but lacks technical, planning and financial capacity. The Ministry of Territorial Development, Urban Planning and Housing (*Ministère de l'Aménagement du Territoire, de l'Urbanisme et de l'Habitat,* MATUH) is traditionally the delegated project implementation unit (PIU) for infrastructure works implemented in the city, including flood infrastructure (e.g. retention basins and drainage networks), and is in charge of urban planning (including identification and prioritization of drainage and other flood protection infrastructure investments) While these institutions play an active role in urban resilience and flood risk management, there is no formally established platform to coordinate and align interventions. In addition, they suffer from limited human and material resources as well as weak technical capacity in the areas of public administration (e.g., procurement, financial management (FM), monitoring and evaluation (M&E)), investment planning and execution, communication, and information sharing.

12. **Despite several recent initiatives, existing flood protection infrastructure in N'Djamena remains insufficient and ill-suited to the urbanization of the past decade.** In 2012, the Urban Drainage Master Plan (*Schéma Directeur de l'Assainissement Pluvial*, SDAP) for N'Djamena's city center was updated under the Chad Urban Development Project (P072030, 2007-2015), and several studies for flood risk reduction infrastructure were subsequently developed. However, the SDAP does not consider the newest urban neighborhoods, does not focus on fluvial flooding, and only a very limited part of the proposed infrastructure was ultimately implemented. In response to the 2020 floods, an infrastructure mapping and prioritization exercise to increase the city's resilience to floods was prepared, but most of its suggested investments lack of funding and were finally not implemented. As a result, the city's drainage and flood protection infrastructure remains insufficient across the city's key flood hotspots:

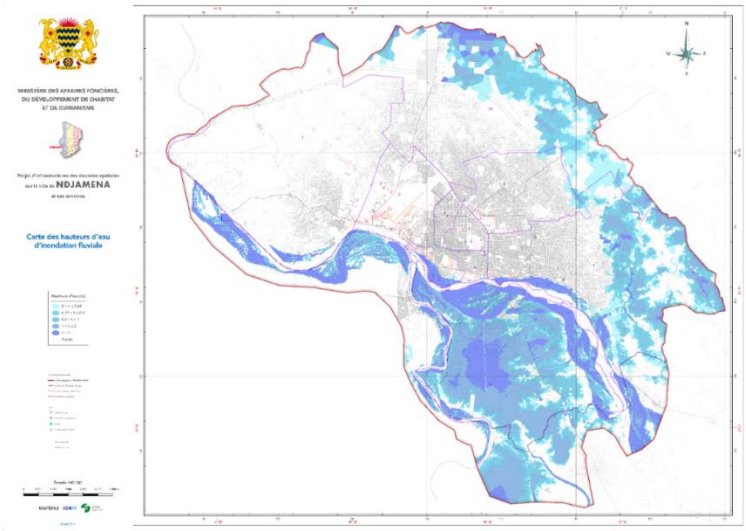
a. **Historical center.** The vast majority of drainage infrastructure is located in the historical center on the right bank of the Chari River, inside a first bypass road. Some additional works are ongoing in this area, including through the Canal des Jardiniers Development Project (*Projet d'Aménagement du Canal des Jardiniers*, PACAJ) of the French Development Agency (*Agence Française de Développement,* AFD), but retrofitting of

retention basins and pumping stations and additional tertiary networks and outlets on the Chari are needed. Besides, the Chari riverbanks are eroding, leading to worries about future fluvial floods in the 1st, 3rd, 6th, and 7th districts. Further, in the Am Riguébé water basin, to the north of the historical center, water flows northward in an unplanned manner rather than towards the Chari.

b. **East and northeast.** To the east in the Gassi neighborhood, where most of the current urbanization of the right bank is happening, little infrastructure exists and ongoing works to direct water towards the Chari suffer from a lack of planning and proper design, as exemplified by a recent canal, built without sufficient planning and requiring the addition of an unplanned pumping station. To the northeast, AFD's Project to Strengthen Access to Water and Sanitation in N'Djamena (*Projet de renforcement de l'accès à l'eau et à l'assainissement à N'Djamena*, PEAN) (see paragraph 18), consisting of two retention basins and a primary canal gearing water towards the Lamadji pumping station, the main outlet for water flowing away from the Chari on the right bank, suffers from under-design as evidenced during the 2022 floods: the retention basins overflowed, and the absence of a secondary drainage network left many inhabitants flooded.

c. **Walia-Toukra.** Even though there exists no comprehensive flood hazard and risk assessment, a pilot modeling exercise on fluvial floods (see Figure 2) led by the Government in partnership with the National Geographic Institute France International (*Institut Géographique National France International,* IGN FI), exchanges with Chadian authorities, field visits and satellite imagery of the recent 2020 and 2022 floods, it can be inferred that the 9th district on the left bank of the Chari River (Walia Toukra neighborhood) is particularly exposed to pluvial and fluvial flooding. This neighborhood suffers from inadequate dikes and retentions areas and the absence of a drainage network in a context of massive yet unplanned urbanization in the former riverbeds between the Chari and the Logone.

Figure 2. Results from a pilot fluvial modelling exercise of the city of N'Djamena



Notes: Shading corresponds to different water depths.

Source: MATUH & IGN Fi, 2021.

13. **The city also suffers from a lack of proper O&M, as evidenced by the chronic clogging of drainage channels and pumping stations' malfunction, in particular in the historical center.** In N'Djamena, O&M of flood protection infrastructure is a municipal responsibility. The municipality's technical services, in particular the Roads Department (*Direction de la Voirie*), are in charge of evaluating O&M needs, estimating the annual O&M budget, as well as planning

and implementing cleaning and dredging interventions. While roughly 10 percent of the Municipality's annual budget (around US$1.24 million) is allocated regularly to O&M, the city's drainage network is not dredged sufficiently for several reasons: i) absence of adequate assessments of dredging needs, resulting in an over- or underestimation of the required budget; ii) chronic lack of operational O&M equipment, including dump trucks and excavators, which results in the outsourcing of dredging interventions through costly and nontransparent private sector contracts; iii) lack of regular and preventive maintenance of flood protection infrastructure other than drainage channels (e.g. pumping stations); and iv) timing of the municipal budget cycle, which results in maintenance operations that are carried out late and are often interrupted by the start of the rainy season.

14. **N'Djamena also lacks an effective disaster preparedness and emergency response system to protect the city's population in the event of a natural catastrophe.** Meteorological and hydrological data collection is currently insufficient to establish a functioning flood early warning system (EWS) for citizens and urban farmers. Additionally, in practice the institutional framework for flood early warning, which includes collection, storing, processing, and disseminating data and alerts, is not clearly established and fragmented.[10] In addition, women who have very low literacy rates and persons with disabilities have poor access to formal data and information channels for disaster alerts. The system also lacks sufficient budget, adequate human resources, and clearly established operational procedures to be functional. Contingency planning documents are inexistent or outdated, not allowing proper coordination and clear definition of responsibilities in emergency preparedness and response.

15. **An inadequate SWM system is contributing to the city's flood challenges.** Insufficient and weak SWM services have contributed to the dumping of waste, in particular plastic, which is regularly clogging drainage channels and thus increasing the risk of flooding (see Annex 4 for a description of the solid waste value chain and institutional arrangements). While there is an increase in daily waste production, the collection rate remains less than 20 percent. This has led to illegal dumping, landfilling, and open burning to dispose of municipal waste (see Annex 4 on potential future landfill needs). The city does not possess a proper landfill; waste collected by the city or by private companies is disposed in unsanitary dump sites outside the city without proper treatment. Access to waste collection is uneven from one district to another, and existing collection services are irregular and unreliable especially in flood-prone areas. Pre-collection is generally provided by the Sanitation Committees (*Comités d'Assainissement*, CA), under the supervision of the district mayors and in certain cases undertaken by independent collectors remunerated directly by households. The SWM infrastructure system (collection centers, transfer stations, and final disposal sites) remains incomplete due to a lack of resources, facilities, equipment, and organizational processes. Most of the waste is disposed of without valorization, reuse, recovery, or composting.

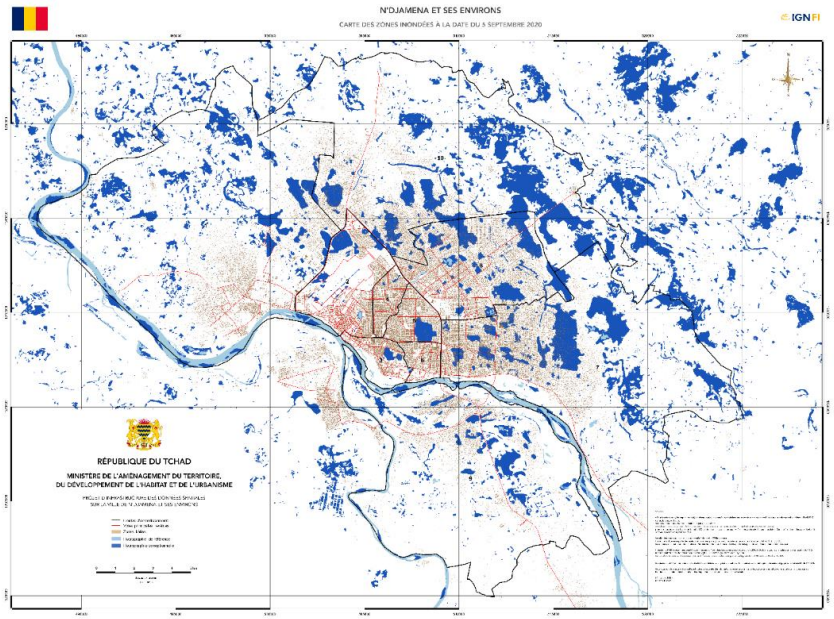
16. **The last three major flood events on record took place in 2012, 2020, and most recently 2022.** They resulted in significant infrastructure damages and economic losses. In August 2012, heavy rainfall damaged buildings in the 5th, 7th, and 8th districts, destroying critical infrastructures and an estimated 120,000 houses, and flooding 1,400,000 hectares of cultivated land. The country's civil protection estimated that almost 20 percent of the city's population was affected, and that the event led to over US$24 million in economic losses. In 2020, pluvial floods followed by fluvial floods with an estimated return period of 20 years occurred between August and October, affecting over 40,000 people, mainly in the 7th and 9th districts, and destroying dikes (Figure 3). Chad experienced high rainfall in the summer 2022, leading to pluvial floods in August and September, and fluvial floods between September and December. Close to 1.4 million people were affected, 80,000 houses were destroyed, and 350,000 hectares of cultivated land and 20,000 cattle have been reported

[10] Civil Protection Directorate (*Direction de la Protection Civile*, DPC), National Meteorological Agency (*Agence Nationale de la Météorologie*, ANAM), Food Security and Early Warning Information System (*Système d'Information sur la Sécurité Alimentaire et d'Alerte Précoce*, SISSAP), Water Ressources Directorate (*Direction des Ressources en Eaux*, DRE), Municipality of N'Djamena.

lost so far.[11] In the capital, 20 official refugee sites had to be organized to serve close to 255,000 people, and unofficial camps were also observed. The Chari reached 8.14 meter in N'Djamena, second highest level recorded for a flood event, behind the 1961 record of 9.16 meters. Initial estimated needs for emergency recovery were of 70 million dollars at the end of 2022 (41 percent of this amount having been mobilized as of January 20th, 2023).

17. The priorities in the next few months will include the return of IDPs into their homes and enabling peri-urban farming to restart. These recent floods demonstrate the need to invest in flood protection infrastructure, improve urban drainage systems and invest in emergency preparedness and response measures (e.g., contingency plans, EWSs, among others).

Figure 3: Areas affected by pluvial floods in August 2020



Source: MATUH & IGN Fi, 2020.

18. **AFD is very active in the urban development sector in Chad and particularly in N'Djamena.** It recently financed several projects on flood risk management and water access with a total financing of EUR 51.5 million. Flood-related projects include: i) the improvement of a major urban drainage channel, initiated in 2017 (PACAJ Project - EUR 15 million); ii) strengthening flood risk protection in the north-east of N'Djamena, co-financed with the European Union (EU), initiated in 2013 and completed in 2022 (PEAN Project – EUR 27 million); and iii) a small-scale emergency operation strengthening drainage infrastructure following the 2020 floods, with a first phase completed in 2022 and a second phase being initiated (N'Djamena Flood Emergency Support Project (*Projet d'Appui Urgence Inondations de N'Djaména* ,PAUIN) Project – EUR 1.5 million). AFD is operating through a direct engagement with the Municipality of N'Djamena, which is hosting its PIU. Despite these important AFD interventions, the level of flood protection in the city remains insufficient, as evidenced by the recent 2022 floods. The preparation of the proposed project has been closely coordinated with AFD. It proposes to fill continuous coverage gaps, in full complementary to AFD's existing investments.

[11] Chad Situation Report, January 20th, 2023, UN Office for the Coordination of Humanitarian Affairs (OCHA), *https://reliefweb.int/report/chad/tchad-situation-des-inondations-ndjamena-rapport-de-situation-no-09-20012023.* Note that the total number of people might include people from outside the city, as well as some double counting.

C. Relevance to Higher Level Objectives

19. **The proposed project is aligned with the World Bank ongoing strategies.** With its focus on strengthening flood resilience and promoting citizen engagement, the proposed project is aligned with the transformational goals #1 ("a new social contract") and #4 ("more climate resilience") of the Western and Central Africa regional strategy.[12] It is also aligned with the Chad FY23-24 Country Engagement Note (CEN) [Report number - 178153], approved in November 2022, Objective #4 ("promote natural resource management and sustainable agriculture"). The SCD, approved in March 2022, identifies i) the impact of climate change, including increased frequency and severity of urban flooding, as a key binding constraint to poverty reduction and shared prosperity; and ii) climate change adaptation as a prerequisite to seize development opportunities. With its focus on flood risk reduction and climate-related urban services, the project is thus strongly aligned with the World Bank's overall strategic goals and engagement in Chad. It will also complement other World Bank initiatives at country- and regional-level, such as the Chad Fragility and Resilience Project (P177163), the PROGREEN – Sahel Landscape Restoration Program (P176188) or the Chad-specific interventions of the Climate Risk and Early Warning Systems Initiative (CREWS).

20. **The project is closely aligned with Chad's National Development Plan (NDP) for the period 2017-2021**.[13] With its focus on flood risk reduction and strengthened urban services, the project will support the implementation of the NDP's fourth strategic axis ("Improving the quality of life of the Chadian population") and in particular its sub-axis ("A healthy environment with preserved natural resources") that covers improvements of drainage systems, the strengthening of urban planning, as well as policies for climate change adaptation.

21. **The proposed project is aligned with the World Bank Group (WBG) climate change and resilience agenda, including the Climate Change Action Plan (2021-2025), the Next Generation Africa Climate Business Plan, the World Bank's Strategy "Supporting a Resilient Recovery: Western and Central Africa Region Priorities 2021-2025" with the goals to Adapt-Connect-Transform (ACT) and to promote Green, Resilient, Inclusive Development, and Competitive Cities (GRID+)**, **and the G5 Sahel Region CCDR.** By financing activities to reduce flood risk in N'Djamena, the proposed project aligns with the "WBG Action Plan on Climate Change Adaptation and Resilience", in which the WBG commits to scaling up adaptation efforts to build resilience against climate and disaster impacts. The project is also aligned with the "Next Generation Africa Climate Business Plan," whose fourth strategic direction focuses on building resilient cities. By strengthening resilience to disaster events, integrating nature-based solutions (NBS), and promoting an inclusive approach to urban planning and management, the proposed project is aligned with the GRID framework and its focus on resilient and green recovery from the COVID-19 pandemic. The project will also follow the Quality Infrastructure Investment (QII) Principles, approved by the G20 in 2019, which provides a framework for approaching infrastructure investment in line with GRID+. Finally, the proposed project is aligned with the G5 Sahel Region CCDR[14] and in particular the prioritized sector "Cities: Urbanization and Provision of Basic Services". The following activities identified as critical in the CCDR report are directly embedded in the project design: i) management of climate risks through resilient urban and land use planning, and flood management; and ii) improvement of community resilience through increased basic services notably solid waste management.

22. **The project is aligned with the WBG Strategy for Fragility, Conflict, and Violence (FCV), Chad's Prevention and Resilience Allocation (PRA) Action Plan.** Recognizing that this project, with its focus on investments in the capital city,

[12] Supporting A Resilient Recovery: The World Bank's Western and Central Africa Region Priorities 2021-2025 (English). Washington, D.C.: World Bank Group. *http://documents.worldbank.org/curated/en/978911621917765713/Supporting-A-Resilient-Recovery-The-World-Bank-s-Western-and-Central-Africa-Region-Priorities-2021-2025*.

[13] The new NDP for the period 2022-2026 is still under preparation. The latest implementation monitoring report, validated in April 2022, recommended the continuation of the key strategic axes of the 2017-2021 NDP.

[14] World Bank. 2022. G5 Sahel Region CCDR. Washington, DC: World Bank.

does not directly address the historic regional imbalances that have been identified as one of Chad's key fragility drivers in the 2021 Risk and Resilience Assessment (RRA), the project strengthens disaster- and climate-related resilience of the most vulnerable and marginalized population groups, including women, youth, and refugees, who are disproportionality impacted by FCV. In addition, the project's focus on providing employment opportunities for young men and women (e.g. through urban agriculture investments) is closely aligned with the Government's PRA Action Plan. The proposed project is also complementary to the Chad Fragility and Resilience Project (P177163), currently under preparation, which will specifically support all the strategic objectives of the PRA.

23. **Finally, the project supports the implementation of the World Bank's Global Crisis Response Framework (GCRF)** by combing short-term crisis response with long-term sustainable development and disaster risk management (DRM), mainly in relation to Pillar 3 "Strengthening Resilience". The project will enhance N'Djamena's resilience to flooding and other disaster-related shocks by strengthening institutional capacities for flood and DRM, emergency and crisis preparedness and response, and climate adaptation.

II. PROJECT DESCRIPTION

A. Project Development Objective

24. The Project Development Objective (PDO) is to reduce flood risk and strengthen climate resilient urban planning and selected flood-related services[15] in N'Djamena.

25. The PDO-level indicators for the proposed project include the following:

- People with reduced flood risk through investments under the project (sub-indicator: those who are female) (number)
- Reduction of the 20-year return period flood plain (ha)
- Drainage networks dredged and cleaned of solid waste according to yearly O&M plan (percentage)
- Population living in a radius of 2 kilometers to a NBS (percentage)
- MATUH and Municipality have improved urban planning and management capacity (text)

B. Project Components

26. **The proposed project will be implemented over a six-year period and represents the World Bank's first engagement in the urban development and resilience sector in Chad since 2015.** Component 1 aims to reduce flood risk by strengthening the city's physical resilience against pluvial and fluvial floods through sustainable structural and non-structural investments in flood protection. Component 2 aims to strengthen climate-resilient urban planning and selected flood-related services, including key urban planning studies and instruments, community-level interventions,[16] as well as disaster preparedness and response. Component 3 covers project management and monitoring. Component 4 is a contingent emergency response component (CERC) aimed at helping the government improve response times in the event of future crises.

27. **The project will rely on an integrated approach to increase the city's climate resilience capacity and strengthen**

[15] "Selected flood-related services" refers to services that are directly related to strengthening flood risk management, including, amongst others, disaster alerts and early warning systems and communication, disaster awareness sensibilization campaigns, emergency response and civil protection initiatives, NBS for flood protection (e.g. bioswales, wetlands), community green spaces, urban agriculture, and neighborhood-level waste collection around drainage channels.

[16] Interventions are inspired from the Urban Fabric Initiatives Network initiatives financed by AFD: *https://pepinieres-urbaines.org/en/*

selected urban services. It will invest in priority and medium- to long-term flood protection and drainage infrastructure in the city's flood hotspots while promoting their sustainability and effectiveness (Component 1) and strengthen flood-related urban services that are complementary to the infrastructure investments, including mainstreaming disaster and climate-related risk management considerations in urban planning instruments, community-level, small-scale interventions as well as disaster preparedness and response (Component 2). This integrated approach will incorporate a gender-sensitive design and an active engagement of communities across all activities to maximize project benefits for the city's population. The project has a long-term vision of transforming N'Djamena towards a more resilient, green, and sustainable city that can adapt to urban growth, economic transitions and the impacts of climate variability and change. NBSs and non-structural interventions to mitigate flood risks will feature as key project design elements, as a way to complement traditional infrastructure investments, support both climate adaptation and mitigation, improve urban livability in the context of more frequent heat waves due to climate change, and contribute to long-term flood protection.

28. **The project also aims to establish a medium- to long-term programmatic platform on urban development between the Government of Chad (GoC), the Municipality of N'Djamena, the World Bank as well as other development partners**. Successfully addressing the city's large-scale urban resilience challenges, which will be further exacerbated due to climate change impacts, will require a decade-long engagement and significant investments that go beyond the scope, volume, and duration of the proposed project. In addition, even though not within the scope of this project, urban resilience also needs to be built outside of the city through improved water catchment management, which could reduce fluvial flooding downstream and support agriculture production in the catchment area. For these reasons, the proposed project is designed to serve as a programmatic platform for future investments and develop a replicable methodology and approach to scale up the project in other secondary cities through follow-up operations. By providing the required analytical underpinnings (e.g., SWM studies, core urban planning documents, etc.) and strengthening the technical and operational capacity of national and local institutions, it can facilitate the identification and preparation of future projects to fully address the city's diverse urban resilience challenges across a variety of sectors (e.g., water and sanitation, SWM, municipal finance, etc.).

Component 1: Flood protection and drainage infrastructure (US$90 million equivalent)

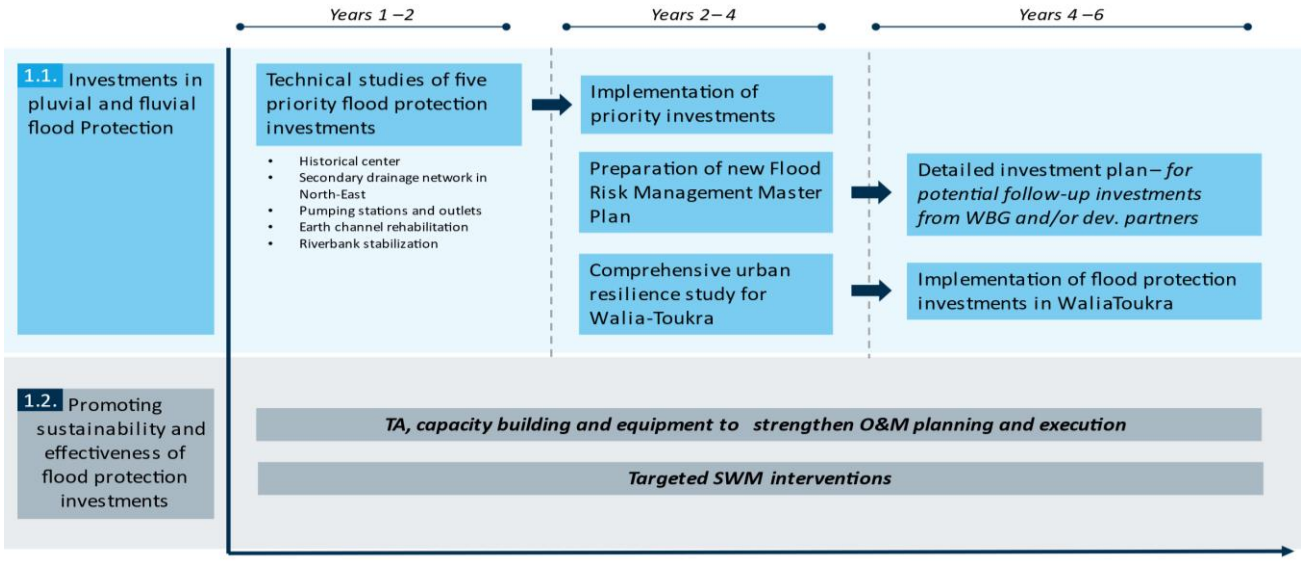
29. **The first component focuses on mitigating the negative impacts of floods through green and grey infrastructures to protect vulnerable areas of N'Djamena against recurrent fluvial and pluvial floods.** It finances structural and non-structural measures, including urban drainage and associated roadworks, dikes, and retention basins, with a strong emphasis on NBS. In parallel, the component will ensure the sustainability of the supported infrastructure by strengthening O&M practices at the city level and investing in solid waste collection to reduce the clogging of the supported drainage networks. Given the component's focus on green and grey infrastructure, it is expected that the associated works will contribute significantly to the creation of local and green jobs.

30. **The infrastructure investments will be implemented through a phased approach, with the goal of enabling no-regret investments to start in the first half of the project while the necessary technical and environmental and social (E&S) studies for more complex investments are prepared in parallel**. In a first phase, the project will finalize the studies for five priority, no-regret investments that have been pre-identified by the Government and validated by the World Bank during project preparation. These studies themselves will be sequenced so that smaller, quick-win investments can be implemented starting in Year 2. In a second phase, the project will finance the implementation of these priority investments while preparing a new Pluvial and Fluvial Flood Risk Management Master Plan (*Schéma Directeur de l'Assainissement Pluvial and Fluvial*, SDAPF), including its associated investment plan, as well as a comprehensive urban resilience study for the flood hotspot Walia-Toukra (9th district). In a third phase, the project will finance the implementation of investments outlined in the Walia-Toukra study.

31. **Ensuring the sustainability and effectiveness of flood protection infrastructure will require investments in O&M**

and solid waste collection. Simply investing in infrastructure alone will not be enough to reduce flood risks in N'Djamena, given existing challenges in ensuring appropriate O&M and the chronic clogging of drainage channels through solid waste. Therefore, the component will also finance the strengthening of city-level O&M processes and targeted SWM interventions to promote the sustainability and effectiveness of flood protection infrastructure.

Figure 4. Component 1 structure and timing



32. **Throughout this component, a strong emphasis will be placed on NBS**. The NBS Opportunity Scan, conducted by GFDRR's Global Program on NBS, identified promising avenues in N'Djamena's city context, including: i) rain gardens or bioswales to allow for a better infiltration of stormwater and reducing runoff; ii) green corridors along roads and waterbodies to reduce stormwater runoff and to provide cooling; iii) rehabilitation and maintenance of retention basins and/or urban wetlands allowing to increase water storage capacity in the city; iv) landscaping and greening of the surroundings of infrastructure built by the proposed project as well as targeted investments on N'Djamena Green Belt Initiative, with an emphasis on retention basins to protect them against waste dumping and promote activities such as urban agriculture; and v) promoting the development of agro-sylvo-pastoral systems along dikes and open drainage canals providing livelihood benefits to communities, while also potentially reducing ambient temperatures and stormwater runoff. The effectiveness of these NBS investment options to reduce high frequency flooding will be modeled in the comprehensive flood risk assessment (as introduced in paragraph 34). Besides the reduction of flood and heat risk, well-implemented NBS can support local livelihoods, promote income-generating opportunities for women, and sustain biodiversity.

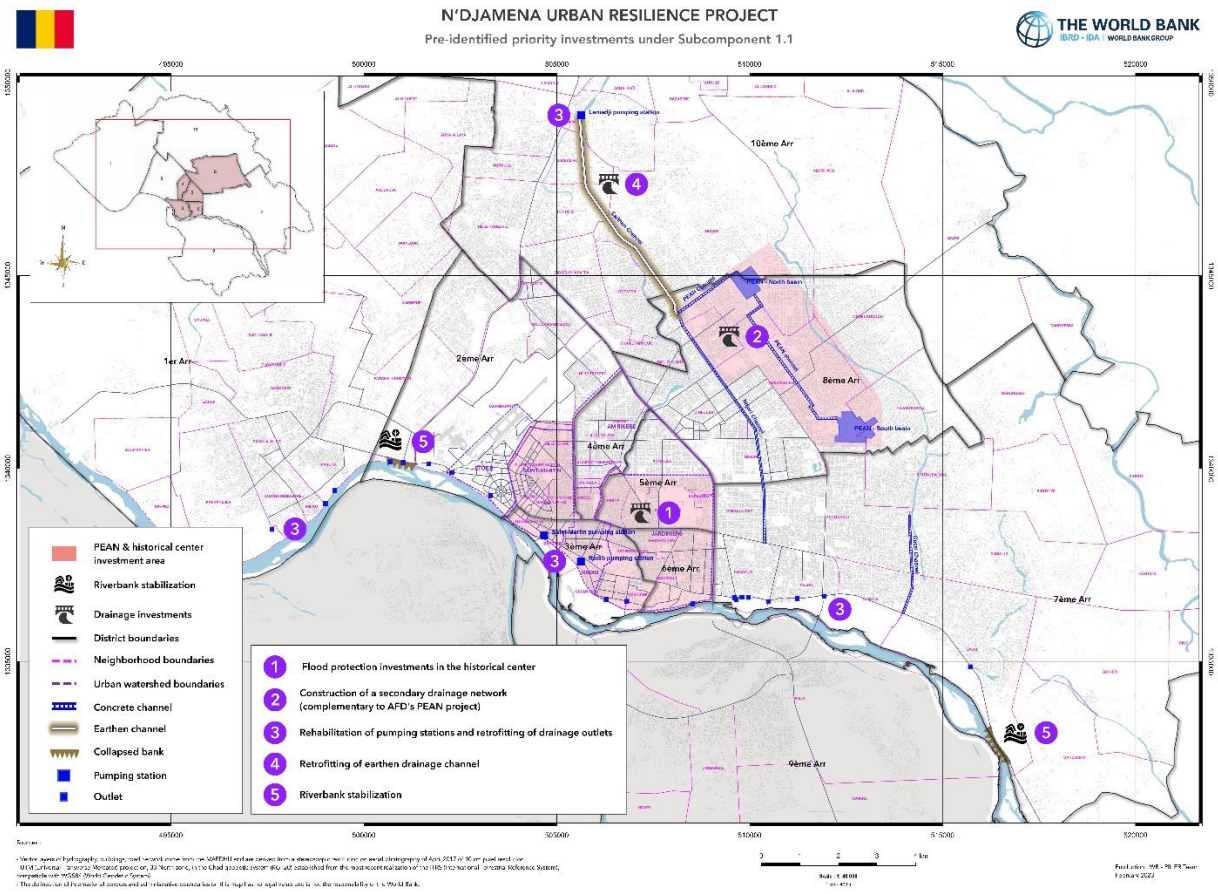
Subcomponent 1.1: Investments in pluvial and fluvial flood protection (US$70 million)

33. **This subcomponent will be implemented in three overlapping phases:**

a. **In the first phase (Years 1-2, ~US$4.5 million),** the project will finance technical studies of five priority, no-regret measures that have been pre-identified by the GoC and the World Bank during project preparation. These technical studies are currently being procured under a Project Preparation Advance (PPA) to ensure rapid implementation during the first years of the project. The five priority investments (see Figure 5) will include: i) flood protection investments (water retention areas, drainage works, dikes, associated roadworks, etc.) in flood hotspots in the historical center, identified through a partial update of the 2012 SDAP; ii) the construction/rehabilitation of a secondary drainage network in the north-east of the city and its integration

with the primary drainage network and existing retention basins that were recently constructed through AFD's PEAN project; iii) rehabilitation of two pumping stations (Saint-Martin and Radio) and installation or retrofitting of several drainage outlets to the Chari River and the addition of two pumps at the Lamadji pumping station to the north of the city; iv) riverbank stabilization in the 1st and 7th districts; and v) the retrofitting of an earthen drainage channel upstream of the Lamadji pumping station. These priority investments were identified based on the Government's prioritization and flood mapping exercise following the 2020 floods and updated after the 2022 floods, field visits during project preparation as well as discussions with key stakeholders and development partners. Selection criteria included the high flood exposure of the populations living in the above-mentioned areas, an analysis of the hydrological setting, and low E&S impact. Neighborhoods and city areas where the best strategy for stormwater evacuation was not easily identifiable, where interdependencies with other water basins need to be further studied, and/or where safeguard issues (esp. resettlement) require further analysis have been excluded. The Walia-Toukra neighborhood in the 9th district, while showcasing a very high exposure, is not featured in this initial phase due to the lack of previous studies, complex safeguards issues (e.g. informal settlements) that need to be thoroughly examined, and the need to define an urbanization strategy for the area alongside flood protection measures.

Figure 5. Priority investments under Subcomponent 1.1



b. **In the second phase (Years 2-4, ~US$42.5 million),** the project will finance the implementation of the above-mentioned five priority investments (see detailed project sheets in Annex 3), for an estimated investment

volume of US$39 million. In Year 2, a first lot of priority investments, consisting of the retrofitting of pumping stations and check-valves additions to water outlets, will be prioritized. The remaining, technically more advanced investments will be implemented in Years 3-4. In addition, the project will develop a new SDAPF which includes a comprehensive, long-term strategy to strengthen the city's resilience to floods, including the identification of non-structural, green, green-grey, and grey flood risk reduction measures that will be prioritized based on cost-benefit analysis, stakeholder consultations, as well as associated co-benefits (e.g., recreation, biodiversity, water supply, etc.). These measures will then be translated into a comprehensive medium- to-long term investment pipeline. The SDAPF and the associated investment pipeline will be a strategic government document with prioritized investment options, while adopting a long-term strategic vision of the city in the context of rapid urbanization and changing climate conditions. Investments identified in the SDAPF could set the ground for potential follow-up investments from the WBG and/or developments partners, in line with the project's platform approach. Finally, the project will prepare a comprehensive urban resilience study for the flood hotspot Walia-Toukra (9th district) on the left bank of the Chari River, which will focus on developing a long-term vision for the neighborhood's urban development and protection against current and future floods. Expected outputs of this study include feasibility studies on flood protection and stormwater management measures (with an emphasis on NBS), an urban integration plan including the development of non-aedificandi areas, a plan for retrofitting existing houses at risk of collapse from recurrent flooding, and a neighborhood-level contingency plan including dedicated shelter areas in the case of flood events. Thus, the study should be seamlessly integrable with the city's Master Plans (SDAPF and Urban Development Masterplan).

c. **In the third phase (Years 4-6, ~US$23 million),** the project will implement the urban and flood risk protection investments outlined in the Walia-Toukra study to strengthen the neighborhood's resilience to floods. These will likely include: i) the design, construction and/or rehabilitation of primary and secondary stormwater collectors, drainage channels, retention basins, and related road networks; ii) the design and implementation of landscaping, slope stabilization and greening of flood-prone areas, relying on NBS; and/or iii) the design, construction and/or rehabilitation of dikes.

34. The Walia-Toukra study as well as the SDAPF and its investment pipeline will be informed by a comprehensive flood hazard and risk assessment focusing on both pluvial and fluvial flooding led by the World Bank.[17] This study has been initiated during project preparation and is expected to be concluded by the end of 2023. It will outline investment options for grey, green, and grey-green infrastructure solutions that can reduce pluvial and fluvial flood risk in N'Djamena in a holistic and integrated manner.

35. Subcomponent 1.1 supports the implementation of the World Bank's GCRF, Pillar 3 "Strengthening Resilience", by investing in flood mitigation measures, reducing the vulnerability to flooding.

Subcomponent 1.2: Promoting sustainability and effectiveness of flood protection infrastructure (US$20 million)

36. Insufficient infrastructure maintenance and the clogging of the city's drainage networks through solid waste is jeopardizing the proper functioning of flood protection infrastructure in N'Djamena. To ensure the sustainability of supported investments under the project and more broadly increase the effectiveness of the city's flood protection infrastructure, this subcomponent will follow a two-pronged approach of: i) providing TA, capacity building and investments to strengthen the Municipality's O&M practices; and ii) financing targeted SWM interventions in selected areas along the flood protection infrastructure financed under Component 1 to directly reduce the clogging of supported drainage channels and retention basis.

[17] With financial support from the Global Facility for Disaster Reduction and Recovery (GFDRR).

37. **Strengthening O&M of flood protection infrastructure (~US$8 million)**. To strengthen the Municipality's O&M practices, with a view to ensuring regular dredging of the drainage networks, the subcomponent will finance: i) capacity building and TA for improved O&M planning and budgeting, for example for the development of Standard operating procedures (SOPs) for dredging needs identification, the setup of a (geo-enabled) infrastructure management database with technical capacity building that could be provided through the Geo-enabling Initiative for Monitoring and Supervision (GEMS), and/or standardized private sector service contracts; ii) conduct a specific study on sludge coming from dredging and their disposal in line with WBG's Environmental Health and Safety (EHS) Guidelines for Waste Management; (iii) purchase of relevant O&M equipment for the Municipality (vehicles, excavators, backhoes, etc.) for dredging identification and dredging activities not covered by private sector contracts; and iv) output-based O&M service contract(s) with private contractors for newly constructed/rehabilitated flood protection infrastructure under the project . These interventions will be complementary to the regular financial allocations for O&M (a minimum of US$1.24 million) that the government is providing through the annual municipal budget.

38. **Targeted SWM interventions (~US$12 million**). To directly reduce the chronic clogging of drainage networks, the subcomponent will also support targeted SWM interventions in selected areas along the flood protection infrastructure financed under Subcomponent 1.1. More specifically, this subcomponent will finance: i) awareness campaigns conducted at the household level and provision of relevant equipment (e.g. differentiated bins) to promote the reduction, sorting and recycling of waste in selected areas; ii) upgrading of the pre-collection system in selected areas by providing pre-collectors with relevant equipment (e.g. dumpsters, motorized tricycles) and by constructing transfer centers; iii) capacity building for the sanitation neighborhood committees to strengthen their pre-collection services; iv) acquisition and repair of municipal waste collection trucks and maintenance workshops; v) upgrade of the city's waste volume control system; vi) set-up of a recycling demonstrator and pre-identified, temporary waste disposal sites to dispose collected waste;[18] and vii) development of adequate SWM governance and financing mechanisms (government funding and private sector mobilization) to sustain the SWM value chain and increase the government's capacity to pay operational expenditures. These targeted SWM interventions, coupled with the city-wide SWM strategy developed under Subcomponent 2.1, can help set the stage for a more comprehensive engagement on SWM in the medium- to long-term, in line with the project's platform approach (cf. paragraph 28).

39. Subcomponent 1.2 supports the implementation of the World Bank's GCRF, Pillar 3 "Strengthening Resilience", by improving the and technical capacities to manage flooding and cope with climate change and other drivers of future risks.

Component 2: Climate resilient urban planning, services, and community investments (US$50 million equivalent)

40. **This component focuses on improving risk-informed urban planning and management, promoting climate resilient community investments, and strengthening selected flood-related services.** It covers the mainstreaming of DRM and climate change considerations into urban planning instruments and studies, technical assistance (TA), and capacity building for the Municipality as well as key national institutions with flood-related mandates, strengthening flood early warning and disaster preparedness and response at the city level, as well as small-scale, community-level resilience interventions in selected neighborhoods. These activities are expected to complement the flood protection investments supported under the first component. They will also provide an integrated, multi-sectoral solution to N'Djamena's current

[18] The project is not intended to offer SWM solutions across the entire value chain. It will not intervene in the development of a sanitary landfill for the whole of N'Djamena, but only in a temporary cell in the Gassi neighborhood, for the need and the duration of the project. The infrastructure thus created will mainly serve the areas of intervention of the project, including disposing sludge and soil from the cleaning of the existing drainage canals. However, this initial engagement can serve as a basis for the elaboration of a future waste management project for the entire city. Studies will therefore be carried out to define the infrastructures of tomorrow, including sorting plants, recovery units and one or more sanitary landfills.

urban resilience and flood risk issues and strengthen the city's ability to adapt to future challenges impacted by rapid urban expansion and climate change. They thus play an important role in ensuring sustainability beyond the project's duration.

41. In addition to reducing the impact of floods on physical assets and the population, these activities will also have wider benefits for the citizens of N'Djamena by improving public service delivery and efficiency. Recognizing that the proposed project cannot provide comprehensive solutions for all urban resilience challenges (e.g., the city's inadequate SWM system) but rather tailored solutions to prioritized areas, the component will focus on targeted interventions in flood risk reduction and protection and disaster preparedness and emergency response, while investing in technical and analytical studies that can set the stage for additional medium- to long-term investments that could be financed through other projects or development partners.

Subcomponent 2.1: Strengthening climate risk-informed urban planning and management (US$8 million)

42. This subcomponent aims at supporting the Municipality of N'Djamena and the MATUH in their ability to plan for a climate resilient urban development, and to provide risk-informed land use management services. To achieve these objectives, the project will finance the following activities: i) update and enforcement of the city's main urban planning and land use instruments[19] and studies to ensure that they are disaster risk- and climate change-informed, relying on a participatory approach to promote knowledge and capacity transfers as well as stakeholder ownership. The update and enforcement of these instruments will be critical to ensure the project's sustainability over the medium-to long-term; ii) preparation of a climate-sensitive urban mobility plan focused on accessibility for people with disabilities in the city; iii) TA and capacity building to strengthen the capacity of the Municipality, MATUH and Ministry of Water and Sanitation (*Ministère de l'Eau et de l'Assainissement,* MEA) on urban planning and management in collaboration with local and international academic partners[20]; iv) rehabilitation and retrofitting of selected municipal and MATUH buildings and premises (in particular Cadaster Services and relevant technical municipal services); v) office supplies and IT equipment for city technical directorates; vi) the development of a city-wide SWM strategy, including feasibility studies for a new landfill site that could form the basis of a potential follow-up project and/or additional investments; and vii) awareness raising campaigns on urban planning and land-use management services.

43. To ensure the effective implementation and enforcement of urban planning and land use instruments, the Municipality and the MATUH will need to strengthen and streamline internal processes for land use control and spatial planning, notably related to building permits. The subcomponent will focus on deploying the methodological tools, training, and TA to allow the municipality and the MATUH to undertake strategic, risk, and spatially informed participatory urban planning. This will require improving information and data sharing between key actors of urban planning as well as designing and implementing IT management tools.

44. Subcomponent 2.1 supports the implementation of the World Bank's GCRF, Pillar 3 "Strengthening Resilience", by facilitating the development of planning instruments, regulations and institutional capacities for climate resilience at city level.

Subcomponent 2.2: Promoting climate resilient community interventions and disaster preparedness and response (US$42 million)

45. To further complement the flood protection infrastructure supported by the project, this subcomponent aims to strengthen flood-related urban services, with a focus on engaging with local communities. This covers, on the one hand, community-level, small-scale urban interventions with a focus on flood protection at the neighborhood level, as well as

[19] Urban Reference Plan, Urban Development Masterplan, Agenda 21.
[20] ENSTP (National school of Public Works), University of N'Djamena, EPFL (Ecole Polytechnique de Lausanne) and Centers of Excellence in Africa.

on the other hand, strengthening disaster preparedness and response mechanisms at the city level.

46. **Community-level interventions program (~US$32 million).** Building climate resilient basic infrastructure and urban services at the community level can significantly reduce hazard exposure and vulnerability to disasters and climate change in urban areas.[21] Under this subcomponent, the project will finance a community-level interventions program that will support a positive list of community-level interventions (see Table 1), which will be selected through a participatory approach based on a prioritization protocol and geographical targeting criteria that will be developed and agreed upon with the Government. All neighborhoods in N'Djamena will be eligible for these investments, with a focus on low-income and climate vulnerable areas. The program administration and management will initially be facilitated by an external service provider (e.g., international NGO with experience in the field, International Organization for Migration (IOM), United Nations Office for Project Services (UNOPS) among other possibilities that are being assessed with the Government), with a gradual shift over the duration of the project towards administration by the Municipality. Under the oversight of the service provider who will retain full fiduciary responsibility, the interventions will be implemented by local and national non-governmental organizations (NGOs) and local contractors (for small-scale works). Detailed guidelines and tools will be developed for engaging communities at the local level (e.g., through neighborhood-level committees such as the sanitation and community preparedness and response committees) in the planning, implementation (with a particular focus on enforcing E&S safeguards), and O&M of planned activities. These guidelines and tools will be field tested and included in the Project Operational Manual (POM), with corresponding training of local officials in the use of these tools. To ensure the technical integrity of community-level interventions, detailed technical design guides will prepared in consultation with local communities. Finally, to ensure transparency of community interventions and ensure broader buy-in and ownership at the local level, a communication package will be developed to inform all community members about the community-level activities. Special attention will be paid to ensure that this communication package is accessible to all community members, including women, youth, and people with disabilities.

Table 1. Positive list of community-level interventions

#	Category	Amount	Objective	Indicative Examples
1	Basic urban infrastructure and urban services	US$ 150,000 – 200,000	To strengthen community-level infrastructure and service delivery (e.g., new construction or improvements)	• Secondary and tertiary drainage • SWM • Water and sanitation service delivery • Footpaths, and bridges
2	Community green spaces	US$ 100,000 – 150,000	To provide environmental improvements and livelihood benefits to women, youth, and marginalized communities	• Community parks, greening of public space, shading • Sports fields (e.g., soccer fields) • Urban NBS (e.g., bioswales, wetlands)
3	Livelihood strengthening activities	US$ 50,000 – 100,000	To promote climate-resilient livelihoods of women, youth, and marginalized communities	• Urban agriculture (e.g., training, provision of tools and seeds, drip irrigation) • Small works • Operations and maintenance (e.g., canal cleaning, litter removal)
4	Youth activities	US$ 10,000 –50,000	To strengthen agency among youth (<35 years old[22]) to	• Awareness campaigns (in partnership with local universities

[21] Revi, A., D.E. Satterthwaite, F. Aragón-Durand, J. Corfee-Morlot, R.B.R. Kiunsi, M. Pelling, D.C. Roberts, and W. Solecki, 2014: Urban areas. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

[22] As per African Union definition of youth.

			realize climate solutions for local communities	and NGOs) • Hackathons • Youth climate entrepreneur competitions • Digital mapping
	Program administration and project management	Around US$ 6 million		

47. **Disaster preparedness and response (~US$10 million).** The subcomponent will also support the foundations for a city-level gender-sensitive EWS and the strengthening of an adequate emergency preparedness and response capacity in the event of flooding. Considering the establishment of a city-level EWS is a long-term effort with significant institutional, technical, and operational challenges, the project will take a two-pronged approach. At the community level, the establishment of community preparedness and response committees primarily led by woman in each district with the objective of reinforcing the capacity of local authorities to protect communities in the event of flooding, strengthen their capacity to monitor local conditions and alert as well as receive, analyze, and act on warnings. At the municipal level and in coordination with the national level, a formal EWS will be established in collaboration with development and technical partners working under the CREWS initiative. The subcomponent will finance: i) TA to strengthen the city's disaster response capacity through the update of contingency plans, the preparation of a dedicated emergency management plan ("Plan ORSEC" - *Organisation de la Réponse de Sécurité Civile*), and the development of SOPs for early warning and emergency response and temporary shelters for flood affected-people; ii) the retrofitting of fire stations and rescue centers in selected districts and the acquisition of operational equipment; iii) capacity building, equipment and material to establish the community preparedness and response committees; (iv) capacity building and material upgrading of the national hydrometeorological agencies (Water Resources Directorate [*Direction des Ressources en Eau*, DRE] and the National Meteorological Agency [*Agence Nationale de la Météorologie*, ANAM]) to generate accurate and timely data for weather forecasting through the operationalization of automatic weather stations[23] and the set-up of a fully equipped national Data Treatment Center (DTC); v) the establishment of a Municipal Operational Crisis Center located within the Municipality, which will ensure dissemination of information and alerts to the population during flood events and coordinate with the community preparedness and response committees; and vi) a gender-sensitive communication and citizen engagement strategy for disaster preparedness and response at the community level, including awareness raising campaigns with a focus on reaching women.

48. Subcomponent 2.2 supports the implementation of the World Bank's GCRF, Pillar 3 "Strengthening Resilience", by facilitating the development of disaster preparedness and response at the city level. It is also aligned with Pillar 1 "Responding to food insecurity" by supporting urban agriculture activities.

Component 3: Project Management and Monitoring (US$10 million equivalent)

49. This component will finance the costs associated with implementation support, including project coordination, implementation, supervision, FM, procurement, audits, communication and outreach, E&S management (including supervision of the Environmental and Social Commitment Plan [ESCP] and grievance management), M&E, and knowledge management. It will also finance the costs associated with day-to-day management, including the purchase of equipment, the provision of TA and capacity building, and the operations of the PIU (including the financing of its training and operating costs).

Component 4: Contingent Emergency Response Component (US$0 million)

[23] This activity will be implemented in partnership with development partners, including UNDP and WMO. Part of the technical assistance will be financed by the Climate Risk and Early Warning Systems Initiative (CREWS).

50. This component will provide an immediate response to an eligible crisis or emergency, as needed, by financing the implementation of emergency response, early recovery, and/or urgent reconstruction measures, bridging the gap to long-term recovery and reconstruction. Resources will be allocated to this component as needed during implementation. A CERC Operations Manual will be prepared by the GoC and will provide detailed guidelines and instructions on how to trigger the CERC and use funds (including activation criteria, eligible expenditures, and specific implementation arrangements as well as required staffing for the Coordinating Authority).

51. The CERC supports the implementation of the World Bank's GCRF, Pillar 3 "Strengthening Resilience", as it provides the opportunity to reallocate funds to quickly respond in the event of an emergency or crisis.

Table 2. Project Costing Table

Designation	Components	Subcomponents	Percentage
	(US$ million)		
Component 1: Flood protection and drainage infrastructure	**90**		**60.0**
1. Investments in pluvial and fluvial flood protection		70	
2. Promoting sustainability and effectiveness of flood protection infrastructure		20	
Component 2: Climate resilient urban planning, services and community investments	**50**		**33.3**
1. Strengthening climate risk-informed urban planning and management		8	
2. Promoting climate resilient community interventions and disaster preparedness and response		42	
Component 3: Project Management and Monitoring	**10**	**10**	**6.6**
Component 4: Contingent Emergency Response Component	**0**	**0**	
Total	**150**	**150**	**100.0**

52. **Climate change co-benefits.** The project aims to maximize climate change adaptation and mitigation co-benefits through investment selection and design. All project investments are expected to contribute substantially to climate change adaptation, with some of them also contributing to mitigation. Chad is extremely vulnerable to the effects of climate variability and climate change, with the N'Djamena urban and peri-urban areas particularly exposed. Fluvial flooding frequency has been increasing rapidly in recent years from being a decadal event to happening in 2012, 2020 and 2022, and pluvial flooding has been an almost yearly occurrence. Increases in extreme heat events and higher volatility of precipitation is to be expected under climate change, with important variability at different frequencies difficult to capture precisely for now. All the activities of Component 1 are directly related to adaptation: i) Subcomponent 1.1 will be dedicated to flood protection infrastructure. All infrastructure will be designed to climate-resilient standards, and green spaces along drainage networks and retention basins will be designed to improve conditions during heatwaves and contribute to increased resilience to flood events; ii) investments along infrastructures in NBS (e.g. urban agriculture and tree planting) will have adaptation co-benefits and will seek to maximize climate mitigation co-benefits by systematically pursuing the integration of green infrastructure solutions in riverine flood management. This includes river widening, retention ponds, and wetland preservation as part of the project's integrated approach to sustainable flood management; iii) Subcomponent 1.2 will be dedicated to O&M of built infrastructure and targeted SWM actions to ensure that infrastructures fulfill their role under worsening climate change conditions and that O&M processes are well adapted to the increased frequency of hydrogeological events due to climate change; iv) finally, the promotion of recycling practices and set-up of a recycling demonstrator and pre-identified, temporary waste disposal sites should have

mitigation co-benefits. Activities of Component 2 will contribute to risk-informed urban planning, flood-related urban services, and community engagement, which will ensure the sustainability of infrastructures financed under Component 1. They will consist in: i) the development of contingency plans to better protect populations and infrastructure from the worsening effects of climate change, notably increased flood risk; ii) financing urban planning and land management documents and instruments that incorporate flood and climate resilient principles aimed at protecting vulnerable areas against potential climate-related increases in flood discharge and heavy rain, incorporating heatwave mitigation measures; iii) capacity building of government and municipal services for climate risk-informed urban planning and management, including emergency preparedness and response capabilities to enable them to be better prepared for, and respond to, climate-induced disasters risks, and reduce their impact; iv) promoting resilient and green city practices at the local level through a number of urban plans and instruments (promoting mitigation co-benefits); v) the foundation for a city-wide flood EWS system with significant adaptation benefits; and vi) community-level, small-scale urban interventions at neighborhood level with a focus on climate and flood resilience.

53. Besides, project activities and technical studies will be used to engage on a longer-term, climate-risk based approach to urban planning. Coupled with rapid urbanization and inadequately planned urban growth, the share of the population that is exposed and vulnerable to flooding is increasing. With a large dependence on climate-sensitive livelihoods (such as rainfed-agriculture), changing rainfall patterns and the recurrence of climate-related shocks may result in further surges in disaster-induced displacement, compounding a growing competition over land and resources at the country level. While the area is not yet constrained by water availability, droughts of the 70's and 80's a food security situation among the most precarious in the world yield worries for the future. Thus, all NBS under Component 1 (whether along flood-protection infrastructure under 1.1. or SWM-related ones under 1.2) as well as urban planning and community-level activities under Component 2 will be used to promote sustainable use of the water and land resources.

54. **Gender.** While Chad's legislative framework encourages equality between women and men[24], the country currently ranks 142nd out of 153 countries on the Global Gender Gap Index.[25] Women in N'Djamena are especially vulnerable to floods and climate change impacts. A recent gender vulnerability assessment commissioned by the *Global Center on Adaptation* (GCA) in support of project preparation identified, amongst others, the following gender gaps: i) in part due to low levels of literacy (22.4 percent for women as compared to 40.7 percent for men), focus group discussions and key informant interviews revealed low disaster awareness and limited access to weather and disaster alert information among women; ii) especially in the 7th and 9th districts, many women carry out income- and livelihood-generating activities in the urban agriculture sector, which is heavily impacted by floods; iii) women tend to be more affected by floods as they need to spend more time collecting drinking water and fuel for cooking, for which they often bear sole responsibility; iv) inadequate representation of women in formal and informal decision making structures; and v) during floods, gender-based violence (GBV) tends to increase.

55. Building up on the GCA assessment, the proposed project embeds gender considerations in its technical design and results chain across three key areas:[26]

a. **Strengthen gender-inclusive DRM decision making at the community level.** *Analysis*: Chadian women suffer from an inequality of status and position in the family and in society, which restricts their ability to participate in community decisions at the same level as men. Community participation is highly controlled and prioritized, both by gender and age. Disaster relief efforts often rely on existing patriarchal structures of the

[24] Article 14 of the Chadian Constitution guarantees "the elimination of all forms of discrimination against women and the protection of their rights in all areas of private and public life". Other policies such as the Action Plan for gender policy (PA-PNG 2019-2023) reflect efforts to support gender equality and women's empowerment.
[25] *http://www3.weforum.org/docs/WEF_GGGR_2020.pdf*
[26] Throughout these three areas, the project will ensure that consultations and participatory activities are held in venues and formats that are suitable and possible for women to attend so that women can voice their concerns and questions safely.

society, which often marginalize women's access to relief resources, or do not consider their specific needs. These factors result in a gap in voice and agency of women to influence emergency planning and disaster response. *Action*: Through Subcomponent 2.2, the project will establish community-level preparedness and response committees in each district. At least 25 percent of these committees will be exclusively composed of women and adolescent girls to prioritize female participation and help ensure that women's needs, and concerns are reflected in the decision-making process related to early warning and disaster response. The creation of gender-segregated committees is informed by the existence of several women-led cooperatives in N'Djamena in the fields of waste management (e.g. compost and/or recycling) and agribusiness (e.g. soap making, herbal medicine). Given prevailing gender culture and norms in Chad, gender-segregated committees will be more effective in promoting women's voice and agency as compared to mixed committees. To overcome literacy and cultural barriers that prevent women from speaking in public, specific support to their leadership roles will be provided through dedicated trainings that strengthen their preparedness and response capacity and ensure their involvement in the local committees. The objective is to reinforce the capacity of local communities and women to raise their voice, protect themselves in the event of flooding, strengthen their capacity to monitor local conditions and alert as well as receive, analyze, and act on warnings. *Indicator*: Women in leadership positions in the community preparedness and response committees supported by the project [target: 25 percent].

b. **Strengthen women's access to weather reports and alert messages.** *Analysis*: Due to their lower literacy rate and lack of access to modern communication means (e.g., cell phone, etc.), women have limited access to early warning communication, which limits their ability to anticipate and prepare for disaster events (e.g., find shelter, protect children and goods, etc.) and effectively protect their family. *Action:* Through Subcomponent 2.2, the project will establish the foundations for a city-wide EWS and promote a gender-sensitive communication and citizen engagement strategy for disaster preparedness and response at the community level through awareness campaigns and training to the population. This strategy will ensure the dissemination of weather reports and information as well as alerts that are intelligible and adapted to women (e.g., translated into traditional tribal dialects), for example through the radio programming of the Women's House in N'Djamena. *Indicator:* Neighborhoods reached by gender-sensitive disaster awareness campaigns targeting women [target: 90 percent].

c. **Provide income-generating opportunities for women:** *Analysis:* Due to their significant dependence on the agricultural sector to provide additional income to the household, women are disproportionately affected in the event of floods as their source of financial resources is directly impacted. In the context of the pre-existing access constraints to economic activities (e.g., lower education level, underemployment as compared to men, salary discrimination, etc.), flood events reduce women's ability to carry out economic activities with a significant impact on their household support roles. *Action:* Through Subcomponent 2.2, the project will finance community-level interventions that will generate local job opportunities. In the detailed guidelines for the community- led interventions program, women will be prioritized in the selection process for participating in those income-generating activities, which will include activities traditionally handled by women in N'Djamena, such as local urban agriculture, agroforestry and greening initiatives, neighborhood cleaning and awareness campaigns. *Indicator:* Person-days of employment created by community-level interventions supported under the project (sub-indicator: of which female [target: 35 percent]).

56. **Citizen engagement**. The project will support citizen engagement throughout the implementation of all activities. This is expected to result in increased local ownership of project activities and hence project sustainability, long-term changes in public behavior (e.g., on solid waste disposal), and increased capacity of communities to contribute positively to urban resilience. Subcomponents 1.2 and 2.2 will carry out extensive citizen communication and awareness campaigns

to reduce incivilities to flood protection infrastructure, promote participation in the maintenance of the drainage networks and raise awareness towards community-based disaster risk reduction, early warning and local response. Social facilitators will support community engagement and beneficiary participation, including the involvement of local associations for community-level interventions included in Subcomponent 2.2. The project will also support a robust grievance redress mechanism, and the engagement of women and vulnerable groups (such as youth, IDPs, and people with disability) using participatory approaches. Additional citizen engagement activities will include: i) training and awareness raising on social inclusion, women's empowerment, and GBV; ii) promotion of youth participation during consultations to improve their involvement in the community, which is of particular importance in a FCV context; and iii) sensibilization of communities on urban planning prescriptions and construction permit procedures for a greater commitment to respect non-aedificandi zones localized in flood prone areas.

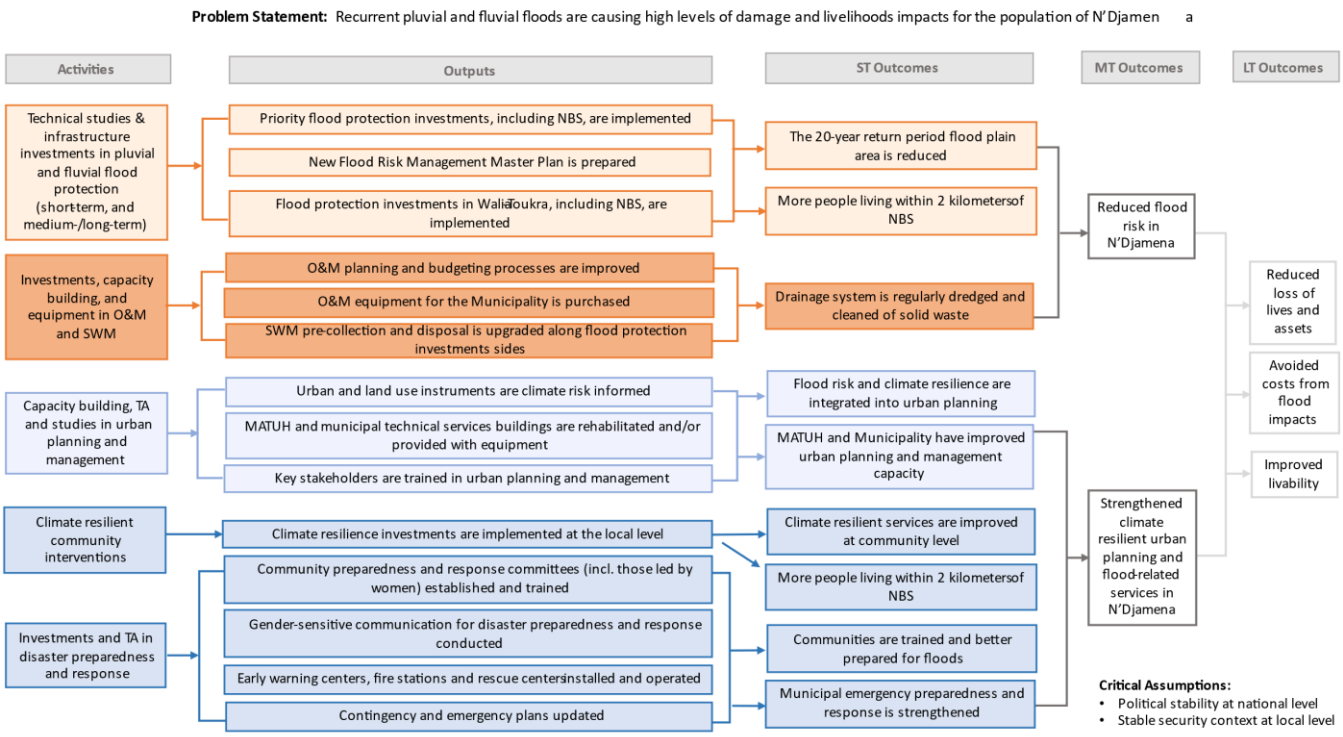
57. **Fragility, conflict, and violence.** Fragility dynamics in the capital city of N'Djamena are being taken into account in project design and future implementation. The project's beneficiaries will include about 10,000 refugees living in the flood-prone 9th district. The project will coordinate closely with IOM who is coordinating development partners' humanitarian relief efforts for flood response to strengthen the humanitarian-development nexus. In addition, the project will strengthen resilience and generate employment opportunities for vulnerable and marginalized population groups, including women and youth, who are disproportionately impacted by FCV. Finally, the project is complementary to the Chad Fragility and Resilience Project (P177163), currently under preparation, which will specifically support all the strategic objectives of the PRA.

C. Project Beneficiaries

58. **The main project beneficiaries are the urban population of N'Djamena (est. 1,230,000 in 2022),** including the most vulnerable communities who live in the growing urban and peri-urban areas of the city who will benefit from flood protection and climate resilience investments under the project, including women, youth, people with disabilities and about 10,000 refugees living in the 9th district. Project activities will pay specific attention to the inclusion of youth and women. Project beneficiaries will benefit from increased access to urban infrastructure and basic services, protection from floods, as well as improved urban planning and management. These were all identified in GCA's gender vulnerability assessment as being especially beneficial to women. Expected benefits include improved livability, climate resilience, and well-being of the population, which will support social cohesion and reduce fragility drivers. The project is expected to improve beneficiary access to jobs and create economic opportunities geared primarily towards young men and women. In addition, the project will benefit the Municipality of N'Djamena by strengthening its capacity in flood risk management, urban planning, and urban services. It will also strengthen the capacity of the Directorate of Civil Protection (*Direction de la Protection Civile*), the MATUH, DRE, ANAM, and other sectoral ministries.

D. Results Chain

Figure 6. Theory of Change



E. Rationale for World Bank Involvement and Role of Partners

59. **The proposed project addresses development challenges in areas where the World Bank has global expertise and can draw upon regional and global lessons learned.** It focuses on strengthening urban resilience of the capital city of N'Djamena, which concentrates a big part of Chad's population and economic activity and thus plays a critical role for the sustainable development of the country. The World Bank has a broad background in financing and implementing urban resilience and flood risk management projects in similar contexts in Africa and beyond. The proposed project's technical design has benefitted from recent analytical work, including the Chad Country Environmental Analysis (P175290) and the 2021 Policy Note on Urban Resilience in Chad. The proposed project also builds on key achievements and lessons learned from the Chad Urban Development Project (P072030) and other projects in West Africa, such as the Niger Disaster Risk Management and Urban Development Project (P145268), the various diagnostics conducted under the CREWS-TF0B1173, and the CIV-Urban Resilience and Solid Waste Management Project (P168308). The project is also closely linked and complementary to other ongoing and planned World Bank-supported activities in Chad, such as the Chad Local Development and Adaptation Project (P171611) and the Chad Fragility and Resilience Project (P177163).

60. **Rationale for public sector financing.** The interventions supported under the proposed project cover local public goods and services where private sector financing is currently absent or difficult to incentivize. In addition, due to weak revenue mobilization and limited fiscal capacity, the necessary resources to finance interventions are not available at the municipal level.

61. **The proposed project is prepared in close coordination with AFD and the EU, which have supported the urban development sector in N'Djamena for several years.** For example, the flood protection infrastructure financed under Component 1 is complementary to existing AFD investments. The project is also conceptualized as a platform for future

urban investments, which could benefit from technical and financial contributions of AFD, EU and/or other development partners. In addition, the project will coordinate whenever possible with humanitarian partners, for example with United Nations High Commissioner for Refugees (UNHCR) on data sharing and expertise related to forced displacement, and with IOM on flood response and recovery.

62. **Partnership with the Global Center on Adaptation (GCA).** The GCA is an international organization supporting adaptation through three areas: programs, advocacy, and knowledge. GCA has recently launched the Africa Adaptation Acceleration Program (AAAP). The AAAP aims to mobilize a total of up to US$25 billion for adaptation between 2020 and 2025. Through its City Adaptation Accelerator (CAA), GCA is providing the following TA to enhance the climate adaptation measures of the proposed project: i) a gender vulnerability assessment to identify measures to narrow gender gaps and appropriate indicators to measure gender related outcomes; ii) an in-depth assessment to inform the prioritization of green, grey and hybrid options for flood risk reduction (including NBS and urban agriculture). Cost and risk reducing potential will be considered as well as ability to fulfill other development objectives, such as increased water supply, improved environmental and soil conditions, reduced heat island effect, and so on; and iii) support for the development of a local community engagement strategy.

F. Lessons Learned and Reflected in the Project Design

63. The project design builds on lessons learned from WBG- and development partner- funded projects in Chad and the Sahel as well as urban resilience projects across regions. A Policy Note on Urban Resilience in Chad, prepared during FY21, provided analytical elements to support policy dialogue at the project identification stage. The design incorporates lessons learned from the Chad Urban Development Project (P072030), the Niger Disaster Risk Management and Urban Development Project (P145268 and the Mozambique Cities and Climate Change Project (P123201), as well as from the AFD's PEAN and PACAJ projects.

64. **Sound institutional and implementation arrangements for stakeholder ownership** are needed to clarify responsibilities and build project ownership, especially in environments with low capacity. Lessons learned from the PADUR show that strong and well-defined partnership and coordination between the PIU and institutions involved in project implementation is crucial. The proposed project sets up a Technical and a Project Steering Committee (PSC) for implementation, focusing on strengthening stakeholder ownership as well as quality assurance and coordination among key stakeholders. These committees include members from all relevant ministries and institutions.

65. **Phasing of interventions is key to enable quick wins in priority areas while setting the stage for more complex investments.** While these quick wins are implemented, the project can invest in comprehensive technical and E&S studies to gain a better understanding of the complex hydrological and urbanization dynamics before investing in neighborhoods where this knowledge is currently low. This approach is based on lessons from the AFD's PEAN project which had to be delayed because of avoidable resettlement issues at the level of a pumping station.

66. **Integration and consultation of beneficiaries.** The WBG-funded urban development and resilience projects in the Sahel have demonstrated how the active participation of beneficiaries helps ensure proper identification of project activities. Fully integrating community participation and consultation in project design can also strengthen implementation and promote sustainability of investments. In this endeavor, the project is working closely with the GCA to develop effective strategies for community engagement. Vulnerability and community mapping exercises have started during preparation, and communication and awareness raising campaigns are planned under the project. Further, Subcomponent 2.2 will focus heavily on community interventions, to develop quick wins and support the appropriation of the project by the population.

67. **Effective O&M of flood protection infrastructure is critical for sustainability.** Lessons learned from the Mozambique Cities and Climate Change Project (P123201) indicate that post-construction technical support can reduce

the risk to the development outcome. They underscore the importance of allocating adequate attention and resources to institutional capacity building for O&M in projects that are financing the construction/rehabilitation of infrastructure systems in countries with weak institutional capacity and limited resources for O&M. Based on this experience, the proposed project is providing TA and capacity building to the Municipality of N'Djamena to strengthen the O&M of supported infrastructures and thereby help ensure the medium- to long-term functionality of investments.

68. **The proposed project also integrates insights from ongoing projects in the Chad portfolio.** Based on the recent Country Program Evaluation for Chad,[27] these lessons include: i) addressing upfront infrastructure projects' procurement challenges with a particular focus on design, a close management of the contracts, and supervision of works; and ii) ensuring that the PIU is in place at project effectiveness to start implementation quickly.

III. IMPLEMENTATION ARRANGEMENTS

A. Institutional and Implementation Arrangements

69. To support the preparation of the project, a Technical Preparation Committee (*Comité Technique de Preparation, CTP*) was formally established by the Government in May 2022. This institutional body is led by the Ministry of Economic Forecasting and Partnerships (*Ministère de la Prospective Economique et des Partenariats internationaux*, MPEPI), and includes representatives from the following institutions: MPEPI, MEA, MATUH, Ministry of Infrastructure and Access Improvement (*Ministère des Infrastructures et du Désenclavement,* MID), the Municipality of N'Djamena, the Ministry of Territorial Administration, and Decentralization and Good Governance (*Ministère de l'Administration du Territoire, de la Décentralisation et de la Bonne Gouvernance*, MATDBG).

70. The project preparation is being coordinated by the CTP and implemented by the MID's Project Coordination and Monitoring Unit (*Cellule de Suivi et de Coordination des Projects-CSCP*), which is responsible for administering the project PPA of close to US$4 million in place since June 2022.

71. For the implementation phase, a three-tiered institutional arrangement will be set up (see Fig. 7):

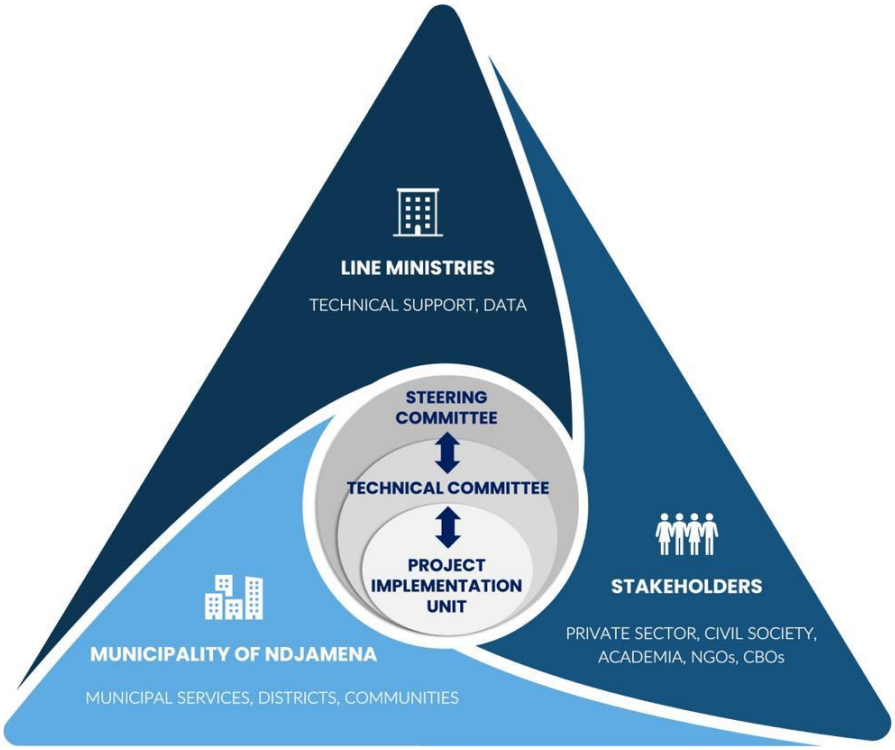
- **A Project Steering Committee (PSC)** will be established at a high level under the auspices of the Minister in charge of Territorial Development, Urban Planning and Housing and with the participation of all Ministers involved in the project. This committee will provide policy and general guidance, strategic decision-making, and overall oversight of project implementation, with alignment and complementarity with ongoing or planned projects and initiatives. It will act as a strategic coordination platform on urban resilience and flood risk management across sectors and actors.
- The CTP will be transformed into a **Technical Committee (TC)**, co-chaired by the MATUH and the Municipality of N'Djamena. It will include the technical focal points of the different institutions involved in the implementation of the project. The TC will ensure a comprehensive and coherent approach to tackle issues related to urban resilience and flood risk management across different projects and initiatives. It will facilitate data collection, sectoral buy-in and contributions, technically sound design, formal validation, and people-centered transformational impact. It will help strengthen technical coordination on urban resilience and flood risk management across all relevant institutions in N'Djamena.
- **A Project Implementation Unit (PIU)** will be formally constituted and operationalized during PPA implementation and expected to be in place before project effectiveness. The PIU will be under the auspices of

[27] Independent Evaluation Group (2022). The World Bank Group in Chad, Fiscal Years 2010-2020, Country Program Evaluation.

MATUH and will be responsible for overall coordination, FM, procurement, E&S safeguards, and flow of funds. The PIU's capacity will be assessed from a technical and fiduciary perspective by the World Bank during project preparation, and a capacity-building plan will be developed. For any big work contracts, the PIU will ensure support and clearance from the relevant line ministries with the sectoral mandate for the specific investment, including the ministries in charge of urban development, water and sanitation, roads and transport, decentralization, agriculture, environment, women and youth, the agencies in charge of meteorology, hydrologic resources, preparedness and response, new information and communication technology, etc.

72. As the proposed project is focused on urban resilience, the Municipality of N'Djamena is the core beneficiary and will play key roles in terms of urban planning, investment identification and prioritization, stakeholders, and community engagement (including the private sector, academia, NGOs, civil society organizations, and community-based organizations), land deliberations, possible resettlements, O&M and infrastructure sustainability. Detailed coordination mechanisms between the PIU and the Municipality of N'Djamena will be established and detailed in the POM to ensure that project activities are vertically and horizontally well-coordinated with the city's planning and to allow for subsidiarity in implementation.

Figure 7. Institutional Arrangements



73. **Project implementation readiness.** A PPA in the amount of US$4 million was used to carry out project preparation activities. Under the PPA, feasibility and technical studies and safeguards documents for the priority flood protection investments under Subcomponent 1.1, as well as Terms of Reference (ToRs) for the capacity building and TA activities under Subcomponent 2.1 are being developed (estimated cost of US$8 million); some of the studies are expected to be procured before project effectiveness. The total estimated cost of works under Component 1 that can commence during the first two years of project effectiveness, including safeguards measures, is estimated to be around US$40 million,

which could be disbursed in the first four years of implementation. The recruitment process of PIU staffing has commenced under the PPA: the five key positions (project coordinator, environmental specialist, social specialist, financial management specialist (FMS) and procurement specialist) were advertised in August 2022 and are in the final stage of selection.

74. **Use of IDA funds for resettlement costs.** During project preparation, the Recipient requested the World Bank to contemplate the possibility of financing with IDA funds the resettlement compensation costs related to the implementation of the Resettlement Plan under the project. Due to limited information on this particular request, it was agreed with the Recipient that this request would be revisited during project implementation, once a detailed Resettlement Action Plan (RAP) has been prepared and processed in accordance with applicable World Bank policy and procedures.

B. Results Monitoring and Evaluation Arrangements

75. To improve the quality of project implementation, the PIU will be responsible for the overall M&E of the project and for reporting on overall progress, results (disaggregated by gender whenever possible) and grievances. To support results M&E arrangements, the PIU will develop a POM, laying out the modalities and timing of data collection as well as reporting formats (including project progress reports, third-party evaluation studies, and specific baseline and beneficiary surveys) and will appoint a dedicated M&E officer who will collect and present data in a standardized reporting format in conjunction with the World Bank's implementation support missions (ISM). The project will provide training on data collection, reporting, and quality control.

76. Semi-annual progress reports will be prepared by the PIU and discussed with the World Bank during ISM. A Mid-Term Review (MTR) will be conducted to assess progress and make any necessary adjustment to project implementation. Monitoring will include community participation and comprise periodic, independent monitoring of project performance, including beneficiary feedback, and satisfaction surveys. Monitoring of project activities will be supported by geo-mapping and remote supervision, using digital solutions such as GEMS and Project360, which will provide timely data on implementation progress and project performance. The project will include external evaluations before the MTR and the Implementation Completion and Results Report (ICR) stages. The M&E evaluation system will generate knowledge products and information that will be disseminated among project beneficiaries through various communication channels, and project data should be generated and accessible on an open data platform to allow free and easy use by the Government and the World Bank. Financing for M&E arrangements will be provided through Component 3 "Project Management and Monitoring".

C. Sustainability

77. Ensuring sustainability will happen through three main channels: institutional collaboration, community-level involvement, and financial and operational capacity building of relevant technical services. First, the project has an anchorage at the central level (MATUH), the local government (Municipality of N'Djamena) being the main beneficiary, and all relevant services being implicated, which will promote shared transversal appropriation and ownership. This approach will guarantee better governance of flood risks at central and local levels, as recommended by the 2015 Sendai Framework for Action on Disaster Risk Reduction. Furthermore, the involvement of the other sectoral ministries, agencies and non-governmental stakeholders will promote dynamic inter-sectoral coordination and ownership, and subsequently the sustainability of the transformational impact created by the project investments. This process has already started during preparation, with, for instance, the strong involvement of the MEA at both strategic and operational levels. Thus, the concomitant implication of the Municipality, the MEA and MATUH is leading to appropriation of strategic decisions, but also active collaboration between technical services on the ground. This large spectrum of actors requires broad and

efficient stakeholder consultations during project preparation and implementation, taking into consideration sectoral strategies and municipal policies, community needs and priorities, as well as institutional capacity building. This inclusive approach, with particular attention to specific needs and problems of women and youth, will foster ownership of the project's design, implementation, and results, as well as relevant dispatching of responsibilities on the ground (e.g., for the O&M of infrastructures and necessary data collection) thus promoting the sustainability beyond project closure. Second, community engagement, especially as part of the community-level interventions program (under Subcomponent 2.2), forms a core part of project design and will help enhance ownership and sustainability of supported investments. One example is the development of urban agriculture in retention basins, an activity for which there is already observed interest and demand, and which, when successfully implemented, would enable productive use of these areas during the dry season as well as preventing the clogging by solid waste. N'Djamena is particularly well-suited for such NBS-related activities as it is not crowded and sound water management year-round is possible to achieve. Third, the project has budgeted capacity-building and TA for municipal services in charge of O&M of flood-related infrastructure and services. Optimization and enhancement of current practices (e.g., planning of dredging activities and output-based contracting of local dredging firms) should outlast the project life. Financial support would ensure the sustainability of infrastructure during the project life, and activities from Component 2 related to cadaster are aimed to lead, in the long run, to higher tax collection for the municipality with the goal of allocating the relevant resources to O&M.

78. Specific measures to support project sustainability include:

a. Inclusion and active participation throughout project preparation and implementation of national directorates and the Municipality of N'Djamena. Strategic documents for urban planning, land administration, and flood management will be financed by the project (Component 2) and will require early inclusion and continuous capacity building of government officials, municipal services, and decision makers.

b. Integrated flood risk management, including grey and green infrastructure and NBS adapted to N'Djamena's context, with options for improved stormwater management, fluvial flooding, SWM, environment and disaster risk reduction, urban development, greening activities, and peri-urban agriculture.

c. Strengthening of O&M mechanism for urban drainage and flood protection infrastructure (Subcomponent 1.2). The design will target to minimize O&M costs using local materials and manpower in a context of limited resources. The O&M mechanism will be executed through annual plans including all the drainage network, retention basins built, and green infrastructure, with a dedicated budget and operating manual. For SWM, a comprehensive study will determine the most suitable and sustainable options, the phasing of interventions (pre-collection, collection, transit, transfer, valorization, dumping), the choice of simple and less expensive methods, with community ownership and inclusion, especially women and youth.

d. Synergy with other World Bank and development partner projects in N'Djamena (Fragility Project, Corridor Project, PEAN-AFD, etc.) to build complementarities and sustainability.

IV. PROJECT APPRAISAL SUMMARY

A. Technical, Economic and Financial Analysis (if applicable)

79. **Technical analysis.** The project's technical design maximizes investment impacts by focusing on no-regret measures identified by the Chadian authorities and the World Bank, and by providing a thorough flood risk assessment to further refine future prioritization based on exposure and vulnerability to floods. The interventions combine infrastructure investments with TA for the Municipality of N'Djamena and relevant ministerial services to increase the city's resilience to floods and improve its urban management and provision of basic services to the population. The

project is ready for rapid implementation with several priority interventions already identified and their technical studies being procured. The project design builds on several technical studies and analyses: i) spatial analytics produced in-house by the World Bank, such as the City Scan; ii) an urban planning and management diagnostics of the municipality and relevant ministries; and iii) technical studies performed by engineering firms during the implementation of PADUR and AFD projects or at the initiative of the government (e.g., flood hazard assessment from Hydratec). Furthermore, the project's aims at optimizing O&M of drainage and flood protection infrastructures through two main avenues: i) support to the municipal O&M services during the project lifetime and optimization of O&M procedures; and ii) targeted SWM activities based on a co-diagnostic of the SWM value chain and challenges. The following ongoing or future studies will help further refine specific investments during the early stages of project implementation: i) a detailed, city-wide flood hazard assessment using aerial imagery and digital elevation models of the city and hydrological data to support flood modeling; ii) a hotspot identification and prioritization exercise, led by GCA, using the results from i); and iii) a study to identify the best ways to modernize hydromet services in the country, based on the CREWS TA.

80. **Economic analysis.** The proposed project is funding public goods in terms of soft (e.g., capacity building) and tangible investments based on the build back better principle following the 2020 floods that resulted in severe direct and indirect economic effects, notably in urban areas. Tangible investments include improved drainage networks, new dikes and other infrastructure and urban services (e.g., sidewalks, streetlights, cleaner markets, SWM, etc.) that will flood-proof areas and reap socio-economic and environmental benefits over the medium to long term. A three-pronged economic analysis was performed, in which: i) project impacts were quantitatively evaluated through a cost/benefit analysis; ii) the relevance of the public sector as the project implementer was discussed; and iii) the World Bank added value was analyzed. The detailed economic analysis is included in Annex 5.

81. **Quantitative analysis.** The project is viable when considering the entire investment envelope. With a 20-year time horizon, and under a 5 percent discount rate, the proposed project has a Net Present Value (NPV) of US$205 million as well as an acceptable economic internal rate of return (IRR) of 24.7 percent, a positive Benefit-Cost Ratio of 2.4, and a payback time of 9 years.

82. **Public sector relevance.** The involvement of the public sector is instrumental to strengthen the resilience of N'Djamena's population to floods. Reducing the risks of flooding through municipal multi-prong interventions will increase urban resilience with significant benefits accruing to the poor, notably those living in low laying areas. Setting up an EWS is a local public good that requires public investments and TA.

83. **World Bank value added.** The World Bank value added can be considered at two levels: i) the World Bank's objectivity and legitimacy allows the institution to play a convening and synergetic role that strengthens coordination on effective DRM action between various governmental institutions as well as among the development community; and ii) based on its experience preparing similar projects in the subregion and its strong technical know-how, the World Bank is uniquely positioned to the complexity and technicality of reducing flood risk and strengthening climate resilience of Chad's capital city.

B. Fiduciary

(i) Financial Management

84. An FM assessment was undertaken to evaluate the adequacy of the FM arrangements for the proposed project. Project activities and payments will be executed by the PIU to be established within MATUH. The assessment focused on the FM capacity in terms of planning and budgeting, financial accounting, financial reporting, and internal controls and external auditing in place to satisfy the World Bank's Policy and Directive – Investment Project Financing (IPF) which describes the overall FM World Bank policies and procedures. The implementing entity's arrangements are found to be acceptable if they are capable of: i) recording all budgets and transactions and balances correctly; ii) supporting the

preparation of regular and reliable financial statements; iii) safeguarding the entity's assets; and iv) are subject to auditing arrangements acceptable to the World Bank. This FM assessment was conducted in accordance with the FM Manual for World Bank IPF Operations that became effective on March 1, 2010 and was last revised on September 7, 2021.

85. The inherent risk of the Public Financial Management (PFM) is rated **Substantial**. The GoC has demonstrated over the past years its willingness to maintaining strong building blocks in PFM with a sound and regular dialog with development partners to support the implementation of PFM reforms in the Country. With the support of the international community, the GoC has undertaken a series of PFM reforms since 2012. Internal control rules and procedures have been strengthened for processing and recording transactions and procedures have been computerized with the implementation of various revenue and expenditure management systems (CID, SYDONIA, SYSTAS, SYGADE, SIGASPE). Recently, many projects and programs being funded by development partners (including the IDA-financed Domestic Resources Mobilization and Management Project - P164529 which became effective in December 2018) support the GoC in its effort to modernize the current PFM system in order to improve the efficiency of collection and use of public resources, strengthen the budget preparation process and accelerate the availability to the public of budgetary information. Despite these improvements and commitments, there are some challenges, which still need to be tackled to contribute to addressing poor services delivery issues. Weak planning, budgeting and internal and external control systems have contributed to deepening weak governance and undermining the government's ability to deliver the services expected as well as contributing to poor human development. The strengthening of PFM through the World Bank financed projects is expected to enhance the PFM's system to provide timely and reliable information and improve governance.

86. The overall FM residual risk rating for the project is assessed as Substantial, considering the mitigation measures included in the project design. The proposed FM arrangements for this financing are considered adequate to meet the World Bank's minimum FM requirements under the FM Manual for World Bank for IPF. To mitigate the FM risks, the project design incorporates the following actions: i) the recruitment, prior to the effectiveness, of a qualified and experienced FMS and Accountant dedicated to the project FM activities; ii) the development, prior to the effectiveness, of a comprehensive Administrative, Accounting and Financial Manual of procedures, as part of the POM in form and substance acceptable to the World Bank; iii) the recruitment, within three months after project effectiveness of a qualified and experienced internal auditor fully dedicated to the project internal auditing, based on quarterly internal audit report preparation using a risk-based approach; and iv) the purchasing within three months after project effectiveness of a multi-project and multi-site financial and accounting management software in a manner satisfactory to the World Bank. Furthermore, the PIU will submit quarterly unaudited IFRs to the World Bank, using the same formats as for PMCR. Finally, the project's annual accounts will be audited by an independent external auditor to be recruited within six months after effectiveness in compliance with ToRs acceptable to the World Bank.

87. During the first year of the implementation, the new establish PIU will benefit from the coaching of the PMCR Unit Project Monitoring and Coordination Unit (CSCP) which is familiar with the World Bank FM requirements and is satisfactorily managing the ongoing Rural Mobility and Connectivity Project (PMCR) (US$45 million, P164747) and Cameroon-Chad Transport Corridor (PCDN) (US$225 million, P167798). The project will leverage the existing FM arrangements of CSCP for its implementation. The FM performance of the ongoing PMCR was rated Satisfactory following the last implementation support mission of February 2022.

88. The proposed FM arrangements including the risk mitigation measures (see FM Action Plan) are considered adequate to meet the World Bank's minimum FM requirements under World Bank Policy and Directive. Detailed FM arrangements are provided in Annex 1.

(ii) Procurement

89. **Applicable procurement rules and procedures.** Procurement under the proposed Project will be carried out in accordance with the following World Bank procedures: (i) the World Bank Procurement Regulations (PRs) for IPF Borrowers, dated November 2020; and (ii) "Guidelines on Preventing and Combating Fraud and Corruption in Projects Financed by IBRD Loans and IDA Credits and Grants", dated October 15, 2006 and revised in January, 2011 and as of July 1, 2016 and other provisions stipulated in the Financial Agreements, using the Standard Procurement Documents accompanying the Regulations.

90. **The proposed project will use the Systematic Tracking of Exchanges in Procurement (STEP) system.** The project will be implemented using STEP, a planning and tracking system, in accordance with clause 5.9 of the PR. Procurement Plans and their updates and requests for prior reviews will be sent to the World Bank for clearance through this tool. Procurement activities not requiring World Bank prior reviews will be recorded in STEP as well.

91. **The procuring entity as well as bidders and service providers, that is, suppliers, contractors, and consultants** will need to observe the highest standard of ethics during the procurement and execution of contracts financed under the project in accordance with paragraph 3.32 and Annex IV of the PR. For all works contracts, procurements that apply standard procurement documents will adopt the provisions of the World Bank related to environmental, social (including sexual exploitation and abuse/sexual harassment [SEA/SH] and GBV), and health and safety risks and impacts. This includes codes of conduct (CoCs) that include prohibitions against SEA/Sh.

92. **Special considerations.** Given that insecurity and fragility affect considerable areas in Chad where the project will operate and the country is also facing capacity constraints, the project will use flexibility and simplification in procurement. These procurement arrangements will draw on the World Bank Guidance on Procurement Procedures in Situations of Urgent Need of Assistance or Capacity Constraints issued on July 1, 2016. These measures include the use of Recipient's national procurement provided the arrangements are consistent with the World Bank's Core Procurement Principles. Other key measures to fast-track procurement include the use of United Nations agencies, NGOs, Direct Selection and/or Limited Competition, Community-driven Development (CDD), and Request for Quotations with identified manufacturers and suppliers for other urgent items. If need be, the Recipient can also request a Hands-on Expanded Implementation Support (HEIS) on procurement during project implementation. The simplified procurement arrangements will be detailed on the procurement section of the POM.

93. **Procurement capacity assessments**. The MATUH will be the implementing entity for the project. It will delegate day-to-day management of the project, including procurement, to a selected PIU that will function as the MAFDHU PIU, before effectiveness. The procurement capacity assessment has been conducted and is detailed in Annex 1. At this stage, the following identified risks are summarized as follow: (i) procurement staff with the experience required to effectively implement procurement actions on time and in line with World Bank procurement policies and procedures are insufficient; (ii) administrative routines may result in procurement delays with the potential to affect project implementation; (iii) procurement in fragile areas with few bidders can restrict competition and possibly increase prices and collusion risks; (iv) insufficient capacity can lead to poor contract management and administration of large contracts; and (v) poor filing of documents may lead to loss of documents.

94. **Procurement risk of the project**. As part of the Procurement Risk Assessment and Management System (PRAMS) exercise carried out by the World Bank Procurement Specialist, the overall procurement risk of the project is assessed as **Substantial**. The key risks mitigation measures identified for procurement under the project are as follows: (i) hire on a competitive basis a Procurement Specialist and a Junior Procurement specialist who are experienced and familiar with World Bank procurement procedures and policies prior to effectiveness; (ii) training all project staff involved in PR; (iii) organizing procurement red flags training in collaboration with the Integrity Vice Presidency (Preventive) for implementing agency at appropriate time including procurement and contracts management experts from the early stage of project; (iv) developing a section on procurement procedures as part of the POM to clarify roles of each team member

involved in the procurement process and define the maximum delay for each procurement stage (specifically with regard to review and approval systems and the signing of contracts); (v) developing contract management plans for prior-review contracts; (vi) transferring the major risks (identified in the Procurement Risk Assessment and Management System exercise) to a day-to-day monitoring matrix and monitoring it through project implementation monthly meetings with the client during the first two years of the project, to ensure things are on track; and (vii) improving the filing system to ensure compliance with the World Bank Procurement Filing Manual.

95. **Project Procurement Strategy for Development (PPSD) and Procurement Plan.** The PPSD and the Procurement Plan covering the first 18 months of the project implementation has been approved prior the negotiations. The PPSD for the project includes a market analysis and an assessment of risks and opportunities of procurement activities, as input to the proposed institutional arrangements, approach to market, selection methods, and evaluation options for procurement. The Procurement Plan shall be submitted for the World Bank's approval and include for each contract: (i) a brief description of the activities/contracts; (ii) the selection methods to be applied; (iii) the cost estimates; (iv) time schedules; (v) the World Bank's review requirements; and (vi) any other relevant procurement information. In accordance with paragraph 5.9 of the PRs, the Recipient shall use the World Bank's online procurement planning and tracking tools to prepare, clear, and update its Procurement Plans and conduct all procurement transactions.

C. Legal Operational Policies

	Triggered?
Projects on International Waterways OP 7.50	Yes
Projects in Disputed Areas OP 7.60	No

96. **Projects on International Waterways (OP 7.50).** This OP is applicable to the proposed project as some of the planned interventions may impact water resources of the Chari and Logone Rivers, tributaries of the Lake Chad, shared by Chad, Cameroon, Niger, and Nigeria, and which are international waterways according to Paragraph 1 of the Policy. Accordingly, on October 11th 2022, the GoC notified other riparian countries of the proposed project through the Lake Chad Basin Commission (LCBC), which includes Cameroon, CAR, Chad, Libya, Niger, and Nigeria as its members. On November 11th, 2022, a response was received from the LCBC. The response was supportive of the project but requested the GoC to share any additional project documents to facilitate a better appreciation of the project's impacts (such as the Environmental and Social Impact Assessment and Environmental and Social Management Plan (ESMP)) for transmission to LCBC member states as project preparation advances. In response, on February 14th, 2022, Chad invited the LCBC to the national validation workshop that was held in N'Djamena on February 17th and 19th, 2023 to present the preliminary versions of the project's safeguards instruments, to which the LCBC attended. On February 22, 2023, the GoC responded to the LCBC's letter of November 11th, 2022, by sharing the relevant project instruments and asking for a temporary authorization to be able to meet the project negotiations and World Bank Board approval timeline. On March 2nd, 2023, the LCBC granted temporary authorization to the project. On March 3rd, the RVP approved the Memo Update on OP/BP 7.50 on International Waterways.

D. Environmental and Social

97. **The E&S risk is substantial.** The risks and impacts associated with the implementation of the activities financed by this project are expected to be site-specific, mainly associated with investments in priority and medium- to long-term flood protection and drainage infrastructure including sustainable solutions for their O&M (Component 1) as well as investment to strengthen selected urban services that are complementary to the infrastructure investments and that will

further reduce flood risks, including mainstreaming disaster and climate-related risk management considerations in urban planning instruments, community-based, small-scale interventions, and disaster preparedness and response activities (Component 2).

98. **The project design incorporates key E&S features**, i.e., the approach is based on a gender-sensitive design and an active engagement of communities across all activities to maximize project benefits for the city's population. In addition, the project has a long-term vision of transforming N'Djamena towards a more resilient, green, and sustainable city that can adapt to urban growth, economic transitions and the impacts of climate variability and change. NBS and non-structural interventions to mitigate flood risks will feature as key project design element, as a way to complement traditional infrastructure investments, support both climate adaptation and mitigation, and contribute to long-term flood protection.

99. The **main environmental risks** are related to the potential impact of the activities of Component 1 and 2 on the environment and communities around projects' sites, particularly during infrastructure works. These risks are mainly related to occupational health and safety, labor and working conditions, community health and safety (possible drowning in retention basins), biodiversity (during operation of the drainage network, pollution could be a threat to biodiversity, depending on the outlets, mostly for wastewater), resource efficiency and pollution, related to the waste disposal and management; nuisances related to air and noise emissions related to construction/rehabilitation work. In addition, there might be some risks related to temporary landfills and associated collection points and transfer centers such as leachate pollution.

100. The **main social risks** and impacts are related to: i) civil works for flood protection in densely populated areas, which may require physical and/or economic resettlement of people, and small businesses; ii) a positive impact is in the recruitment of local labor, especially of young people, and women in green jobs; which should in turn lower the need for external labor and the risk of labor influx; iii) however, the risk level for community health and safety may be higher given the urban setting and also possible SEA/SH incidents between workers and local communities given the proximity of work sites to communities; iv) need to ensure effective consultations and exchange of information with the impacted communities is carried out throughout project lifecycle and grievances are managed effectively; and v) the challenges for supervision in the rainy season, given the inaccessibility of some sites.

101. The following are the Environmental and Social Standards (ESSs) that apply to the project activities:

- **ESS1 Assessment and Management of Environmental and Social Risks and Impacts**. This standard is relevant. The proposed project activities are likely to have substantial E&S risk and impact mainly related to occupational health and safety, labor and working conditions, community health and safety, biodiversity (during operation of the drainage network, pollution could be a threat to biodiversity, depending on the outlets, mostly for wastewater), resource efficiency and pollution, related to the disposal and management of construction and waste; nuisances related to air and noise emissions related to construction/rehabilitation work. In addition, there might be some risks related to temporary landfill and associated collection points such as leachate pollution. The Environmental and Social Management Framework (ESMF) including an annex on SEA/SH has been prepared by the Recipient and was consulted upon and disclosed nationally and on the World Bank website on March 1, 2023.[28] It sets out the principles, rules, guidelines, and procedures to assess the E&S risks and impacts of the project and contains measures and plans to reduce, mitigate and/or offset adverse risks and impacts as well as provisions for estimating and budgeting the costs of such measures. Specifically, it includes sections on i) health, safety, and environment (HSE), including specific instruments to be prepared by the client or contractor prior to the start of work (E&S checklists, codes of conduct, safety training, etc.); ii) on resource efficiency and Pollution

[28] All ESF instruments were disclosed by the Recipient at: *https://www.mit-tchad.org/index.php/fr/*

Prevention and Management in line with WBG's EHS Guidelines for Waste Management; iii) guidance to protect community health from wastes and (water) contamination; iv) provision and mitigation measures for biodiversity conservation and sustainable management of living natural resources (during project preparation, specific ToR were drafted to conduct feasibility studies (including Environmental and Social Impact Assessments [ESIAs]) on no-regret investments (under Component 1) and which will include an assessment of the outflow of collected wastewater and rainwater in order to properly address the risks to biodiversity, if any); and v) chance find procedures. For the areas already known (i.e., existing retention basins built through AFD's PEAN project), the Recipient will undertake an E&S audit under PPA funding to be finalized no later than 30 days after project effectiveness. An addendum to the ESMF will be done to cover relevant project activities under the CERC component, should it be activated.

- **ESS2 Labor and Working Conditions.** This standard is relevant because project activities are expected to have some environmental / social risks and impacts related to labor and working conditions. Following an assessment of the labor requirements and types of employees engaged in the project, the Recipient has prepared and disclosed on March 1, 2023 the Labor Management Procedures (LMP)[29] to comply with ESS2 requirements regarding the different categories of project workers: i) direct workers; ii) contracted workers; iii) community workers; and iv) primary supply workers. It also addresses the working conditions, management of worker relationships, protection from workplace hazards, issues on non-discrimination, minimum work age, and the prohibition of forced labor. The ESMF prepared by the project includes sections on EHS, including specific instruments to be prepared by the client or contractor prior to the start of work (checklists, codes of conduct, safety training, etc.). In addition, to ensure health and safety of workers during the construction and operational phases of the project, the PIU will develop and implement a Environmental, Health and Safety Plan that is consistent with World Bank Environmental, Health and Safety Guidelines. The EHS plan will include procedures for incident investigation and reporting, recording and reporting of any non-compliances, emergency preparedness and response procedures and continuous training and awareness to workers as required.
- **ESS3 Resource Efficiency and Pollution Prevention and Management.** This standard is relevant as the project may generate waste and air, water, and land pollution and consume finite resources that may threaten people, ecosystem services and the environment. Activities financed by the project such as civil works, drainage system (rainwater and wastewater), community-level interventions (urban agriculture, greening initiatives, constructions/rehabilitations, etc.) as well as temporary landfill will generate general wastes and pollution. Therefore, the ESMF includes sections on resource efficiency and Pollution Prevention and Management. Assessment of risks and impacts, and proposed mitigation measures related to relevant requirements of ESS3 are included within scope of the ESMF and will be included in the scope of ESMPs as relevant. In addition, a specific study will be conducted on sludge coming from drainage activities and their disposal in line with World Bank's EHS Guidelines for Waste Management.
- **ESS4 Community Health and Safety**. The expected civil works, the functioning of the water retention areas, as well as the operation of the temporary landfill, could have risks and impacts on the health and safety of the community (risk of drowning in the water retention areas, risks related to the movement of waste collection and transfer vehicles). The project is taking place in an urban environment where health and safety management could be a challenge (construction sites, roads) for urban neighborhoods. The ESMF will provide guidance to protect community health from wastes and (water) contamination. The ESMF has also described SEA/SH-related risks and includes an SEA/SH Action Plan.

[29] *https://mit-tchad.org/index.php/fr/component/content/article/98-avis-et-annonces/522-projet-integre-pour-la-lutte-contre-les-inondations-et-la-resilience-urbaine-andjamena-pilier?Itemid=437*

- **ESS5 Land Acquisition, Restrictions on Land Use and Involuntary Resettlement.** Even though new land acquisition is not anticipated**,** the civil works may require some economic and/or physical resettlement since some public spaces and water retention areas are illegally occupied by people who use these spaces for their residence, or small businesses or kitchen gardens. There may also be temporary loss of revenue due to disruption of small business activities. The Recipient has prepared a Resettlement Policy Framework (RPF) compliant with the national legal and regulatory framework and ESS5, which was disclosed on March 1, 2023, by the Recipient and the World Bank.[30] During consultations with the affected populations in Farcha, Walia and Toukra, they expressed concerns about not being compensated in a timely manner for any losses, as well as wanting to be involved in the project monitoring. The RPF details the principles that will be used during the implementation phase of the project where individual RAP will be prepared as necessary. This includes the principles and procedures for the involuntary resettlement and/or compensation of project-affected people, and establishes standards for identifying, assessing, and mitigating the negative impacts of project supported activities. It includes the following topics: a) assessment of national regulatory and institutional frameworks; b) likely categories of affected assets and parties, including an entitlement matrix; c) eligibility criteria and a compensation framework consistent with ESS5 and national legislation; d) measures to assist vulnerable groups; e) a consultation framework to enable the continuous participation of the affected populations in the preparation of specific resettlement plans; f) an institutional framework for the implementation of the RPF; g) a grievance mechanism (GM); and h) a M&E framework as well as a budget.
- **ESS6 Biodiversity Conservation and Sustainable Management of Living Natural Resources.** During operation of the drainage network, pollution could be a threat to biodiversity, depending on the outlets, mostly for wastewater. During project preparation, specific ToR were drafted to conduct feasibility studies (including ESIAs) on no-regret investments (under Component 1) and which will include an assessement of the outflow of collected wastewater and rainwater in order to properly address the risks to biodiversity, if any. The ESMF includes specific provisions and mitigation measures.
- **ESS8 Cultural Heritage.** While the ESMF includes already find chances procedures, ESIAs (to be prepared during implementation) will assess potential risks and negative impacts of project activities on cultural heritage. If deemed appropriate, a Cultural Heritage Management Plan will be prepared, which will include mitigation measures (for instance, relocating or modifying the physical footprint of the project; conservation and rehabilitation in situ; relocation of cultural heritage; documentation; strengthening the capacity of national and subnational institutions responsible for managing cultural heritage affected by the project; establishment of a monitoring system to track the progress and efficacy of these activities; establishment of an implementation schedule and required budget for the identified mitigation measures; and cataloguing of finds). As part of the culture heritage assessment, the Recipient will carry out meaningful consultations by identifying, in accordance with ESS10, stakeholders that are relevant for the cultural heritage that is known to exist or is likely to be encountered during the project life cycle.
- **ESS10 Stakeholder Engagement and Information Disclosure**. A Stakeholder Engagement Plan (SEP), prepared by the Recipient and disclosed by the Recipient and the World Bank on March 1, 2023,[31] is consistent with the requirements of ESS10 and proportional to the nature and scale of the project and associated risks and impacts. The primary stakeholders in project activities are the ministries involved in the project, city officials of N'Djamena, affected people in the project areas who suffer the consequences of flooding, including those who illegally occupy

[30] *https://mit-tchad.org/index.php/fr/component/content/article/98-avis-et-annonces/524-cadre-de-politique-de-re-installation?Itemid=437*
[31] *https://mit-tchad.org/index.php/fr/component/content/article/98-avis-et-annonces/523-plan-de-mobilisation-des-parties-prenante?Itemid=437*

public spaces, squatters and street vendors, and potentially waster pickers. They may be negatively impacted by the project activities, particularly through economic and/or physical displacement, which could be of a temporary or permanent nature. Other stakeholders include members of civil society such as women's organizations, youth-based organizations, and the NGOs working in the project area. These stakeholders have different interests, economic or cultural, regarding project objectives and activities. In consultations during project preparation, stakeholders have expressed the following concerns: the need for effective project communication; involvement in all stages of the project particularly for women and youth; timely compensation for any losses caused by project activities; and safety of the adjacent communities during the civil works. The SEP considers the inclusion of the voices of vulnerable groups (women, female household heads, persons living with handicap) through focus group discussions. A project level GM is included in the SEP and will enable a broad range of stakeholders to channel concerns, questions, and complaints to the implementation agency. The GM will include channels/procedures for SEA/SH complaints including multiple and accessible entry points, referral to GBV service providers and management of complaints in a confidential and survivor centered manner.

- **Environmental and Social Commitment Plan (ESCP**). The Recipient prepared, with the support of the World Bank, an ESCP, setting out the necessary actions to ensure that the project complies with the ESSs. The ESCP was disclosed by in country and in the World Bank intranet on March 1, 2023, respectively.[32] The ESCP identifies the material measures and actions that are required as well as their timeframe and dates of completion and defines the responsibilities of different institutional partners. In addition, the ESCP has identified a number of safeguards instruments which have to be prepared during project implementation in accordance with the relevant requirements of the ESSs. The PCU will also ensure that the consultancies, studies, capacity building, training, and any other TA activities under the project, as well as any other E&S assessments (including the ESIAs and RAPs for the feasibility studies) and related instruments to be supported under the TA will be carried out in accordance with the ESSs. Safeguards instruments will also be prepared and adopted before the carrying out of the relevant project activities under the CERC component, should it be activated.
- **The GBV/SEA/SH risk level for this project is rated as Moderate**. Drivers of risk include context-specific risks, such as general social acceptability of GBV, as well as conflict and proximity of workers to communities in densely populated areas. In response to these realities and aligned with the requirements outlined in the SEA/SH Good Practice Note, the ESF requirements, and a survivor-centered approach, the project assessed the risks of GBV/SEA/SH and includes an action plan in the ESMF. In addition, the project-level GM is SEA/SH sensitive to ensure the safe and confidential documentation, response and management of GBV/SEA/SH complaints and includes targeted and regular involvement of women and other groups at-risk in stakeholder engagement. Contractual obligations in terms of GBV/SEA/SH mitigation will be enforced through the integration of specific provisions on codes of conduct addressing GBV/SEA/SH and training of workers.

V. GRIEVANCE REDRESS SERVICES

102. ***Grievance Redress.*** Communities and individuals who believe that they are adversely affected by a project supported by the World Bank may submit complaints to existing project-level grievance mechanisms or the Bank's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the Bank's independent Accountability Mechanism (AM). The AM houses the Inspection Panel, which determines whether harm occurred, or could occur, as a result of Bank non-compliance with its policies and procedures, and the Dispute

[32] *https://mit-tchad.org/index.php/fr/component/content/article/98-avis-et-annonces/525-cadre-de-gestion-environnementale-et-sociale?Itemid=437*

Resolution Service, which provides communities and borrowers with the opportunity to address complaints through dispute resolution. Complaints may be submitted to the AM at any time after concerns have been brought directly to the attention of Bank Management and after Management has been given an opportunity to respond. For information on how to submit complaints to the Bank's Grievance Redress Service (GRS), please visit *http://www.worldbank.org/GRS*. For information on how to submit complaints to the Bank's Accountability Mechanism, please visit *https://accountability.worldbank.org*.

VI. KEY RISKS

103. **The overall risk rating for the proposed operation is high.** Political and governance risks as well as the risks related to institutional capacity for implementation and sustainability are rated as high despite the proposed mitigation measures. Risks around sectoral strategies and policies as well as technical design are substantial while stakeholder risk is rated moderate. Fiduciary risks are rated substantial and will require attention throughout the project implementation despite proposed mitigation measures. Macroeconomic risks are rated substantial. E&S risks are substantial. 'Other Risks' is rated substantial, mainly driven by the high security risk.

104. **Political and governance risk is rated high**. Following the death of President Idriss Déby of Chad on April 20, 2021, a Transitional Military Council, headed by President Deby's son, Mahamat Déby, took over. The constitution was suspended, and a transition period of 18 months (April 2021 to September 2022) was adopted. The transition aimed to lead to an inclusive national dialogue, the establishment of a new constitution and the holding of elections. The national dialogue which was criticized as being one-sided and constituting essentially a "monologue", resulted in a new government, where General Mahamat Idriss Déby Itno was sworn in on October 10, 2022, as president of a two-year transitional period ahead of elections. On January 25th, the committee responsible for organizing the next referendum on the form of the state was appointed. Some political parties that, previously, supported the transition published a press release to denounce a commission composed exclusively of representatives of the government and Parliament too favorable to the transitional government. There are several uncertainties to complete the democratic transition within this second phase of the transition. This uncertainty, coupled with weak institutional capacity, lack of transparency, weak decentralization, and the high probability of significant changes in government counterparts, represent a high risk to the successful implementation and delivery of the proposed project. To mitigate this risk, the project will develop anticipation, adaptation, flexibility, and resilience to the potential governance risks susceptible to occur during the project life. The project will closely monitor how the political transition will unfold in coming months and develop an appropriate, modular, and adjustable strategy with the support of the World Bank Country Management Unit (CMU).

105. **Macroeconomic risk is rated as substantial.** Chad's economy is highly dependent on oil, which constitutes about 20 percent of GDP, 35 percent of revenue, and 75 percent of exports. A potential decline in oil prices may result in drastic cuts to public expenditure risking core development spending, derailing long-term development objectives and hampering growth. Unpredictable security costs and potential economic disruptions could also divert resources away from important social programs. The uncertainty regarding future oil prices and oil production, as well as the volatile security situation, also jeopardizes progress along the structural reform path. The most recent International Monetary Fund-World Bank Debt Sustainability Analysis (December 2021) concluded that Chad's debt is unsustainable. Chad has a history of commercial borrowing and liquidity constraints that resulted in periods of external and domestic arrears accumulation. Moreover, the fallout from the COVID-19 shock is adding to the country's debt challenges. Considering mounting financing and debt challenges, the authorities requested debt restructuring under the G20 Common Framework to restore debt sustainability and the discussions are currently ongoing.

106. **Sector strategies and policies risk is rated substantial**. N'Djamena currently lacks an overall strategic vision or policy on integrated flood risk management. In addition, urban resilience is cross-sectoral by nature and requires effective

vertical and horizontal coordination between different administrative and sectoral levels. This can be a major challenge in Chad in the current context of transition, uncertainty, instability, fragility, and weak capacity. To mitigate this risk, a strategic steering committee supported by a multi-sectoral TC will be established with a dual representation of key institutions to ensure continuity of dialogue and interventions, sectoral synergies and complementarities in the urban agenda, mutual capacity building, and a systemic approach to flood risk management that considers the interdependencies of the various elements. In addition, the proposed project will invest in the development of an urban drainage master plan and other key urban planning instruments, which offers the city with a strategic and integrated approach to flood risk management while strengthening the capacity for urban planning and management.

107. **Technical design risk of this project is rated substantial.** The technical complexity of structural flood reduction and protection investments addressing both fluvial flood protection systems as well as drainage networks, retention basins, and pumping stations for pluvial floods respond to well identified challenges and prioritized solutions. The project design builds on the experience and lessons learned from the AFD urban resilience portfolio and the Government recovery plan after 2020 and 2022 floods. Given the city's flood risk profile, all technical designs need to integrate hydraulic considerations, climate change considerations, topographic realities, communities' needs, urban expansion, and connectivity with other urban issues such as SWM. To mitigate these risks, dedicated expertise in civil and hydraulic engineering, communication, and stakeholder engagement, and SWM will be mobilized for the project's implementation and delivery to ensure sustainable and transformational impacts. A close coordination with AFD will ensure the project benefits from the technical capacity already built within the Government.

108. **Institutional capacity for implementation and sustainability risk is rated high**. At the national level, many sectors of the central administrations are involved in flood risk management (MATUH, MEA, MID, etc.), with often overlapping mandates, due to the lack of a coherent legal and institutional framework. At the local level, the Municipality of N'Djamena faces serious gaps in terms of human, technical, material, and financial resources to properly manage floods, solid waste, and other urban risks and vulnerabilities. The transfer of competencies in terms of decentralization has not been translated into a concomitant transfer of resources, while the capacity to collect fiscal resources at the local level is extremely limited. As a result, local governance and coordination of sectoral policies are still deficient, especially in a context where key urban planning and management instruments are either non-existent or completely obsolete. To mitigate this risk, Component 2 of the project is focused on substantial TA and capacity building activities in urban planning, urban services management, urban resilience and human, material, and technical capacity building for DRM including disaster prevention, preparation, and response, in order to provide the city and central partners with the necessary capacities. In addition, a Project Management Unit with various operational skills is being established at the MATUH level to support the design, prioritization, management, and supervision of activities with support of the PPA.

109. **Fiduciary risk is rated substantial** as the urban sector agencies have limited experience in the new PR. This is accentuated by the lack of experience of the MATUH in implementing fiduciary requirements in World Bank operations, by the fact that fiduciary staff are not yet in place, and the fact that the project will implicate many entities (MPEPI, MID, MATUH, the Municipality of N'Djamena, MATDBG, and MEA, etc.) with low capacity in fiduciary-related matters. To mitigate those risks, PIUs will be set up under the MATUH, and experienced fiduciary staff will be hired. The project will finance significant implementation support to the PIU, and the entities involved. In addition, the World Bank team will closely monitor the procurement and FM aspects of the project.

110. **Environmental and social risk is rated substantial**. The civil works will be carried out in a densely populated urban environment, where the risks of economic and/or physical resettlement, and community health and safety concerns can be exacerbated. In addition, flood protection and drainage infrastructure investments may cause environmental damage and increase the risks related to occupational health and safety and resource efficiency and pollution issues. To mitigate these risks, the PIU has prepared relevant E&S instruments prior to appraisal so that these can be implemented once the

project becomes effective.

111. **Other risks are rated substantial.** Chad is facing the fragile and instable regional context with security threats due to Boko Haram and other terrorist groups operating in the region and causing massive displacements and migrations. Chad has hosted tens of thousands of refugees who fled fighting or terrorist attacks in the neighboring CAR, Cameroon, and Nigeria. In 2015, Chad joined the G5 Sahel regional coalition to address the Boko Haram insurgency and is playing a key role in this group. This overall environment requires continued support and assistance from development and humanitarian partners to allow Chad to better handle insecurity in order to improve its ability to implement development agenda, including WBG-supported operations.

VII. RESULTS FRAMEWORK AND MONITORING

Results Framework
COUNTRY: Chad
N'Djamena Urban Resilience Project

Project Development Objectives(s)

The Project Development Objective (PDO) is to reduce flood risk and strengthen climate resilient urban planning and selected flood-related services in N'Djamena.

Project Development Objective Indicators

Indicator Name	PBC	Baseline	Intermediate Targets						End Target
			1	2	3	4	5	6	
Reduced flood risk									
People with reduced flood risk through infrastructure investments under the project (Number)		0.00	150,000.00						650,000.00
Those who are female (Number)		0.00	75,000.00						325,000.00
Reduction of the 20-year return period flood plain (Hectare(Ha))		0.00	315.00						1,050.00
Drainage networks dredged and cleaned of solid waste according to yearly O&M plan (Percentage)		35.00	50.00						75.00

Indicator Name	PBC	Baseline	Intermediate Targets						End Target
			1	2	3	4	5	6	
Strengthened climate resilient urban planning and selected flood-related services									
Population living in a radius of 2 kilometers to a nature-based solution (Percentage)		0.00	10.00						30.00
MATUH and Municipality have improved urban planning and management capacity (Text)		N/A	Urban Development Master Plan updated and taking into account climate and disaster risk	Pluvial and Fluvial Flood Risk Management Master Plan prepared.	Selected Municipality and MATUH technical services buildings have been rehabilitated and/or provided with adequate equipment.	City-wide SWM strategy developed.	A contingency plan for the city (plan ORSEC) is developed, validated and adopted.	Climate-sensitive urban mobility plan focused on accessibility for people with disabilities prepared.	Urban planning, flood risk management and emergency preparedness and response instruments approved and being enforced and selected municipal and MATUH buildings rehabilitated and adequately equipped.

Intermediate Results Indicators by Components

Indicator Name	PBC	Baseline	Intermediate Targets	End Target
			1	
Flood protection and drainage infrastructure				
Constructed and/or rehabilitated flood protection infrastructure (Meter(m))		0.00	10,000.00	42,000.00
of which drainage infrastructure (Meter(m))		0.00	10,000.00	20,000.00

Indicator Name	PBC	Baseline	Intermediate Targets	End Target
			1	
of which dikes (Meter(m))		0.00		22,000.00
Preparation of Pluvial and Fluvial Flood Risk Management Master Plan (Yes/No)		No		Yes
Waste collected in selected areas targeted by the project (Tons/year)		0.00	50,000.00	146,000.00
Climate resilient urban planning, services and community investments				
Update of the Urban Development Masterplan (Yes/No)		No		Yes
Municipality's technical services buildings rehabilitated and/or provided with adequate equipment (Percentage)		0.00	65.00	90.00
Municipal and ministerial staff from selected technical services trained according to the project's capacity building plan (Percentage)		0.00	45.00	90.00
Women in leadership positions in the community preparedness and response committees supported by the project (Percentage)		0.00	10.00	25.00
Community-level interventions supported by the project (Number)		0.00	60.00	200.00
of which led by women (Percentage)		0.00	15.00	30.00
Person-days of employment created by community-level interventions supported under the project (Number)		0.00	50,000.00	250,000.00
of which those who are female (Percentage)		0.00	35.00	35.00
A contingency plan for the city (plan ORSEC) is developed, validated and adopted (Yes/No)		No		Yes
Neighborhoods reached by gender-sensitive disaster awareness campaigns targeting women (Percentage)		0.00	40.00	90.00

Indicator Name	PBC	Baseline	Intermediate Targets	End Target
			1	
Registered grievances appropriately addressed (Percentage)		0.00	90.00	90.00
Beneficiaries whose needs are met through community-level interventions (Percentage)		0.00	85.00	85.00
of which those who are female (Percentage)		0.00	50.00	50.00
People provided with improved urban living conditions (CRI, Number)		0.00	150,000.00	750,000.00
People provided with improved urban living conditions - Female (RMS requirement) (CRI, Number)		0.00	75,000.00	300,000.00

Monitoring & Evaluation Plan: PDO Indicators

Indicator Name	Definition/Description	Frequency	Datasource	Methodology for Data Collection	Responsibility for Data Collection
People with reduced flood risk through infrastructure investments under the project	Number of people in N'Djamena who are better protected from recurrent pluvial and fluvial floods due to structural and non structural measures provided by the project. This number is limited to beneficiaries of Component 1 (as per footnote in PAD)	Annual	Project surveys and activity reports	Estimates based on M&E reports on project's activities and geospatial data	PIU

Those who are female	Number of women in N'Djamena who are better protected from recurrent pluvial and fluvial floods due to structural and non structural measures provided by the project	Annual	Project surveys and activity reports	Estimates based on M&E reports on project's activities and geospatial data	PIU
Reduction of the 20-year return period flood plain	Reduction of the surface area of N'Djamena flooded by a 20-year return period flood due to newly built and rehabilitated infrastructure under the project	Annual	Project surveys and activity reports	Estimates based on reports from the construction firms, M&E reports on project's activities, flood modelling, and geospatial data.	PIU
Drainage networks dredged and cleaned of solid waste according to yearly O&M plan	Percentage of drainage canals effectively dredged and cleared of solid waste yearly before the start of the rainy season. This indicator is also supported under Component 2.2 activities.	Annual	Project surveys and activity reports	Municipal activity reports and field monitoring of firms	PIU
Population living in a radius of 2 kilometers to a nature-based solution	Share of population living in a radius of 2km to a nature-based solution (as identified in the World Bank Catalogue of Nature-Based Solutions for Urban Resilience, including urban greening, green corridors, urban agriculture, river flood	Annual	Project surveys and activity reports	Monitoring of progress reports, on-site visits, quality control by civil work engineers	PIU

	plains restoration, and parks, etc.) developed under the project.				
MATUH and Municipality have improved urban planning and management capacity	This indicator measures the improved urban planning and management capacity of MATUH and the municipality of N'Djamena through several intermediate targets, including the preparation of key urban planning, flood risk management and emergency preparedness and response instruments as well as the rehabilitation and equipping of selected technical services buildings.	Annual	Project surveys and activity reports	M&E reports on project's activities, field surveys	PIU

Monitoring & Evaluation Plan: Intermediate Results Indicators					
Indicator Name	**Definition/Description**	**Frequency**	**Datasource**	**Methodology for Data Collection**	**Responsibility for Data Collection**
Constructed and/or rehabilitated flood protection infrastructure	Linear in meters of drainage and dikes in targeted neighborhoods of N'Djamena built or rehabilitated under the project according to climate-resilient standards	Annual	Progress reports	Monitoring of progress reports, on-site visits, control quality by civil work engineers	PIU

of which drainage infrastructure	Linear in meters of drainage infrastructure in targeted neighborhoods of N'Djamena built or rehabilitated by the project according to climate-resilient standards	Annual	Progress reports	Monitoring of progress reports, on-site visits, control quality by civil work engineers	PIU
of which dikes	Linear in meters of dikes in targeted neighborhoods of N'Djamena built or rehabilitated by the project according to climate-resilient standards	Annual	Progress reports	Monitoring of progress reports, on-site visits, control quality by civil work engineers	PIU
Preparation of Pluvial and Fluvial Flood Risk Management Master Plan	Preparation by the Chadian government of the Pluvial and Fluvial Flood Risk Management Master Plan to allow for a city-wide strategic development of flood mitigation investments	Once	Finalized Master Plan, meeting reports, progress reports	Review of documents	PIU
Waste collected in selected areas targeted by the project	Volume of waste collected and disposed in official temporary disposal sites in the neighborhoods targeted by the project	Semi-annual	Project surveys and activity reports	Reports from the waste volume monitoring system implemented through the project / Field surveys	PIU
Update of the Urban Development Masterplan	Update of the Urban Development Masterplan to better cope with climate change and strengthen urban resilience.	Annual	Project surveys and activity reports	Municipal activity reports	PIU

Municipality's technical services buildings rehabilitated and/or provided with adequate equipment	Percentage of the N'Djamena municipal premises dedicated to technical services that have undergone rehabilitation/ retrofitting and/or are provided with the necessary equipment to fulfill their mandate	Annual	Project surveys and activity reports	Monitoring of progress reports by construction firms, on-site visits, control quality by civil work engineers	PIU
Municipal and ministerial staff from selected technical services trained according to the project's capacity building plan	Training of key municipal staff on urban management, DRM, and solid waste, including technical skills, institutional capacity for administration, communication and information-sharing, and mobilization of local revenues	Semi-annual	Project surveys and activity reports	Training firms reports, participant lists, and surveys	PIU
Women in leadership positions in the community preparedness and response committees supported by the project	Percentage of leadership positions (lead and co-lead) in the community preparedness and response committees created by the project that are occupied by women to manage disaster early warning system and reduce the impacts of extreme climate events, such as floods in targeted	Annual	Project surveys and activity reports	Analysis of composition of community preparedness and response committees from project's reports	PIU

	neighborhoods				
Community-level interventions supported by the project	Number of community-led small interventions funded by the project, to address flood resilience challenges	Annual	Project surveys and activity reports	Reports from social facilitation firms in the neighborhood	PIU / Municipality
of which led by women	Percentage of community-led interventions supported under the project that are led by women	Annual	Grant applications and progress reports	Review of leadership structures of community-led interventions	Grant administrator
Person-days of employment created by community-level interventions supported under the project	Person-days of employment created by community-led interventions supported under subcomponent 2.2 of the project	Annual	Project surveys and activity reports	Estimates based on M&E reports on project's activities	Grant administrator
of which those who are female	Number of women of person-days of temporary jobs created by activities supported by the project	Annual	Project surveys and activity reports	Estimates based on M&E reports and field visits	PIU/Municipality
A contingency plan for the city (plan ORSEC) is developed, validated and adopted	Create a contingency plan for the city (plan ORSEC) including its development, validation and adoption	Annual	Progress reports	Monitoring of progress reports	PIU
Neighborhoods reached by gender-sensitive disaster awareness campaigns targeting women	Share of N'Djamena's neighborhoods in which gender-sensitive disaster awareness campaigns targeting women have been organized	Annual	Project reports; participation lists	Review of reports and participation lists	PIU

Registered grievances appropriately addressed	Percentage of complaints received, answered within 2 weeks and resolved satisfactorily	Semi-annual	Project surveys and activity reports, GRM	List of complaints collected, processed and monitored through the GRM	PIU
Beneficiaries whose needs are met through community-level interventions		Annual	Program surveys and activity reports	Estimates based on M&E reports and field visits	Grant administrator
of which those who are female		Annual	Program surveys and activity reports	Estimates based on M&E reports and field visits	Grant administrator
People provided with improved urban living conditions		Annual	Project surveys and activity reports	M&E reports on project's activities, field surveys	PIU
People provided with improved urban living conditions - Female (RMS requirement)		Annual	Project surveys and activity reports	M&E reports on project's activities, field surveys	PIU

ANNEX 1: Implementation Arrangements and Support Plan

1. **The PIU for the proposed project will be attached to the Ministry of Land Management, Housing and Urban Development** (*Ministère de l'Aménagement du Territoire, de l'Urbanisme et de l'Habitat*, MATUH). The MATUH will chair the high-level Steering Committee and co-chair, with the Municipality of Ndjamena, the TC, including different stakeholders.

2. **The design of the Implementation Support Plan (ISP) has taken into consideration the risks identified in the risk assessment section of the PAD.** A key element of the World Bank's implementation support strategy would be to focus on and closely monitor the principal institutional, environmental, social, security, and fragility risks identified and described in the Systematic Operations Risk Rating Tool (SORT), over the project duration. A POM will be elaborated and adopted by the implementing agency in form and substance satisfactory to the World Bank, before the project effectiveness date. The POM will be developed according to the nature and the characteristics of the project, as well as its risk profile and presents the details of the implementation modalities and institutional arrangements to support project implementation. The World Bank team will conduct periodic risk reviews through ISM to identify and agree mitigation measures to be taken by the project.

3. **Beyond routine ISMs and a MTR mission, a number of technical missions will be conducted by various sector experts covering the various components and corporate obligations**. This will allow to continuously provide the technical advice necessary to facilitate achieving the PDO and overcome the identified gap in institutional capacity. Safeguards compliance will require strong support from the World Bank for the application of the ESMF in the difficult context of N'Djamena. The ISP also identifies the minimum requirements to meet the World Bank's fiduciary obligations. Collaboration with the sectoral agencies at central and municipal level is a central factor for project implementation. The GoC has initiated several policies on decentralization, local development, poverty and vulnerability reduction, but both central and local institutions still need intensive technical support to implement policies and operations.

4. **Technical support will be provided by the World Bank team to the participating agencies, in general, and the newly established PIU at the MATUH to ensure compliance with different agreed modalities and procedures.** Through its participation in semi-annual ISMs, the MTR, and ad hoc advisory services, the World Bank will provide continuous extensive technical support, efforts and resources to support the implementation on the ground. The project will develop and monitor synergies and alignment with other World Bank-financed projects and associated GoC entities, and benefit from lessons learned in the country and from best international practices. The above will help identify and address major factors and risks that may hinder the proper implementation of the PILIER activities and provide guidance on mitigating any issues identified with fiduciary requirements, safeguards compliance, and project management.

5. **The ISP includes frequent reviews of implementation performance and progress.** The World Bank team will monitor progress on several fronts including (i) key performance indicators as defined in the Results Framework and the project's contributions to broader programmatic outcomes for urban resilience and development; (ii) project implementation; (iii) third-party verification of project activities; (iv) proper fiduciary management of all activities carried out by the PIU and other implementing agencies; (v) reconciliation of payments with contracts; (vi) supervision of large numbers of procurement activities; (vii) monitoring of key legal covenants; and (viii) maximizing the use of national staff, international staff, and consultants on a needs basis. The plan will be regularly reviewed and revised as required.

Financial Management

A. Detailed FM Arrangements

6. **Budgeting Arrangements.** The budgeting process (preparation, adoption, execution, and revision) will be clearly defined in the budget section of the FM procedures manual. The budget will be reviewed and adopted by the PSC before the beginning of the year, i.e., not later than November 30 each year. Annual budgets adopted by the PSC will be submitted for World Bank's approval before implementation. Budgets should be regularly monitored at all levels. The approved annual budget of the project should be at least quarterly monitored against actual expenditure. The budget variances will be adequately explained and justified through the quarterly interim financial report (IFRs).

7. **Accounting policies and procedures.** The current OHADA accounting standards (SYSCOHADA) in use in West and Central African Francophone countries will apply to the project. The project's accounts will be maintained on an accrual basis, supported with appropriate records and procedures to track commitments and to safeguard assets. Annual financial statements will be prepared by MATUH PIU, in accordance with the SYSCOHADA and World Bank requirements. Accounting and control procedures will be documented in the FM procedures manual.

8. **Accounting staff**. An FMS, and an Accountant will be recruited on a competitive basis by the PPA refinancing date based on ToR acceptable to World Bank. Hence, the required FM skills should be in place before the project effectiveness. Further training relating to the FM and monitoring of projects and programs will be designed and provided to the team.

9. **Accounting software.** For the needs of recording, managing the proposed project, and reporting on the use of the funds in a timely manner, an appropriate accounting software will be procured and installed by MATUH PIU, within three months after project effectiveness. The accounting software should also be able to prepare WAs and periodic financial reports (IFRs and annual financial statements). The FM staff will be trained on using the accounting system. The team will keep records on Excel spreadsheets until the accounting system is acquired and installed**.**

10. **Internal control system.** The internal control system comprises (i) a PSC to oversee the project activities, and (ii) a POM including Administrative, Financial, Procurement and Accounting Procedures to reflect project requirements by effectiveness, and (iii) an internal audit function to carry out ex-post reviews on quarterly basis (and as needed), and physical verifications to evaluate the performance of the overall internal control system.

11. **Disbursement arrangements.** The disbursement methods to be used under this project will be based on the Disbursement Guidelines for IPF, issued on May 4, 2017. Upon effectiveness, this operation will follow the transaction-based disbursement method. Direct payment, reimbursement, and special commitment methods will be available to the project and might apply as appropriate. The minimum value of the direct payments, reimbursements and special commitments will be 20 percent of the designated account (DA) ceiling. Further details about disbursements to the project will be included in the disbursement procedures described in the Disbursement and Financial Information Letter (DFIL) and the FM procedures manual.

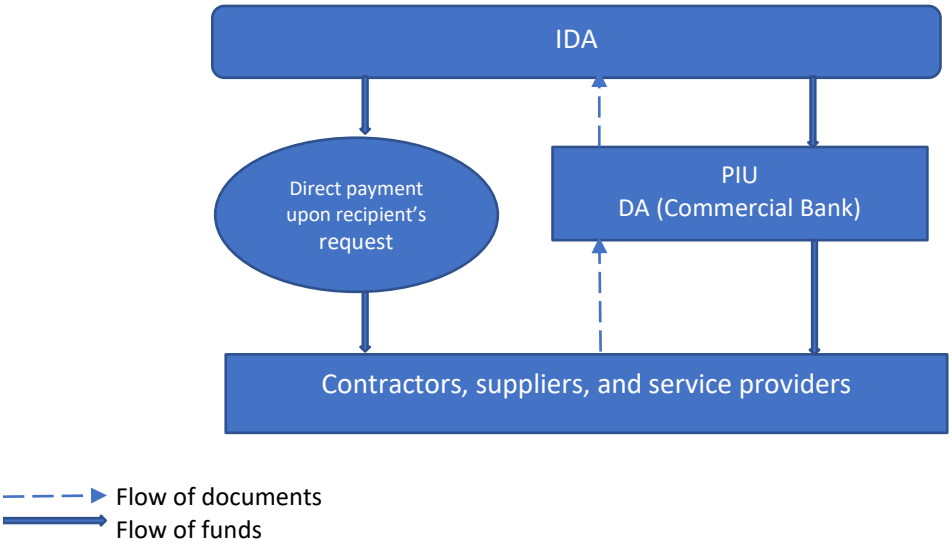
12. **Banking arrangements for eligible expenditures.** The MATUH PIU will open a DA denominated in Central African CFA franc (XAF) in a commercial bank on terms and conditions acceptable to IDA for payment of eligible expenditures. The project's DA will function under the co-signature of the project Coordinator and the FMS of the PIU. If ineligible expenditures are found to have been made from either of the DAs, the Recipient will be obligated to refund the same. If either one of the DA remain inactive for more than six months, the Recipient may be requested to refund to IDA amounts advanced to the DAs. IDA will have the right, as reflected in the Financing Agreement, to suspend

disbursement of funds if reporting requirements are not complied with.

13. IDA will make an initial advance disbursement in Central African CFA franc (XAF) into the DA opened for this purpose, upon receiving a withdrawal application from the Recipient. Replenishment of funds from IDA to the DA will be made upon evidence of satisfactory utilization of the advance, reflected in statement of expenditures (SoEs) replenishment applications would be required to be submitted regularly monthly. Further details about disbursements to the project will be included in the disbursement procedures described in the DFIL.

14. **Fund flow mechanism between implementing entities.** Fund flow arrangements between various implementing entities and reporting requirements will be detailed in the POM.

Figure 1.1. Fund Flow Chart



B. Financial Reporting Arrangements

15. **Interim Financial Reporting arrangements.** For this project, the PIU will prepare quarterly unaudited IFRs. These will be submitted to the World Bank within 45 days of the end of the trimester. The format and the content, consistent with the World Bank's standards, will be agreed between the World Bank and the Recipient. At a minimum, the financial report will include: (i) a statement of sources and uses of funds and opening and closing balances for the quarter and cumulative; (ii) a statement of use of funds that shows actual expenditures appropriately classified by main project activities (categories, subcomponents) including comparison with budget for the quarter and cumulative; (iii) a statement on movements (inflows and outflows) of the project DAs including opening and closing balances; (iv) a SoE forecast for the next quarter together with the cash requirement; (v) notes and explanations; and (vi) other supporting schedules and documents**.**

16. The project will also prepare annual accounts/financial statements within three months after the end of the accounting year in accordance with the accounting system implemented in the subregion (SYSCOHADA). The audited financial statements will be submitted to the World Bank within six months after end of accounting year.

17. **Auditing arrangements**. The annual audited financial statements and audit reports (including Management Letter) will be submitted by the PIU to the World Bank no later than six months from the end of the fiscal year. The audit will be carried out by an independent external auditor with qualification and experience satisfactory to the World Bank.

18. The audit will be carried out in accordance with the International Standards of Auditing (ISA) issued by the International Federation of Accountants (IFAC). The auditor will prepare a work plan to cover all the major risk areas. The following mechanisms are proposed to systematically monitor the timing of audit reports and the timely action on audit findings: (i) the PIU has the responsibility to prepare a consolidated audit action plan within one month of the receipt of the annual audit report; and (ii) within two months of the receipt of the audit report, action must be taken on all audit findings and submitted to the World Bank.

19. In accordance with World Bank Policy on Access to Information, the Recipient is required to make its audited financial statements publicly available in a manner acceptable to the World Bank; following the World Bank's formal receipt of these statements from the Recipient, the World Bank also makes them available to the public.

C. FM Action Plan

20. The overall residual FM risk is considered as substantial. The following actions need to be taken to enhance the FM arrangements for the project (table below).

Table 1.1. FM Risk Assessment and Action Plan

	Significant weaknesses or risks	Action	Due date	Responsible body
1.	Lack of FM skills for adequate FM management of the project	Recruit based on ToRs satisfactory to World Bank (i) one FMS, and (ii) one accountant	By effectiveness	MATUH
2.	Weak internal control environment and lack of an internal audit function	Recruit based on ToRs satisfactory to World Bank one internal auditor	Three (3) months after effectiveness	MATUH
3.	Weak internal control environment and lack of an internal audit function	Elaborate and adopt a POM including Financial, Accounting and Administrative procedures	By effectiveness	MATUH
4.	Information system accounting software	Set up a "multi-project" computerized accounting system to fit project needs and generate useful information and financial statements.	Three (3) months after effectiveness	MATUH
5.	Lack of adequate capacity of court of accounts of Chad	Recruit an independent auditor, with ToR and qualifications acceptable to the IDA.	Within six (6) months following effectiveness	MATUH

21. **FM Implementation Support Plan**. FM ISM will be carried out twice a year based on the substantial FM residual risk rating. Implementation Support will also include desk reviews such as the review of the IFRs and audit reports. In-

depth reviews may be done where deemed necessary. The FM implementation support will include FM training missions for all implementing entities and will be an integrated part of the project's ISP.

Table 1.2. FM ISP

FM Activity	Frequency
Desk reviews	
Interim financial reports review	Quarterly
Audit report review of the project	Annually
Review of other relevant information such as interim internal control systems reports.	Continuous as they become available
On site visits	
Review of overall operation of the FM system	Twice per year (Implementation Support Mission)
Monitoring of actions taken on issues highlighted in audit reports, auditors' management letters, internal audit, and other reports	As needed
Transaction reviews (if needed)	As needed
Capacity building support	
FM training sessions	During implementation and as needed.

Procurement

22. **In Chad, the current public procurement system is governed by the public procurement code adopted in October 202**0 (Decree No 002130/PR/2020) as well as subsequent texts including the decrees relating to: (i) thresholds for awards, control and approval of procurement contracts (Decree 2499 / PR / 2020 of December 21, 2020); and (ii) the simplified procedure for public procurement (Decree 2500 / PR / 2020 of December 21, 2020).

23. **Goods works and non-consulting services** will be procured in accordance with the requirements set forth or referred to in the "Section VI. Approved Selection Methods: Goods, Works, and Non-Consulting Services of the Procurement Regulations", and the consulting services will be procured in accordance with the requirements set forth or referred to in "Section VII. Approved Selection Methods: Consulting Services of the Procurement Regulations". All these requirements will be reflected in the PPSD to be prepared by the client.

24. **Procurement Procedures**. When approaching the national market, the country's own procurement procedures may be used with the requirements set forth or referred to in paragraphs 5.3 to 5.6 related to National Procurement Procedures and subject to certain requirements for national open competitive procurement. Other national procurement arrangements shall be consistent with the World Bank's core procurement principles and ensure that the World Bank's Anticorruption Guidelines and Sanctions Framework and contractual remedies set out in its Legal Agreement apply.

25. **Community participation in procurement:** The project will finance community-based interventions with a focus on non-structural measures related to flood protection at the neighborhood level and will also support the establishment of an EWS, capacity building, provision of equipment and materials for the establishment of community preparedness and response committees. The activities are expected to cost less than US$200,000 which would be procured with procurement methods according to "Section VI (6.52 and 6.53). Approved Selection Methods: Goods,

Works, and Non-Consulting Services of the Procurement Regulations" related to CDD, which are commonly used procurement procedures include Request for Quotation (RFQ); local competitive bidding inviting prospective Bidders for Goods and Works located in and around the local community; direct contracting for small-value Goods, Works, and Non-consulting Services; and the use of community labor and resources. The proposed arrangements will be elaborated in the relevant project implementation document (manual) approved by the World Bank and made publicly available by the Recipient.

26. **Procurement information and documentation, filing and database.** Procurement information will be recorded and reported by PIU as follows: complete procurement documentation for each contract, including bidding documents, advertisements, bids received, bid evaluations, letters of acceptance, contract agreements, securities, and related correspondence will be maintained at the level of respective ministries in an orderly manner, readily available for audit. Also, contract award information will be promptly recorded and contract rosters, as agreed, will be maintained. The PIU/Implementation Agency (IA) will use STEP as required under PR.

27. **Comprehensive quarterly reports.** These reports will be prepared, indicating: (i) revised cost estimates, where applicable, for each contract; (ii) status of ongoing procurement, including a comparison of originally planned and actual dates of the procurement actions, preparation of bidding documents, advertising, bidding, evaluation, contract award, and completion time for each contract; and (iii) updated procurement plans, including revised dates, where applicable, for all procurement actions.

28. **Training, workshops, study tours and conferences.** Training (including training material and support), attendance to workshops and conferences based on individual or group needs, and on-the-job training, will be carried out based on an approved annual training and workshop/conference plan, which would identify the general framework of training activities for the year. A detailed plan and ToR providing the nature of training/workshop, number of trainees/participants, duration, staff months, timing, and estimated costs will be submitted to IDA for review and approval before initiating the process. The appropriate methods of selection will be derived from the detailed schedule. After the training, each beneficiary will be requested to submit a brief report indicating what skills have been acquired and how these skills will contribute to enhance his/her performance and to the attainment of the PDO. Reports by the trainees, including completion certificate/diploma upon completion of training, shall be provided to the Project Coordinators, kept as parts of the records, and shared with the World Bank if

29. **Manual.** Procurement arrangements, roles and responsibilities, methods, and requirements for carrying out procurement activities shall be elaborated in detail in the procurement section of the POM. The manual shall be prepared/updated by the Recipient and agreed with the World Bank before project effectiveness.

30. **Operating costs.** Operating costs financed by the project are incremental expenses, incurred by the PIU or its regional representations, based on the Annual Work Plans and Budgets as approved by IDA, on account of project implementation, management, and M&E, including office supplies, bank charges, vehicles operation, maintenance and insurance, maintenance of equipment and buildings, communication costs, travel and supervision costs, such as transport, accommodation, and per diem, the costs related to utilities and office space rental and salaries of contracted and temporary staff. The related goods/services will be procured using the procurement procedures specified in the POM and accepted and approved by the World Bank.

31. **Procurement capacity assessments**. The MATUH will be the implementing entity for the project. It will delegate day-to-day management of the project, including procurement, to a selected PIU that will function as the MATUH PIU,

before effectiveness. The assessment carried out by the Procurement Specialist, based on the Procurement Risk Assessment Management System (PRAMS) principles showed that the main issues/risks concerning the procurement activities for the project's implementation are: (i) procurement staff with the experience required to effectively implement procurement actions on time and in line with World Bank procurement policies and procedures are insufficient; (ii) administrative routines may result in procurement delays with the potential to affect project implementation; (iii) procurement in fragile areas with few bidders can restrict competition and possibly increase prices and collusion risks; (iv) insufficient capacity can lead to poor contract management and administration of big contracts; and (v) poor filing of documents may lead to loss of documents.

32. **The Procurement risk associated with the project is substantial**. The risk can be reduced to a residual rating of **Moderate** upon considering successful implementation of the mitigation measures below.

Table 1.3: Action Plan Mitigation Measures

Risk	Action	Responsibility	Date
1. Staff involved in the project may not have enough knowledge of the New Procurement Framework (NPF) and/or risk of confusion with the former guidelines.	• Hire, on a competitive basis, a Procurement Specialist and a Junior Procurement Specialist who are experienced and familiar with World Bank procurement procedures and policies. • Organize workshop sessions on the NPF to train all staff involved in the procurement of the project. • Continuous hands-on trainings on the NPF for identified key staff and the Communities involved in procurement.	MATUH /PIU MATUH / PIU MATUH / PIU	Before effectiveness Two months after effectiveness During the life of the project
2. Inadequate communication and interaction between the beneficiaries and the PCU which may lead to delays in procurement processes and poor estimation of the costs.	• Develop a procurement section in the POM (including a Community Development para) to clarify the role of each team member involved in the procurement process of the project and the maximum delay for each procurement stage, specifically concerning the review, approval system, and signature of contracts.	MATUH /PCU	Three months after effectiveness
3. Internal administrative procedures may increase delays in the procurement processes and affect project implementation.	• Exercise quality control on all aspects of the procurement process, including developing ToRs, technical specifications, bidding documents, proposals, request of quotations, evaluation, and award. • Monitor, on a regular basis, the Procurement Plan's implementation and set up a close follow-up in relation with beneficiaries to ensure that appropriate actions are taken on time. • Transfer the major risks (identified in the PRAMS exercise) to a day-to-day monitoring matrix and monitor it through monthly meetings with the Client during the first two years of the project, to make sure things are on track.	MATUH /PIU MATUH /PIU MATUH /PIU/WB	During the life of the project During the life of the project During the first two years of the project
4. Poor contract management and administration of contracts	• Develop contract management plans and the contract execution mechanism.	MATUH /PIU	During the life of the project
5. Procurement in a specialized market in a fragile area with few bidders can restrict competition	• Organize procurement red flags training in collaboration with INT (Preventive) for implementing agency at appropriate time.	MATUH /PIU/ /World Bank	Three months after effectiveness

and possibly increase prices and collusion risks.			
6. Poor filing which can lead to loss of documents.	• Improve the filing system at the PCU level to ensure compliance with World Bank procurement filing manual.	PIU s/Procurement Specialist	During the life of the project

33. **Frequency of procurement reviews and supervision**. The World Bank's prior and post reviews will be carried out based on thresholds indicated in table 2.2. The World Bank team will conduct six monthly supervision missions and annual post procurement reviews. The standard post procurement reviews by World Bank staff should cover at least 10 percent of contracts subject to post review. Post reviews consist of reviewing technical, financial, and procurement reports on project procurement actions by World Bank staff or consultants selected and hired by the World Bank. Project supervision missions shall include a World Bank procurement specialist or a specialized consultant. The World Bank staff may also conduct an independent procurement review at any time until two years after the closing date of the project.

34. **PPSD and Procurement Plan.** The PPSD and the Procurement Plan covering the first 18 months of the project implementation were approved before project negotiations. The PPSD for the project, including a market analysis and an assessment of risks and opportunities of procurement activities, as input to the proposed institutional arrangements, approach to market, selection methods, and evaluation options for procurement. The Procurement Plan shall be submitted for the World Bank's approval and include for each contract (i) a brief description of the activities/contracts; (ii) the selection methods to be applied; (iii) the cost estimates; (iv) time schedules; (v) the World Bank's review requirements; and (vi) any other relevant procurement information. In accordance with paragraph 5.9 of the PR, the Recipient shall use the World Bank's online procurement planning and tracking tools (STEP) to prepare, clear, and update its Procurement Plans and conduct all procurement transactions.

35. The markets analysis carried out as part of the PPSD shows that there are no major difficulties in the implementation of the project activities as described below. Considering the economic conditions and general instability of the country, the possibility of attracting large reputable international companies to bid could be limited. However, communicating and consulting with reputable bidders, suppliers, and consultants will be important in improving competition. Open international competition will be the preferred approach for the high value and complex contracts. Consultancy services relate mainly to classic assignments and studies to be selected using Quality Cost-Based Selection (QCBS). While the mobility of foreign consultants is limited by insecurity, partnerships with local consultants remain an alternative for internationals to compete and use national expertise. The procurement of goods varies from office equipment to control equipment for which the local market is reasonably competitive. Capacities constraints of beneficiaries in terms of adequately expressing needs constitute a potential risk for an efficient procurement of products. For lower value, the Procurement Plan may adopt simple procurement approach as appropriate. The rehabilitation and construction work and the installation of a test cell will be procured using open international or national competition using Request for Bids (RFB) follow post qualification depending on the level of competition. These rehabilitation, and construction of drainage networks in urban localities will use 'multi-lot bidding' with an 'open, international, one-stage' approach without prequalification for contracts with a cost estimate equal to or greater than US$5,000,000 and 'open, national and one-stage' for contracts below US$5,000,000. The lots will be grouped together in contracts, preferably in the same area. Community interventions will be procured using CDD. As the project envisages many small-value contracts, the project will used procurement procedures include RFQ; local competitive, bidding inviting prospective bidders for goods and works located in and around the local community; direct contracting for small-value works, and the use of community labor and resources.

Implementation Support Plan and Resource Requirements

36. **Institutional capacity for implementation and sustainability risk is rated high and will require substantial resources to support the client and build capacity.** In terms of human resources, the World Bank team includes various specialists in DRM, urban development, operations, emergency preparedness and response, cartography, meteorology and hydrology, climate change, FM, procurement, E&S safeguards, and administration. The World Bank operational and fiduciary staff are based in N'Djamena, Chad, and Washington, DC, USA; the E&S safeguards team also has staff in N'Djamena, which will facilitate implementation support and resolution of emerging issues, as needed. For specific technical support, international experts in hydrology and meteorology, and climate change are already recruited, and others will be recruited as needed during the implementation of the project. The team is being supported by other Global Practice (GP) resources such as GFDRR's NBS team, GCA, and international firms for flood risk assessments.

37. The World Bank will conduct ISMs at least twice a year to: (i) review the status of implementation and achievement of the PDO and intermediate indicators; (ii) provide support to resolve implementation issues that may arise; (iii) provide technical support for the achievement of results and capacity building of stakeholders; and (iv) discuss apparent or underlying risks and mitigation measures.

38. The World Bank procurement, FM, and E&S safeguards specialists will also provide effective proximity support to the new PIU. In addition to the ex-post review of procurements that fall below the prior review thresholds, the Procurement Specialist will provide routine hands-on support to procurement specialists/agencies as needed. The FMS will review all FM reports and audits and take necessary follow-up actions in accordance with WB procedures. The project will also conduct a comprehensive fiduciary assessment of the implementing PIU to reduce fiduciary risks. Procurement, financial control, and safeguards specialists will also help identify fiduciary and safeguards capacity building needs. Semi-annual inputs from the E&S safeguards specialists will be provided throughout the project, both during formal ISM, field visits, and virtual technical reviews. This holistic approach will ensure that safeguard instruments are implemented in accordance with WB requirements.

39. The PIU is expected to acquire and use, within three (3) months of the project effectiveness, the TomPro accounting system under the multi-project, multi-donors, and multi-sites version, which is capable of recording transactions and reporting on project operations in a timely manner, including preparation of withdrawal applications (WA) and periodic financial reports (IFRs and annual financial statements). The PIU will use CEMAC accounting standards which are commonly used among the Central African countries. The chart of accounts should be prepared to reflect various project components to facilitate the preparation of relevant monthly, quarterly, semiannual, and annual financial statements. The annual financial statements will be prepared in accordance with CEMAC accounting standards and relevant International Public Sector Accounting Standards using a computerized accounting system.

40. **The following ISP reflects the preliminary estimates of the skill requirements, timing, and resource requirements over the life of the Project**. Keeping in mind the need to maintain flexibility over Project activities from year to year, the plan will be reviewed annually to ensure that it continues to meet the implementation support needs of the Project.

Table 1.4. Implementation Support Plan

Time	Focus	Skills Needed	Partner Role

First 0-12 months	• Project launch • Initialization of project components • FM systems functioning effectively • Procurement practice • Monitor implementation of Project activities	• Team Leads • FM, Procurement Specialists and/or Consultants • Safeguards Specialist and/or Consultants • Urban, DRM, NBS, EPR, Hydraulic Engineer, Civil Engineer, and/or Consultants • Internal and External Auditors	• PIU to prepare project launch • Operationalization of the POM • Early recovery component to quickly implement rapid disbursing activities • Prepare comprehensive Project progress and results monitoring reports in advance of each mission • Update implementation and procurement plans routinely • Organize field visits
12-24 months	• Monitor implementation of Project activities, with focus on no-regret and quick wins activities • FM, Procurement, Safeguards • MTR	• Team Leads • FM, Procurement Specialists and/or Consultants • Safeguards Specialist and/or Consultants • Urban, DRM, NBS, EPR, Hydraulic Engineer, Civil Engineer, and/or Consultants • Internal and External Auditors	• In addition to the above, focus on medium-term recovery component
24-36 months	• Monitor implementation of Project activities, with focus on longer-term investments, O&M, and capacity building • FM, Procurement, Safeguards Project Closing and ICR	• Team Leads • FM, Procurement Specialists and/or Consultants • Safeguards Specialist and/or Consultants • Urban, DRM, NBS, EPR, Hydraulic Engineer, Civil Engineer, and/or Consultants • Internal and External Auditors	In addition to the above, prepare MTR of the project
36-48 months	• Monitor implementation of project activities, with focus on longer-term investments, O&M, and capacity building • FM, Procurement, Safeguards	• Team Leads • FM, Procurement Specialists and/or Consultants • Safeguards Specialist and/or Consultants • Urban, DRM, NBS, EPR, Hydraulic Engineer, Civil Engineer, and/or Consultants • Internal and External Auditors	• In addition to the above, anticipate project closing and ICR preparation
48-60 months	• Monitor implementation of Project activities, with focus on longer-term investments, O&M, and capacity building • FM, Procurement, Safeguards • Project closing and ICR	• Team Leads • FM, Procurement Specialists and/or Consultants • Safeguards Specialist and/or Consultants • Urban, DRM, NBS, EPR, Hydraulic Engineer, Civil Engineer, and/or Consultants • Internal and External Auditors	• In addition to the above, facilitate project closing and ICR preparation

Table 1.5. Skills Mix Required

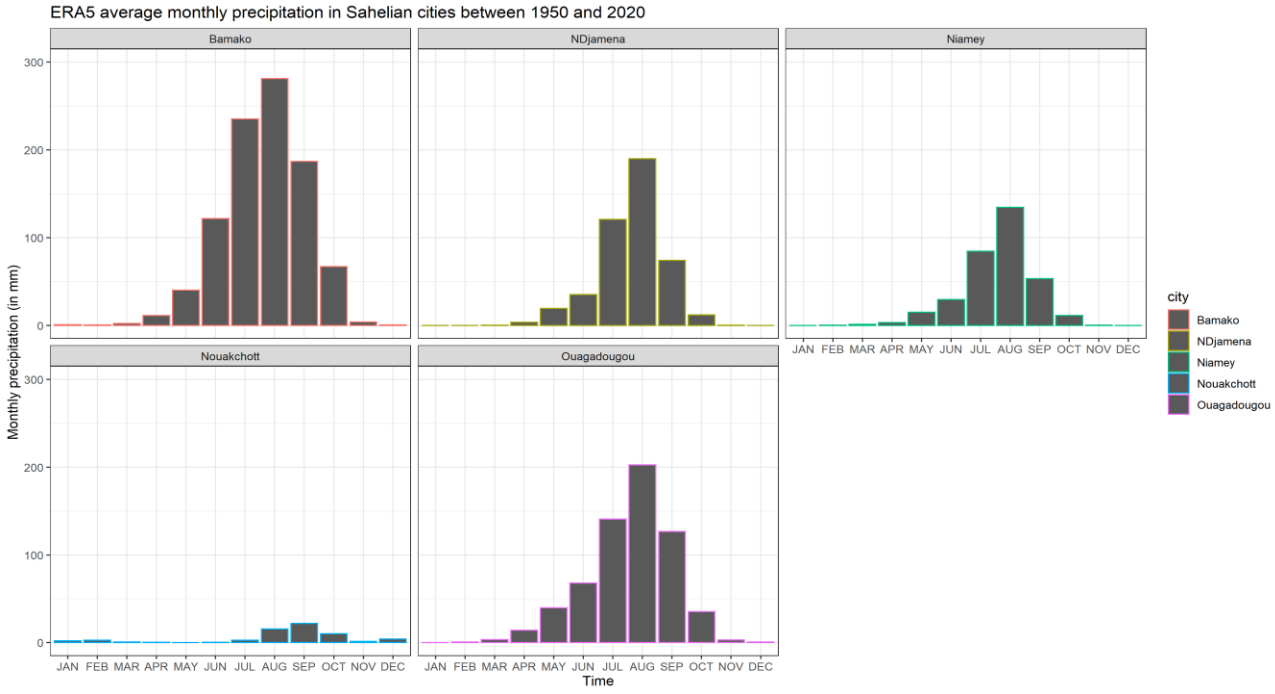
Skills Needed	Number of Staff Weeks	Number of Trips	Comments

• Team Leads • FM, Procurement Specialists and/or Consultants • Safeguards Specialist and/or Consultants • Urban, DRM, NBS, EPR, Hydraulic Engineer, Civil Engineer, and/or Consultants • Internal and External Auditors	• To be outlined after the project is approved	• Routine semestrial ISM	• Ensure safeguard arrangements are built into implementation plans • Review implementation, commitment and disbursement status • Support to monitor progress of activities, in-depth technical review of implementation; adjust implementation plan if needed • Support to monitor progress of activities, in-depth technical review of implementation

ANNEX 2: Climate Co-Benefits

1. Chad Climate Overview. Chad, which extends over more than 15° of latitude, has a variety of climates, ranging from hot arid desert (BWh) in the north (except for the Tibesti mountains, which have a cold arid desert climate BWk), to tropical savannah in the south (including the Sahr and Moundou regions), to a hot semi-arid Sahelian strip (BSh) where the capital N'Djamena is located. Temperatures are high throughout the year, characterized by strong seasonal disparities in the central zone, where monthly averages range from 20° to 27° C in winter to 35° C in summer, while in the south they range from 27° to 29° C year-round. Sahelian rainfall is characterized by one prevailing 1 to 4-month wet season, precipitations being concentrated in the boreal summer months, extending from the late spring to the early fall depending on the location, the south receiving more precipitation than the north (up to 700 mm per year, with a N-S gradient of about 1 mm per km). The region is at northernmost latitudes impacted by the West African Monsoon (WAM) jump and the Inter-Tropical Convergence Zone (ITCZ)'s migration, which controls the regional hydrological regime, along with land-rainfall interactions. Rainfall falls usually through convective storms, whether isolated or organized along squall lines.[4,33] This seasonality is exemplified by the figure below.

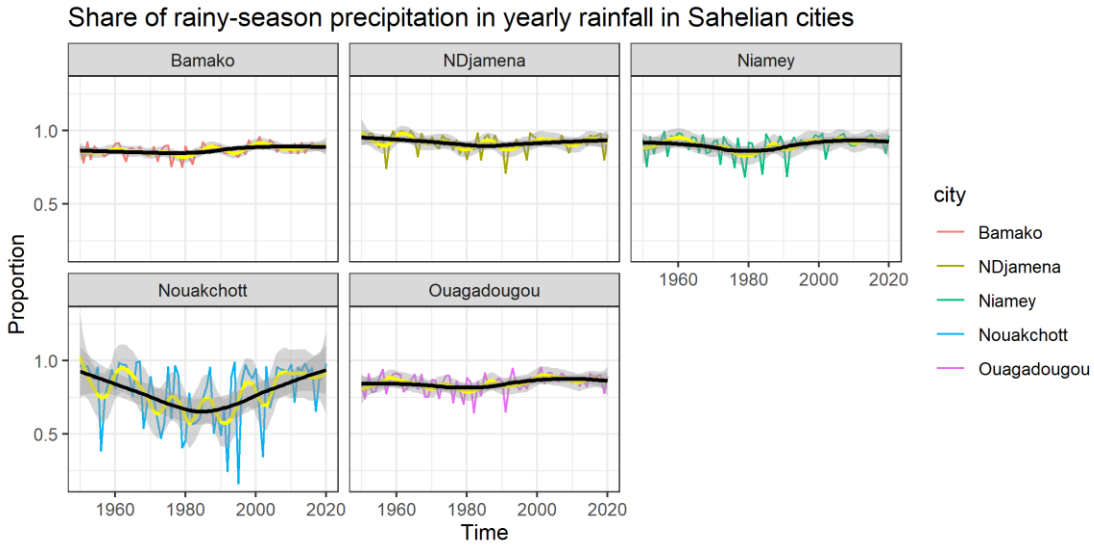
Figure 2.1. Average precipitation in the 5 Sahelian capitals - Source: ERA5



2. In Chad, in the south, annual rainfall can reach between 800 mm and 1,200 mm per year, while N'Djamena receives between 300 and 800 mm (a wide range highlighting the local high inter-annual and inter-decadal variability) and the north of the country can experience years without rain. Rainfall is concentrated in the northern summer months, and the rainy season is longer in the south (May-October) than in the central zone (June-September).

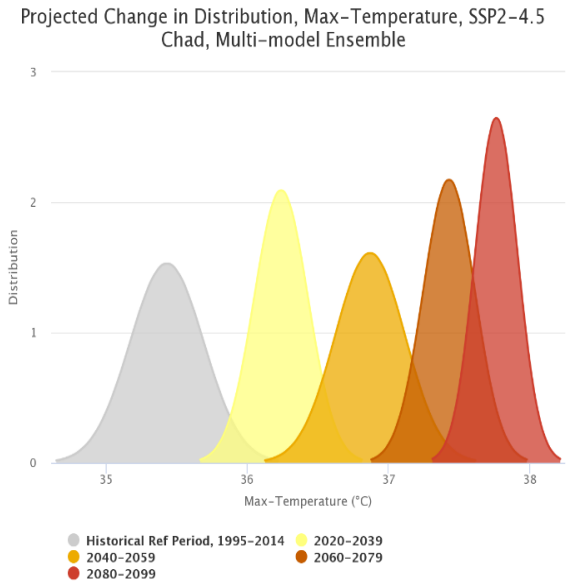
[33] *https://www.britannica.com/science/West-African-monsoon*

Figure 2.2. Time series of the share of rainy season (JJAS) precipitation in yearly rainfall in the 5 Sahelian capitals



3. **Climate variability and change.** Temperature has been increasing faster in the region than the rest of the world, at rates typically greater than 0.2°C per decade since the 1960s - with the increase being particularly pronounced during the wet season. This trend is expected to accelerate, with the potential for +4°C warming by the end of the century, thus increased potential evapotranspiration, which could lead to difficulties for farmers due to more intense droughts, especially if precipitation also decreases. The health effects of the heat index could be more severe in the wetter locations.

Figure 2.3. Source CCKP: CMPI 6 estimate change in temperature distribution over Chad



4. The WAM is a pattern consisting of low-level southwesterly winds carrying moisture from the Atlantic Ocean inland during the wet season, and northeastern winds during the dry season (Harmattan), in concordance with the ITCZ migration (WRCP, 2021) (Sylla, Diallo, & Pal, 2013) (Raj, Bangalath, & Stenchikov, 2019)[34,35,36] (and thus a polarization that is NE-SO rather than N-S as far as the rainy season onset and thus duration are concerned). It is a highly complex phenomena: cumulus-scale to planetary-scale processes influence its timing, extent, and intensity. It comprises three phases: the onset (March to May), during which the rain belt expands north from the coast, the Sahelian high rain period (June-August) initiated by the monsoon jump, an abrupt shift of the rain belt northward and ending the heavy rain period over the Guinean coast, and the southward retreat, which starts in September

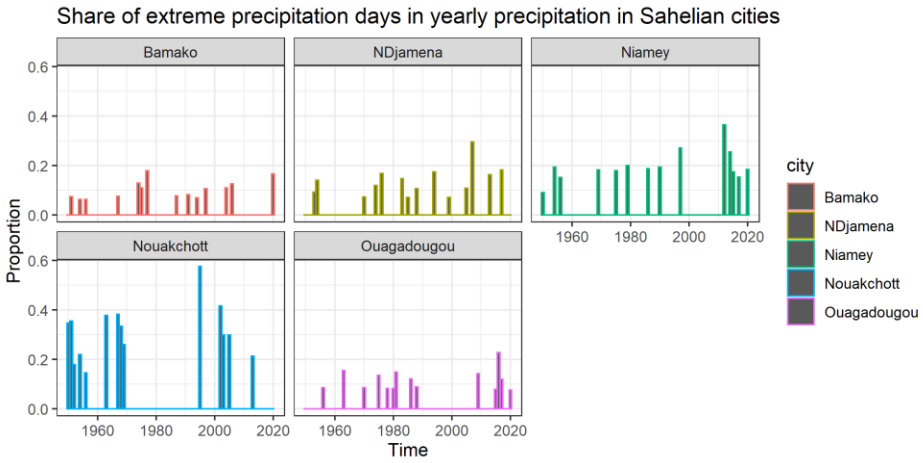
5. High interdecadal climate variability of the WAM stems from influences by climate cycles related to sea-surface **temperatures** anomalies in the Atlantic, east Pacific, Indian Ocean, and the Mediterranean, with long-lasting drought periods alternating with wetter ones[37]. Long droughts of the 1970's and 1980's have been attributed to the conjunction of cooling of the North Atlantic (potentially because of sulphate aerosol emissions), main source of moisture of the WAM, and global increase in ocean SSTs[38].

6. In the 1970's and 1980's, the region experienced severe droughts, leading to heightened food insecurity. In the past decades, yearly rainfall has increased, which has been associated with two narratives in the literature; the "greening of the Sahel", associated with a seemingly hydrological paradox of increased run-off coefficients, and the Dry gets Drier, Wet gets Wetter (DDWW) paradigm, according to which climate change could lead to both longer droughts and more intense extreme rainfall events, generally put in the context of high-impact flood events since the 2000's.

7. In the past four decades, summer rainfall has thus caught up, leading to a return to yearly rainfall close to the levels of the 1960's, while temperature has risen at about 0.15°C per decade, with higher numbers of warm days, and lower numbers of cold days and nights, overall amplifying the impacts of meteorological droughts. The increase in rainfall, which has happened throughout the Sahel, is likely related to warming of the Atlantic Ocean[6,39] (whether this is due to the Atlantic Meridional Overturning Circulation, decrease in aerosol loadings thanks to regulations, or global ocean warming), contrary to the 1970's and 1980's. However, this recovery at the yearly time scale seems to have occurred through more extreme events, as exemplified by the figure below, with the increase in the share of yearly rainfall happening during extreme days seems to be a relatively uniform pattern throughout the region.

[34] CLIVAR (*LINK*)
[35] Sylla et al. (2012), West African Monsoon in State-of-the-Science Regional Climate Models (*LINK*)
[36] Raj, J., Bangalath, H.K. & Stenchikov, G. West African Monsoon: current state and future projections in a high-resolution AGCM. Clim Dyn 52, 6441–6461 (2019). (*LINK)*
[37] Buontempo, C., 2010, Sahelian climate: past, current projections, OECD
[38] Giannini, A. Climate change comes to the Sahel. *Nature Clim Change* **5,** 720–721 (2015). *https://doi.org/10.1038/nclimate2739*
[39] *Hoerling, M., Hurrell J., Eischeid, J., and Phillips A., 2006, Detection and attribution of twentieth-century northern and southern African rainfall change: Journal of Climatology, v. 19, p. 3,989–4,008.*

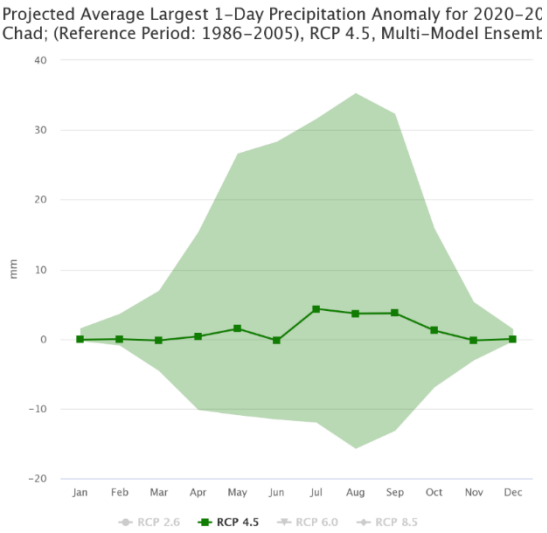
Figure2.4. Share of annual precipitation happening during extreme precipitating days - source: ERA 5



8. Regarding precipitations, the basic paradigm under climate change is the "Dry gets Drier, Wet gets Wetter" (DDWW), stemming from thermodynamic and large-scale atmospheric dynamics arguments. However, climate dynamics organize in complex, interacting ways that evolve at different frequencies, and the picture might not be as straightforward everywhere / all the time, and decision-maker will have to account for this uncertainty, and its narrowing as model progress. Given the mechanisms described earlier to explain recent trends in precipitations, there are reasons to expect increased spatial and inter-annual variability in Sahelian rainfall, while there is still considerable uncertainty regarding the overall sign and the exact location of the changes in traditional CMIP models. However, recent research improving the ability to model relevant mesoscale convective processes does point towards the potential for more extreme rainfall events within the greater Sahelian region[40]. Further, is should be noted that recent research points to the fact that, as far as inter-decadal variability is concerned, CMIP6 runs do not do a better job than CMIP5 one in capturing the magnitude of low-frequency variability in Sahelian rainfall, and may even be worse in matching the timing and pattern of this variability, likely due to failure to simulate the observed combination of forced and internal variability in SSTs (Herman, Biasutti, & Kushnir, 2022).

Figure 2.5. Source: CCKP - projection of largest 1-day precipitation anomaly in the next 2 decades compared to the reference period

[40] *Fitzpatrick et al., 2020, What Drives the Intensification of Mesoscale Convective Systems over the West African Sahel under Climate Change?, Journal of Climate, DOI: https://doi.org/10.1175/JCLI-D-19-0380.1, Page(s): 3151–3172*



9. **Climate vulnerability.** Chad ranks 182 out of 182 in the ND-GAIN index due to its extremely high vulnerability levels and low levels of readiness to adapt to climate change.[41] Land degradation is an important issue in Chad. In N'Djamena, it manifests itself through eroded areas, and more specifically riverbank erosions, leading to increased flood risk. Chad has a large IDP population, due to armed conflicts, but also food insecurity stemming from slow-onset climate change, and, as highlighted by the recent floods that affected 19 of 23 provinces and displaced 255 000 people in the N'Djamena region alone. The Sahel G5 CCDR from the World Bank outlines cities as a priority area for adaptation[42] given their exposure and vulnerability, with the need to perform risk assessments, enhance public spaces with NBS, enhance SWM, and improve drainage systems and flood defenses; these activities are the ones included in the project constituting it.

10. **The need to plan for an uncertain future.** Thus, non-linearities in the climate system, interactions between climate change and climate cycles of different frequencies, difficulties of climate models reproducing historical patterns of extreme rainfall at different frequencies, rational and empirical evidence for more rainfall volatility and more heat and hydrological extremes, and extremely high vulnerability, accounting for increased climate risks should be an integral part of development decision-making in Chad, while also adopting care about use of CMIP model outputs. There is an important responsibility in tackling climate risk and climate change, with the need to include these rising concerns in decision-making.

11. **Statement of intent to address climate risks through climate adaptation and resilience** via project activities. This operation intends to increase resilience to floods through capacity building, infrastructure, climate-informed urban planning and development, to promote NBSs for both flood and heat management and other climate-related risk (e.g. drought). It will also tackle the SWM problematic from the perspective of climate resilience and attempt to set up a value chain preventing GHG-intensive waste management as the city develops.

12. **Project activities contributing to climate change adaptation and mitigation**. All proposed project activities are contributing to climate change adaptation and mitigation. Component 1 activities aim at investing in needed flood protection infrastructure and associated O&M, while initiating SWM activities to enable full

[41] *https://gain.nd.edu/our-work/country-index/rankings*
[42] *https://openknowledge.worldbank.org/handle/10986/37620*

functioning of these infrastructure. Component 2 activities aim to reinforce stakeholders' capacities to understand climate change issues and better cope with them, it also seeks to improve the planning tools to integrate climate risk and develop sub-projects that includes climate smart mitigation and adaptation activities. All Component 2 activities aim to address climate change impacts through climate-risk informed urban planning and community-level activities including afforestation and reforestation, landscape restoration and creation of natural carbon sinks in ecosystems.

Table 2.1. Climate-relevant activity by component

Component 1: Flood protection and drainage infrastructure (US$90 million)

Subcomponent 1.1: ***Investments in pluvial and fluvial flood protection (US$70 million)***

Adaptation activities:

- Improvement of the urban drainage systems, flood protection dikes and rainwater collectors to reduce flooding in the city
- Resilient design of critical infrastructure reconstructed/ rehabilitated to ensure their resilience to climate hazards such as floods and extreme heat

Mitigation activities:

- Use of NBSs will improve carbon dioxide absorption and reduce urban heat

Subcomponent 1.2: Promoting sustainability and effectiveness of flood protection infrastructure (US$20 million)

Adaptation activities:

- Better SWM will aim to reduce the amount of waste entering the river system thereby clogging the drainage system by improving waste collection and driving behavioral changes to reduce open dumping and littering.
- Better O&M of existing infrastructure will enable their use at full capacity during flood events, and will also free municipal services to better manage response

Mitigation activities:

- Investments in SWM, notably composting demonstrator and temporary cell will create the conditions for reduced GHG emissions as the city develops

Component 2: Urban planning, community-level investments, and services for flood resilience (US$50 million)

Subcomponent 2.1: Strengthening risk-informed urban planning and management (US$8 million)

Adaptation activities:

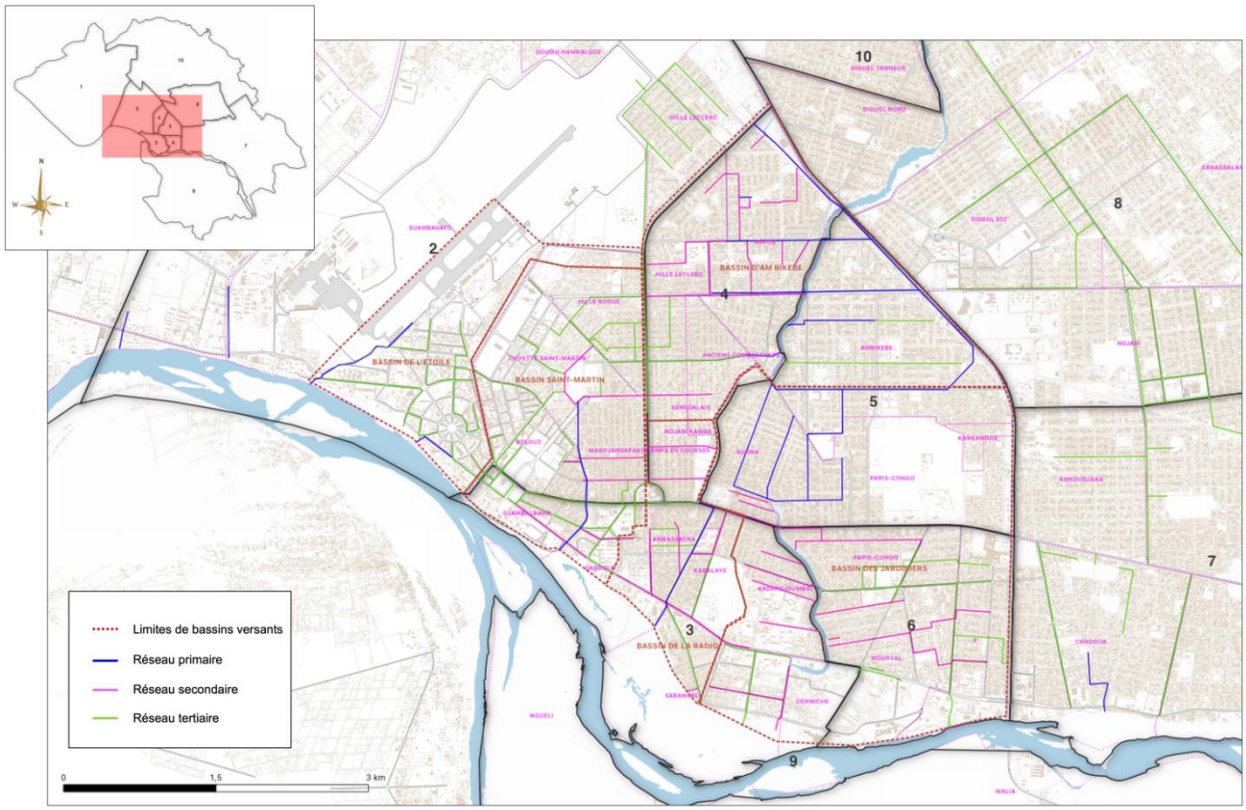
- Emergency shelters, equipment and crisis response center will allow a better response to flood events and climatic hazards
- Reduction of unplanned urban development, will reduce exposure to urban flood risk, and installation of population in flood prone areas
- Use of standard designs for buildings, incorporating climate change and disaster risk considerations, will increase their durability in the context of increased extreme events
- A better knowledge of risk, better coordination and training in emergency preparedness and response will mitigate the impacts of climate disasters on population including those related to floods
- Strengthened institutions and capacity building will improve the ability to prepare for and respond to climate disaster and specific support will be provided for emergency management, in order to reduce vulnerability to flooding

Mitigation activities

• Reduction of unplanned urban development, will limit long-term risks of a higher carbon-built environment • Use of standard designs for buildings, incorporating climate change and disaster risk considerations, will reduce carbon emissions and vulnerability to extreme heat events through passive cooling building design and energy efficient technology
Subcomponent 2.2: Promoting community-level urban interventions and disaster preparedness and response (US$42 million) **Adaptation activities:** • Community equipment and involvement will allow for flood prevention and mitigation • Citizen awareness on climate change considerations, better waste management practices and maintenance of drainage system will help preventing flooding • Sustainable urban farming will mitigate food security risk that will likely increase with drought risk under climate change **Mitigation activities:** • Urban farming activities will lead to a more GHG efficient food value chain • Greening activities such as tree plantation will enable better development of the city as far as GHG emissions are concerned
Component 3: Project Management and Monitoring (US$10 million)
Adaptation and mitigation activities: • This component will finance the direct costs of management and operation of the project to ensure smooth delivery and compliance with World Bank policy and guidelines and M&E including climate change indicators.
Component 4: Contingent Emergency Response Component (US$0 million)
• The CERC could be triggered in the event of a climate-related disaster

ANNEX 3: Priority Investments under Subcomponent 1.1

<table>
<tr><th colspan="2">#1: Flood protection investments in the historical center</th></tr>
<tr><td colspan="2">1. Status quo: Degraded / unfinished drainage network in the historical center</td></tr>
<tr><td colspan="2">2. Description of investment</td></tr>
<tr><td>Objectives:
Stocktaking of the state of the current drainage network and its main bottlenecks
Redesign of the drainage network in the Saint Martin, Radio, and Jardiniers watersheds
Upgrade and retrofitting of the retention basins to ensure durability, bank stabilization, and community involvement in O&M (through NBS and hybrid measures in particular)</td><td>Estimated investment volume: US$15 million</td></tr>
<tr><td colspan="2">Technical description:
The investment concerns the design of the drainage network in the Saint Martin, Radio, and Jardiniers watersheds, whose water needs to be evacuated to the Chari. Activities will include:
Densification, upgrade, and retrofitting of the existing drainage network;
Reassessment of the roles of the basins (Radio and Saint-Martin);
Vegetation of the banks of the basins, creation of green spaces and corridors along the networks;
Possibility of developing urban agriculture in the basins during the dry season (use of underground water, storage solutions, etc.)</td></tr>
<tr><td colspan="2">3. Rationale</td></tr>
<tr><td colspan="2">In 2012, a new Schema Directeur d'Assainissement Pluvial was released outlining a plan for the construction of new drainage infrastructure in the Historical Center of the city (Am Riguebe, Saint Martin, Radio, and Jardiniers watersheds). Yet only a small fraction of the investments proposed have been implemented. Based on updates of the existing studies, this activity will update the design of the network in areas and implement no-regret interventions in the first two years of the project. Despite being part of the historical center the Am Riguebe watershed is excluded from this first phase, due to its more complex hydrology (with part of the water naturally flowing northward away from the city center and existing infrastructure), and further studies taking a holistic perspective on the hydrology of the city are needed.</td></tr>
<tr><td colspan="2">4. Complementarity with other investments</td></tr>
<tr><td colspan="2">This investment will be complementary to the following other investments supported under the project:
Rehabilitation of the Saint-Martin and Radio pumping stations,
Rehabilitation and retrofitting of outlets and addition of check-valves.</td></tr>
</table>

5. **Location**


#2: Secondary drainage network in the intervention zone of AFD's PEAN project	
1. **Status quo:** the PEAN project has built two retention basins, channels, and pumping stations, but no secondary drainage network	
2. **Description of investment**	
Objectives: • Develop a secondary drainage network to ensure runoff from the drainage area is conveyed effectively to the retention basins • Redesign the retention basins to insure gravity flow to the retention basins	**Estimated investment volume: US$11 million**

Technical description:

- Build a secondary drainage network in the investment area of the PEAN project
- Redesign the two retention basins of the PEAN project so they can cope with added influx, and play their role of retention during a longer time as water evacuates to the north
- Study the opportunity to add a pumping station between the two basins to better regulate flow

3. **Rationale**

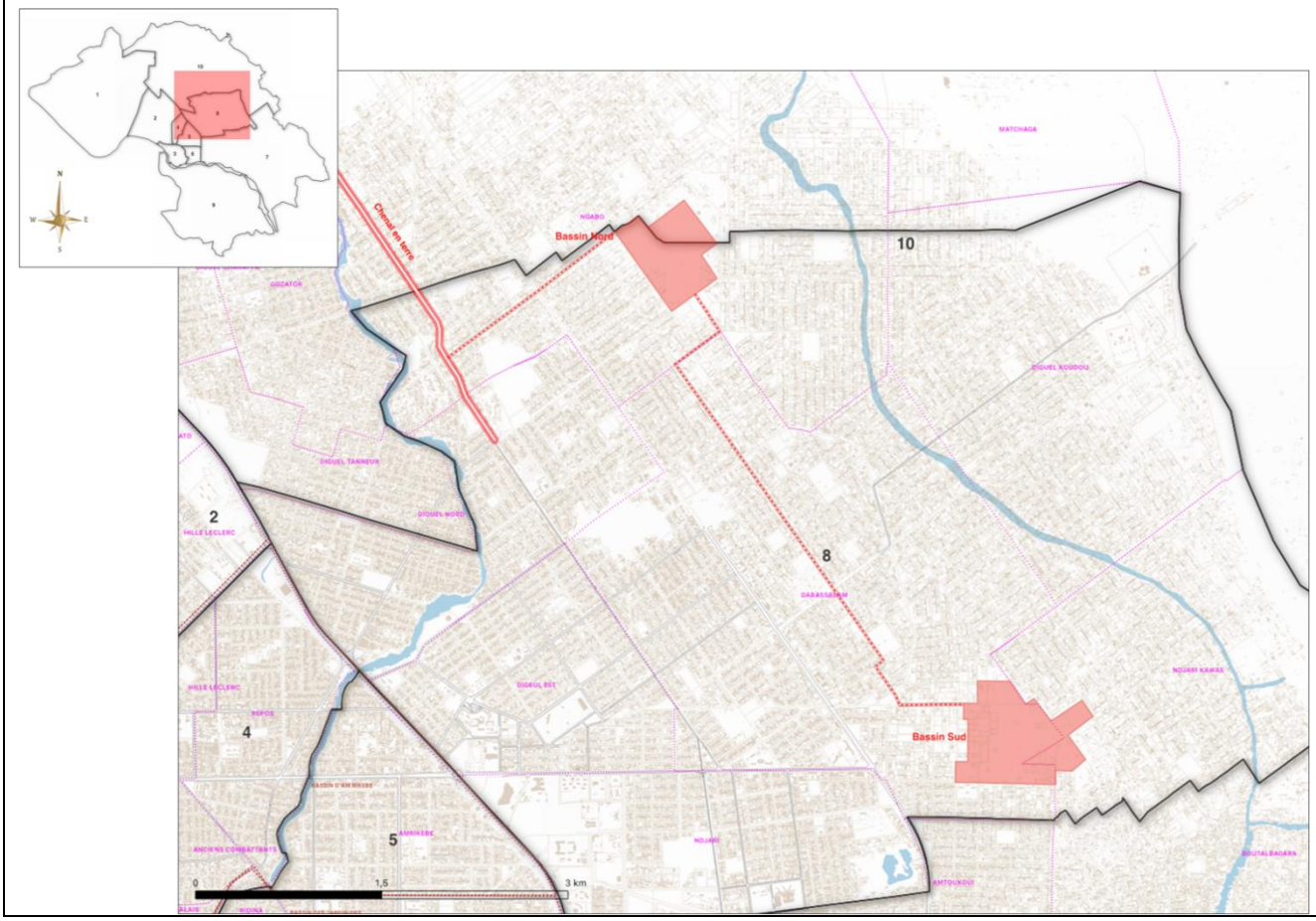
Between 2014 and 2021, the AFD PEAN project (*Projet de renforcement de l'accès à l'eau et à l'assainissement à N'Djamena, et de la gouvernance du secteur*) built primary drainage infrastructure in the north-east of N'Djamena, consisting of a primary canal between N'Dari Kawass and Angabo, the calibration of two retention basins (related by aforementioned canal, the water flowing from the southern to the northern one), and the development of the junction to the Lamadji pumping station to the north, and finally the upgrade of the Lamadji pumping station. However, no secondary network was built to insure proper gravity flow from the neighboring areas to the detention basins. Furthermore, the two retention basins showed their limitations during the 2022 floods and likely need to be redesigned, even without the secondary drainage network. Finally, a pumping station at the outlet of the southern retention basin could not be built as the relocation of the population from the site is taking longer than expected. This is an area for which studies currently exist and for which the interdependencies are well identified (see next section).

4. **Complementarity with other investments**

This investment is complementary with the upgrading of the Lamadji station and the earth channel downstream of Lamadji (for which it is important to take into account the added inflow from this investment). Together, they considerably reduce the risk of flooding in the northeast neighborhoods of N'Djamena.

5. **Location**

Coordinates:
PEAN south basin: 12° 07' 48.15" N. 15° 07' 00.15" E
Pean North basin: 12° 09' 53.91" N. 15° 05' 24.29" E



#3: Rehabilitation of pumping stations and retrofitting of drainage outlets	
1. **Status quo:** Lack of capacity at three pumping stations and dysfunctional drainage outlets	
2. **Description of investment**	
Objectives: • Facilitate proper outflow of water to the Chari in the Historical Center and to the north of the city • Prevent backflow and give time to municipal services to organize emergency response in the case of high river levels	**Estimated investment volume: US$8 million**

Technical description:

- Add two more pumps (and the associated power capacity) for the Lamadji station;
- Rehabilitate pumping stations located at the Saint Martin and Radio (Bokassa avenue) outlets, which are outdated with multiple pumps out of service and dysfunctional outlets. New pumps need to be installed, and the entire stations need to be retrofitted;
- Install or retrofit check-valves or equivalent measure to prevent back-flow during high river flow periods at 11 outlets;
- Prolong 6 collectors and build associated outlets (with check-valves);
- 6 outlets on the Chari River have dysfunctional check-valves. The activity aims to understand the reason of the dysfunction and either retrofit or replace them. 5 outlets on the Chari River do not have check-valves and need to be installed;
- The Farcha – forêt de Milézi outlet, in the Milézi district in the Commune of the 1st district drains water from the 221 hectares Farcha watershed and covers the Farcha and Milézi districts. The drainage network in this watershed consists of a buried rectangular primary collector and an outlet, all built in 2000 and made of reinforced concrete. This outlet collapsed in 2020 and needs to be rebuilt.
- The Sacre Coeur outlet drains water from the eastern part of the Jardiniers watershed, the one not covered by AFD's PACAJ project. This outlet collapsed decades ago and needs to be rebuilt.

3. **Rationale**

The lack of capacity of the pumping stations became evident during the 2022 floods, with water not flowing fast enough to the north, and pumping capacity not being sufficient once the outlets on the Chari River had to be closed. As a result, water to the north evacuated too slowly, and water stagnated in the historical center. Adding pumps at Lamadji will help cope with added inflow so that the retention basins and primary canals to the north do not overflow as much during heavy precipitation events. Further, dysfunctional outlets and pumping station system on the Chari river has created the conditions for improper drainage and back flow from river floods with numerous neighborhoods at risk of being further flooded, either because of the inefficacy of existing check valves, or because none are installed. In 2022, laterite had to be used to prevent further backflow in many locations, which resulted in important time loss for the municipality technical services. Check-valves are necessary in a location like N'Djamena, which is exposed to both pluvial and fluvial flooding at different but sometimes overlapping periods of the year, especially given the low declivity of the area. The rehabilitation and/or retrofitting of the outlet system will allow proper rainwater drainage from its catchment area, improve the living conditions of the population, and prevent the progression of erosion under the collector.

4. **Complementarity with other investments**

The Lamadji pumping station is linked to the earthen channel and north-east drainage network (PEAN), while the other two pumping stations and the outlets will complement the upgrade of the drainage network in the historical center of N'Djamena.

5. **Location**

Coordinates of pumping stations:

Saint-Martin (proche présidence)	12° 06'21.48"N	15° 02'34.33"E
Radio (Bokassa)	12° 05'59.63"N	15° 03'06.07"E

Coordinates of outlets:

Farcha	12° 06'26.65"N	14° 58'41.15"E
Farcha forêt de Milezi	12° 06'48.28"N	14° 59'26.75"E
Farcha abattoirs	12° 06'59.53"N	14° 59'34.77"E
Camp militaire de 27	12° 07'24.01"N	15° 00'22.38"E
Satom	12° 07'23.12"N	15° 00'33.24"E
Rond-point TP	12° 07'14.18"N	15° 01'15.46"E
Ambassade de France	12° 06'55.57"N	15° 01'48.07"E
Saint-Martin (proche présidence)	12° 06'21.48"N	15° 02'34.33"E
Radio (Bokassa)	12° 05'59.63"N	15° 03'06.07"E
Corniche	12° 05'27.67"N	15° 03'27.49"E
Radisson	Not available (private site)	
Sacré-Cœur	12° 05'24.22"N	15° 04'41.38"E
FDAR1 (proche FM Liberté)	12° 05'28.79"N	15° 05'16.97"E
FDAR2	12° 05'27.33"N	15° 05'19.19"E
FDAR3	12° 05'28.93"N	15° 05'24.28"E
FDAR4	12° 05'29.21"N	15° 05'29.75"E
CA7	12° 05'25.41"N	15° 05'46.77"E
Abena 1	12° 05'27.91"N	15° 06'11.26"E
Double voie	12° 05'30.03"N	15° 06'34.54"E
Camp militaire de gassi	12° 04'30.51"N	15° 08'40.02"E
Assemblée	12° 03'49.40"N	15° 08'55.00"E

#4: Retrofitting of the earthen drainage channel upstream to the Lamadji pumping station	
1. **Status quo:** Degraded earth channel used to convey stormwater towards the Elbiher river	
2. **Description of investment**	
Objectives: • Improve bank stability, and hence effectiveness, of the drainage channel	**Estimated investment volume:** **US$3 million**

Technical description:
The channel was built in 2000 to convey water away from N'Djamena to the Elbiher riverbed through the Lamadji pumping station. Upstream of the Lamadji pumping station, the channel extends from the Charles-de-Gaulle Avenue, where it connects to the N'Djari canal, to the Diguel neighborhood, for a total of approximately 6.2 km. Its width evolves from 1.20 m upstream to 8 m at the Lamadji station, its depth from 1m to 1.20 m, and its total footprint from 8 m to 30 m. It also receives water from the newly constructed primary PEAN canal. The channel will be retrofitted through concrete and masonry lining.

3. **Rationale**

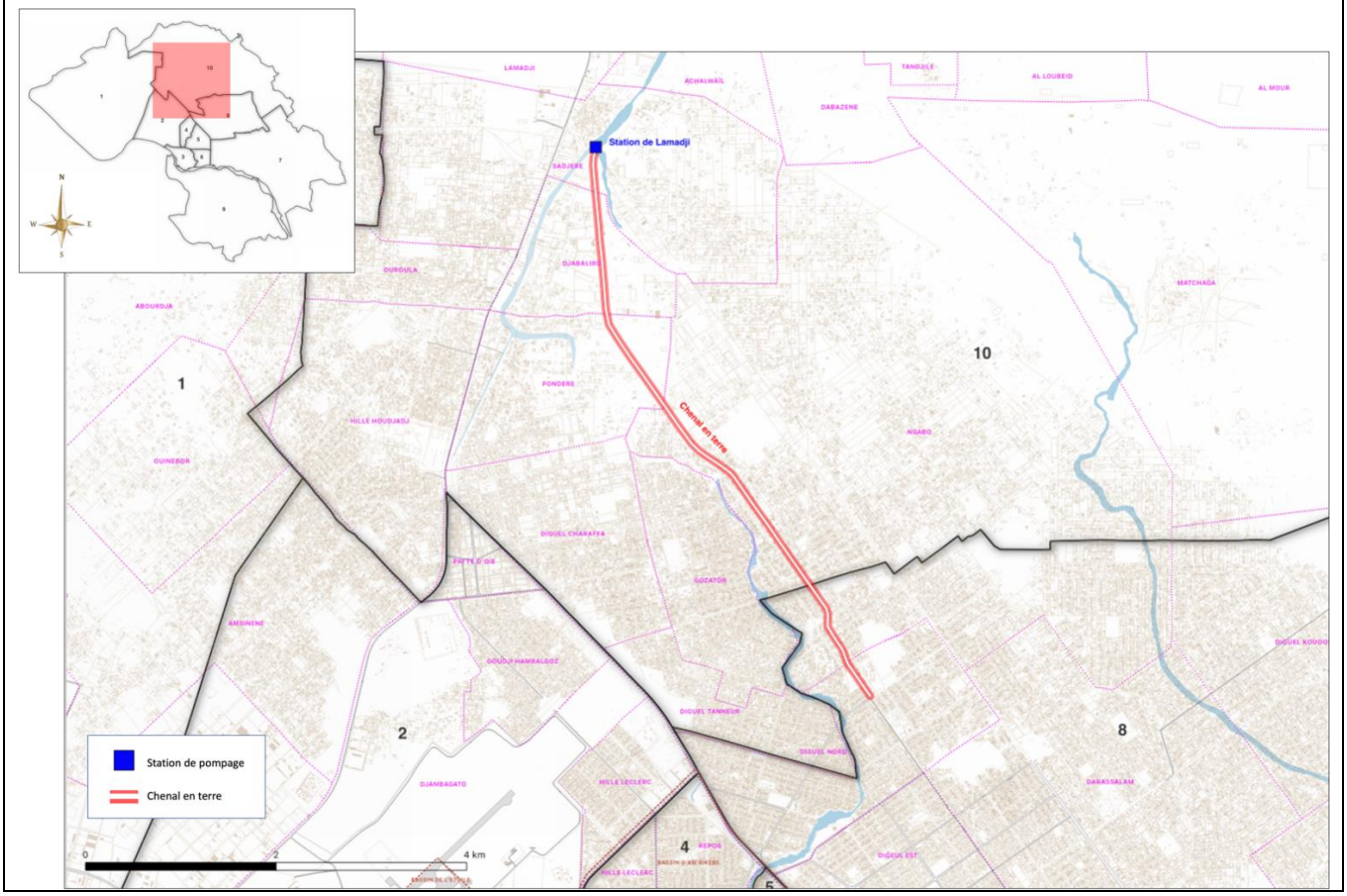
With urbanization of the area, the channel banks get eroded, and right-of-way gets encroached. This leads to increased exposure and risk of alteration of the channel's role to evacuate water to the north. The investment will ensure the Lamadji pumping station can be used at full capacity without flooding populations upstream. Failure to realize the investment will create a flood risk both upstream and downstream of the Lamadji station.

4. **Complementarity with other investments**

Given that this investment will receive water from the N'Djari canal, which collects water from several parts of the city, and from the northeast, it will need to account for added inflow from new investments in the PEAN area. Further, downstream of the station, the channel merges into the Elbihar, the northern outlet for the N'Djamena stormwater system; the Elbiher riverbed is 30 to 40 m wide and flows towards Lake Chad, with a 30 km length from the Lamadji station to Djarmaya where it passes under the Massaguet national road thanks to two culverts.

5. **Location**

6,2km length from 12° 9'28.25"N 15° 4'28.25"E (Ngabo) to 12°12'9.35"N 15° 3'5.09"E (Lamadji pumping station)



#5: Riverbank stabilization in the 1st and 7th districts	
1. **Status:** Eroding riverbanks in the 1st and 7th districts	
2. **Description of investment**	
Objectives: • Rehabilitate and stabilize eroding riverbanks on the right Bank of the Chari in the 1st and 7th districts to provide protection against fluvial floods.	**Estimated investment volume:** **US$2 million**
Technical description: An estimated 1 km of earth riverbanks need to be rehabilitated in the 7th arrondissement, and 700 m need to be rehabilitated in the 1st arrondissement.	
3. **Rationale**	

Riverbanks of the Chari are subject to fast erosion due to the heterogeneity of the material that constitute them, the variations in climate patterns and river flows at different timescales, the impact of wind during the dry season, and the exploitation of sand from the riverbed from the population. Proper rehabilitation of these banks is needed to protect the road leaving N'Djamena on the way to the Chari Baguirmi in the 7th district, and inhabited neighborhood in the 1st district. Further, the stabilization of these banks will prevent the collapse of outlets located in these areas.

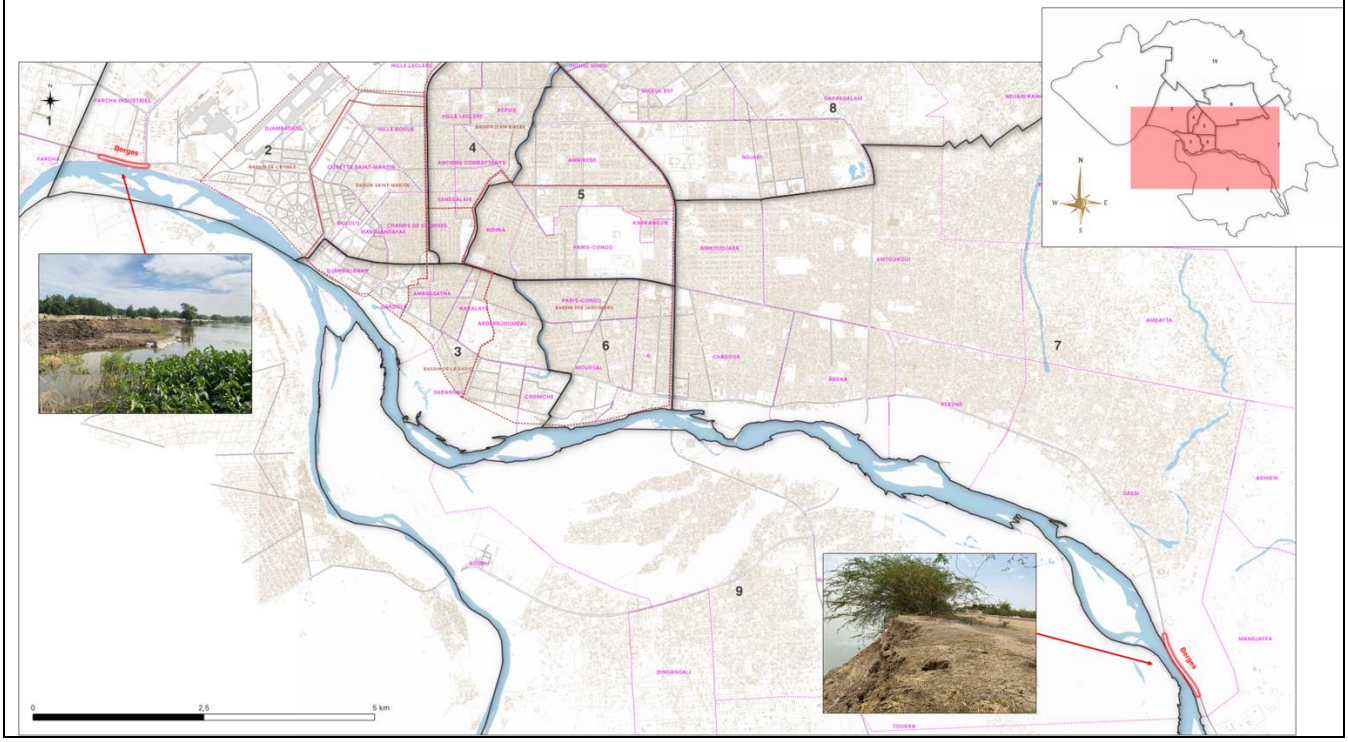
4. **Complementarity with other investments**

In the 1st arrondissements, outlets to be rehabilitated are located near or at the level of the riverbanks to stabilize. As such, this investment will be designed in close coordination with the rehabilitation, construction and/or retrofitting of drainage outlets (see #3 above).

5. **Location**

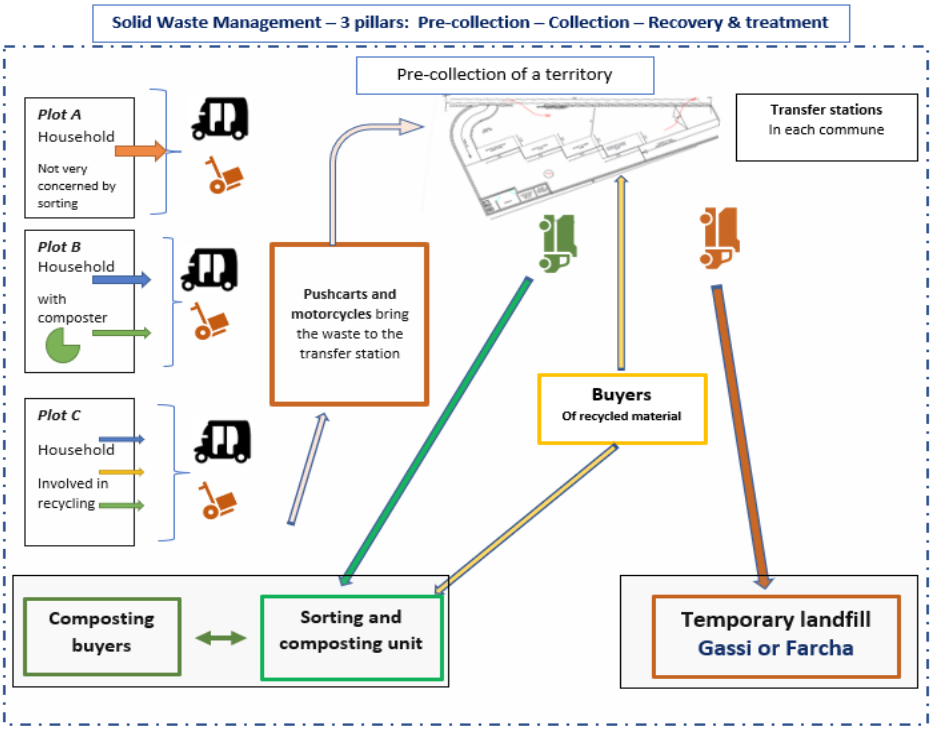
Coordinates:

Farcha riverbanks	700 m	From 12° 07'25.94"N. 15° 00'22.30"E	To 12° 07'21.94"N. 15° 00'45.06"E
Gassi riverbanks	1000 m	From 12° 03'37.45"N. 15° 08'57.77"E	To 12° 03'09.15"N. 15° 09'14.17"E



ANNEX 4: Solid Waste Value Chain

1. Waste management in N'Djamena is broken down into three segments: pre-collection, collection, and treatment.



2. To optimize the whole value chain, the focus needs to be on the adequacy of logistics, by maximizing the density of transport while limiting breaks in load. At the same time, the gradual recovery of the material may limit burial and extend the life of the landfill.

There are the two major axes to be deployed relating to waste deposit:

(i) *Dry recoverable*: the flows of plastics, paper and cardboard, metals, glass, could be recovered from pre-collection by involving, through an incentive mechanism, households, and rag pickers to separate these materials. We can consider a modest quantity of 3 to 8 percent of a waste deposit, but on products whose recovery can be high and of the order of US$100 to US$300 per ton. The organization of the local sector (start-up economy) is therefore a major issue.

(ii) *Recovery of organic and sandy components*: this second material corresponds to the organic waste mixed with the sand, resulting from the cleaning of the plots, and the sweeping of road and sidewalk. Added to this, there is green waste from the maintenance of gardens and public spaces. The added value on composting, after process remains low (between 0 and US$5 per ton) but because of the importance of the quantities, of the order of 50 percent, the added value lies in the optimization of the use of the landfill, and indirectly, this new local resource will create a substitute for chemical fertilizers. Since sorting and composting justify a large surface area, it is preferable to position it outside the city, and probably near a market gardening area. In certain cases, a pre-sorting may take place near the transfer center, which will be the subject of a demonstrator on the PILIER project.

3. *Quantitative and qualitative optimization.* A good control of the flow of parasitic waste such as rubble from construction works and demolitions (very high in an expanding city) and hazardous waste in small quantities like waste from medical and mechanical activities is a prerequisite to sorting channels efficiency. Those waste must therefore have identified channels to limit the spoilt of resources and guarantee a return to the earth of qualitative composted materials.

4. *Existing landfills and potential future needs.* There are no landfills in N'Djamena currently while the need is increasing daily. The project is not intended to offer global SWM and will not intervene in the development of a real sanitary landfill for the whole of N'Djamena. However, it will lay the foundations and identify critical steps to implement and sustain a sound SWM. To do so, the project will finance a temporary landfill in the Gassi neighborhood over the duration of the project. The infrastructure to be financed will mainly serve the areas of intervention of the project, including sludge and soil from the cleaning of the existing canals. This experience can serve as a basis for the elaboration of a future waste management project for the entire city. Studies will therefore be carried out by the project to define the infrastructures of tomorrow, including sorting plan, recovery units and one or more sanitary landfills.

ANNEX 5: Detailed Economic Analysis

Approach

1. This economic analysis follows a Cost Benefit Analysis (CBA) approach, consisting of comparing the project costs' –Capital and Operational Expenditures (CAPEX and OPEX) – with its benefits. The project is found economically sound when its metrics beat set thresholds, namely 5 percent IRR, positive NPV, Benefit to Cost Ratio (BCR) above the unity. The benefits associated with a given project are the difference in economic value between the project scenario (i.e. when the project is implemented) and a baseline (or counterfactual), i.e. when it is not. In DRM projects, economic benefits are avoided damages. These are usually estimated as the sum over the project time horizon of the present value of the difference between the Average Annual Losses (AAL) without and with the project.

2. The following subsections lay out the key modelling assumptions for estimating costs and benefits – their types as well as their expected variations over time. A concluding section computes the economic metrics and highlights salient points. The analysis and modelling build on significant quantitative and qualitative, primary, and secondary data. A conservative approach on both data selection and modelling was followed to handle uncertainties, avoid overestimating the benefits and in turn overly optimistic assessments that jeopardize the robustness of the analysis[43].

Costs

3. The grant amounts to US$150 million (m) and break down into three components and more subcomponents. Each subcomponent amount is in turn split into three categories that reflect the different levels of O&M costs these investments yield. ese broad categories are infrastructures, EWS[44], and Support Services (SS)[45]. We assume that yearly OPEX are 3 percent, 12 percent, and 0 percent of CAPEX respectively for infrastructures –DRM, SWM, or any other urban fabric asset that requires servicing, EWS e.g., the Crisis Management Center (CMC), and SS e.g., technical studies, capacity building or supervision.

4. Investments are disbursed over 6 years[46] and are discounted at 5 percent (common practice for DRM projects and Chad country profile). The economic time horizon is set for 20 years to reflect the aggregated benefits of infrastructure development while avoiding too much uncertainty and wild speculations[47]. Last, we adjust for transfers through labor expected in the community-led interventions program in Component 2.2 as a notional illustration of Ravaillon's approach. [48]

Benefits

5. **Approach.** Two types of losses result from a disaster strike: a destruction of capital (dwellings, infrastructures, crops) followed by a subsequent loss these destroyed assets would otherwise produce. This is well interpreted in terms of loss of stock and flows, i.e., direct and indirect losses[49]. The aggregation of these losses provides a quantitative estimate of the AAL based on which the project yields savings. The trend of the AAL over the project time horizon is

[43] e.g. sources are cross-checked to the feasible extent and input variable values ranging within a plausible range are picked close to the lower bound.
[44] Inclusive of hydrometeorological assets and processes, Crisis Management Centres (CMC) etc.
[45] SS includes Project Management (PM) costs as well as Technical Assistance (TA).
[46] Consistently benefits are claimed using the same ram up.
[47] An advantage for longer horizon is that it can allow to account for climate variation patterns. No reliable data on flood in the project area is available on the matter though. Shorter time horizon is also consistent with the conservative approach.
[48]Ravaillon, M, Appraising Workfare Programs, Policy research working paper 1955, World Bank, 1998 We conservatively assume that 25 percent of the earmarked US$32 m in Component 2 are retained as wages for the community, as a common benchmark for programs with a strong labor component.
[49] This is consistent with *Economic Resilience: Definition and Measurement*, Hallegatte, S., Policy Research Working Paper 6852, The World Bank, 2014. The modelling framework is adapted to best suit the project specific context.

discussed together with the estimate of the share of AAL the project is expected to save.

6. An additional tier of benefits in relation to health and urban development is discussed. The quantitative estimates of these benefits are nonetheless subject to high uncertainty and raise methodological issues. We thus restrict its use to a qualitative insight of important patterns.

7. Whenever feasible, it can be convenient to map projects components to economic benefits to find out their specific impact. The relation between project components and their benefits is nonetheless seldom one-to-one and neat[50]. Economic insight - and hence project rationale – thus better stems from a breakdown into direct and indirect damages and first or second tier benefits.

8. **Direct damages.** Direct damages estimate result from damage aggregation in the project area and accounting for hazard events (i.e., the flood return periods). This is expressed in the following equations where AAL_d denotes the average (annual) direct damages, x_k the damage value for an event of return period k (RP_k) and $\overline{x_k}$ the average of $x_k$and x_{k+1}.

$$AAL_d = \sum_k \left(\frac{1}{RP_k} - \frac{1}{RP_{k+1}}\right) * \overline{x_k}$$

9. The building block of this trapezoidal approximation formula of AAL is x_k : beyond its estimation (see below), it must be linked to RP_k which is first and foremost a hydrological matter. x_k is computed according to the following model, where the index (j) ranges across the various areas of the city[51], and s, d, e, and v respectively denote the flooded surface[52], a density factor[53], the unit value of exposed assets[54], and their vulnerability to flooding[55]. ρ is a coefficient to adjust for other assets damaged, infrastructures essentially (connectivity, water, energy, etc.)[56]

$$x_k = \sum_{j \in J} s_j * d_j * e_j * v_j * (1 + \rho)$$

10. N'Djamena is currently very exposed. It is flooded every single year and hence annual floods have a prevalent weight in the AAL. This is a relatively common pattern in flood risk. A more surprising pattern is that rarer events (e.g. RP of 10 years), albeit greater, remain somewhat comparable to frequent events. This stems from specific site features[57]. Yet rarer floods entail higher water depth which in turn yields more damages for a given impacted area[58]. This leads to

[50] All of infrastructure development, including SWM, EWS and urban planning will combine, in an intertwined fashion, in reducing flood losses. This is conducive to double counting which is a methodological flaw. Conversely, assuming a given valuation of SWM or flood reduction services, it is difficult to break it down quantitatively into health benefits or other form of utility and well-being.

[51] 10 arrondissements

[52] IGNFI and GIS analysis (WB)

[53] This accounts for urbanization and built area. Sources : *Projet d'Infrastructure des Données Spatiales sur la ville De N'Djamena et ses Environs, Projet Pilote de Suivi de la Dynamique Urbaine de N'Djamena entre 1965 et 2017*, IGN FI (2021).

[54] WB computation based on Subject Matter Expert (SME) elicitation and secondary sources including SOPROFIM and Hayatt Architecture, quoted in WB (2020) *Financement du logement en zone CEMAC: Vers un logement abordable pour tous*, Banque Mondiale, 2020.

[55] SME opinion and *Global flood depth-damage functions. Methodology and the database with guidelines*, Huizinga, J., Moel, H. de, Szewczyk, W. (2017), JRC

[56] Damages to crops was computed using surface-based approach, expected yields and market value. It turned out to be negligible with respect to other assets losses. Yet large livelihood setbacks can be particularly harmful to the poorest. This issue is addressed by factoring in utility and welfare - c.f. subsection below on benefit aggregation and distortions.

[57] Hydrology and morphology ; see *Prévention des inondations fluviales sur la ville de N'Djamena, Rapport hydraulique*, Setec Hydratec Octobre 2021 - v1. A telling sign of this peculiarity is that the best fit for river flows data is a Gaussian distribution, which has a very thin tail, whereas Generalized Extreme Values (GEV) functions are usually expected instead.

[58] This is reflected with a conservative (1.2) depth-damage factor – c.f. table 3.1 in JRC (2017), op.cit.

a current estimate of the direct AAL of nearly US$70 m, i.e., 3.8 percent of the area's GDP, which marks relatively high in the expected benchmark range. This is explained by several factors: (i) the protection is almost inexistent (floods occur every year); (ii) urban centers are expected concentrate assets and thus value; (iii) N'Djamena economic profile is consumption-oriented, hence the limited productivity and in turn a higher ratio. It is worth noting that in the above equation input variables are time dependent, hence AAL changes over time. This has essentially to do with exposure, vulnerability to a lesser extent.[59] Conservative estimates of exposure trends were performed using global data sets and prepared by WB teams under the umbrella of the Regional DRM Analytics Program in SSA and the Global Program for Disaster Risk Analytics[60].

11. **Indirect damages.** It is natural to think of indirect damages as a percentage of the destroyed capital. In the disaster aftermath, consumption is foregone to rebuild these assets, which description requires insights on the post-disaster capital productivity. This problem relates to the general theory of capital (and production), which goes well beyond that of DRM economics per se. For our purpose, it suffices to mention that the consensus leans towards avoiding the use of the pre-disaster marginal productivity rate – as might be otherwise convenient – and that Cobb-Douglas production functions can hardly be considered a reliable model either[61].

12. We instead build on and adapt from Hallegate (2014) approach to resilience[62] and use the following model, where AAL_i, K, ρ, respectively represent the indirect AAL, the lost capital (asset destruction), and the share of infrastructure among destroyed assets; in turn η, the α's, and τ respectively account for the productivity of capital lost in a disaster, the ripple effects on the economy of specific items, and the expected time lap to recover the lost assets

$$AAL_i = K * \eta * [(1 + \alpha_1) * (1 - \rho) + (1 + \alpha_2) * \rho] * \tau$$

13. The model is populated as follows:

a. By definition $K = AAL_d$ which is computed according to the previous subsection.

b. $\eta = 24\ percent$, the microfinance lending rate[63], which is a relevant proxy[64].

[59] Hazard can evolve too, but 20 years is too short of a timeframe to ascertain with reasonable confidence any change in this respect. The approximation of a constant climate regime complies with the conservative approach (unless the expectation is that there will be less flood events) and should not be expected to be quantitatively relevant in comparison to the instead very tangible trends in population density and wealth. Exposure and vulnerability are known to be the main drivers of flood risks.

[60] Sources: *Updating global urbanization projections under the Shared Socioeconomic Pathways Scientific Data,* Chen et al. (2022), *Mapping global urban land for the 21st century with data-driven simulations and Shared Socioeconomic Pathways*, Nature Communication Gado and O'Neill (2020), *Description of the GHS Urban Centre Database 2015*, Version 1.0, Florczyk et al., 2019, JRC115586, Oxford Economics, WSF, Digital Globe 2020, Fathom 2017, Image cat.int, METEOR, as well as some local data, e.g. population census, INSEED (2014).

[61] The following is a small selection of non-specific DRM publications the interested reader might benefit from delving into: *The rate of interest and the Marginal Product of Capital*, Metzler L., Journal of Political Economy Vol. 58, No. 4 1950; *Interest and the Marginal Product of Capital: A Critique of Samuelson*; Murphy, R. Journal of the History of Economic Thought, Vol. 29, No. 4, 2007; *"A Theory of Production" The Estimation of the Cobb-Douglas Function: A Retrospective View*, Felipe J., Adams G., Eastern Economic Journal, Vol. 31, No. 3, Summer 2005

[62] Op. cit.

[63] Tchad Questions Générales, Rapport du FMI No 16/275, Août 2016 in WB, 2020 ; quoted in Banque mondiale, 2020. *Financement du logement en zone CEMAC : Vers un logement abordable pour tous. Banque Mondiale*, Washington D.C.

[64] De-accumulation of capital due to the disaster shock is indeed expected to yield a high loss interest rate - this is sometimes coined as the path dependency of the production function in the literature - a pivotal argument in Hallegate (2014) to tweak the Cobb Douglas model. The microfinance lending rate is thought to be an interesting alternative, as a credible yet likely conservative proxy given the high-risk and high-reward profile of investments it usually supports. In comparison, interest rates for real estate over 10 years is close to 12 percent (op. cit.).

c. The α's are positive for N'Djamena –urban centers yield agglomeration economies[65]; but since not all damages cascade down the economy alike[66], we distinguish between large ripple effects resulting from dysfunctional infrastructure[67] ($\alpha_2 = 1$) and moderate diffusion associate with private properties damages[68] ($\alpha_1 = 0.2$).

d. ρ=15 percent is an expected benchmark for urban centers.

e. τ is the duration (in years) before the foregone consumption in the aftermath of a disaster tallies up to the amount of destroyed assets; it is hazard dependent and the weighted average is 0.25 (2 months on annual floods and occasionally more).

14. According to this model, AAL_i barely makes 8 percent of AAL_d, which is small, but benchmarking is more speculative on indirect impacts than on direct ones. This value is explained by the specific project features: (i) N'Djamena is plagued with very frequent flood, for which indirect damages are relatively limited in magnitude and recovery is very fast[69]; (ii) its efficiency as a production centre is limited[70], hence the moderate losses when it is dysfunctional. It is noteworthy that projections are that population will grow slightly faster than built up area in N'Djamena in the coming decades. Hence the share of indirect damage is expected to increase to reflect that if a given flood affects more people, the diffusion of the shock in the economy is greater.

15. **Benefits – 1st tier.** The total AAL is the sum of direct and indirect AAL. Two further adjustments are required to estimate the project benefits: (i) a distributional issue: though poor people have few to lose, this "few" has a much higher marginal utility than for they wealthier neighbors, thus requiring an adjustment of the AAL; (ii) extent of the benefit claim: the share of the adjusted AAL the project can claim to save is yet to be estimated.

16. A large literature relates to the distributional issue. A practical consensus consists in giving a larger weight to the losses incurred by poorer segments of the population. This allows to shift from a sheer cash logic to that of utility and welfare. With a poverty rate of 14 percent[71] and a 1.75 distortion factor[72], a "welfare premium" of 10 percent is yielded.

17. The share of avoided damages should account for all of the (sub)components contribution to damage reduction (infrastructure, EWS, urban planning). It is tempting to think that the compounded effect of these will save all or nearly

[65] Two decades of literature stress the key role of urban centres in growth through specialization and economy of scale. See e.g. *Cities and Development* Henderson, J. Journal of regional science, Vol 50, 2010; also *The magnitude and causes of agglomeration economies*, Puga D. Journal of regional science, Vol 50, 2010; and *Cities as engines of growth: evidence from a new global sample of cities*, Jones, P, Collier P, Spijkerman, D; Journal of applied business and economics, Vol. 22, 2020.

[66] This intuitive and promising idea is developed in *An Exploration of the Link between Development, Economic Growth and Natural Risk*, Hallegate S., Policy Research Working Paper 6216, World Bank, 2012, though in greater generality. This adaptation seeks to be context specific and avoid the (controversial) recourse to common production functions for it is challenging to justify theoretically and fit empirically – see Felipe (2005) "debunking" of the Cobb-Douglas model (op.cit.).

[67] For which there is a form of monopoly, with the notable exception of energy production – recourse to generators is commonplace but requires a high threshold of profitability for it is a relatively capitalistic investment.

[68] This again reflects that N'Djamena has limited production but rather a consumption centre (high number of civil servants and official with regular income streams).

[69] Urban centres, through connectedness, are good at buffering small impacts, yet beyond a tipping point that greater shocks trigger, connectedness becomes a liability as it is conducive to shock diffusion- the dark side of agglomeration economies. See e.g. chap. 5 of *Social and economic networks*, Jackson, 2008.

[70] Only 18 percent of Chad GDP stems from N'Djamena, while it is by far the most populated city.

[71] Here the poverty rate is defined as the poverty headcount rate or monetary basic needs poverty rate, i.e. the percentage of the population living below the national poverty line of 242,094 CFA francs (CFAF) per year; source: *Chad poverty assessment*, 2021, WB.

[72] Hendren 2017, *Efficient Welfare Weights*, National Bureau of Economic Research (NBER) Working Paper 20351 – well accepted and robust framework – see e.g. *Cost-Benefit Analysis, concepts and practice,* A.E. Boardman, D.H. Greenberg, A.R. Vining, D.L. Weimer, 5th edition, Cambridge University Press, 2018. Yet this is far more conservative than the model developed in Hallegate (2014) – it is based on very strong assumptions and conflicts with the conservative principle.

of the entire AAL base[73]. But the economic analysis should account for the baseline (counterfactual) change that occurs regardless of the project implementation. This is the case with other upcoming improvements, such as those that will result from the AFD support, which aims at reducing much of the current AAL.

18. On balance, it is found realistic (yet conservative) that the project infrastructures will save 30 percent of the AAL current base. This assumes that AFD engagement will already shrink the AAL base by 40 percent[74] and a 30 percent rate of remaining damages due to residual implementation risks (e.g., informal housing, obstruction of canals, underfunding of O&M, lack of capacities).

19. As infrastructure operates, the base of AAL from which to save from shrinks down, though increased exposure over time (wealth accumulation) somewhat mitigates this trend. In turn, this reduces EWS benefits, which base is precisely the remaining AAL.

20. 5 percent of AAL is considered a plausible figure for EWS savings[75]. This estimate builds on a benchmarking sample of case studies based on the Flood Hazard Research Centre (FHRC) approach[76].

21. All together this yields annual savings ranging between US$18 m and US$27 m of present value throughout the 20 years of the project horizon – i.e., the discounting is somewhat compensated by the exposure increase so that AAL – and savings alike – remain nearly constant in present terms.

22. **Benefits – 2nd tier.** Reducing flood risk is expected to have further positive impact on health and welfare: first, stagnating water is conducive to water borne diseases; also, disruptions of utility services that may result from flooding, notably water and energy supply, can be harmful too[77]. SWM, beyond its direct contribution to flood risk reduction (solid waste clogs drainage canals) also enhances local environmental conditions, and in turn health and overall welfare.

23. A direct quantification of the specific contribution of SWM in reduction of inundated area or improvement of key environmental variables is very complex and beyond the scope of this analysis. In such a situation it can be convenient to recourse to other metrics to get a ballpark of benefits. Stated preferences, through Willingness to Pay (WTP) is a useful approach

24. No such primary data is available for N'Djamena unfortunately and the only alternative is Transfer Benefits (TB), i.e., the use of such existing study in a different context. Such adaptation (transfer) raises the issue of the external validity of the study along with the method to convert one data point from one context to another. Only one publication was found fit for this purpose – a study on WTP of SWM in Hawassa in Ethiopia[78]. As common practice, a TB adjusting for

[73] It is common for flood protection in urban environments to be designed to cope with all events below a 10 years RP, which makes almost all of the AAL in this case

[74] Though it is challenging to figure this out at the time this document is drafted, it is reasonably expected that marginal saving costs are increasing, hence the higher rate of savings for AFD.

[75] Recent (forthcoming) references with the WB include Climate Risk and Early Warning Systems (CREWS) in the Caribbean, Tajikistan Preparedness and Resilience to Disasters Project, Diagnostic and modernization plan of weather, climate, water and early warning services in Niger, South-East European Multi-Hazard Early Warning Advisory System (phase III).

[76] This is a state-of-the-art approach for EWS economics because the model is consistent with the Impact Based Forecasting (IBF) approach, inasmuch as it accounts for all the information value chain from forecasting models down to population use of the information. Such models are multiplicative, i.e. benefits occur only if a series of (relatively independent) conditions are met such as reliable flood forecasting, warning issuance, information diffusion to the exposed population, and effective use of this information.

[77] See chap.3 of Hallegatte, S., Vogt-Schilb, A., BangaloreM., Rozenberg, J. 2017. *Unbreakable: Building the Resilience of the Poor in the Face of Natural Disasters. Climate Change and Developmen*; World Bank.

[78] Kayamo S.E., *Willingness to pay for solid waste management improvement in Hawassa city, Ethiopia*, Journal of Environmental Management, 2022.

GDP/cap gives an estimate of annual SWM benefit in N'Djamena ranging from US$2.5 m to US$7.2 m[79].

25. It is noticeable that SWM and health related benefits alone would make a significant share of the total DRM benefits (about 20 percent now and increasing along with population in N'Djamena). Two caveats ought to be mentioned:

a. the study used in this TB is a good fit, but this is a sample of 1, and good practice is to have a least several good studies to cope for WTP variance.

b. WTP as such is criticized on the base that, unlike revealed preference methods, its bias leans towards overestimation, which conflicts with the conservative principle.

26. As an alternative approach, improved health or well-being may also be captured in real estate valuation. As the city develops, becomes safer and cleaner, the value of properties increases. This yields a two-fold challenge: (i) the likely increase of real estate assets and (ii) the part of this value creation imputable to a specific factor (the project in this case).

27. Albeit speculative, ballpark estimates can hint on insights. Below is a simple model for the Real Estate Cost of Opportunity (RECO) on year n ($RECO_n$), where K is the destroyed capital, V the vulnerability (hence the ratio K/V amounts to the exposed real estate assets), χ is the share of avoided damages, η_{RE} is the net growth rate of real estate in areas not prone to flood risk and r the discount rate:

$$RECO_n = \frac{K}{V}\frac{(1+\eta_{RE})^n}{(1+r)^n} * \chi$$

28. Since r is small, RECO, the net present value of the $RECO_n$'s aggregation, can be estimated as:

$$RECO = \frac{K * \chi}{V * (\eta_{RE} - r)}$$

29. Beyond uncertainties, what matters is how RECO compares to the present value of the first-tier benefits, which tallies up to some US$0.3 bn over 20 years, or US$0.5 bn over the infinite horizon. This is roughly one order of magnitude higher than K or direct AAL.

30. Significant infrastructure project is likely to achieve a $\frac{\chi}{V}$ over 1. In most contexts, especially urban, it is common for the real estate growth to be superior to the average and hence the risk-free rate, which is in turn often above the discount rate. A meagre 2 percent-5 percent spread means a 20-50 factor. This means that a reasonable expectation is that real estate valuation would be at least of the same order of magnitude of the first-tier benefits, probably above. This hints how floods can be a significant impediment to value concentration in land and real estate assets in urban centers, way beyond the face value of direct and indirect losses incurred.

31. As with the SWM TB model, important caveats ought to be considered:

a. The RECO model is simplistic and very sensitive to highly uncertain variables.

[79] Result is parametrized by elasticity in the transfer function as well as the share of the population who would be more directly benefiting an improvement in SWM.

b. The model is hard to fit both theoretically[80] and empirically[81].

c. Real estate valuation is likely to reflect any benefits, hence the risk of double counting.

d. The value created in a given city may be at the expense of other places hence the cost of opportunity, on a national scale, can be easily underestimated.

32. Given the caveats of the models discussed to estimate second-tier benefits, we do not include them in the quantitative analysis. It would otherwise jeopardize the robustness of the overall results.

33. This suggests that beyond the specific benefits likely imputable to the project, the investment can be part – or even the catalyst of - a wider momentum for unlocking urban growth. Put differently, beyond its specific first-tier benefits, the project can be thought of as holding a "shadow potential" of wealth creation, provided the wider context allows. This opportunity also entails some risks. While regulation is an efficient leeway to reduce flood risks and promote NBS, its opportunity costs in terms of foregone urban growth deserves consideration[82].

Results

34. The project is analyzed along a CBA methodology where benefits are estimated as a fraction of damages, which in turn are broken down along a direct component, i.e., the loss of stock or asset destruction – and an indirect one, i.e. the loss of economic flows that the lost assets would otherwise generate.

35. These direct and indirect benefits together make the first-tier benefits which are weighted against the project costs to derive the CBA metrics based on a 5 percent discount rate and 20 years horizon. The project shows strong economic rationale with overall estimates for IRR, BCR and NPV of respectively 24.7 percent, 2.4 and US$205 m and a payback time (when NPV becomes positive) of 9 years.

36. In spite of the uncertainties, the conservative approach to benefit estimate and the large extent to which metrics thresholds are exceeded make the economic rationale of the investment robust.

37. It is noteworthy that the IRR is relatively high for such a capitalistic investment. This is explained by the current low level of protection (annual floods in N'Djamena with significant flooded surface) which in turn provides great opportunities to avoid losses.

38. Conversely, EWS, which is far less capitalistic, shows moderate profitability on the benchmark scale – just above threshold (BCR=1.03). This is explained by the expected shrinking of the AAL resulting from the support of both AFD and WB on infrastructure and management, which is the base on which EWS saves from. Also, the saving rate is estimated from benchmarks based on an enhanced and conservative approach[83].

39. An additional tier of benefits is discussed in this analysis, including health benefits in relation to SWM as well as urban land and real estate valuation. As these large benefits are subject to higher level of speculations they were not used as input for the computation of economic metrics.

40. This "hidden potential" is expected in any urban center where many variables are intertwined, and a lot of value can end up concentrated in real estate. This should be contemplated in the wider context of urban networks and hubs that structure the Chadian economy.

[80] The (often) imperfect nature of real estate markets makes the benchmark speculative.
[81] The literature as a whole is somewhat unconclusive – results are context dependent and hard to transpose for hedonic methods are data intensive and context specific.
[82] Housing supply restriction that can be conducive to speculation, gentrification and exacerbate existing inequalities.
[83] Last, injuries and casualties were not valued for the data was not found robust enough and it can be controversial.