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**IMPLEMENTATION COMPLETION AND RESULTS REPORT**

**CREDIT NUMBERS 5096 & 5663-SN/GRANT NUMBER TF-A4329**

**ON A**

**CREDIT**

**IN THE AMOUNT OF SDR 61.3 MILLION**

**(US\$90.6 MILLION EQUIVALENT)**

**AND A**

**TRUST FUND GRANT**

**IN THE AMOUNT OF US\$5,504,587**

**TO THE**

**REPUBLIC OF SENEGAL**

**FOR THE**

**STORMWATER MANAGEMENT AND CLIMATE CHANGE ADAPTATION PROJECT**

**November 17, 2020**

Urban, Resilience, and Land Global Practice  
Africa Region

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**CURRENCY EQUIVALENTS**  
(Exchange Rate Effective October 20, 2020)

Currency Unit = CFA Franc (CFAF)

CFAF 555 = US\$1

US\$1.42 = SDR 1

**FISCAL YEAR**  
July 1 – June 30

**ABBREVIATIONS AND ACRONYMS**

ACT-SL	Association of Saint-Louis Local Governments ( <i>Association des collectivités locales de Saint-Louis</i> )
ADM	Agency for Municipal Development ( <i>Agence de Développement Municipal</i> )
AF1	First Additional Financing
AF2	Second Additional Financing
BCA	Benefit-Cost Analysis
CAS	Country Assistance Strategy
COLIGEP	Local Committees for Flood Control ( <i>Comités Locaux d'Initiative pour la Gestion des Eaux Pluviales</i> )
COVID-19	Coronavirus Disease 2019
CPS	Country Partnership Strategy
DIME	Development Impact Evaluation
DMP	Drainage Master Plan
DRM	Disaster Risk Management
EO4SD	Earth Observation for Sustainable Development
ERR	Economic Rate of Return
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
GEF	Global Environment Facility
GIS	Geographic Information System
GoS	Government of Senegal
GRM	Grievance Redress Mechanism
ICR	Implementation Completion and Results Report
IEC	Information Education and Communication
ISR	Implementation Status and Results Report
MoU	Memorandum of Understanding
M&E	Monitoring and Evaluation
NDF	Nordic Development Fund
NPV	Net Present Value
O&M	Operation and Maintenance
OH&S	Occupational Health and Safety
ONAS	National Office of Sanitation ( <i>Office National de l'Assainissement du Sénégal</i> )

PAD	Project Appraisal Document
PAP	Project-affected Person
PDGI	Ten-Year Flood Management Program ( <i>Programme Décennal de Gestion des Inondations</i> )
PDNA	Post Disaster Needs Assessment
PDO	Project Development Objective
PIC	Participatory Community Investment Project
PIM	Project Implementation Manual
PROGEP	Stormwater Management and Climate Change Adaptation Project ( <i>Projet de Gestion des Eaux Pluviales et d'Adaptation au Changement Climatique</i> )
PRSP-II	Second Poverty Reduction Strategy Paper
PVBCR	Present Value of Benefit over Cost Ratio
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
SERRP	Saint-Louis Emergency Recovery and Resilience Project
STEP	Systematic Tracking of Exchanges in Procurement

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**DATA SHEET****BASIC INFORMATION****Product Information**

Project ID	Project Name
P122841	Stormwater Mgt. and Climate Change Adaptation Project
Country	Financing Instrument
Senegal	Investment Project Financing
Original EA Category	Revised EA Category
Full Assessment (A)	Full Assessment (A)

**Organizations**

Borrower	Implementing Agency
Republic of Senegal	Municipal Development Agency (MDA)

**Project Development Objective (PDO)**

## Original PDO

The proposed project will improve stormwater drainage and flood prevention in peri-urban Dakar for the benefit of local residents.

## Revised PDO

To reduce flood risks in peri-urban areas of Dakar and improve capacity to plan and implement sustainable city management practices, including climate resilience, in selected urban areas.



## FINANCING

	Original Amount (US\$)	Revised Amount (US\$)	Actual Disbursed (US\$)
<b>World Bank Financing</b>			
IDA-50960	55,600,000	55,596,732	52,191,779
IDA-56630	35,000,000	35,000,000	35,191,349
TF-A4329	5,504,587	5,504,587	5,381,994
<b>Total</b>	<b>96,104,587</b>	<b>96,101,319</b>	<b>92,765,122</b>
<b>Non-World Bank Financing</b>			
Borrower/Recipient	13,200,000	0	0
Nordic Development Fund (NDF)	4,100,000	0	0
<b>Total</b>	<b>17,300,000</b>	<b>0</b>	<b>0</b>
<b>Total Project Cost</b>	<b>113,404,587</b>	<b>96,101,319</b>	<b>92,765,122</b>

## KEY DATES

Approval	Effectiveness	MTR Review	Original Closing	Actual Closing
10-May-2012	21-Nov-2012	29-Jun-2015	31-Dec-2017	31-May-2020

## RESTRUCTURING AND/OR ADDITIONAL FINANCING

Date(s)	Amount Disbursed (US\$M)	Key Revisions
14-Dec-2019	74.77	Change in Loan Closing Date(s)
09-May-2020	90.03	Change in Loan Closing Date(s)

## KEY RATINGS

Outcome	Bank Performance	M&E Quality
Satisfactory	Satisfactory	Substantial



## RATINGS OF PROJECT PERFORMANCE IN ISRs

No.	Date ISR Archived	DO Rating	IP Rating	Actual Disbursements (US\$M)
01	05-Feb-2013	Satisfactory	Satisfactory	0
02	18-Jun-2013	Satisfactory	Satisfactory	6.89
03	01-Jan-2014	Satisfactory	Satisfactory	6.89
04	10-Aug-2014	Satisfactory	Satisfactory	19.72
05	26-Mar-2015	Moderately Satisfactory	Moderately Satisfactory	29.95
06	17-Nov-2015	Satisfactory	Moderately Satisfactory	37.48
07	29-Jun-2016	Satisfactory	Satisfactory	45.13
08	22-Dec-2016	Satisfactory	Moderately Satisfactory	47.05
09	30-Jun-2017	Satisfactory	Moderately Satisfactory	56.22
10	26-Dec-2017	Satisfactory	Moderately Satisfactory	57.53
11	25-Jun-2018	Satisfactory	Moderately Satisfactory	62.17
12	17-Dec-2018	Satisfactory	Moderately Satisfactory	64.34
13	17-Jun-2019	Satisfactory	Moderately Satisfactory	70.17
14	18-Dec-2019	Satisfactory	Moderately Satisfactory	74.77

## SECTORS AND THEMES

### Sectors

Major Sector/Sector (%)

**Public Administration 14**

Other Public Administration 14

**Transportation 14**

Other Transportation 14



<b>Water, Sanitation and Waste Management</b>		<b>72</b>
Public Administration - Water, Sanitation and Waste Management		6
Other Water Supply, Sanitation and Waste Management		66
<b>Themes</b>		
Major Theme/ Theme (Level 2)/ Theme (Level 3)		(%)
<b>Finance</b>		<b>13</b>
Finance for Development		13
Disaster Risk Finance		13
<b>Urban and Rural Development</b>		<b>39</b>
Disaster Risk Management		39
Disaster Response and Recovery		13
Disaster Risk Reduction		13
Disaster Preparedness		13
<b>Environment and Natural Resource Management</b>		<b>148</b>
Climate change		98
Adaptation		98
Water Resource Management		50
Water Institutions, Policies and Reform		50
<b>ADM STAFF</b>		
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## I. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES

### A. CONTEXT AT APPRAISAL

#### Context

1. **Senegal is extremely vulnerable to varied climate-related hazards, with recurrent stormwater flooding as one of the most damaging natural events.** From 1980 to 2008, floods affected an estimated 400,000 to 600,000 people a year and caused significant damage to critical infrastructure, public assets, and private property, as well as substantial economic losses. In 2009, intense rainfall led to serious flooding across the country, with the total cost of damages and losses amounting to US\$104 million, including US\$82 million within Dakar peri-urban areas, according to the Post Disaster Needs Assessment (PDNA 2009). In 2012, floods displaced thousands of families in Dakar and across the country.

2. **Rapid urbanization after decades of extreme drought and lack of adequate urban planning led to the proliferation of informal settlements in and around the peripheries of Dakar, often in low-lying flood-prone areas.** Urban primacy of Dakar in Senegal has not changed over years. Dakar region, comprising Dakar, Guédiawaye, Pikine, and Rufisque and 10 other districts,<sup>1</sup> with more than 3.13 million people (approximately 23 percent of national population), is growing at 3 percent annually and is extremely vulnerable to climate hazards, especially inland flooding. Decades of extreme drought between 1968 and 1997 resulted in massive migration of rural population to Dakar.<sup>2</sup> The most accessible land to settle for these migrants was the depressions (called the ‘Niayes’) mostly situated in the districts of Guédiawaye and Pikine, which were formerly marshes or wetlands but became dry patches of land after the drought.<sup>3</sup> These zones in the *Niayes* (including built-up areas) are flooded almost every year in the rainy season. In 2012, over 90 percent of the population settled in peri-urban Dakar (specifically Pikine and Guédiawaye) lived in areas that were classified as slums or spontaneous settlements.<sup>4</sup>

3. **Changes in land use, population growth, and densification of built-up areas in the past decade exacerbated the exposure of Dakar residents, especially the poor population living in informal settlements in flood-prone peri-urban areas.** As the land use in Dakar peri-urban areas changed from wetland or vegetation to densely populated, largely unplanned settlements, soil compaction and drainage have become major issues in Pikine and Guédiawaye. This lack of natural drainage and adequate infiltration was exacerbated by the lack of infrastructure to facilitate the drainage of surface water. The drainage system was generally insufficient and, in places where it existed, was already overburdened with pressure of population growth. Moreover, often the infrastructure was poorly maintained and clogged with waste. Therefore, poorer households in Dakar peri-urban areas suffered disproportionately from flood events. In 2009, there were about 360,000 people (44 percent of population) in Pikine and 22,000

<sup>1</sup> Ndiaye, et al. 2016. “Detection and Ranking of Vulnerable Areas to Urban Flooding Using GIS and ASMC (Spatial Analysis multicriteria): A Case Study in Dakar, Senegal.” *International Journal of Advanced Engineering, Management and Science*.

<sup>2</sup> European Space Agency. 2019. *EO4SD-Urban Project: Dakar City Report*.

<sup>3</sup> Mbow C., A. Diop, A.T. Diaw, and C.I. Niang. 2008. “Urban Sprawl Development and Flooding at Yeumbeul Suburb (Dakar, Senegal).” *African Journal of Environmental Science and Technology* 4: 75–88.

<sup>4</sup> *Plan Directeur d’Urbanisme* (Urban Masterplan) Dakar: Horizon 2025; Agence Nationale de la Statistique et de la Démographie (ANSD) 2003: Dakar 950,331, Pikine 774,314, and Guédiawaye 248,809.



people in Guédiawaye (7.2 percent of the population) who were directly affected by floods.<sup>5</sup> It was estimated that a household affected by the impact of a natural hazard in Senegal was 25 percent more likely to have fallen into poverty over 2006–2011.

**4. The 2012 floods were a key turning point in shaping Senegal’s flood risk management strategy.**

In August 2012, heavy rains that exceeded 156 mm in two hours caused local flooding in several areas of Senegal, including Saint-Louis and Dakar. These rains proved to be catastrophic, resulting in loss of life and a severe deterioration of public and private infrastructure. Public services such as schools, health systems, water, and electricity were significantly affected, most of which were suspended for several days. Following the event, the Government of Senegal (GoS) adopted measures toward tackling flood issues.

**5. In recognition of the above issues, the GoS adopted a Ten-year Flood Management Program (*Programme Décennal de Gestion des Inondations*, PDGI) (2012–2022) amounting to approximately US\$1.4 billion.**

The World Bank provided technical and financial support to the PDGI through the Stormwater Management and Climate Change Adaptation Project (*Projet de Gestion des Eaux Pluviales et d’Adaptation au Changement Climatique*, PROGEP). PROGEP was designed based on the Dakar Drainage Master Plan (DMP) for stormwater adopted by the GoS on January 25, 2012, to respond to the emergency following the 2012 floods. The project aimed to address the most pressing needs in areas where the event’s consequences were most acute, that is, Dakar peri-urban areas covered by the districts of Pikine and Guédiawaye, which accommodate close to 1.3 million inhabitants (12 percent of total population).

**6. Derived from the 2009 PDNA action plan and in alignment with the PDGI, PROGEP was developed to reduce flood risks in Dakar peri-urban areas through capacity building, strategic planning, and infrastructure investments.**

Benefiting from two additional financings, PROGEP encompassed an IDA credit equivalent to US\$90.6 million and government counterpart funds equivalent to US\$16.2 million.<sup>6</sup> PROGEP was implemented over an eight-year period from 2012 to 2020. The parent project was approved by the Board of Executive Directors on May 10, 2012, with a total of US\$55.6 million in IDA financing. The first additional financing (AF1), with an IDA financing amount of US\$35 million, was approved on May 5, 2015, and helped (a) fill a cost overrun related to the stormwater drainage infrastructure investments; (b) scale up community engagement activities; and (c) introduce climate change-resilient urban planning and management activities in two additional urban areas, Diamniadio and Saint-Louis. The second additional financing (AF2), which was approved on March 28, 2017, consisted of US\$5.5 million in trust fund grant financing from the Global Environment Facility (GEF) and specifically focused on scaling up the project’s sustainable cities subcomponent. Both the IDA credit and the trust fund grant closed on May 31, 2020, with a 99.46 percent disbursement.

**7. PROGEP was and remained extremely relevant throughout its duration to both the Senegal’s high-level objectives and to the three World Bank Country Partnership documents under implementation.**

It is in alignment with the country’s national development plan, the *Plan Sénégal Emergent* (2014), which identifies climate change impacts and the need to develop sustainable solutions for the challenges of floods, coastal erosion, and salinization. The World Bank Country Assistance Strategy (CAS) FY07–FY10 (Report Number: 75063) was the most recent and valid country strategy at the time of the project’s approval in FY2012. The CAS (FY07–FY10) was designed to support the GoS’ Second Poverty

<sup>5</sup> Ndiaye, et al. 2016. “Detection and Ranking of Vulnerable Areas to Urban Flooding Using GIS and ASMC (Spatial Analysis multicriteria): A Case Study in Dakar, Senegal.” *International Journal of Advanced Engineering, Management and Science*.

<sup>6</sup> The project also included a US\$9 million Nordic Development Fund (NDF) in parallel financing.

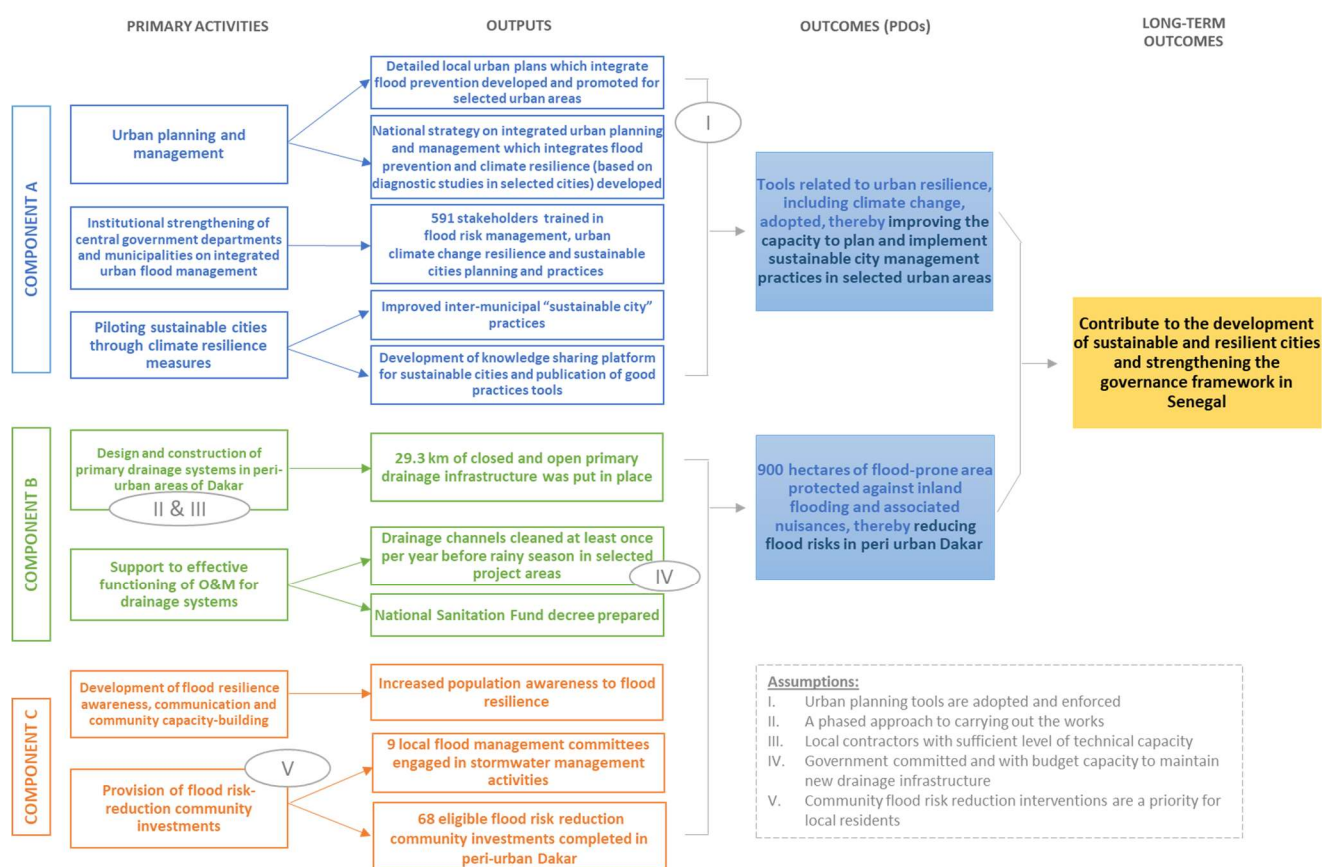


Reduction Strategy Paper (PRSP-II) for the 2006 to 2010 period. PROGEF had a strong link with the broader urban, regional, and territorial planning aspects; the lack of basic infrastructure systems; and the impact of increased climate variability. At the time of Board approval, PROGEF helped inform the preparation of the forthcoming Senegal Country Partnership Strategy (CPS) FY13–FY17 (Report Number: 73478-SN), which ultimately included a spatial and integrated approach to development issues, with a strong focus on disaster risk management (DRM) and climate change adaptation, emphasizing the need for improved drainage and flood prevention in urban areas. PROGEF continues to be extremely relevant to the Country Partnership Framework for Senegal FY20–FY24. Specifically, it is in alignment with Focus Area 3 to ‘increase resilience and sustainability in the context of growing risks’.

## Theory of Change (Results Chain)

8. **The project adopted a three-pronged integrated approach to flood risk management that focused on** (a) improving strategic urban planning and urban governance on the national and subnational levels, (b) reinforcing stormwater drainage infrastructure through targeted investments in Pikine and Guédiawaye, and (c) creating greater community awareness and engagement in relation to urban flood risk reduction and adaptation to climate change in Pikine and Guédiawaye. Although it was not required for the original Project Appraisal Document (PAD), a Theory of Change was prepared for this Implementation Completion and Results Report (ICR), as illustrated in figure 1.

Figure 1. PROGEF Theory of Change, Components A, B, and C





### **Project Development Objectives (PDOs)**

9. The original PDO was to “improve stormwater drainage and flood prevention in peri-urban areas of Dakar for the benefit of local residents.” As described later, the PDO was revised under AF1 in 2015 to “reduce flood risks in peri-urban areas of Dakar and improve capacity to plan and implement sustainable city management practices, including climate resilience, in selected urban areas” and remained the same for the rest of the project.

### **Key Expected Outcomes and Outcome Indicators**

10. The expected outcomes and PDO-level indicators from the parent project included the following:

- ‘Direct beneficiaries (number) of which female (50 percent)’, which measured the number of people with increased opportunities and reduced vulnerabilities against a 10-year flood return period.
- ‘Area protected against recurrent flooding through drainage works (ha)’, which, similar to the above, measured the increased opportunities and reduced vulnerabilities against a 10-year flood return period but in relation to drained surface area.

11. The revised outcomes following AF1 and AF2 are described in section B.

### **Components**

12. The parent project included four components.

**Component A: Flood Risk Mainstreaming in the Urban Sector (Estimated: IDA US\$3.6 million/Actual: IDA US\$2.2 million)**

13. This component provided support to mainstream flood risk to urban planning through three subcomponents, including (a) urban planning and management, (b) institutional strengthening and capacity building of government actors and municipalities, and (c) formulation of an Integrated Stormwater Management and Climate Change Adaptation Program for peri-urban Dakar.

**Component B: Drainage Investment and Management (Estimated: IDA US\$78.2 million/Actual: IDA US\$82.3 million)**

14. This component supported the establishment and maintenance of an effective drainage system in Dakar peri-urban areas (Pikine and Guédiawaye), identified as the districts most vulnerable to recurrent floods. It was implemented through two subcomponents: (a) drainage investments and (b) operation and maintenance (O&M). The first subcomponent established the drainage network in Pikine and Guédiawaye to remediate recurrent floods and included feasibility and technical studies, resettlement of project-affected persons (PAPs), construction of drainage infrastructure, and additional basic urban rehabilitation including road connections. The second subcomponent aimed at ensuring that investments were adequately managed and maintained. It included the establishment of an institutional and financial mechanism for the O&M of the stormwater drainage system, the development of a maintenance plan, and annual cleaning of drainage channels.



**Component C: Community Engagement in Urban Flood-Risk Reduction and Adaptation to Climate Change (Estimated: IDA US\$4.6 million/Actual: IDA US\$2.4 million)**

15. This component aimed at empowering municipalities, residents, and community groups to actively engage in urban flood risk reduction measures and adaptation to climate change through piloting the development and implementation of participatory urban community investments and an awareness raising and communication campaign. It supported the participation of community members in urban flood risk management and small-scale pilot investments aimed at the rehabilitation and maintenance of natural or artificial retention basins and/or urban wetlands allowing for natural runoff. It was implemented through two subcomponents: (a) flood resilience awareness, communication, and community capacity building and (b) flood risk reduction community investments.

**Component D: Project Coordination, Management, Monitoring, and Evaluation (Estimated: IDA US\$4.2 million/Actual: IDA US\$3.6 million)**

16. This component included management support for the effective and efficient implementation of the project, including the development and operationalization of a monitoring and evaluation (M&E) system.

17. Changes to the project components undertaken under AF1 and AF2 are described in the following sections.

**B. SIGNIFICANT CHANGES DURING IMPLEMENTATION**

**Revised PDOs and Outcome Targets**

18. **With AF1 and restructuring of the parent project in 2015 (Level 1 restructuring), the PDO was revised** to (a) bring forward into the PDO the second main outcome of the project on improving planning capacities, (b) address the piloting of the climate resilient and sustainable cities approach under AF1, and (c) broaden the geographic scope of the planning activities under Component A beyond Dakar peri-urban areas to include the urban areas of Diamniadio and Saint-Louis. The PDO remained the same for AF2.

**Revised PDO Indicators**

19. **Two changes to the PDO indicators were introduced under AF1.** First, the second PDO indicator was adjusted to (a) specify the intervention zone in peri-urban Dakar in the indicator according to the original design and (b) review the indicator end target value to reflect the investment prioritization made under AF1 to elevate development effectiveness. Second, a third PDO indicator was also added to measure project performance in relation to the newly added PDO outcome. The PDO indicators remained the same for AF2.

**Revised Components**

20. **With AF1, an adjustment was made to Component A, while Components B, C, and D remained unchanged throughout the project duration.** Component A was revised from 'Flood Risk Mainstreaming in the Urban Sector' to 'Integration of Climate Risks in Urban Planning and Management'. This was to reflect the (a) introduction of climate change-resilient urban planning and management in the component





activities and (b) piloting of climate resilience interventions under the sustainable cities concept in two selected sites, Diamniadio and Saint-Louis, under a newly defined Subcomponent A.3, 'piloting sustainable cities through climate resilience measures'.

## Other Changes

21. **The scope of Component B was revised to capture investment prioritization made when closing the financing gap under AF1.** In the original design, four sites (catchments) were selected within the two targeted districts—Dalifort, Thiourour, Yeumbeul, and Mbeubeuss, the latter with four sub-catchments 3.1 to 3.4. Works in the four sites were sequenced in two phases—Phase 1 (covering Dalifort and Thiourour) and Phase 2 (covering Yeumbeul and Mbeubeuss). Following a cost overrun incurred due to the scaled-up works carried out as part of Phase 1,<sup>7</sup> prioritization of investments was made, and in the Mbeubeuss site financing was only possible for sub-catchment 3.1. Other changes included (a) scaling up the existing project activities under Component C and (b) transferring the coordination, management, and monitoring of activities under Subcomponent B.2 to the National Office of Sanitation (*Office National de l'Assainissement du Sénégal*, ONAS), while all other components remained under the responsibility of the original implementing entity (Agency for Municipal Development [*Agence de Développement Municipal*, ADM]). The scope of Component A was increased to scale up the project's sustainable cities Subcomponent A.3 through four main activities under AF2.

22. **The Results Framework was revised following each of the additional financings, in line with new changes introduced** (see annex 6). The financing plan was revised to reflect the increase in IDA financing under AF1 and the GEF grant funding under AF2. The estimated and actual resource allocations for each component under the parent project, AF1, and AF2 are presented in table 1.

**Table 1. Resource Allocation per Component (US\$, millions)**

Component	PROGEP		AF1		AF2	Total Estimated			Total Actual		
	IDA	GoS	IDA	GoS	GEF	IDA	GEF	GoS	IDA	GEF	GoS
Component A	1.6	—	2.0	—	5.2	3.6	5.2	—	2.2	5.0	—
Component B	48.2	7.1	30.0	3.0	—	78.2	—	10.1	82.3	—	4.5
Component C	3.6	—	1.0	—	—	4.6	—	—	2.4	—	—
Component D	2.2	6.1	2.0	—	0.3	4.2	0.3	6.1	3.6	0.0	2.1
<b>Total</b>	<b>55.6</b>	<b>13.2</b>	<b>35.0</b>	<b>3.0</b>	<b>5.5</b>	<b>90.6</b>	<b>5.5</b>	<b>16.2</b>	<b>90.5</b>	<b>5.0</b>	<b>6.6</b>

23. **With AF1, the closing date of the project was extended by two years, to December 31, 2019.** The original project design was conceived with the assumption that detailed technical studies for the infrastructure and works would be completed during implementation. This made the original five-year implementation period too short, especially considering that some unplanned works were recommended under the detailed studies (for example, additional works, reconstruction of demolished roads due to

<sup>7</sup> The project was prepared to respond to a flood emergency based on cost estimates from the Dakar DMP. One year into implementation, a cost overrun was identified and described in detail in annex 3 of the May 2013 Aide Memoire. The cost overrun was derived from the (a) unit cost that was underestimated in the DMP, (b) financing of secondary drainage network and roads that were deemed necessary under the technical studies to enable full functionality of investments and that were not accounted for in the DMP, and (c) improvements brought about to reinforce design. Based on the actual prices of Phase 1, the financing gap identified for Phase 2 was an additional US\$54 million including financing for Mbeubeuss sub-catchment 3.1 only. In line with the phased approach adopted, technical studies were developed for sub-catchments 3.2 to 3.4, and it was understood that works for these sub-catchments would be financed at a later stage, given the limited funding available.



works, and additional structures to reinforce and ensure the durability of structures including channel outlets to the sea). While the closing date was not changed under AF2, a three-month project extension to March 31, 2020, was granted to ensure orderly completion of the ongoing contracts. With restrictions put in place to mitigate the spread of the coronavirus disease 2019 (COVID-19), the project closing date was extended again to May 31, 2020, to allow for finalization of activities and ensure adequate safeguards management.

## **Rationale for Changes and Their Implication on the Original Theory of Change**

24. **There was no major implication for the original Theory of Change/Results Framework other than strengthening climate resilience results.** Under Component A, the various tools related to the promotion of urban planning and management integrating climate risks were scaled up. Physical investments under Component B were carried out in accordance with the updated targets set under AF1. The activities planned under Component C were also scaled up to promote further civic engagement for the protection and management of drainage assets.

## **II. OUTCOME**

### **A. RELEVANCE OF PDOs**

#### **Assessment of Relevance of PDOs and Rating**

Rating: High

25. **The relevance of the PDO is rated High, given that at design and over its lifetime, the project (a)** contributed to implementation of the strategies developed by the World Bank with its client countries in the area of poverty reduction, urban development, and climate change, as described in section I and (b) was highly relevant to the GoS' priorities. The PDO remained highly relevant to a country context characterized by recurrent stormwater flooding and rapid urbanization. Given the severity of flood events in Dakar and other urban centers, floods and DRM are always high on the GoS' agenda. DRM was a priority pillar in the GoS' PSRP-II covering 2006–2010. DRM addressing urban vulnerabilities and flood risk reduction was also confirmed as a national priority in the Economic and Social Policy Document (2011–2015). The development of sustainable cities and the integration of climate resilience into urban policy is another national priority as demonstrated by the GoS' participation in the GEF's new Sustainable Cities Program as a pilot country since 2015. By supporting flood risk reduction and strengthening urban resilience to climate change in peri-urban Dakar, PROGEP contributed to the implementation of the National Climate Change Adaptation Program of Action.

### **B. ACHIEVEMENT OF PDOs (EFFICACY)**

#### **Assessment of Achievement of Each Objective/Outcome**

Rating: Substantial

26. **PROGEP largely achieved its two subobjectives of reducing flood risks in peri-urban areas of Dakar and improving the capacity to plan and implement sustainable city management practices, including climate resilience, in selected urban areas.** The project met targets for all the PDO indicators and met and exceeded all but one intermediate result indicators. The indicators measuring intermediate



results and achievement of the PDO comprised relatively simple aggregates and yes/no results, but the achievement of many more tangible and intangible benefits—social, economic, health, and so on—than officially reported as indicators, as well as the clear progression toward the achievement of the PDO over time, contributes significantly to the Substantial rating.

27. **PROGEP exceeded the targets of the two PDO indicators related to the first subobjective of reducing flood risks in peri-urban areas of Dakar, as set out in table 2.**

- **PDO Indicator #1: Direct project beneficiaries.**<sup>8</sup> Some 167,000 residents benefited directly from the project. The original target of 132,000 was therefore surpassed by 27 percent. Despite the change in the scope of Component B, the target for this indicator remained unchanged after the AF1 restructuring for two main reasons: (a) the need to account for residents who benefited from additional infrastructure (secondary network, roads, and so on), which were not accounted for under AF1, and (b) the increase in population throughout project lifetime driven by (i) the return of some residents to their dwellings in the aftermath of drainage improvements and (ii) increasing urbanization at an average annual rate of change of 2.5 percent. For the same reasons, the target was overachieved.
- **PDO Indicator #2: Area in peri-urban Dakar protected against recurrent flooding through drainage works.** Some 900 ha in peri-urban Dakar has been protected against recurrent flooding through the construction of drainage infrastructure (exceeding the AF1 target of 400 ha by 125 percent and the original target of 660 ha by 36 percent). The protected area was computed using a Geographic Information System (GIS) with the surface of sub-catchments as the unit of analysis. Initially, the counting methodology included only primary infrastructure. With the change in scope of Component B under AF1, the target for this indicator was thus not increased to account for the increase in scope due to secondary infrastructure. It was revised downward to take into account the change in scope of the primary infrastructure with the phasing of the three Mbeubeuss sub-catchments. The final total area protected exceeded the AF1 target because the final counting methodology covered both primary and secondary infrastructure.
- **PROGEP achieved significant gains in drainage capacity as follows:** 700,000 m<sup>3</sup> from ponding, 5,000 m<sup>3</sup> per hour from pumping stations, and 25,000 ml from sanitized interlocking concrete block paving roads.<sup>9</sup>
- **There is evidence that the drainage system implemented helped improve both groundwater and stormwater management in the intervention zones throughout the year.** Groundwater level, the main source of flooding in these areas, was reduced from 1 m to 2 m.<sup>10</sup> This led to a decrease in the need to empty septic tanks by households, and the reduction in water infiltration has resulted in substantial improvements in sanitation.

<sup>8</sup> Direct beneficiaries were defined as residents of high-risk areas who immediately benefited from drainage infrastructure.

<sup>9</sup> Given that the drainage capacity before the project was insignificant, with the construction of the drainage network capacity has improved. The ICR team assumed that the gain in drainage capacity generated by PROGEP could be calculated based on the overall drainage capacity of the built infrastructure.

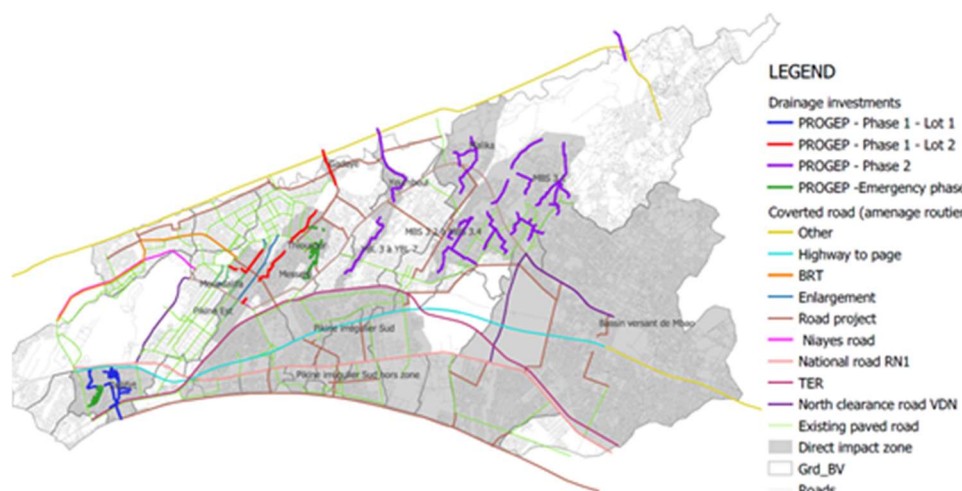
<sup>10</sup> According to an evaluation carried out by the GoS in May 2016 combined with an end-of-project assessment.





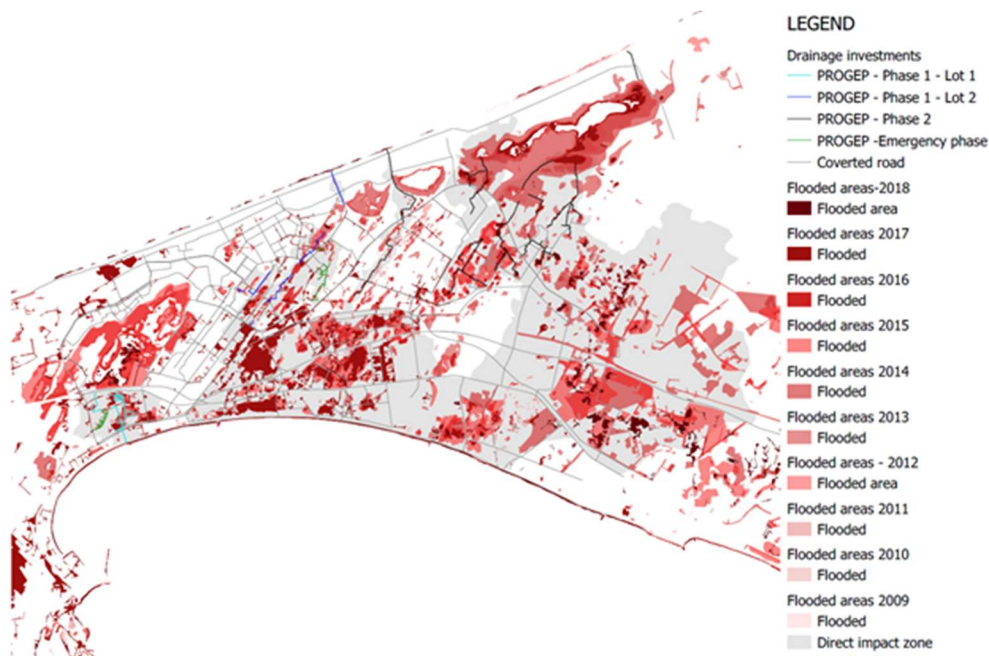
- **Out of the 21 project intervention communes, 18 had seen a positive reduction in flooding extent area from 2012 to 2018.** Based on a quantitative analysis using geospatial data carried out for the ICR (refer to figures 2 and 3 and annex 8 for further details), there is evidence that PROGEP investments have helped reduce the risk of flooding in Dakar densely populated areas. The total area flooded in the 21 project intervention communes has reduced from 11.74 km<sup>2</sup> in 2009 (2.13 percent of total commune area) to 1.44 km<sup>2</sup> in 2018 (0.26 percent of total commune area).

Figure 2. PROGEP Infrastructure Investments



Source: ICR Team, ADM data.

Figure 3. Extent of Flooding Area from 2009 until 2018 in Project Intervention Area



Source: ICR Team, Flooding data from Earth Observation for Sustainable Development (EO4SD).



28. **PROGEP also exceeded all but one of the intermediate results indicator targets related to the first subobjective.** More specifically, under Intermediary Result #2: A flood prevention system in the most vulnerable districts in peri-urban areas of Dakar (Pikine and Guédiawaye) is established, the following was achieved:

- **Primary drainage system in Pikine and Guédiawaye put in place.** Some 29.3 km of closed and open primary drainage infrastructure was put in place in the districts of Pikine and Guédiawaye (85 percent more than the 15.82 km AF1 target and 4 percent more than the original 28.2 km target). To ensure proper functioning of the overall drainage system, the primary drainage channels were complemented by 21 km of closed and open secondary channels, 21 stormwater retention basins, 150,000 m<sup>2</sup> of sanitized interlocking concrete block paving roads, 1 high-flow pumping station, and 3 secondary pumping stations.<sup>11</sup>
- **An O&M stormwater drainage management system in Pikine and Guédiawaye is functional.** A study to identify policy reforms related to running an effective O&M system for stormwater management recommended the designation of ONAS as the institution responsible for the O&M of the stormwater management system and the establishment of a National Sanitation Fund. The study financed by PROGEP was validated by the GoS and at project closure, the decree to create the National Sanitation Fund was under examination. During this institutional transition, the transfer of funding from the Ministry of Finance and Budget to ONAS for the O&M of the stormwater management system of Pikine and Guédiawaye experienced delays. To resolve O&M issues and address immediate maintenance needs arising during the project lifetime, ONAS and the ADM agreed to hire contractors from the project funding as a temporary measure while the long-term solution is worked out. Despite the progress made, this intermediate result was not achieved.
- **Drainage channels cleaned at least once per year before the rainy season in the project area.** All the channels were reported to have been cleaned at least once per year before the rainy season during 2015–2019.
- **The project had a positive impact on community engagement in the maintenance and cleanliness of public infrastructure,** as found by the impact evaluation carried out by the World Bank Development Impact Evaluation (DIME) Research Group.<sup>12</sup>

29. **The second subobjective of improving capacity to plan and implement sustainable city management practices, including climate resilience, in selected urban areas—was also largely achieved with all PDO and intermediate results indicators targets fully met or exceeded—as described in the following paragraphs.**

- **PDO Indicator #3: Tools related to urban resilience, including climate change, adopted.** A number of tools related to urban resilience, including climate change, were developed and

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<sup>11</sup> During the ICR mission, the ADM made several visits throughout Dakar to sites with completed infrastructure. The World Bank team was not able to join these field visits given the COVID-19 pandemic but reviewed the studies of the works completed under the project, to ensure that the works were delivered to good standards. Further verification of the achieved results is beyond the scope this ICR and would require a full-scale evaluation.

<sup>12</sup> *Operation Clean Neighborhood: Working with Communities for Flood Risk Mitigation in Senegal (2017)*. Accessible at <http://microdata.worldbank.org/index.php/catalog/3454/download/46514>.



adopted at the national and subnational levels. These were leveraged to feed into the national urban code that is currently being updated, underpin the development of the new city of Diamniadio, and guide the design of new investments such as the ones financed through the Saint-Louis Emergency Recovery and Resilience Project (SERRP) (P166538) and the forthcoming Senegal Affordable Housing Program (P174759) (expected to be delivered in FY21–FY22).

- (a) **Tools produced at the national level include** (i) a study for urban policy gap analysis and action plan for relevant reforms to strengthen cities sustainability, including climate resilience at the national level; (ii) a study of priority urban policy reforms to promote cities' sustainability, including climate resilience at the national level; (iii) a national strategy for integrated urban management and planning addressing, among others, flood prevention and climate change impacts validated by the project technical committee and adopted by the National Urban Committee under the leadership of the ministry in charge of urban affairs; and (iv) a knowledge sharing platform on sustainable cities and urban resilience thematic put in place with academic support in Saint-Louis and Dakar.
  - (b) **Tools produced at the subnational level include** (i) detailed urban plans for Pikine and Guédiawaye, which integrate flood prevention and are pending approval by decree; (ii) flood risk management plan for the Diamniadio agglomeration; (iii) DMP and master plan for the Saint-Louis agglomeration; (iv) diagnostic studies and city action plans to promote cities' sustainability for Saint-Louis and Diamniadio; (v) GIS and Territorial Information System tools developed for Pikine-Guédiawaye and Saint-Louis; (vi) modeling of the Saint-Louis Delta,<sup>13</sup> that improves understanding of the complex hydrodynamic and morphological conditions of the area and identifies suitable coastal protection solutions; and (vii) knowledge generated from investments undertaken in the solid waste management and green city sectors in Saint-Louis and Diamniadio.
- **Under Intermediate Result #1:** Climate change related risks are embedded in national and local urban planning, management and enforcement tools to ensure sustainable -orientated urban practice, the following was achieved:
    - (a) **Key stakeholders (persons) trained in flood risk management, urban climate change resilience, and territorial planning.** In addition to the eight memoranda of understanding (MoUs)<sup>14</sup> that were signed and executed with key stakeholders involved in the management of investments and monitoring of land use in flood-prone areas, 591 key central and local government staff were trained through seven sessions on various themes linked to the project (for example, sustainable city, integrated urban management, flood risk management, climate change resilience, and territorial planning), that is, 48 percent more than the target of 400 stakeholders originally set.
    - (b) **Experience in 'inter-municipal sustainable city' practices, through concerted territorial development (CTD), improved.** A study aimed at defining the governance

<sup>13</sup> Developed with the NDF funding.

<sup>14</sup> MoUs were signed between the ADM and key stakeholders to define the capacity-building support needed.



model of the Diamniadio agglomeration was prepared to lay the groundwork for an inter-municipal agreement between the various municipalities comprising this agglomeration. Furthermore, an inter-municipal cooperation agreement was formalized with the creation of the Association of Saint-Louis Local Governments (ACT-SL) between all the five municipal councils and the concerned district council in the Saint Louis agglomeration; and a three-year program of activities was prepared to support the Association. The ACT-SL is still functioning and is actively involved in the preparation of the Saint-Louis Urban Resilience Plan developed under the SERRP.

- **Under Intermediate Result #3:** Municipalities, residents, and community groups are empowered to engage actively in urban flood risk reduction measures and resilience to climate change, the following was achieved:
  - (a) **Eligible flood risk reduction community investments completed.** Some 68 eligible flood risk reduction participatory community investment projects (PICs)<sup>15</sup> were completed (127 percent more than the target of 30 PICs set at the AF1 restructuring and 136 percent of the target of 50 PICs set before AF1). An estimated 69 percent of community infrastructure and equipment affected in 2012 were rehabilitated, including eight functioning schools.
  - (b) **People reached by IEC strategy at local and national levels.** Some 84,366 people were reached by the information education and communication (IEC) strategy at the national and local levels (that is, 41 percent more than the AF1 target of 60,000, and 5 percent more than the original target of 80,000).
  - (c) **Local flood management committees in Pikine and Guédiawaye are engaged in stormwater management activities.** Nine local committees for flood control (*Comités Locaux d'Initiative pour la Gestion des Eaux Pluviales*, COLIGEP) were created to ensure community participation in stormwater management, drainage O&M, and flood prevention. The committees' capacities were strengthened throughout the project duration through training and provision of equipment.
  - (d) **DIME showed that the increase in community engagement undertaken by the project led to changes in the quality of life of residents living in the intervention areas, even after just one year of project implementation.** In particular, households in the areas were found to be less affected by flooding. They also reported reduced levels of both illness and income loss due to flooding (by 47 percent for Phase 2 of the works).

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<sup>15</sup> PICs had a triple objective: (a) mitigating the risk of informal resettlement in the zones freed under the project; (b) animating the urban landscaping works through landscaping, sporting, and recreational facilities; and (c) facilitating community mobilization by closely involving the community in the identification, implementation, and management of the PICs.


**Table 2. PROGEP Results Achievement**

PDO and Intermediate Results Indicators	Original Target	AF1 Target	AF2 Target	Number Achieved	% Achieved
<b>PDO Indicators</b>					
Direct project beneficiaries (Number) of which female (50%)	132,000	132,000	132,000	167,000	127
Area in peri-urban Dakar protected against recurrent flooding through drainage works (ha)	660	400	400	900	225
Tools related to urban resilience, including climate change, adopted	n.a	Yes	Yes	Yes	100
<b>Intermediate Results 1</b>					
Key stakeholders (persons) trained in flood risk management, urban climate change resilience, and territorial planning	n.a	400	400	591	148
Experience in 'inter-municipal sustainable city' practices, through concerted territorial development (CTD), improved	n.a	Yes	Yes	Yes	100
<b>Intermediate Results 2</b>					
Primary drainage system in Pikine and Guédiawaye put it place (m)	28,200	15,828	15,828	29,317	185
An O&M stormwater drainage management system in Pikine and Guédiawaye is functional	O&M system functional	O&M system functional	O&M system functional	O&M system functional but not funded	Not achieved
Drainage channels cleaned at least once per year before rainy season in project area (%)	100.0	100.0	100.0	100.0	100
<b>Intermediate Results 3</b>					
Eligible flood risk reduction community investments_completed (Number)	50	30	30	68	227
People reached by IEC strategy at local and national level (Number)	80,000	60,000	60,000	84,366	141
Local flood management committees in Pikine and Guédiawaye are engaged in stormwater management activities	Yes	Yes	Yes	Yes	100

**Justification of Overall Efficacy Rating**

Rating: Substantial

30. Based on the analysis previously summarized, the overall efficacy is rated Substantial.



## C. EFFICIENCY

### Assessment of Efficiency and Rating

Rating: Substantial

31. **The design and implementation—although with a time lag—of the project were efficient,** reflecting lessons learned from other World Bank projects; building on local experience and sector knowledge; leveraging other ongoing GoS programs; adjusting for exogenous (for example, COVID-19) and endogenous (for example, detailed designs proved more costly than initially estimated and difficulty in putting the project in full swing after effectiveness) factors; and adapting to the external environment continuously. The phased approach adopted helped achieve time gains despite delays inherent to complex interventions in densely populated areas. After the AF1 restructuring, implementation ratings for financial management, environmental and social safeguards, procurement, and M&E were mostly satisfactory, while the share of project management cost did not exceed 3.77 percent of the total envelop.

32. **The project is viable with an ex post net present value (NPV) of US\$26 million discounted at 12 percent over 30 years, an economic rate of return (ERR) of 28 percent (against an ex ante 26 percent), and a present value of benefit over cost ratio (PVBCR) of 1.4.** The NPV is higher and reaches US\$52 million when the 6 percent discount rate suggested by the World Bank since 2016 is used.<sup>16</sup> Table 3 compares the ex ante and ex post benefit-cost analyses (BCAs). The project generates almost the same benefits when the conservative land appreciation of 34 percent calculated at appraisal is maintained. The project realizes a staggering ERR of 173 percent if the full 500 percent land appreciation realized in the project area is accounted for, knowing that land price increase could partially be attributed to flood-proofing as higher demand, speculation, and so on could also increase land prices. In addition to the tangible benefits considered in the ex post economic analysis, there are significant unquantified tangible social, environmental, economic, and financial benefits, as well as intangible benefits (capacity building, master plans, pilots, and so on), that will improve the overall management of the urban environment in the future, which were not accounted for in the analysis.

**Table 3. BCA Result Comparison over 30 Years<sup>a</sup>**

BCA Indicators	Economic Analysis Results	
	Ex Ante Discounted at 12%	Ex Post Discounted at 12%
NPV (US\$, millions)	27.0	26.0
ERR (%)	26.0	28.0
PVBCR	2.0	1.4

*Note:* The same methods used to calculate the ex ante economic analysis benefits (hedonic pricing method and income opportunity associated with flood-proofing in terms of days) were used ex post.

33. In light of the above and given the tangible and intangible benefits not captured in the economic analysis, the overall efficiency of the project is rated Substantial.

<sup>16</sup> According to the 2016 World Bank Technical Note titled 'Discounting Costs and Benefits in Economic Analysis of World Bank Projects', the discount rate to be used in the economic analysis should not exceed 6 percent but could be reduced to 3 percent based on the projected economic growth during the project lifetime. That is why 6 percent was used in the ex post analysis.





## D. JUSTIFICATION OF OVERALL OUTCOME RATING

Rating: Satisfactory

34. Project restructuring comprising PDO revisions and changes to some of the components resulted in material changes to project scope. As such, this ICR uses a split rating approach, as presented in table 4. Based on the split evaluation performed (see detailed calculation in table 4), the overall outcome rating of the project is Satisfactory. A rating of High for the relevance of the PDOs, a rating of Substantial for overall efficacy, and a rating of Substantial for efficiency justify an overall outcome rating of Satisfactory.

**Table 4. Calculations for the Overall Outcome Ratings before and after Restructuring**

		Before Restructuring	After Restructuring
Relevance of objective		High	
Efficacy (PDO)		Substantial	
	a	Substantial <sup>a</sup>	Substantial
	b	n.a.	High
Efficiency		Substantial	
1	Outcome ratings	Moderately Satisfactory <sup>b</sup>	Satisfactory
2	Numerical value of the outcome ratings	4	5
3	Disbursement	US\$29.95 million <sup>c</sup>	US\$65.55 million
4	Share of disbursement (%)	31	69
5	Weighted value of outcome rating	1.24	3.45
6	Final outcome rating	Satisfactory (1.24 + 3.45 = 4.69, rounding it to 5.0)	

Note: a. Based on PDO rating from the March 2015 Implementation Status and Results Report (ISR).

b. Based on implementation progress rating from the March 2015 ISR.

c. Formal approval was obtained to revise the project objectives when US\$29.95 million had been disbursed.

## E. OTHER OUTCOMES AND IMPACTS

### Gender

35. **Gender impacts can be considered in the context of project direct beneficiaries and the implementation of Components A and C.** A total of 86,840 women have directly benefited from the project. Women also played a prominent role in project implementation spanning participation in urban planning and in decision-making processes at local committee and municipal levels to actual implementation of the highly participatory PICs. According to DIME, the majority of members of community-based organizations that participated in the implementation of Component C were women (60 percent). Literature on the impact of disasters shows that there are often gendered elements at play, which can harm men and women differently and disproportionately when disasters strike. By benefiting women, the project contributed to an improvement with respect to reducing this gender gap.

### Institutional Strengthening

36. **Institutional strengthening was an integral part of the project and the outcomes are discussed under section II.B.** There are indications that PROGEP brought about enhanced efficiency gains due to improved institutional support for urban resilience management and capacity.



### Poverty Reduction and Shared Prosperity

37. **The project is thought to have helped reduce poverty and increase shared prosperity for 167,000 people** in the low-income districts of Pikine and Guédiawaye benefiting from the increased protection against the impacts of future floods. More generally, the 1.3 million residents of the 18 communes in Pikine and Guédiawaye benefited from the project. This does not include indirect beneficiaries outside the geographic scope of the project, such as rescue workers, health care workers, and others highly exposed to the risks associated with floods.

38. **There are indications that the project had a positive impact on education, health, income, and employment as well as safety and mobility.** In particular, the GoS reported the following:<sup>17</sup>

- **An increase in the land value in the project intervention zones by 500 percent**, whereby the market value of a land size of 300 m<sup>2</sup> increased from an average equivalent of US\$890–US\$5,300 in 2012 to an average equivalent of US\$7,100–US\$14,200 in 2016 when Phase 1 of the works was completed.
- **Positive social and business impacts**, with a 200 percent increase in average incomes of businesses operating in the intervention zones. The average daily income of women working in project intervention sites (where the works were completed) increased from US\$2.6 equivalent in 2012 to US\$5.2 equivalent in 2016.
- **The increase in real estate value and in income**—coupled with a decrease in municipal expenditures on emergency pumping, recurrent septic tank cleaning, and maintenance of depreciated infrastructure—reflected positively on municipal finances.
- **A significant decrease in the number of days lost by students** estimated at 30 days in 2013.
- **A gradual reduction of unhealthy sanitary conditions** with the control of disease vectors (for example, mosquitoes).
- **Safety and mobility improvements** with lower risk of drowning and access to new public transportation means such as buses facilitated by the pavement of roads under the project.

### Other Unintended Outcomes and Impacts

39. **The project also contributed to improvements in the beautification of green spaces in local neighborhoods.** Trees create a natural barrier and help prevent mudslides and hold water. Eight municipalities benefited from beautifying and adding green spaces from the project and 80 neighborhoods received cleaning materials.

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<sup>17</sup> Based on the 2016 evaluation and the end-of-project assessment as well as anecdotal evidence gathered by the task team during the ICR mission. The results do not take into account inflation, which at the time of the writing of the ICR, is around 2 percent.





### III. KEY FACTORS THAT AFFECTED IMPLEMENTATION AND OUTCOME

#### A. KEY FACTORS DURING PREPARATION

40. **The project design was adapted to the existing institutional framework.** In the sanitation code, it is stipulated that stormwater management falls under the purview of the central government, which can delegate the function to any public or private entity. The financing and operations of stormwater investments, however, fall under the responsibility of communes, and so do developing and adopting DMPs. Implementing the project, therefore, required experience in working with municipalities and managing the project's multisectoral aspects in a fluid institutional context. The ADM was appropriately chosen with adequate project management systems and track record of implementing donor-funded projects including World Bank-financed projects that engaged municipalities.

41. **The project design affected implementation positively.** The project was structured in a streamlined fashion, with a priority-based phased approach allowing for quick delivery in the field despite (a) the multiplicity of issues it sought to address, from mitigating recurrent flooding to strengthening urban planning and management, and increasing resilience to the effects of climate change, (b) its participatory approach based on a close involvement of communities, and (c) its intervention in a sociogeographical context characterized by a hyper-dense and informal occupation of land and vulnerability of the beneficiaries. The priority emergency drainage works under Phase 1 were able to start shortly after effectiveness (four months), in March 2013. Investments were selected in accordance with a multicriteria approach developed under the Dakar Metropolitan DMP, with a particular focus on number of beneficiaries/densities. A Results Framework that all partners were committed to achieving was prepared. Implementation support plans were developed for various project aspects like safeguards or procurement. Action plans were also devised to mitigate high risks identified during preparation. The implementing agency's capacity was bolstered through the recruitment of five full-time experts. The original design also included an impact evaluation.

#### B. KEY FACTORS DURING IMPLEMENTATION

42. **An important factor positively affecting implementation was the stability of working with the ADM coordination team.** The ADM is a government agency endowed with an autonomous budget and a stable executive capacity. Through several changes in the GoS' ministerial setup, the ADM coordination team remained largely the same. The coordination team continuously worked with key partner ministries (local government, water and sanitation, urban planning, environment, and interior) despite several leadership and organizational changes that occurred in these ministries.

43. **One year into implementation, the project ran into a financing gap amounting to US\$50 million that was partially filled through AF1, which did not affect the project end targets.** AF1 was identified and documented early on, during the first implementation mission of May 2013—appropriate proactive follow-up was carried out and documented in subsequent Aide Memoires. AF1 was processed on time to not delay works of Phase 2.

44. **PROGEP encountered difficulties to mobilize counterpart funding from 2017 onward.** Counterpart funding was rated Satisfactory in the ISRs until July 2017 and then downgraded to Moderately



Satisfactory. Thereafter, most of the PAP compensations were paid by the GoS with delays. The most difficult situation was experienced in 2019 during the presidential election period, when the GoS was unable to mobilize counterpart funding and the country's portfolio was affected. The GoS was able to pay PAP compensations fully only in November 2019. At project closure, US\$3 million counterpart funding for the O&M was yet to be mobilized.

45. **Signing partnership agreements with the institutions involved in the project did not guarantee full ownership by all of them.** Partnership agreements allowed the stakeholders to actively participate in the project and its implementation. They helped entities have access to trainings and tools for urban planning and management. However, these agreements did not always translate into a stronger buy-in from stakeholders. For instance, the partnership agreement with ONAS did not translate into them effectively taking over the O&M function, in part because the necessary counterpart funding was not allocated to them and political economy issues. Furthermore, building restrictions were not always respected. While some municipalities were committed to respecting building restrictions, other continued providing licenses or supporting private building in high-risk areas.

46. **Another factor helping implementation was the support provided to the GoS by the World Bank's task team.** The task team leader and key members of the task team were based in Dakar throughout project implementation and were able to provide day-to-day support to ADM. Restructuring of the project under AF1 helped smooth implementation. It aligned the project's objectives and time frame with the additional resources provided. Following the restructuring, the midterm review, which took place in June 2015, provided a comprehensive assessment of progress toward development objectives and implementation performance. The midterm review confirmed the overall relevance of the project and recommended actions to address implementation delays.

47. **Illegal wastewater discharges in stormwater drainage system in some instances negatively affected project outcomes.** For example, in Dalifort, it was noted during the May 2019 mission that the water body in Basin 2 (PROGEP Phase 1) was degraded by wastewater coming from clandestine emptying practices of riparian populations and by used oils likely coming from local mechanics' workshops. The task team worked with ONAS toward expediting the implementation of a wastewater treatment system in the project intervention zones.

#### IV. BANK PERFORMANCE, COMPLIANCE ISSUES, AND RISK TO DEVELOPMENT OUTCOME

##### A. QUALITY OF MONITORING AND EVALUATION (M&E)

###### M&E Design

48. **The PAD included a Results Framework with PDO and intermediate results indicators, and with baseline and target values for all indicators, making clear links between the PDO, project activities, data sources, and responsible agencies.** Subsequently, the Results Framework was revised under AF1 and AF2, including revisions to the PDO and intermediate indicators and their targets, as previously described. Overall, the Results Framework indicators during the course of implementation proved to be adequate in measuring PDO but could nonetheless have been strengthened further by setting up targets informed by



technical studies. The M&E design could have included a survey to generate data on beneficiary satisfaction or living conditions in the intervention zones before and after the project.

### **M&E Implementation**

49. **Implementation of the M&E system was Satisfactory.** M&E of project activities was the responsibility of the ADM whose capacity was strengthened with the establishment of an M&E system including a software and staff trainings. The project M&E team collected, measured, recorded, analyzed, verified, and stored data on all the activities in progress and the results achieved. At project completion, the M&E team provided consistent and verifiable project data.

50. **The M&E team, through its M&E focal points and the social facilitators, regularly visited project areas to document progress of activities and to learn what impact these activities were having.** These regular site visits were essential for collecting data for the M&E framework. For example, until 2018, a GIS specialist was collecting data in the field to feed into the reporting on the first two PDO indicators.

51. **The project included an impact assessment that complemented the project M&E system.** A DIME in relation to Component C was conducted in 2015. This helped inform the implementation of the subsequent stages of the project and provided useful information for the development of the community engagement strategy.

### **M&E Utilization**

52. **Updated data of the Results Framework and PROGEP progress reports served as the basis of discussions during implementation support missions.** The M&E framework informed project-related decisions especially monitoring the progress of drainage infrastructure works, as well as their impacts in the project intervention areas and beneficiaries. The World Bank task team reported on the functioning of the project's M&E system in each Aide Memoire, noting improvements and areas requiring further strengthening. In addition, PROGEP generated nine online knowledge notes to disseminate lessons learned and communicate M&E results.

### **Justification of Overall Rating of Quality of M&E: Substantial**

53. **Overall outcome rating of quality of M&E is rated Substantial.** Despite moderate shortcomings in its design, the M&E system was sufficient to assess the achievement of objectives.

## **B. ENVIRONMENTAL, SOCIAL, AND FIDUCIARY COMPLIANCE**

54. **Compliance with overall social and environmental safeguards is deemed to be Moderately Satisfactory.** Five safeguard policies were triggered throughout the lifetime of the project—Environmental Assessment (OP/BP 4.01), Natural Habitats (OP/BP 4.04), Pest Management (OP 4.09), Physical Cultural Resources (OP/BP 4.11), and Involuntary Resettlement (OP/BP 4.12). After AF1, Natural Habitats and Pest Management policies were no longer triggered. During the early years of implementation, compliance with safeguards was Satisfactory<sup>18</sup> given that (a) all appropriate safeguards instruments (Environmental and Social Impact Assessment [ESIA], Environmental and Social Management

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<sup>18</sup> See annex 7 for a summary of all ISR ratings.



Framework [ESMF], Resettlement Policy Framework [RPF], and Resettlement Action Plan [RAP]) were prepared and disclosed on time and (b) there was no issue with the smooth implementation of these instruments in the field, despite the project being Category A. However, gaps in compliance with World Bank's safeguards policies and procedures were identified in the later years of the project, as described in the following paragraphs.

55. **Despite delays, the three RAPs were to a large extent fully executed, with almost 99 percent of the PAPs compensated (see table 5). In addition, 20 PAPs were supposed to be compensated for damages incurred as a result of the works – the Government committed to fully compensate these PAPs by December 10, 2020 at an amount equivalent to US\$36,232.** At early stages of implementation, the project took into account the existing settlements to minimize the resettlement of residents. The PAPs were identified and compensation amounts were determined in line with the existing legal framework. However, with the start of Stage 2 of Phase 2, some delays were experienced in the compensation of the PAPs, driven primarily by delays related to (a) a decree that took a year to be signed, (b) lack of availability of counterpart funding in 2018 and 2019 during the election period. Aside from delays, the implementation of the RAPs was characterized by other weaknesses including (a) continuous updating of the PAPs' numbers throughout implementation due to the nature of PAP counting in informal densely populated areas, (b) insufficient data on the socioeconomic profiles of the PAPs, (c) adequacy of some activities undertaken in relation to the livelihood restoration of PAPs, and (d) the need to provide additional training to the administrative and local structures involved in the RAPs' implementation. Remedial actions were identified in the RAPs' audit, and recommendations were made to improve forthcoming operations.

**Table 5. Summary of RAPs' implementation on November 25, 2020**

PROGEP Phase	Updated PAP number (as of March 30, 2020)	Number of paid PAPs	Number of unpaid PAPs (not found)	Total compensation disbursed (in US\$ equivalent) as of November 25, 2020	Compensation execution rate (percentage)
Phase 1	124	124	0	1,204,279	100
Phase 2 - stage 1	142	138	4	1,094,119	97.18
Phase 2 - stage 2	292	283	9	2,106,955	97.91
<b>Total</b>	<b>558</b>	<b>545</b>	<b>13</b>	<b>4,405,352</b>	<b>98.67</b>

56. **Shortcomings relating to environmental, health, and safety issues were observed in some of the work sites.** While these should be viewed in the context of the constraints specific to the intervention area being extremely dense and informally occupied, several noncompliances to occupational health and safety (OH&S) measures at a drainage work site in the neighborhood of Keur Massar (Mbeubeuss catchment) resulted in the occurrence of a fatality of a 10-year-old boy on June 10, 2018. Proactive measures were taken by the task team before and following the fatality. Before the fatality, a detailed action plan was developed with the implementation agency, the contractor, and the supervision firm.

57. **A grievance redress mechanism (GRM)<sup>19</sup> with functioning committees at the district, municipal, and neighborhood levels was put in place as part of the approved abbreviated RAP and was later**

<sup>19</sup> Complaints from communities were handled by the implementing agency through a social facilitation firm and COLIGEP.



**reinforced.** The GRM that existed was deemed to be functional for resettlement but failed to address sensitive issues such as gender-based violence. It also failed to fully respect the timeliness requirement for grievances resolution in accordance with World Bank standards. GRMs dating from 2013 are not fully in line with the current World Bank approach to GRMs, which is more inclusive and provides more visibility on grievances processing. A comprehensive GRM manual was adopted by the Government in March 2019, following the abovementioned fatality to ensure that OH&S issues were included. However, despite having adopted a clear GRM manual, at project closure, some complaints were not fully resolved.

**58. Compliance with the project's financial management procedures was Moderately Satisfactory.**

Overall, ADM complied with the World Bank's financial management policies with moderate shortcomings. Financial management was rated Satisfactory during nearly the entire project implementation period. All financial management and audit reports submitted were unqualified and in accordance with all World Bank requirements. ADM had adequate financial management capacity with a qualified full-time financial and administrative director. The budgeting and accounting arrangements were assessed as adequate. The project was in compliance with the financial reporting arrangements, with the quarterly interim financial reports and annual audit reports being submitted to the World Bank mostly within the stipulated timelines. The project disbursed 99.93 percent of IDA and 91.61 percent of trust fund resources at project closure. However, government and project contributions were often not mobilized on time and weaknesses were noted in internal audit arrangements and advance payments. Internal and external audit recommendations were not fully implemented. Despite these weaknesses, the project's financial management system provided the necessary assurance that the World Bank proceeds were being used for the intended purposes and that reports could be relied upon to monitor the project.

**59. Compliance with the project's procurement procedure was Moderately Satisfactory.**

Procurement was rated Satisfactory or Moderately Satisfactory during the project implementation period. Procurement shortcomings identified include, among others, the following: (a) insufficient staff in the Procurement Unit, (b) the absence of core team members in charge of project implementation in the implementing agency's procurement commission, (c) unavailability of a detailed procurement and contract management manual, (d) unavailability of a database with companies/suppliers/providers for restricted consultations, and (e) delays in updating activities in the online platform Systematic Tracking of Exchanges in Procurement (STEP). The World Bank team intensively monitored compliance with the project's procurement procedures. By the end of the project, progress was made with regard to entering all the transactions in STEP. Despite these shortcomings, the contracts were generally awarded in accordance with the stipulations of the competition documents and after confirmation of the qualification of the successful candidate. Furthermore, no cases of fraud or corruption were observed in this context.

## **C. BANK PERFORMANCE**

### **Quality at Entry**

**60. The World Bank's performance in ensuring quality at entry was Satisfactory.** The World Bank's performance in identification, preparation, and appraisal was Satisfactory. The design responded to priorities identified in the 2009 PDNA. The operation came as a response to a series of disasters that hit the country and had significant adverse economic impacts. It was prepared to respond to an emergency and benefited the poorest and most affected communes. The design reflected lessons learned from the World Bank's experience in the country and in the sector more broadly while being aligned with the GoS'



developmental objectives. At the time of presentation to the Board, an ESMF and an RPF were completed. An ESIA was also prepared for the first priority investment. A comprehensive Results Framework was developed, with indicators covering all results areas with gender disaggregation, baseline, and target values. Arrangements for monitoring and reporting were agreed. Appraisal of implementation arrangements was satisfactory with agreements reached on the roles and responsibilities of the Steering and Technical Committees. The Operational Risk Assessment Framework included in the original PAD specified the risks that the project would face and identified adequate mitigation measures, and subsequent project papers reevaluated these risks adequately.

### **Quality of Supervision**

61. **World Bank performance in supervision was Satisfactory.** It stands out that the project was rated Satisfactory for progress toward development objectives in all but one ISR. Close supervision was provided throughout project implementation. The task team leader was involved in the project in different roles from preparation to closure. She is based in Senegal along with most of team members, which enabled them to provide day-to-day support during implementation. The World Bank carried out some 16 implementation support missions during the project's eight years of implementation. Missions took place twice a year and lasted about a week each. They comprised eight or more members and included local and international consultants with expertise in DRM, integrated urban planning, urban development, civil engineering, water supply and sanitation, coastal management, social and environmental safeguards, impact evaluation, procurement, and financial management.

62. **Supervision of fiduciary and social and environmental safeguards.** The World Bank team played a critical role in helping the GoS improve capacity for compliance with environmental and social safeguards, procurement and financial management. Given the high social and environmental risks associated with PROGEP, close supervision was provided to ensure that resettlement procedures were completed in an adequate manner. The team was also proactive in flagging potential issues and devising action plans to remedy them, as well as taking strong measures to proactively address problems when they arose, as demonstrated in the aftermath of the accident that occurred in June 2018.

63. **Focus on development impact.** The team processed additional financing to fill a financing gap so that design quality and scale of works would not be undermined. As part of the restructuring, the team introduced new activities to reinforce the impact of the project in terms of rendering Senegalese cities more resilient. The team mobilized trust fund resources to provide additional technical value and specialized expertise in DRM to support the GoS throughout the design and development of complex studies implemented under the project.

64. **Candor and quality of performance reporting.** Aide Memoires were of high quality and candid, comprehensively covering implementation challenges and providing programmatic recommendations on how to address challenges. They consistently assessed ISR ratings. ISRs were regularly updated, and project performance indicators were realistically rated. The task team kept the GEF informed through timely and thorough reporting.

### **Justification of Overall Rating of Bank Performance: Satisfactory**

65. The World Bank's performance in ensuring both quality at entry and supervision justifies the overall rating of Satisfactory for the World Bank's performance.





#### D. RISK TO DEVELOPMENT OUTCOME

**Lack of O&M would shorten the life-span and reduce the effectiveness of drainage infrastructure.** Over the past nine years, Senegal has invested more than US\$1 billion in new drainage infrastructure to reduce urban flood risks in Dakar and other cities. Yet, an O&M system for the drainage network is still not in place. The drainage network financed under PROGEP is thus at a risk of not being maintained after project closure, in part due to lack of viable financing for O&M. Therefore, to protect and ensure the sustainability of investments, it is critical that a long-term solution is worked out, especially because Dakar is highly exposed to floods and an effective O&M system for drainage infrastructure would reduce flood risk and the associated environmental health risks.

#### V. LESSONS AND RECOMMENDATIONS

66. **The DMP provided the GoS with a vision of how stormwater could be managed in an integrated manner.** The master plan allowed for a better understanding of flood issues in Dakar region and for a sound evaluation of flood management options within an integrated approach encompassing structural and nonstructural measures, sound socioeconomic analysis, and environmental impact assessments. Furthermore, combining a watershed-level drainage approach that would help restore the natural pathways for evacuating stormwater—often ignored in the development of stormwater management plans—with gravity drainage infrastructure that facilitated the evacuation of rainwater all the way to the sea through the natural slope of the ground, represented a less costly choice to invest, operate, and maintain than pump-based sanitation systems. This represented a new vision to flood risk management in Senegal. While the DMP proved to be not precise in terms of costing, it allowed to alleviate the most pressing needs and adopt an incremental phased approach by defining minimum or optimal levels of acceptable risk. This demonstrates the potential of flexible, multiphased approach to drainage infrastructure design.

67. **Community engagement is key to facilitating the execution of works and ensuring sustainability of investments in densely populated informal settlements.** PROGEP placed emphasis on the ‘social dimension’ by dedicating a full-fledged component on community engagement targeting both national and local actors. The component was rolled out with the support of social facilitators who played a central role in disseminating information and ensuring continuous communication with communities. This approach has shown that integrating community participation as well as communication and awareness raising activities into project design can lead to continuous engagement and behavior change in the project intervention areas, foster ownership of infrastructure by communities, ensure their participation at the different stages of infrastructure development, and limit the risks of conflicts. The approach helped support a culture of flood risk management and reinforce the knowledge of stakeholders in terms of coping with climate risks. This is a valuable lesson for other donor funded operations intervening in informal urban areas in the country.

68. **While overall the project objectives were well-fitted with the GoS’ priorities and built on the GoS’ capacities, objectives related to systemic reforms proved to be too ambitious to be achieved over the project lifetime.** Institutional and financial reforms (for example, the establishment of a sanitation fund for O&M and the implementation of several tools as such plans, monitoring systems, and enforcement mechanisms) require time and proactive engagement with decision-makers to ensure sustainability of the infrastructure built under the project. Approaching the issue from the financial



perspective through, for example, a study on the cost of informality or the cost of lack of maintenance could be a powerful tool to engage with decision-makers beyond the DRM field.

69. **Piloting Sustainable Cities Initiative in Dakar, Diamniadio, and Saint-Louis resulted in the development and adoption, at the national and city levels, of a number of tools related to urban sustainability and resilience, including climate change.** This knowledge was capitalized on to provide a clearer perspective on cities' sustainability challenges and priority action needed to address them. It equipped national and local decision makers with strategic documents, tools and expertise, informed key national documents such as the urban code and guided the design of ongoing and forthcoming operations.

70. **Recovery can be used to build capacity to withstand flooding in the future.** Exacerbated by the effects of climate change, flood events will unfortunately continue to devastate communities despite good flood risk management practices. On September 5, 2020, Senegal—and Dakar peri-urban areas, in particular—witnessed an exceptional amount of 200 mm of rain in 24 hours (almost half of the annual average rainfall). World Bank-financed infrastructure in Pikine and Guédiawaye performed at higher level—withstanding floods believed to have had a higher return period than the 10-year return period they were designed for. Following the event, it became evident that while some areas of Dakar region were protected, others remain vulnerable. This was an opportunity for the GoS to assess investments, financing, and human resources needed to further improve its capacity to respond to flooding and strengthen its PDGI. More specifically, the GoS identified the need to extend its integrated flood management approach to new sites in peri-urban Dakar, while planning in a phased approach, additional interventions in the other regions (through an expected follow-up project—PROGEP 2). The GoS also recognized that it can benefit from a contingent financing line that provides immediate liquidity to address shocks related to such events.





## ANNEX 1. RESULTS FRAMEWORK AND KEY OUTPUTS

### A. RESULTS INDICATORS

#### A.1 PDO Indicators

**Objective/Outcome:** Reduce flood risks in peri-urban areas of Dakar

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Direct project beneficiaries	Number	0.00 01-Sep-2012	132000.00 30-Apr-2019	132000.00 28-Mar-2017	167000.00 31-May-2020
Female beneficiaries	Percentage	0.00	52.00 15-May-2018		52.00
<b>Comments (achievements against targets):</b>					

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Area in peri-urban Dakar protected against recurrent flooding through drainage works	Hectare(Ha)	0.00 01-Sep-2012	660.00 30-Apr-2019	400.00 28-Mar-2017	900.00 31-May-2020



Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Tools related to urban resilience including climate change, adopted	Text	No Tools related to urban resilience including climate change, adopted	Tools related to urban resilience including climate change, adopted	Tools related to urban resilience including climate change, adopted	A national strategy for integrated urban management and planning addressing, inter-alia, flood prevention and climate change impacts has been validated by the project technical committee and adopted by the National Urban Committee under the leadership of the Urban Ministry
		01-Sep-2012	30-Apr-2019	28-Mar-2017	31-May-2020

**Comments (achievements against targets):**



## A.2 Intermediate Results Indicators

### Component: Integration of Climate Risks in Urban Planning and Management

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Key stakeholders (persons) trained in flood risk management, urban climate change resilience and territorial planning	Text	0 01-Sep-2012	n.a. 30-Apr-2019	400 28-Mar-2017	591 31-May-2020
Comments (achievements against targets):					

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Experience in "inter-municipal sustainable city" practices, through concerted territorial development (CTD), improved	Text	No 01-Sep-2012	Yes 30-Apr-2019	Yes 28-Mar-2017	Yes 31-May-2020
Comments (achievements against targets):					

### Component: Drainage investments and management

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised	Actual Achieved at
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				Target	Completion
Primary drainage system in Pikine and Guediawaye put it place.	Meter(m)	0.00	28200.00	15828.00	29317.00
		01-Sep-2012	30-Apr-2019	28-Mar-2017	31-May-2020
<b>Comments (achievements against targets):</b>					

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
AN O&M stormwater drainage management system in Pikine and Guediawaye is functional.	Text	No	O&M system functional	O&M system functional	O&M system functional but not funded
		01-Sep-2012	30-Apr-2019	28-Mar-2017	31-May-2020
<b>Comments (achievements against targets):</b>					

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Drainage channels cleaned at least once per year before rainy season in project area	Percentage	0.00	100.00	100.00	100.00
		01-Sep-2012	30-Apr-2019	28-Mar-2017	31-May-2020
<b>Comments (achievements against targets):</b>					



Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Eligible flood risk reduction community investments completed.	Number	0.00 01-Sep-2012	50.00 30-Apr-2019	30.00 28-Mar-2017	68.00 31-May-2020
<b>Comments (achievements against targets):</b>					

**Component:** Community engagement in urban flood-risk reduction and adaptation to climate change

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
People reached by IEC strategy at local and national level.	Number	0.00 01-Sep-2012	80000.00 30-Apr-2019	60000.00 28-Mar-2017	84366.00 31-May-2020
<b>Comments (achievements against targets):</b>					

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Local flood management committees in Pikine and Guediawaye are engaged in stormwater management activities.	Text	No 01-Sep-2012	Yes 30-Apr-2019	Yes 28-Mar-2017	Yes 31-May-2020



Comments (achievements against targets):



## B. KEY OUTPUTS BY COMPONENT

Objective/Outcome 1: Reduce flood risks in peri-urban areas of Dakar	
Outcome Indicators	<ol style="list-style-type: none"> <li>1. Direct beneficiaries (number) of which female (50 percent)</li> <li>2. Area in peri-urban Dakar protected against recurrent flooding through drainage works (ha)</li> </ol>
Intermediate Results Indicators	<ol style="list-style-type: none"> <li>1. Primary drainage system in Pikine and Guédiawaye put in place (m)</li> <li>2. An O&amp;M stormwater drainage management system in Pikine and Guédiawaye is functional</li> <li>3. Drainage channels cleaned at least once per year before rainy season in project area (%)</li> <li>4. Eligible flood risk reduction community investments completed (Number)</li> <li>5. People reached by IEC strategy at local and national level</li> <li>6. Local flood management committees in Pikine and Guédiawaye are engaged in stormwater management activities</li> </ol>
Key Outputs by Component (linked to the achievement of the Objective/Outcome 1)	<ol style="list-style-type: none"> <li>1. 167,000 direct beneficiaries of which 52% are female</li> <li>2. (a) 900 ha peri-urban Dakar protected against recurrent flooding</li> <li>2. (b) 29.3 km of closed and open primary drainage infrastructure put in place</li> <li>2. (c) 21 km of closed and open secondary channels completed</li> <li>2. (d) Stormwater retention basins with a cumulative capacity of 700,000 m<sup>3</sup> put in place</li> <li>2. (e) 150,000 m<sup>2</sup> (that is, 25,000 ml) of sanitized interlocking concrete block paving roads completed</li> <li>2. (f) 1 high-flow pumping station installed</li> <li>2. (g) 3 secondary pumping stations installed</li> <li>3. All the channels were cleaned at least once per year before the rainy season during 2015–2019</li> <li>4. Some 68 eligible flood risk reduction community investment projects completed</li> <li>5. Some 84,366 people reached by IEC strategy at local and national levels</li> <li>6. Some 9 functioning local flood management committees in Pikine and Guédiawaye engaged in stormwater management activities</li> </ol>
Objective/Outcome 2: Improve capacity to plan and implement sustainable city management practices, including climate resilience, in selected urban areas	
Outcome Indicators	<ol style="list-style-type: none"> <li>1. Tools related to urban resilience including climate change, adopted</li> </ol>





Intermediate Results Indicators	<ol style="list-style-type: none"> <li>1. Key stakeholders (persons) trained in flood risk management, urban climate change resilience, and territorial planning</li> <li>2. Experience in ‘inter-municipal sustainable city’ practices, through concerted territorial development (CTD), improved</li> </ol>
Key Outputs by Component (linked to the achievement of the Objective/Outcome 2)	<ol style="list-style-type: none"> <li>1. (a) 8 MoUs signed and executed with key stakeholders</li> <li>1. (b) 591 key central and local government staff trained</li> <li>1. (c) 7 training sessions linked to the objectives of the project held</li> <li>2. (a) Study on the governance model of Diamniadio agglomeration prepared</li> <li>2. (b) ACT-SL created</li> <li>3. (a) Study for urban policy gap analysis and action plan for relevant reforms to strength cities sustainability produced</li> <li>3. (b) Study for priority urban policy reform to promote cities’ sustainability produced</li> <li>3. (c) National strategy for integrated urban management and planning addressing, among others, flood prevention and climate change impacts validated by the project technical committee and adopted by the National Urban Committee under the leadership of the ministry in charge of urban affairs</li> <li>3. (d) Knowledge sharing platform on sustainable cities and urban resilience thematic put in place</li> <li>3. (e) Detailed urban plans for Pikine and Guédiawaye produced</li> <li>3. (f) Flood risk management plan for Diamniadio agglomeration produced</li> <li>3. (g) DMP and master plan for the Saint-Louis agglomeration developed</li> <li>3. (h) Diagnostic studies and city action plans promoting cities’ sustainability for Saint-Louis and Diamniadio developed</li> <li>3. (i) GIS and Territorial Information System tools for Pikine-Guédiawaye and Saint-Louis developed</li> <li>3. (k) Modeling of the Saint-Louis Delta produced</li> <li>3. (l) Knowledge from investments undertaken in the solid waste management and green city sectors in Saint-Louis and Diamniadio generated</li> </ol>

**ANNEX 2. BANK LENDING AND IMPLEMENTATION SUPPORT/SUPERVISION****A. TASK TEAM MEMBERS**

Name	Role
<b>Preparation</b>	
Maman-Sani Issa	Task Team Leader(s)
Demba Balde	Social Specialist
Africa Eshogba Olojoba	Social Specialist
Denis Jean-Jacques Jordy	Social Specialist
<b>Supervision/ICR</b>	
Isabelle Celine Kane	Task Team Leader(s)
Mouhamadou Kabir Ndoeye, Rahmoune Essalhi, Mountaga Ndiaye	Procurement Specialist(s)
Fatou Fall Samba	Financial Management Specialist
Sung Heng C. Kok Shun	Team Member
Salamata Bal	Social Specialist
Lucienne M. M'Baipor	Social Specialist
Anta Tall Diallo	Team Member
Seynabou Thiaw Seye	Team Member
Nicolas Kotschoubey	Environmental Specialist
Medou Lo	Environmental Specialist
Amina Ajola Cole Fofana	Team Member
Aminata Ndiaye Bob	Team Member
Veronique Marie Morin Floissac	Team Member

**B. STAFF TIME AND COST**



Stage of Project Cycle	Staff Time and Cost	
	No. of staff weeks	US\$ (including travel and consultant costs)
<b>Preparation</b>		
FY11	56.550	212,573.56
FY12	66.048	231,569.88
FY13	3.800	4,856.36
FY15	0	4,699.42
FY16	0	0.00
<b>Total</b>	<b>126.40</b>	<b>453,699.22</b>
<b>Supervision/ICR</b>		
FY13	32.124	157,616.82
FY14	19.614	92,715.43
FY15	28.877	85,795.19
FY16	26.103	93,066.33
FY17	15.467	66,446.21
FY18	14.540	108,229.58
FY19	28.364	165,529.21
FY20	21.307	94,871.42
<b>Total</b>	<b>186.40</b>	<b>864,270.19</b>

**ANNEX 3. PROJECT COST BY COMPONENT****IDA**

Components	Amount at Approval (US\$, millions)	Actual at Project Closing (US\$, millions)	Percentage of Approval
A. Integration of Climate Risks in Urban Planning and Management	3.6	2.2	61.10
B. Drainage Investment and Management	78.2	82.3	105.20
C. Community Engagement in Urban Flood-risk Reduction and Adaptation to Climate Change	4.6	2.4	52.17
D. Project Coordination, Management, Monitoring, and Evaluation	4.2	3.6	85.71
<b>Total</b>	<b>90.6</b>	<b>90.5</b>	<b>99.89</b>

**GEF**

Components	Amount at Approval (US\$, millions)	Actual at Project Closing (US\$, millions)	Percentage of Approval
A. Integration of Climate Risks in Urban Planning and Management	5.2	5.000	96.20
D. Project Coordination, Management, Monitoring, and Evaluation	0.3	0.009	3.00
<b>Total</b>	<b>5.5</b>	<b>5.000</b>	<b>90.91</b>



## ANNEX 4. EFFICIENCY ANALYSIS

### Background

1. Financial analysis (that is, commercial profitability analysis) and economic analysis (that is, national profitability analysis) differ in several ways. The objective of the commercial profitability analysis is to assess the net financial results of a project from the investor's point of view, while the national profitability analysis aims to identify and measure the net economic benefits of the project from the society's point of view. Moreover, the commercial profitability analysis is based on prevailing market prices, while the national profitability analysis is determined with the help of adjusted prices (that is, shadow prices), which are deemed to approximate true economic prices (reflecting the social opportunity cost, for example, price distortions, subsidies, taxes, and so on). Similarly, for the commercial profitability analysis, the time value of money is described by applying the private discount rate based on the prevailing interest rate of the capital market, while for the national profitability analysis, the social discount rate is applied, that is, the rate at which the country can borrow money taking into consideration the country risk.

2. Three main indicators are usually considered in the financial and economic analysis to determine the viability of the project:

- **The NPV**, which is the difference between the discounted flow of total benefits and costs.
- **The internal rate of return**, which is the discount rate that zeroes out the NPV or the interest rate that makes the NPV of all cash flows equal to zero. In other words, the internal rate of return estimates the actual return on the project, expressed as a percentage or interest rate.
- **The PVBCR**, which is the ratio of the present value of benefits over the present value of costs over the lifetime of the project. Sometimes the benefit-cost ratio is based on undiscounted benefits to costs, but this is a less useful measure.

### Ex Ante Economic Analyses

3. At appraisal, the parent PROGEP total costs amounted to US\$72.9 million, of which IDA's share totaled US\$55.6 million. Benefits were mainly based only on (a) forgone economic activities during recurring flooding events and (b) the depressed hedonic pricing of land (real estate data were not readily available) in flood-prone areas in the targeted areas. A number of social (for example, waterborne and vectorborne diseases and schooling); environmental (for example, wastewater percolation from septic tanks during floods); and economic (for example, multiplier and trickle-down effect and fiscal space) benefits were not included and financial (for example, income generation and forgone opportunities) benefits were not quantified. Despite these conservative benefits, the parent project was viable over 30 years when discounted at 12 percent with an NPV of US\$27 million, an ERR of 26 percent, and a PVBCR of 2.

4. While AF2 did not bring major changes to the breadth of the project (additional US\$5.5 million funding from the GEF), AF1 increased both the envelop by US\$43 million (of which US\$35 million from IDA) and project activities, which is expected to bring about intangible benefits in the future. In addition



to the hedonic pricing and forgone economic activities used in the BCA of the parent project, additional benefits were considered due to the early warning systems that could prevent premature death, injuries, spread of disease, damages, and so on (Hallegatte 2012). Hence, the AF1 project viability over 30 years when discounted at 10 percent exceeded the parent project's results with an NPV of US\$66.8 million, an ERR of 45 percent, and a PVBCR of 2.

### Ex Post Economic Analysis

5. AF2 total costs are considered in the BCA, whereas the same preliminary premises in terms of benefits (hedonic valuation techniques) are used but, when available, rely on more recent and robust data to derive the benefit flows of land appreciation only. However, the analysis considers a project span over 30 years.

6. Regarding costs, the estimated disbursement of IDA and the GoS funds by component and year are illustrated in table 4.1. The GEF monies added under AF2 and the NDF parallel financing are illustrated in table 4.1 but are not considered in the economic analysis. These two funding sources were not totally disbursed by the end of PROGEP unlike the IDA and GoS monies that were almost fully disbursed although some residual amount remains and was delayed being used due to the COVID-19 pandemic. The O&M of the flood management system is set at 3 percent of Component B.

**Table 4.1. PROGEP Estimated Disbursement by Component and Year (US\$, millions)**

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total
	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	
	US\$, millions								
World Bank and GoS total cumulative	4.40	9.40	15.00	40.00	65.00	90.00	104.00	106.80	257.73
Component A	0.15	0.33	0.52	1.39	2.25	3.12	3.60	3.70	87.11
Component B	3.63	7.75	12.37	33.00	53.62	74.24	85.79	88.10	62.69
Component C	0.19	0.40	0.65	1.72	2.80	3.88	4.48	4.60	53.95
Component D	0.43	0.92	1.46	3.90	6.33	8.76	10.13	10.40	53.98
World Bank and GoS total cumulative	4.40	5.00	5.60	25.00	25.00	25.00	14.00	2.80	106.80
Component A	0.15	0.17	0.19	0.87	0.87	0.87	0.49	0.10	3.70
Component B	3.63	4.12	4.62	20.62	20.62	20.62	11.55	2.31	88.10
Component C	0.19	0.22	0.24	1.08	1.08	1.08	0.60	0.12	4.60
Component D	0.43	0.49	0.55	2.43	2.43	2.43	1.36	0.27	10.40
GEF total yearly	—	—	—	—	0.75	1.25	1.50	2.00	5.50
NDF parallel financing	—	—	—	—	—	—	—	—	9.00
Grand total	—	—	—	—	—	—	—	—	121.30

7. Regarding benefits, the valuation method used are as follows:

- The drainage system set up in four watersheds of Thiourour, Grandes-Niayes de Pikine, Yeumbeul Nord, and Mbeubeuss-Keur Massar and covering parts of the communes of Pikine and Rufisque increased the land price by a staggering 500 percent, whereas at project



appraisal, the hedonic pricing method derived an increase of 34 percent in land prices when compared to flood-proof areas in Dakar. It is obvious that the increase is not only attributable to the new drainage system but also to inflation, increased demand, speculation, and the construction boom. Hence, the same increase derived at appraisal will be considered for the ex post analysis as a lower bound benefit associated with the appreciation due to the project drainage system covering an area of 900 ha. Table 4.2 provides the land price appreciation of 34 percent for the targeted areas in 2019 prices that accrue in 2018 and is annualized over three years.

- The 167,000 inhabitants who will benefit from days without floods (5.6 days based on the average flood-day disruption of the past 25 years in Senegal) and where the gross domestic product per capita per day is assigned to the forgone flooding days. Not all benefits were considered as the indicators and the data needed to carry out the BCA were not always in sync, which complicated the BCA ex post process. The population growth is not considered in the analysis although it could generate more benefits.
- All figures are in 2019 prices and constant terms.

**Box 4.1. PROGEP Benefits According to the GoS**

- 167,000 inhabitants, 52 percent of whom are women, are no longer at risk of flooding.
- 900 ha protected from recurrent floods.
- 69 percent of community infrastructure and equipment recovered or 22 of the 32 lost in 2012.
- 66 percent of school equipment recovered, or 8 of the 12 lost in 2012.
- 62 percent of the 51 flooded bare fields in 2012 are under construction.
- An average of 500 percent land upgrading in the neighborhoods affected by the works.
- 200 percent average income from businesses in the neighborhoods affected by the works.
- 8 km of right-of-way freed along the structures.
- The water table level is about 1 m to more than 2 m depending on the site.
- Schooling: Significant decrease in the number of days lost by students.
- Health: Gradual reduction of unsanitary conditions, proliferation of mosquitoes, and other disease vectors (diseases that had become endemic).
- Savings: A significant improvement in the purchasing power of households with the reduction of expenditures on the emptying of septic tanks and the frequent pumping of standing water and restoration of livelihoods with the resumption of trade and production activities (small food shops, food shops, restaurants, bakery, carpentry, and so on), restaurants, multi-services, and so on.
- Environment and living environment: Valuation of the banks of the Niayes, conquest of natural and landscaped spaces (lakes, walking areas, relaxation areas, sports courses, playgrounds, and so on), thus facilitating the return of populations to abandoned houses.
- Safety: Reducing delinquency, securing ponds, and reducing the risk of drowning.
- Mobility: improved mobility and the opening up of exempt neighborhoods with access to public transport buses (facilitated by paving roads carried out).

Source: MCTDAT 2020.



Table 4.2. Land Price Appreciation in PROGEP-targeted Areas

Targeted Areas	Land Cost 2010 in 2019 Prices	Cost Appreciation 2020	Cost Appreciation 2020	Total Area	Total Area	Targeted Area	34% Cost Appreciation 2020
	CFAF	CFAF	Average US\$	ha	m <sup>2</sup>	m <sup>2</sup>	US\$
Area 1	43,251	14,705	27	1,785	17,850,000	3,392,819	90,075,493
Area 2	21,626	7,353	13	1,092	10,920,000	2,075,607	27,552,504
Area 3	27,032	9,191	17	1,487	14,870,000	2,826,399	46,898,550
Area 4	43,251	14,705	27	285	2,850,000	541,711	14,381,801
Area 5	43,251	14,705	27	86	860,000	163,464	4,339,772
Total					47,350,000	9,000,000	<b>183,248,120</b>
Annualized over 3 years starting 2018							61,082,707

### Ex Post Economic Analysis Results

8. The ex post economic analysis was carried out for the project implementation lifetime over 30 years with a discount rate of 6 percent as suggested by the World Bank since 2016 (World Bank 2016), 10 percent (used for AF1), and 12 percent (used for the ex ante), as elaborated in table 4.3.

9. **The ex post economic analysis of the overall project considered three scenarios.** The first scenario considered the initial 34 percent ex ante land appreciation (hedonic method) being annualized and assumed to start accruing in 2018 although the effective land appreciation reached 500 percent but the entire appreciation could be attributed to the project (land demand for construction, speculation, and so on) and therefore, it is not retained. Still, using 34 percent as land appreciation is considered conservative.

Table 4.3. Overall BCA Results with the First Scenario of 34 Percent Land Appreciation

PROGEP	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 30
	2013	2014	2015	2016	2017	2018	2019	2020	2042
<b>Total Cost</b>	4.40	5.00	5.60	25.00	25.00	27.64	16.64	5.44	2.64
IDA and GoS expenditures	4.4	5.0	5.6	25.0	25.0	25.0	14.0	2.8	—
OMEX (3% of flood component investment)	—	—	—	—	—	2.6	2.6	2.6	2.6
<b>Total Benefit</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>64.8</b>	<b>64.8</b>	<b>64.8</b>	<b>3.7</b>
Benefit 1: land price appreciation	—	—	—	—	—	61.1	61.1	61.1	—
Benefit 2: income opportunity associated with forgone flood days	—	—	—	—	—	3.7	3.7	3.7	3.7
<b>BCA flows (US\$)</b>	<b>-4.4</b>	<b>-5.0</b>	<b>-5.6</b>	<b>-25.0</b>	<b>-25.0</b>	<b>37.2</b>	<b>48.2</b>	<b>59.4</b>	<b>1.1</b>
<b>Indicators</b>	<b>6%</b>	<b>10%</b>	<b>12%</b>	<b>Criteria</b>					
NPV (US\$, millions)	51.9	32.9	26.0	<b>&gt; 0</b>					
ERR (%)	28.0	28.0	28.0	<b>≥ discount rate considered</b>					
PVBCR	1.5	1.5	1.4	<b>&gt; 1</b>					





10. The project is viable with an ex post NPV of US\$26 million discounted at 12 percent over 30 years, an ERR of 28 percent (against an ex ante 26 percent), and a PVBCR of 1.4. The NPV reaches US\$52 million when the 6 percent discount rate suggested by the World Bank since 2016 is used (table 4.3).

**Table 4.4. Overall BCA Results with the Second Scenario of 68% Land Appreciation**

BCA Indicators	Economic Analysis Results	
	Ex Ante Discounted at 12%	Ex Post Discounted at 12%
NPV (US\$, millions)	27.0	26.0
ERR (%)	26.0	28.0
PVBCR	2.0	1.4

11. Table 4.4 compares the ex ante and ex post BCA results. The project generates almost the same benefits when the conservative land appreciation of 34 percent as calculated at appraisal is maintained. However, the project realizes a staggering ERR of 173 percent if the full 500 percent land appreciation realized in the project area is accounted for. However, the land price increase could partially be attributed to flood-proofing as higher demand, speculation, and so on could increase land prices.



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## **ANNEX 5. BORROWER, CO-FINANCIER AND OTHER PARTNER/STAKEHOLDER COMMENTS**

The ICR was translated into French and shared with the GoS for comments. The GoS commended the team for a well-written document and thanked the World Bank for the confidence placed in ADM and the commitment of the entire WB team for the implementation of the project, which today sets an example in terms of flood risk management and resilience to climate change.

Below is a summary of the main comments received from GoS:

- **Change in the scope of Component B.** GoS raised a question about the change in the scope of Component B and stated that it is rather the scope of the project's intervention that has been extended to Diamniadio and Saint-Louis.
- **Internal audit arrangements and advance payments.** The ICR noted “However, government and project contributions were often not mobilized on time and weaknesses were noted in internal audit arrangements and advance payments. Internal and external audit recommendations were not fully implemented.” GoS asked which defaults and advance payments and indicated that for 2019, the report on internal control mentions only one recommendation related to the slowness observed in social and tax contributions. The recommendations related to the FY 2018 audit have all been satisfied. The only one remaining relates to the opening of an account for PROGEP in a commercial bank to receive counterpart funds, which is not applicable because the Ministry of Finance is not supportive.



**ANNEX 6. SUMMARY OF CHANGES TO THE RF FOLLOWING EACH OF THE ADDITIONAL FINANCINGS**

<b>Parent Project</b>	<b>AF1</b>	<b>AF2</b>	<b>Comments/Rationale for Change</b>
Area protected against recurrent flooding through drainage works (ha)	Revised to 'Area in peri-urban Dakar protected against recurrent flooding through drainage works (ha)'.	No change	Revised as follows: (a) added 'peri-urban Dakar' to link indicator to the Pikine and Guédiawaye intervention zones and (b) recalibrated target value to be focused on the three intervention sites and one out of the four sub-catchments in the Mbeubeuss site.
	Added PDO indicator, 'Tools related to urban resilience, including climate change, adopted'.	No change	The indicator was added to measure project performance in developing and integrating appropriate urban area resilience concepts and instruments in city management strategies and plans. Proxy indicator using site-specific scorecard for Diamniadio and Saint-Louis.
Capacity-building program related to flood risk management and climate change adaptation completed.	Key stakeholders (persons) trained in flood risk management, urban climate change resilience, and territorial planning.	Key stakeholders (persons) trained in flood risk management, urban climate change resilience, and sustainable cities planning and practices.	AF1: Revised including target values to better evaluate project impact on actors and their competencies gained in the two project domains. It captured knowledge generation and sharing, lessons learned, and training generated by the new Subcomponent A.3. AF2: Revised to include additional needs (integrate capacity-building needs in sustainable cities management for targeted stakeholders).
	Experience in inter-municipal 'sustainable city' practices, through concerted territorial development (CTD), improved.	No change	New indicator added to assess the project performance to stimulate and support cooperation among neighboring communities to share common resources for the benefit of local residents.
Primary drainage system put in place.	Primary drainage system in Pikine and Guédiawaye put in place.	No change	Revised to link indicator to the Pikine and Guédiawaye intervention zones.
O&M stormwater drainage management system is functional.	Interim O&M stormwater drainage management system in Pikine and Guédiawaye is functional.	No change	Revised including end target values, to link indicator to the Pikine and Guédiawaye intervention zones. Lessons learned after a year of implementation revealed that the initial formulation was too ambitious as it relates to broader systemic reforms.
Drainage channels cleaned at least once per year before rainy season in project area.	Drainage channels cleaned at least once per year before rainy season in Pikine and Guédiawaye.	No change	Revised to link indicator to the Pikine and Guédiawaye intervention zones.



Parent Project	AF1	AF2	Comments/Rationale for Change
Eligible flood risk community investments completed.	Eligible flood risk community investments in Pikine and Guédiawaye completed.	No change	Revised to clarify targeted areas by linking indicator to the Pikine and Guédiawaye intervention zones.



## ANNEX 7. ISR RATINGS

Date	ISR - Progress towards achievement of PDO	ISR- Overall IP	ISR - Component A	ISR - Component B	ISR - Component C	ISR - Component D	ISR - Financial Management	ISR- Project Management	ISR - Counterpart Funding	ISR- Procurement	ISR - M&E	ISR - Safeguards Overall	ISR - Env. Assessment	ISR - Physical Cultural Resources	ISR - Resettlement
Dec-19	S	MS	MS	MS	S	S	MS	S		MS	S	MU	MU	S	MS
Jun-19	S	MS	MS	MU	S	S	MS	S		MS	S	MS	MS	S	MS
Dec-18	S	MS	S	MU	S	S	S	S		S	S	MS	MS	S	MS
Jun-18	S	MS	S	MU	S	S	S	S	MS	S	S	U	U	S	MS
Dec-17	S	MS	S	S	S	S	S	S	MS	S	S	MS	S	S	MS
Jun-17	S	MS	S	S	S	S	S	S	S	S	S	MS	S	S	MS
Dec-16	S	MS	S	S	S	S	S	S	S	MS	S	MS	S	S	MS
Jun-16	S	S	MS	S	S	S	S	S	S	MS	S	S	S	S	S
Nov-15	S	MS	MS	S	S	MS	MS	S	S	MS	MS	S	S	S	S
Mar-15	MS	MS	MS	S	S	S	S	S	S	S	S	S	S		S
Aug-14	S	S	MS	S	MS	S	S	S	S	S	S	S	S		S
Jan-14	S	S	S	S	S	S	S	S	S	S	S	S	S		S
Jun-13	S	S	S	S	S	S	S	S	S	S	MS	S	S		S
Jan-13	S	S	S	S	S	S	S	S	S	S	MS				
Summary	S	MS	S	S	S	S	S	S	S	S	S	MS?	MS?	S	MS



## ANNEX 8. GEOSPATIAL ANALYSIS

### Impact of Project Interventions on Reducing Flood Risk in Select Areas

#### Context

1. More than half of the Dakar region is vulnerable to flooding, particularly the suburban area of Pikine and Guédiawaye, where some zones in the *Niayes* are flooded almost every year in the rainy season. In August and September 2009, about 360,000 people (44 percent of the population) in Pikine and 22,000 people in Guédiawaye (7.2 percent of the population) were directly affected by floods.<sup>20</sup> One-third of Pikine's 1.2 million residents regularly experience flooding, with a significant portion of these people living in areas that were not flooded previously.<sup>21</sup> In 2012, over 90 percent of the population in peri-urban Dakar (Pikine and Guédiawaye) lived in areas that were classified as slums or spontaneous settlements.<sup>22</sup> As the land use changed over these past years from wetland/vegetation to densely populated residential area (mostly unplanned settlements) in these peri-urban areas, soil compaction and drainage have become major issues. Pikine and Guédiawaye are divided, respectively, into 16 and 5 *communes de plein exercice* or communes, each of which comprises a number of quartiers, or neighborhoods. The project covers eight of these communes which include a total of 398 quartiers.<sup>23</sup> Annual rainfall has varied between 150 mm (1983) and 664 mm (2005) over recent decades. The current average annual rainfall amounts to 484 mm and has become slightly above the mean of 410 mm between 1961 and 1990.<sup>24</sup>

#### Project Background

2. PROGEF targeted the population of the peripheral area of the Dakar region in the cities of Pikine and Guédiawaye, because almost 40 percent of new population in peri-urban Dakar has settled in areas with significant hazard potential, especially inland flooding.<sup>25</sup> In 2012, there were about 1.2 million people (Pikine 900,000 and Guédiawaye 300,000) living in the project intervention zone, of which 600,000 people resided in flood-prone areas.

3. Apart from PROGEF's infrastructure component (rehabilitation of old water basins, implementation of new drainage pipelines, and so on), community-level infrastructure investments (PICs) were also implemented by community-based organizations. These PICs focused on adding value to the areas surrounding water retention ponds (for example, walk paths, fishing areas, picnic tables, sports infrastructure, and so on); securing unbuildable lands; improving waste management around drainage

<sup>20</sup> Ndiaye, et al. 2016. "Detection and Ranking of Vulnerable Areas to Urban Flooding Using GIS and ASMC (Spatial Analysis multicriteria): A Case Study in Dakar, Senegal." *International Journal of Advanced Engineering, Management and Science*.

<sup>21</sup> Hungerford, et al. 2019. "Coping with Floods in Pikine, Senegal: An Exploration of Household Impacts and Prevention Efforts." *Urban Science*.

<sup>22</sup> *Plan Directeur d'Urbanisme* (Urban Masterplan) Dakar: Horizon 2025; Agence Nationale de la Statistique et de la Démographie (ANSD) 2003: Dakar 950,331, Pikine 774,314, and Guédiawaye 248,809.

<sup>23</sup> ADM, World Bank, and Trinity College. 2017. *Impact Evaluation Report. Operation Clean Neighborhood: Working with Communities for Flood Risk Mitigation in Senegal*.

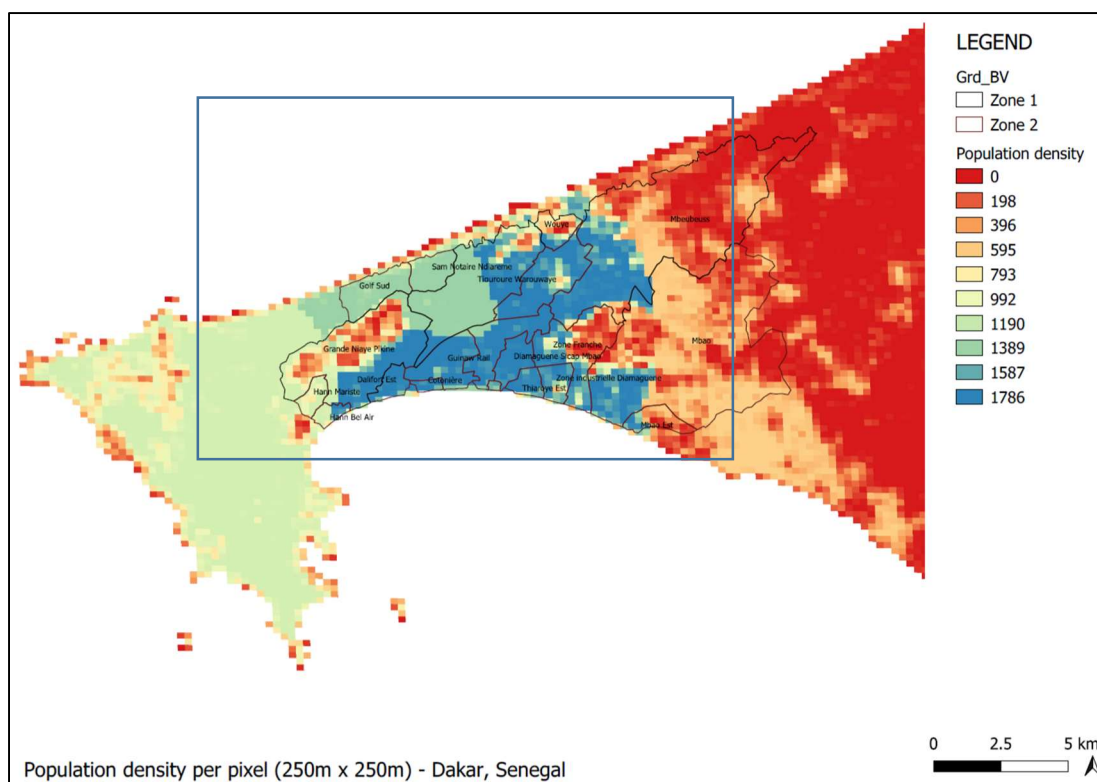
<sup>24</sup> Diouf, et al. 2013. *Climate and Health: Observation and Modeling of Malaria in the Ferlo*. (Senegal). <https://www.sciencedirect.com/science/article/pii/S1631069113000735>.

<sup>25</sup> World Bank, Geoville, and Institut Africain de Gestion Urbaine. 2009. *Preparing to Manage Natural Hazards and Climate Change Risks in Dakar, Senegal*.



infrastructure; and decreasing possible negative impacts of drainage infrastructure, such as malaria transmission.

**Figure 8.1. Project Intervention Area (Zones 1 and 2): PROGEP-targeted Densely Populated Peri-urban Areas of Dakar**



Source: Global Human Settlement Layer data on population density.





Figure 8.2. Infrastructure Investments and Direct Impact Zone under the Project

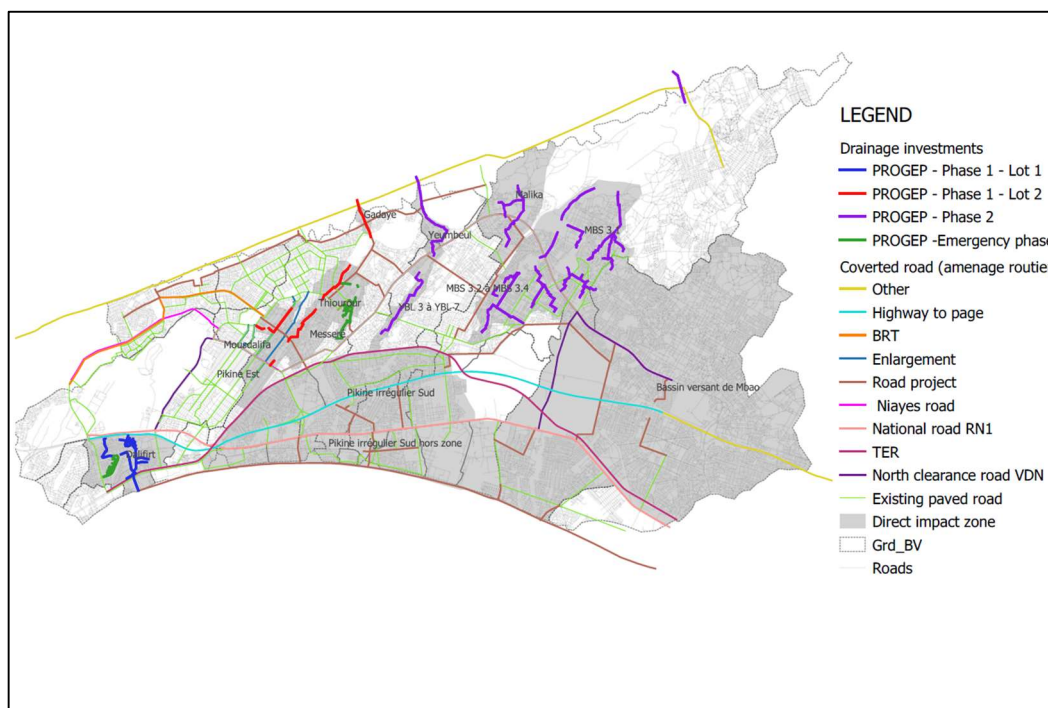
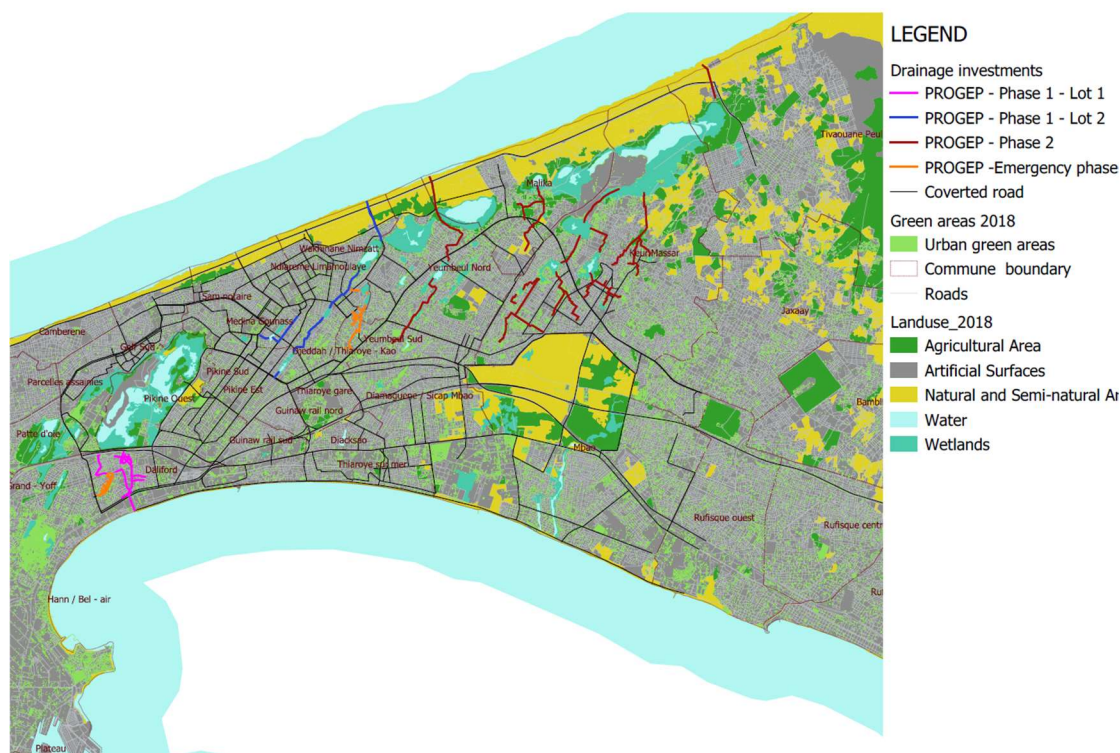


Figure 8.3. 2018 Land Use in Project Intervention Areas



Source: Land use cover data from EO4SD.



### *Hypothesis*

4. Project interventions, both infrastructure investments in drainages/roads/water basins and small-scale community infrastructure through PICS as well as the capacity-building component, have helped reduce flood inundation risk in the project intervention areas. Anecdotal evidence from field visits during the supervision missions, photographs from before and after the project, and meetings with the project team reinforced the hypothesis and analysis.

### *Methodology*

5. For the analysis, each commune in the project intervention area was compared. Specifically, change in area and percentage of commune area that was flooded, population density, length of drainage lines constructed/rehabilitated, projected flood risk zones, and overall reduction in flooded area were quantified for each of the communes under the project area from 2009 to 2018.

### *Data Source*

6. Geospatial data from the EO4SD-Urban Dakar City Operations Project - flooding extent from 2009–2018, identified high-low flood risk zones in 2018, change in green areas from 2006 to 2018, change in land use from 2006 to 2018, and transport data have been used for the analysis. Other datasets such as GHSL (population data); Open Aerial Imagery (satellite image); OpenStreetMap (roads, buildings, waterbodies, and so on); and data from the World Bank open data portal and climate change portal (rainfall data) have been used for the analysis. Project-level data, including investment in drainage, converted roads, sub-basin, zones, and so forth, are provided by the GIS specialist from the ADM team.

7. The EO4SD flood hazard data on Dakar were classified according to the following specifications for the hazard definition: area flooded once between 2009 and 2018 as low hazard; area flooded twice or thrice as medium hazard; and area flooded more than thrice as high hazard. Also, the EO4SD flood extent data include only the flood events for which Google Earth Very High Resolution images were available for extracting the reference dataset by independent visual interpretation.<sup>26</sup>

### *Limitations*

8. It should be noted there are multiple factors affecting the flood risk, including population density, change in land use, increased rainfall, climate change, reduced green areas/retention areas, poor solid waste management, and so forth. With limited availability of data, this analysis is a quick exercise to analyze the impacts of the project, but it is not comprehensive.

9. Additionally, because the geospatial data on flooding extent for recent years, 2019 and 2020, are not available, this analysis does not include that information. It should be noted that 2020 was an exceptional year for flooding, where the regions of Dakar and Thiès recorded 800 mm of rainfall mainly in the suburbs in the capital city and in the department of Thiès. The heavy rains affected 11 regions, including 25 departments, causing the displacement of nearly 3,285 people representing 365 families in the suburbs of Dakar and the department of Thiès. In both the Dakar and Thiès regions, the houses in the neighborhoods of Grand Yoff, Parcelles Assainies, Camberène, Guédiawaye, Pikine, Rufisque, and Keur

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<sup>26</sup> EO4SD-Urban Dakar City Operations Report.



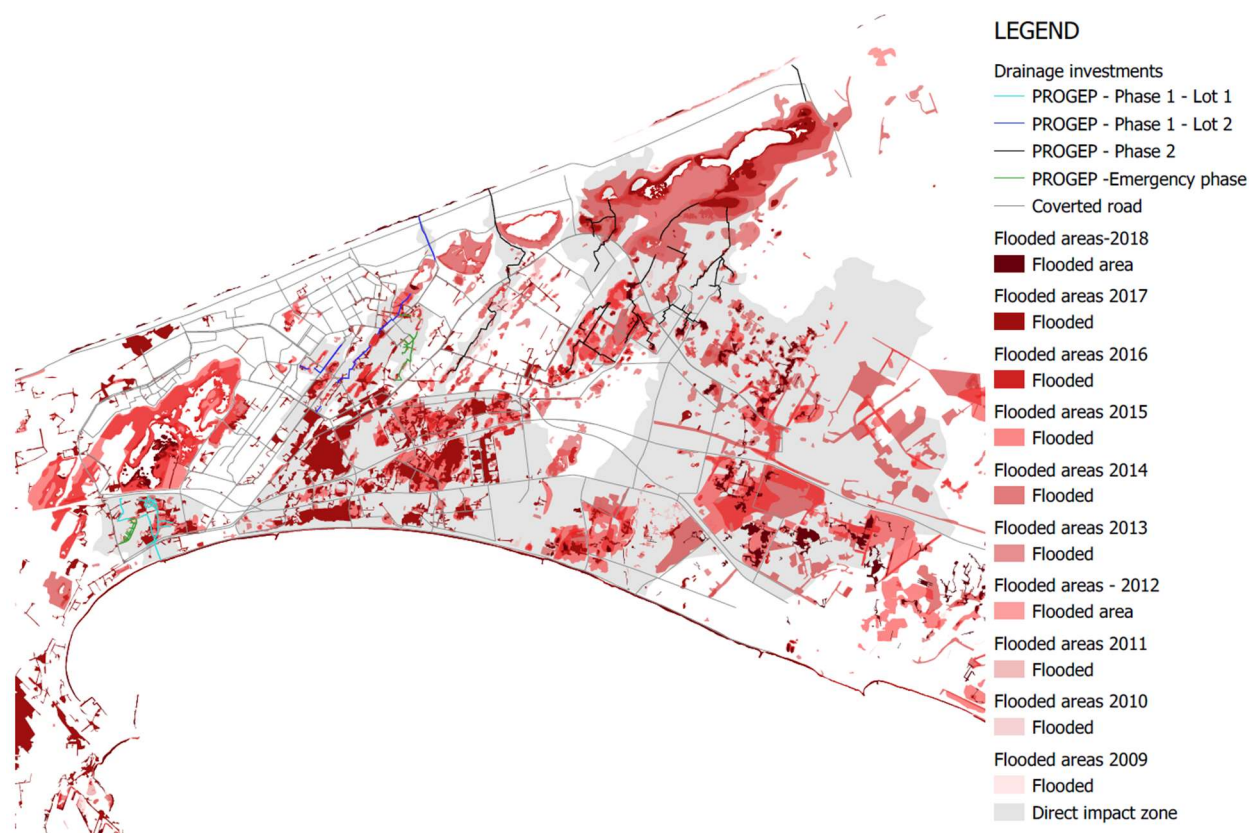
Massar were trapped in the waters for a week and road traffic was disrupted for 24 hours. The sanitation network is out of order in all departments where hundreds of families abandoned their houses to be accommodated either in schools or in host families besides insalubrity and health risks in the context of the COVID-19 pandemic.<sup>27</sup>

## Results

10. **Reduced flooded areas in project intervention area.** Out of 52 communes within the project intervention area covering about 550 km<sup>2</sup>, 21 communes had infrastructure investments to reduce flood risk under the project (such as drainages and road improvements) . According to the quantitative analysis using geospatial data ( , 18 communes (out of the 21) had seen a positive reduction in flooding extent area from 2012 to 2018.

11. The total area flooded reduced from 11.74 km<sup>2</sup> in 2009 (2.13 percent of total commune area) and 3.39 km<sup>2</sup> in 2012 (0.62 percent of total commune area) to 1.44 km<sup>2</sup> in 2018 (0.26 percent of total commune area) (refer to figure 8.4 and table 8.1).

Figure 8.4. Extent of Flooding Area from 2009 to 2018



Source: Flooding data from EO4SD.

<sup>27</sup> <https://reliefweb.int/disaster/fl-2020-000198-sen>.



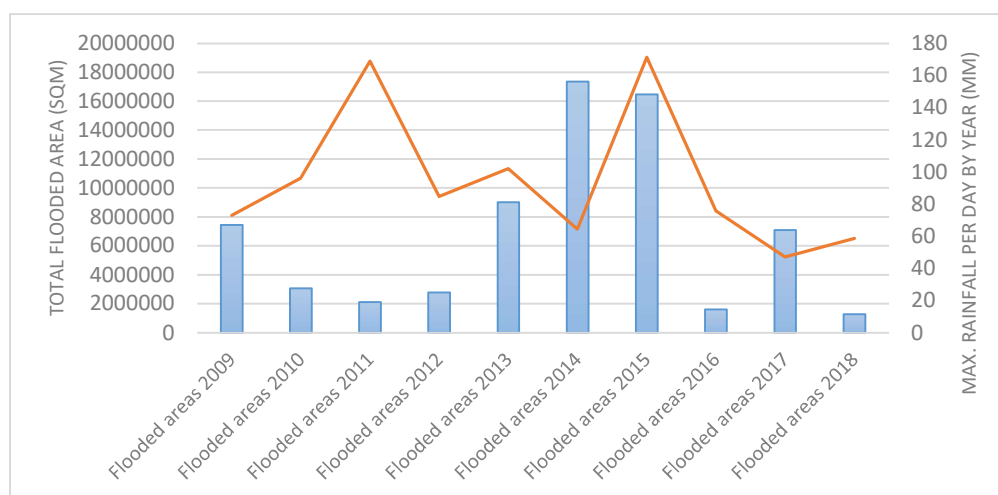


**Table 8.1. Quantification of Flooded Area Extent Changed over the Years**

Department	Commune name	Total area of commune	Length of drainage	Length of converted road	Average Pop. Density per pixel	Flood reduced between 2012-2018 (Y/N)	% flooded area in 2012	% flooded area in 2018
PIKINE	Daliford	3026703.504	10513.321	50647.4707	1736	Y	2.56	0.09
PIKINE	Diacksao	1122881.087	3070.923	24092.2168	1703	Y	8.23	0.00
PIKINE	Diamaguene / Sicap Mbao	4716436.186	8261.299	55371.6941	1582	Y	8.20	0.00
PIKINE	Djeddah / Thiaroye - Kao	2318083.818	1465.724	39915.0038		Y	0.79	0.00
PIKINE	Guinaw rail nord	643439.3741	569.562	31435.6708		Y	6.86	0.00
PIKINE	Guinaw rail sud	1288566.161	6903.576	44148.8389	1638	Y	2.68	0.00
DAKAR	Hann / Bel - air	11848576.29	3253.834	5106.77252	936	Y	0.33	0.00
PIKINE	Keur Massar	20646654.29	14011.074	69999.3611	575	Y	5.24	1.71
PIKINE	Malika	7859859.427	3276.533	53146.975	824	Y	5.47	0.11
PIKINE	Mbao	20352969.31	11262.333	86798.1962	763	Y	2.19	2.06
GUEDIAWAYE	Medina Gounass	732357.2043	1069.117	10817.6205	1375	Y	1.26	0.00
DAKAR	Patte d'ole	3198526.138	2927.355	2806.82438	680	Y	0.63	0.16
PIKINE	Pikine Est	771531.5461	19.592	49516.8766		Y	0.09	0.00
RUFISQUE	Rufisque centre	7075614.668	3825.097	4652.46995	524	N	0.37	1.37
RUFISQUE	Rufisque ouest	8839119.954	5487.692	33148.2201	422	N	0.53	2.91
PIKINE	Thiaroye gare	1629999.718	2312.734	61116.9721	1616	Y	5.02	0.00
PIKINE	Thiaroye sur mer	3561211.916	3008.212	25291.8973	1740	Y	2.32	0.00
RUFISQUE	Tivaouane Peul / Niagha	61247801.44	718.838	16247.681	122	Y	0.17	0.02
GUEDIAWAYE	Wakhinane Nimzatt	4221882.556	2981.115	46408.1219	1178	N	0.18	0.18
PIKINE	Yeumbeul Nord	7682733.744	3945.727	61739.567	1426	Y	0.97	0.00
PIKINE	Yeumbeul Sud	2271286.647	2100.827	59929.39	1726	Y	2.34	0.00
		550172252.1	90984.485	1068328.77	36897.5329	Y	0.62	0.26

12. As discussed earlier, there are multiple factors affecting the flood risk, including population density, change in land use, increased rainfall, climate change, reduced green areas/retention areas, poor solid waste management, and so forth. For example, as referred to in figure 8.6 from EO4SD data, there is a loss of 6.40 km<sup>2</sup> of green area in Dakar over time, which would have contributed to flooding risk. Therefore, although the trend indicated reduction in extent of flooding in the project intervention zones, based on other factors (including amount of rainfall, solid waste management, and O&M of drainage infrastructure) the flooding extent area may differ from year to year (refer to figure 8.5).

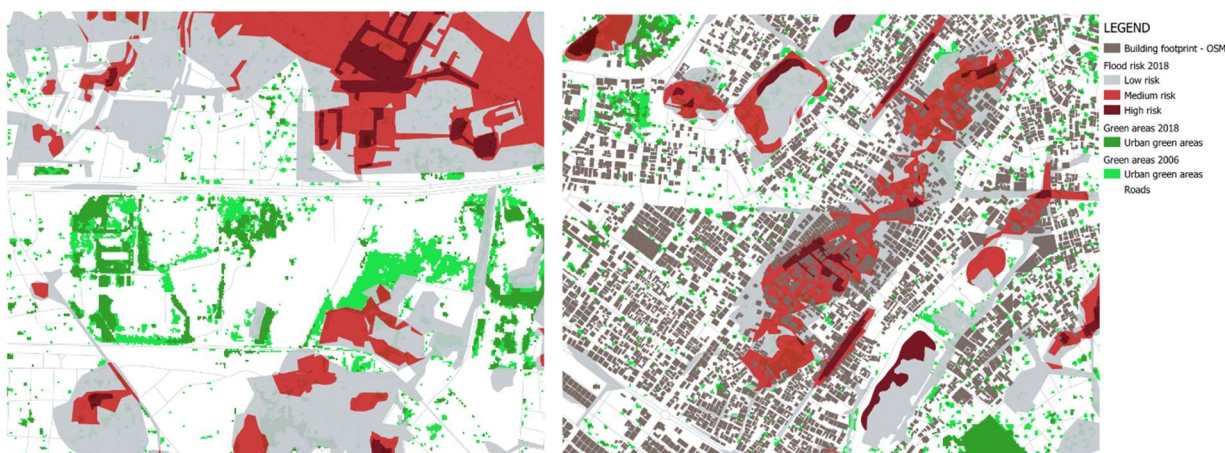
**Figure 8.5. Flooded Area and Maximum Daily Rainfall from 2009 to 2018 in Peri-urban Areas of Dakar**



Source: Flooding data from EO4SD and rainfall data from worldweatheronline.com.



Figure 8.6. Change in Green Cover from 2006 to 2018, Which Would Have Contributed to Flooding Risk



13. **Reduced flood risk zones in densely populated project intervention area.** Particularly, in densely populated areas of the project intervention, projected flood risk has reduced over time. In project intervention communes, population density is as high as 1,740 people per 250 m × 250 m grid. Because the project targeted these high-density zones (refer to Figure 8.1), infrastructure investments (drainages, road improvements, PICs, and so on) have helped reduce the risk of flooding in these areas. However, according to the EO4SD flood risk zoning analysis, 6.3 km<sup>2</sup> is still in high risk zone in low-density areas and 18.8 km<sup>2</sup> is in medium risk zone, that is, about 5 percent of the total area in these 21 communes. In 2009, almost 40 percent of new population in the peri-urban area had settled in areas with significant hazard potential from inland flooding, coastal erosion, or sea level rise (figure 8.7).<sup>28</sup>

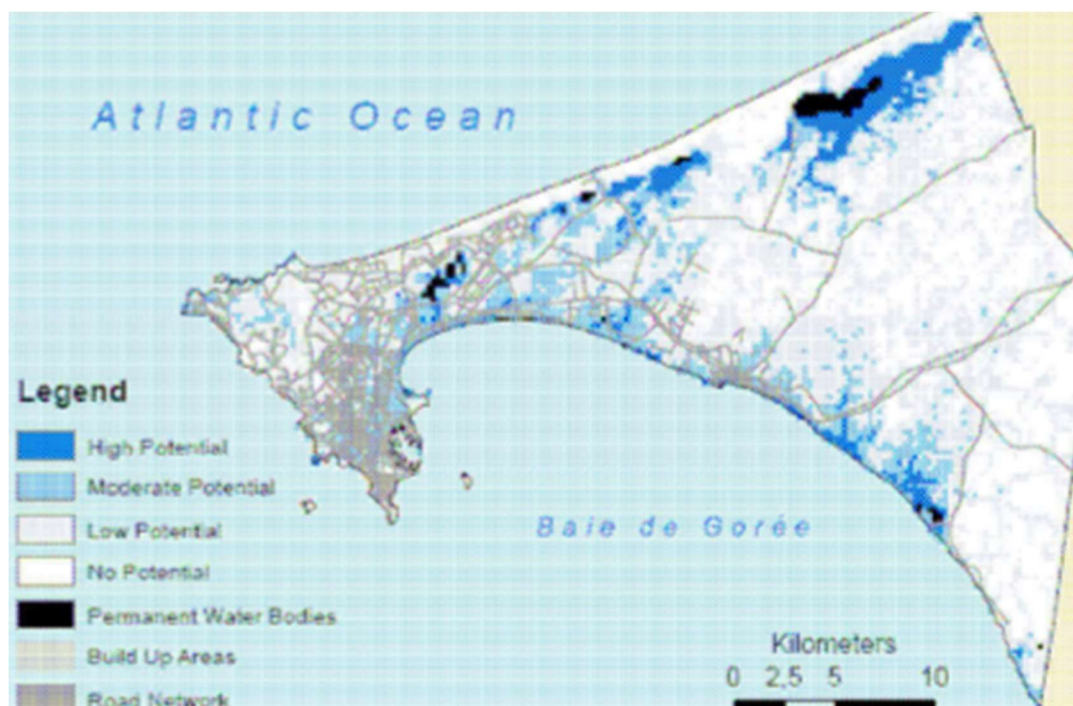
14. **Improved livability.** The project has helped improve the living conditions of residents and neighborhoods through (a) improvement of general urban sanitary situation; (b) improvement of (permanent) access to and protection of social infrastructure (health posts, schools, community centers, and so on) during the rainy season; (c) increased health status of residents, particularly children, due to reduction of vectorborne diseases; and (d) increased employment and/or generation of revenues through participation in community investments and drainage work as well as securing of economic activities in the project area.<sup>29</sup>

<sup>28</sup> Wang and Munoz. 2009. *Preparing to Manage Natural Hazards and Climate Change Risks in Dakar, Senegal*. The Geoville Group.

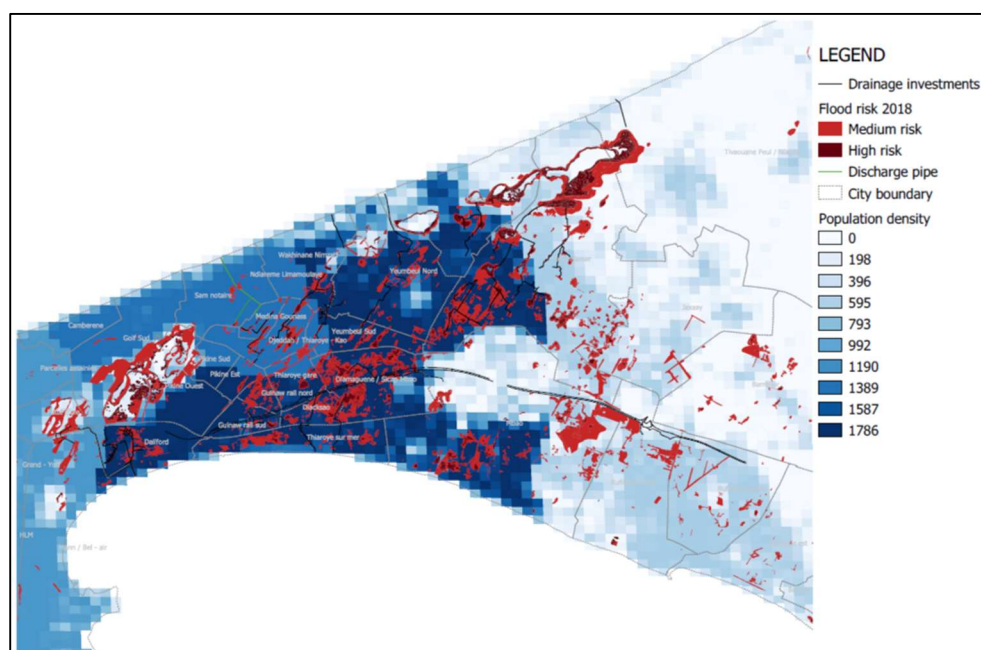
<sup>29</sup> ADM, World Bank, and Trinity College. 2017. *Impact Evaluation Report. Operation Clean Neighborhood: Working with Communities for Flood Risk Mitigation in Senegal*.



**Figure 8.7. Flood Risk Potential of Dakar in 2009**



**Figure 8.8. Flood Risk Zones in Densely Populated Areas along the Project Interventions**



Source: Flooding data from EO4SD and population density from GHSL.





Figure 8.9. PROGEP Infrastructure Investments in Identified Flood Risk Zones

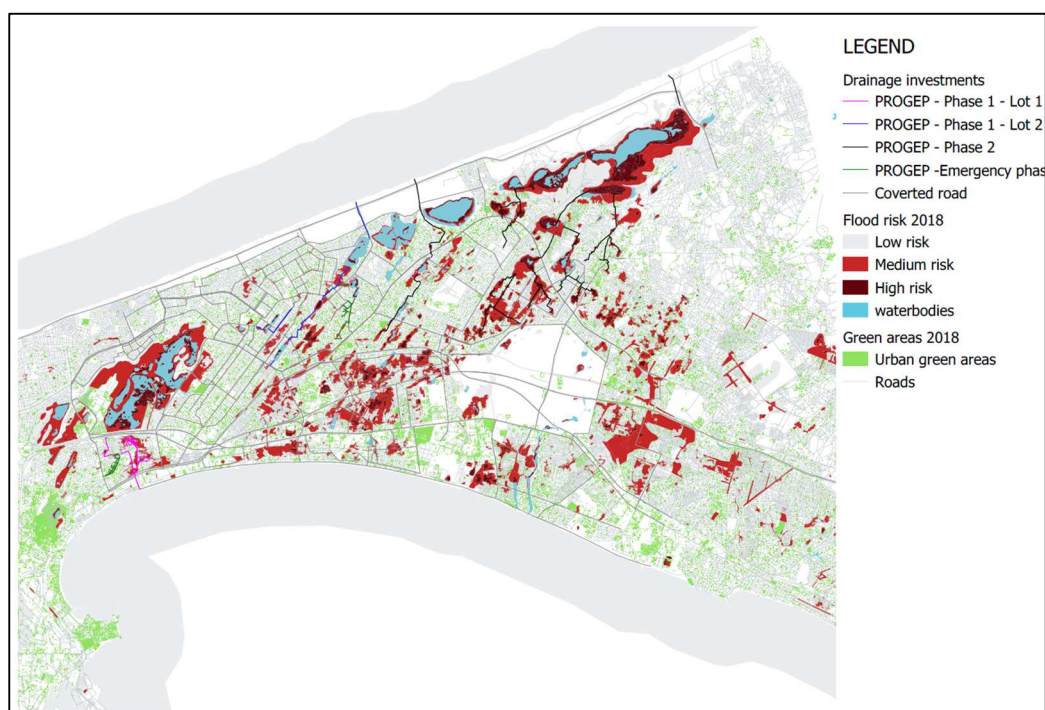
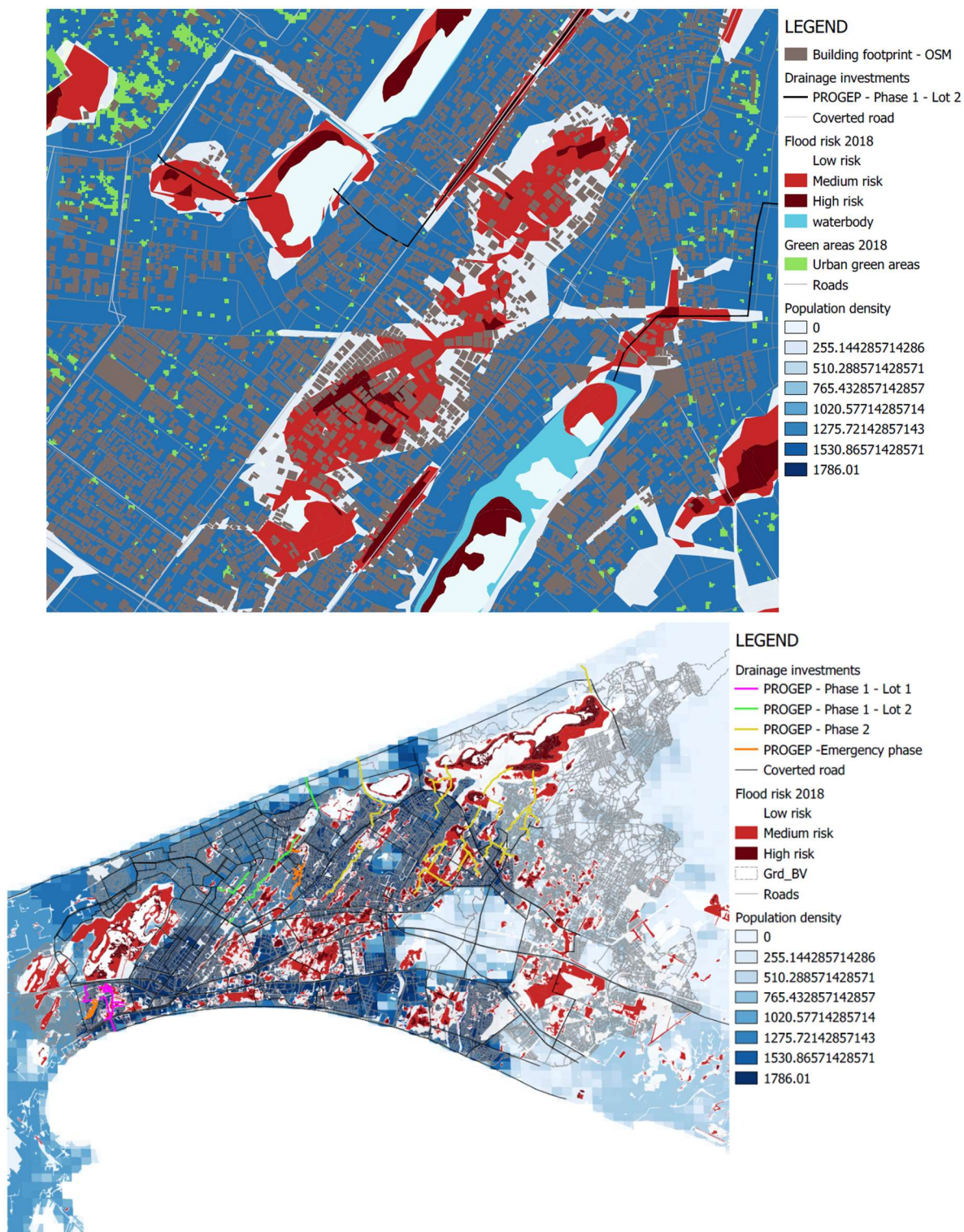


Table 8.2. Quantification of Percentage of Flooded Area Reduced between 2012 and 2018

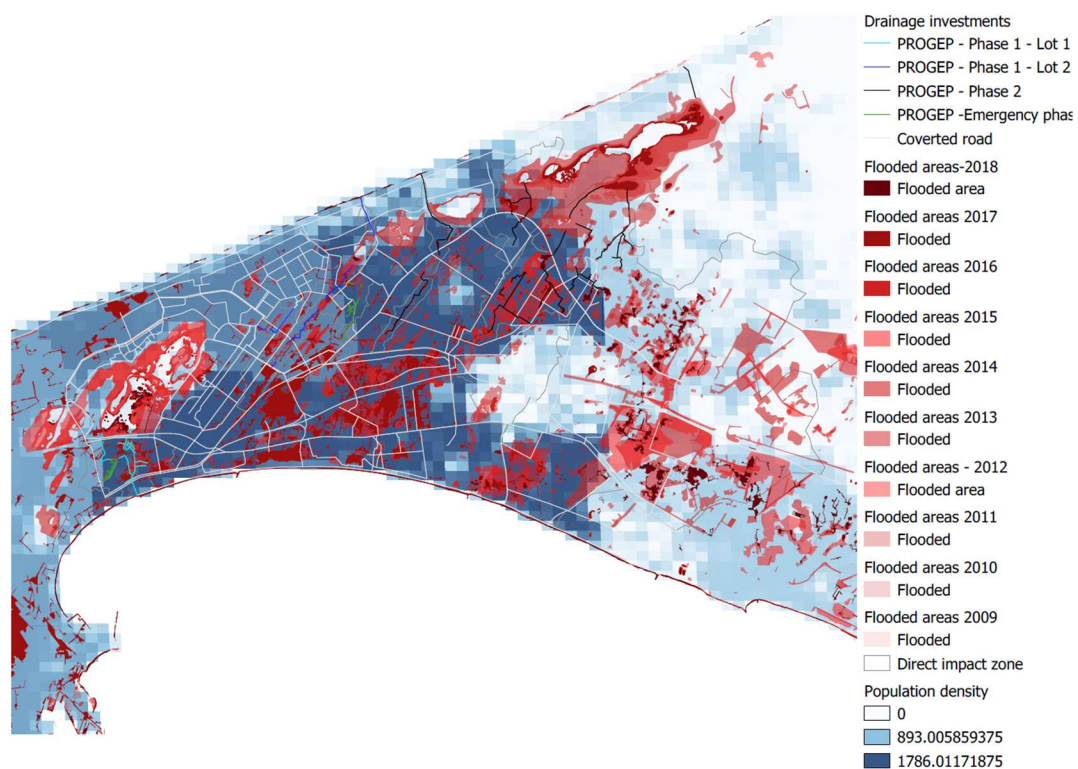
Department	Commune name	Total area of commune (sqm)	Length of drainage	Length of converted road	Average Pop. Density per pixel	Flood reduced between 2012-2018 (Y/N)	% flooded area in 2012	% flooded area in 2018
PIKINE	Thiaroye sur mer	3561211.916	3008.212	25291.89729	1740	Y	2.32	0.00
PIKINE	Daliford	3026703.504	10513.321	50647.4707	1736	Y	2.56	0.09
PIKINE	Yeumbeul Sud	2271286.647	2100.827	59929.39002	1726	Y	2.34	0.00
PIKINE	Diacksao	1122881.087	3070.923	24092.21678	1703	Y	8.23	0.00
PIKINE	Guinaw rail sud	1288566.161	6903.576	44148.83894	1638	Y	2.68	0.00
PIKINE	Thiaroye gare	1629999.718	2312.734	61116.97214	1616	Y	5.02	0.00
PIKINE	Diamaguene / Sicap Mbao	4716436.186	8261.299	55371.69414	1582	Y	8.20	0.00
PIKINE	Yeumbeul Nord	7682733.744	3945.727	61739.56696	1426	Y	0.97	0.00
GUEDIAWAYE	Medina Gounass	732357.2043	1069.117	10817.62055	1375	Y	1.26	0.00
DAKAR	Camberene	1760254.322		3125.806554	1357		0.00	0.00
GUEDIAWAYE	Ndiareme Limamoulaye	1301595.779		25473.03008	1289		0.00	0.00
GUEDIAWAYE	Sam notaire	2749270.647		54525.02405	1241	Y	0.22	0.00
GUEDIAWAYE	Wakhinane Nimzatt	4221882.556	2981.115	46408.12186	1178	N	0.18	0.18
GUEDIAWAYE	Golf Sud	5013073.425		61491.30487	1148	N	0.00	0.00
DAKAR	Mermoz - Sacre cÅur	4394524.365			1087		0.00	0.00
DAKAR	Medina	2473150.107			1079		0.00	0.00
DAKAR	Grand - Yoff	6259805.024			1078		0.00	0.00
DAKAR	Plateau	5412000.333			1060		0.00	0.00
DAKAR	Ngor	4349845.366			1035		0.00	0.00
DAKAR	Fass	1927705.033			1026		0.00	0.00
DAKAR	Fann	4719578.751			1016		0.00	0.00
DAKAR	Hann / Bel - air	11848576.29	3253.834	5106.772519	936	Y	0.33	0.00
DAKAR	Ouakam	7276951.634			887		0.00	0.00
DAKAR	Yoff	13854960.94			875		0.00	0.00
PIKINE	Malika	7859859.427	3276.533	53146.97496	824	Y	5.47	0.11
PIKINE	Mbao	20352969.31	11262.333	86798.1962	763	Y	2.19	2.06
DAKAR	Patte d'oe	3198526.138	2927.355	2806.824377	680	Y	0.63	0.16
PIKINE	Keur Massar	20646654.29	14011.074	69999.36113	575	Y	5.24	1.71



Figure 8.10. Flood Risk Zones in High-density Project Intervention Areas









**ANNEX 9. PHOTOS OF INFRASTRUCTURE DELIVERED**

## TRAVAUX DALIFORT (Cité Soleil) EN IMAGES

AVANT



PENDANT



APRES



## TRAVAUX Yeumbeul sud (quartier Cheikh SY) EN IMAGES

AVANT



PENDANT



APRES







Yeumbeul Sud AVANT :  
Quartier Cheikh SY



Yeumbeul Sud APRES :  
Quartier Cheikh SY



Bagdad AVANT :  
Point Bas Marché Bou Bess



Bagdad APRES :  
Point Bas Marché Bou Bess



Source: Government Completion Report.