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Report No: PAD871

INTERNATIONAL DEVELOPMENT ASSOCIATION

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED CREDIT

IN THE AMOUNT OF SDR 7.7 MILLION  
(US\$11.89 MILLION EQUIVALENT)

TO THE

CO-OPERATIVE REPUBLIC OF GUYANA

FOR A

FLOOD RISK MANAGEMENT PROJECT

May 5, 2014

Disaster Risk Management and Urban Development Unit  
Sustainable Development Department  
Latin American and the Caribbean Region

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## CURRENCY EQUIVALENTS

(Exchange Rate Effective April 1, 2014)

Currency Unit = SDR  
0.65 SDR = US\$1  
US\$1.55 = SDR 1

FISCAL YEAR  
January 1 – December 31

## ABBREVIATIONS AND ACRONYMS

ASDU	Agriculture Sector Development Unit
CAP	Conservancy Adaptation Project
CAS	Country Assistance Strategy
CDC	Civil Defense Commission
CQS	Selection Based on Consultant Qualifications
CV	Curriculum vitae
DC	Direct Contracting
EA	Environmental Assessment
ECLAC	Economic Commission for Latin America and the Caribbean
EDWC	East Demerara Water Conservancy
EIA	Environmental Impact Assessment
EA	Environmental Assessment
EMP	Environment Management Plan
EPA	Environmental Protection Agency
EPP	Emergency Preparedness Plan
ESMF	Environmental and Social Assessment Framework
EU	European Union
FBS	Fixed Budget Selection
FM	Financial Management
FMR	Financial Monitoring Report
GDP	Gross Domestic Product
GIS	Geographic Information Systems
GEF	Global Environmental Facility
GFDRR	Global Fund for Disaster Risk Reduction
GoG	Government of the Republic of Guyana
GPN	General Procurement Notice
IBRD	International Bank for Reconstruction and Development
ICB	International Competitive Bidding
ICR	Implementation Completion Report
IDA	International Development Association
IDB	Inter-American Development Bank

IFC	International Finance Corporation
IFR	Interim Financial Report
ISP	Implementation Support Plan
JICA	Japanese International Cooperation Agency
LCS	Least-Cost Selection
LiDAR	Light Detection And Ranging
MoA	Ministry of Agriculture
MoF	Ministry of Finance
MoPW	Ministry of Public Works
MoU	Memorandum of Understanding
NCB	National Competitive Bidding
NCS	Non-consulting services
NDC	Neighborhood Democratic Council
NDIA	National Drainage and Irrigation Authority
NEAP	National Environmental Action Plan
NDP	Neighborhood Democratic Council
OM	Operations Manual
OMS	Operation and Maintenance System
OP	Operational Policy
BP	Bank Procedure
PAD	Project Appraisal Document
PCC	Project Coordination Committee
PDO	Project Development Objective
PIU	Project Implementation Unit
QBS	Quality-Based Selection
QCBS	Quality and Cost-Based Selection
RAP	Resettlement Action Plan
RDC	Regional Democratic Council
RFP	Request for Proposal
RPF	Resettlement Policy Framework
SBD	Standard Bidding Document
SCCF	Special Climate Change Fund
SOE	Statement of Expenditures
SPN	Specific Procurement Notice
TOR	Terms of Reference
TTL	Task Team Leader
UNDB	United Nations Development Business

Regional Vice President:	Jorge Familiar
Country Director:	Sophie Sirtaine
Sector Director:	Ede Jorge Ijjasz-Vásquez
Sector Manager:	Anna Wellenstein
Task Team Leader:	John Morton/Armando E. Guzmán Escobar

**GUYANA**  
**Flood Risk Management Project**

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## PAD DATA SHEET

*Guyana*

*GY Flood Risk Management (P147250)*

### PROJECT APPRAISAL DOCUMENT

*LATIN AMERICA AND CARIBBEAN*

*DISASTER RISK MANAGEMENT AND URBAN (LCSDU)*

Report No.: PAD871

Basic Information			
Project ID P147250	EA Category B - Partial Assessment	Team Leader John Morton/Armando Guzmán	
Lending Instrument Investment Project Financing	Fragile and/or Capacity Constraints [ ]		
	Financial Intermediaries [ ]		
	Series of Projects [ ]		
Project Implementation Start Date 31-August-2014	Project Implementation End Date 31-January-2019		
Expected Effectiveness Date 31-August-2014	Expected Closing Date 31-January-2019		
Joint IFC No			
Sector Manager Anna Wellenstein	Sector Director Ede Jorge Ijjasz-Vasquez	Country Director Sophie Sirtaine	Regional Vice President Jorge Familiar
Borrower: Co-operative Republic of Guyana			
Responsible Agency: Agriculture Sector Development Unit (ASDU), Ministry of Agriculture			
Contact: Mr. George Jervis	Title: Permanent Secretary		
Telephone +592-227-5527	Email: <a href="mailto:psmoagy@gmail.com">psmoagy@gmail.com</a>		
No.:			

<b>Project Financing Data (in USD Million)</b>					
<input type="checkbox"/>	Loan	<input type="checkbox"/>	Grant	<input type="checkbox"/>	Guarantee
<input checked="" type="checkbox"/>	Credit	<input type="checkbox"/>	IDA Grant	<input type="checkbox"/>	Other
Total Project Cost:		USD 11.89		Total Bank Financing: USD 11.89	
Financing Gap:		0.0			
<b>Financing Source</b>				<b>Amount</b>	
BORROWER/RECIPIENT				0.0	
International Development Association (IDA)				USD 11.89	
Total				USD 11.89	
<b>Expected Disbursements (in USD Million)</b>					
Fiscal Year	2015	2016	2017	2018	
Annual	1.24	4.17	2.63	3.86	
Cumulative	1.24	5.40	8.03	11.89	
<b>Proposed Development Objective(s)</b>					
The objective of the project is to reduce the risk of flooding in the low-lying areas of the East Demarara.					
<b>Components</b>					
<b>Component Name</b>				<b>Cost (USD Millions)</b>	
Priority Works for Flood Risk Reduction				10.35	
Institutional Strengthening for Flood Risk Reduction				0.46	
Project Management and Implementation Support				1.24	
<b>Institutional Data</b>					
<b>Sector Board</b>					
Urban Development					
<b>Sectors / Climate Change</b>					
Sector (Maximum 5 and total % must equal 100)					
Major Sector	Sector		%	Adaptation Co-benefits %	Mitigation Co-benefits %
Water, sanitation and flood protection	Flood protection		100	100	
Total			100		
<input type="checkbox"/> I certify that there is no Adaptation and Mitigation Climate Change Co-benefits information applicable to this project.					
<b>Themes</b>					

Theme (Maximum 5 and total % must equal 100)			
Major theme	Theme	%	
Urban development	Urban planning and housing policy	60	
Environment and natural resources management	Climate change	20	
Environment and natural resources management	Water resource management	20	
Total		100	
Compliance			
Policy			
Does the project depart from the CAS in content or in other significant respects?	Yes [ ]	No [ x ]	
Does the project require any waivers of Bank policies?	Yes [ ]	No [ x ]	
Have these been approved by Bank management?	Yes [ ]	No [ ]	
Is approval for any policy waiver sought from the Board?	Yes [ ]	No [ x ]	
Does the project meet the Regional criteria for readiness for implementation?	Yes [ x ]	No [ ]	
Safeguard Policies Triggered by the Project	Yes	No	
Environmental Assessment OP/BP 4.01	X		
Natural Habitats OP/BP 4.04	X		
Forests OP/BP 4.36		X	
Pest Management OP 4.09		X	
Physical Cultural Resources OP/BP 4.11	X		
Indigenous Peoples OP/BP 4.10		X	
Involuntary Resettlement OP/BP 4.12	X		
Safety of Dams OP/BP 4.37	X		
Projects on International Waterways OP/BP 7.50		X	
Projects in Disputed Areas OP/BP 7.60		X	
Legal Covenants			
Name	Recurrent	Due Date	Frequency
Interim unaudited financial reports	yes	45 days after end of calendar quarter	quarterly
<b>Description of Covenant</b> The Recipient shall prepare and furnish to the Association not later than (45) forty five days after the end of each calendar quarter, interim unaudited financial reports for the Project covering the quarter, in form and substance satisfactory to the Association. (Financing Agreement, Schedule 2, Section II, B, 2).			



Name	Recurrent	Due Date	Frequency
Audit of financial statements	yes	Six months after end of fiscal year	annual
<b>Description of Covenant</b> The Recipient shall have its Financial Statements audited. Each audit of the Financial Statements shall cover the period of one fiscal year of the Recipient. The audited Financial Statements for each such period shall be furnished to the Association not later than six months after the end of such period. (Financing Agreement, Schedule 2, Section II, B, 3).			
<b>Conditions</b>			
<b>Name</b>			<b>Type</b>
Project Operations Manual			Effectiveness
<b>Description of Condition</b>			
The Additional Condition of Effectiveness consists of, namely, that the Project Operations Manual has been adopted by the Recipient. (Financing Agreement, Article IV, Section 4.01).			
<b>Name</b>			<b>Type</b>
Adoption of dam safety plans			Disbursement
<b>Description of Condition</b> Prior to the procurement of any works under Part A of the Project, the Recipient, through the Ministry of Agriculture, shall prepare and thereafter adopt: (a) the Construction Supervision and Quality Assurance Plan, and (b) the Operation, Maintenance and Surveillance Plan, all acceptable to the Association. (Financing Agreement, Schedule 2, Section I, D, 2).			
<b>Team Composition</b>			
<b>Bank Staff</b>			
<b>Name</b>	<b>Title</b>	<b>Specialization</b>	<b>Unit</b>
Noreen Beg	Senior Environmental Specialist	Senior Environmental Specialist	LCSEN
Faten A. Hatab	Resource Management Officer	Resource Management Officer	LCRRM
Gerald E. Meier	Consultant	remote sensing specialist	LCSDU
John Morton	Senior Urban Environment Specialist	Co-TTL	LCSDU
M. Mozammal Hoque	Sr Financial Management Specialist	Sr Financial Management Specialist	LCSFM
Xiaokai Li	Sr Water Resources Mgmt. Spec.	Sr Water Resources Mgmt. Spec.	EASWE
Armando Eduardo Guzman Escobar	Senior Disaster Risk Management Specialist	Senior Disaster Risk Management Specialist	LCSDU
Plamen Stoyanov Kirov	Senior Procurement Specialist	Senior Procurement Specialist	LCSPPT
Ian Marfleet	Consultant	construction management specialist	LCSDU
M. Yaa Pokua Afriyie	Senior Social	Senior Social	LCSSO

Oppong	Development Specialist	Development Specialist			
Darshana Yogendra Patel	Consultant	social safeguards and communication	LCSHE		
Claudia Isabella Bovolo	Consultant	water resources specialist	LCSDU		
Luz Maria Gonzalez	Consultant	Economist	LCSDU		
<b>Non Bank Staff</b>					
<b>Name</b>	<b>Title</b>	<b>Office Phone</b>	<b>City</b>		
<b>Locations</b>					
<b>Country</b>	<b>First Administrative Division</b>	<b>Location</b>	<b>Planned</b>	<b>Actual</b>	<b>Comments</b>
Guyana	Region 4	Region 4	X		

## I. STRATEGIC CONTEXT

### A. Country Context

1. With a GDP per capita of US\$3,647 in 2012, Guyana has a relatively high level of poverty within the Latin America and the Caribbean region. Guyana has achieved significant advances in the reduction of moderate and extreme poverty rates, which fell 14.5 and 17 percent respectively between 1992 and 2006. Additionally, the economic performance of the country has improved in recent years with increasing foreign direct investment and GDP growth, which for the five-year period 2008-2012, grew an average of 4 percent, recovering steadily since 2007 (when it fell by 3.6 percent). In the first half of 2013; the economy grew by 3.9 percent, largely driven by rapid growth in mining, and it was projected to grow by 5.8 percent overall in 2013.

2. Guyana has a land area of approximately 215,000 square kilometers (83,000 square miles) and a low population density, with ninety percent of its 800,000 inhabitants<sup>1</sup> living on the narrow coastal plain, which represents ten percent of the country's area. This coastal plain area, much of which lies below sea level, is crucial to the economy of the country as it supports the majority of the population including the nation's capital, Georgetown, and agricultural areas that account for approximately 27 percent of the nation's GDP.

3. The coastal plain area is flood-prone, making the national economy susceptible to the impacts of the country's high seasonal rainfall and storm events. In January 2005 extreme rainfall caused widespread flooding in the coastal lowlands and resulted in an estimated US\$465 million in damages, which amounted to 59% of Guyana's GDP at the time. Other more recent severe rainfall events (e.g. February 2006, December 2008, January 2009, February 2011, and January 2012) have caused economic and livelihood losses, which further highlighted the importance of reducing Guyana's vulnerability to flooding to foster shared prosperity as an engine for equitable economic growth, job creation and poverty reduction.

### B. Sectoral and Institutional Context

4. The Guyana Flood Risk Management Project focuses on the coastal lands of the East Demerara area, where most of Guyana's Region 4<sup>2</sup> (1,843 square kilometers) population is located. The East Demerara<sup>3</sup> area is bound to the north by the Atlantic Ocean, to the west by the Demerara River and to the east by the Mahaica River and Region 5. This area is comprised of the coastal area in Region 4 ("East Coast Demerara") and the area adjoining the East Bank of the Demerara River in Region 4 ("East Bank Demerara") (see a map in Annex 8). This land is protected from flooding by a seawall along the Atlantic Ocean that prevents the sea from inundating the area, and an inland water reservoir that is dammed on three sides. The reservoir dams parallel the Mahaica River, the Atlantic Ocean and the Demerara River and prevents storm water from the inland area from entering the reclaimed coastal land. The reservoir - referred to as the East Demerara Water Conservancy (EDWC) - is a large, shallow water storage system with a

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<sup>1</sup> Estimate based on 2013 Guyana Bureau of Statistics data.

<sup>2</sup> Region 4 is bounded by the Demerara River to the west, the Mahaica River to the east, the Atlantic Ocean in the north, and the Guyana highlands to the South (see map IBRD 40881 in Annex 8).

<sup>3</sup> East Demerara includes two areas, the East Coast Demerara (along the Atlantic coast from the village of Industry to the village to Mahaica) and the East Bank Demerara (along the Bank of the Demerara river from the village of Eccles to the village of Soesdyke).

catchment area of 571 square kilometers (220 square miles). In addition to flood control, the EDWC provides agricultural lands (for rice and sugar production especially which represents 4.3 and 3.8 percent of the country's GDP<sup>4</sup> respectively) and urban areas with irrigation and drinking water.

5. Region 4 experiences two wet seasons. During the primary wet season, between May and July, it experiences between 250 and 450 mm per month of rainfall and during the secondary wet season, between November and January, it experiences between 150 and 300 mm per month. During rainfall events, flood protection in Region 4 is dependent upon both the integrity of the EDWC dams (consisting of West dam, North Dam, Northeast dam and East dam) and effective drainage in the coastal areas. A series of drainage canals controlled by sluices reduce water levels by draining the EDWC and avoid stressing the dams and increasing the risk of structural failure. A separate network of drainage and irrigation canals and pumps drains water from this area into the Demerara and Mahaica Rivers and the Atlantic Ocean to prevent and reduce the risk of flooding that would occur due to rainfall and runoff of storm water.

6. The National Drainage and Irrigation Authority (NDIA) in the Ministry of Agriculture (MoA) is responsible for drainage and irrigation in Guyana, including management of conservancies such as the EDWC. NDIA responsibilities cover strategic planning, investment, operation, maintenance and monitoring. In the decades leading up to the 2005 and 2006 floods, the operational capacities of the EDWC and coastal drainage systems declined due to insufficient physical investments and inadequate disaster preparation and management capacity. Following the floods, the Government of Guyana (GoG) reemphasized the importance of flood risk management to Guyana's economic, social and political well-being, increasing budget for NDIA to undertake investments, maintenance and future planning.

7. *EDWC and Dams:* Significant improvements have been made to the EDWC dams since 2005; however, they have structural deficiencies and are under stress due to high water levels in the EDWC during heavy rains. The 2005 and 2006 floods left the EDWC dams in a weakened state, in need of maintenance and re-enforcement, and highlighted the fact that the EDWC did not have adequate drainage capacity to protect the dams during storm events. Since that time, the GoG has repaired sections of the dams damaged during the flood, however some sections still present marginal stability. Additionally, significant investments - a combination of GoG, World Bank and Japanese International Cooperation Agency (JICA) funds<sup>5</sup> - were undertaken to improve water flow within the EDWC; rehabilitate several drainage relief canals and sluices; and purchase equipment for maintenance and repair. These investments have improved the stability of the dams and improved the ability of the EDWC system to protect the dams against high operating water levels. However, the dams remain vulnerable to catastrophic breaching as (i) they still operate above safe operating levels during high rainfall events nearly every year, and

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<sup>4</sup> 2013 Guyana Bureau of Statistics.

<sup>5</sup> The Project for Rehabilitation of the East Demerara Water Conservancy is a USD7.4 million JICA Grant that includes equipment purchase and rehabilitation of drainage canals and sluices in the East Coast Demerara area. The project is expected to be completed in 2014. The World Bank Conservancy Adaptation Project (P103539) funded sluice upgrades and equipment (see Annex 6 for details). The proposed USD2.5 million Cunha Canal Rehabilitation Project will rehabilitate this canal to improve its relief capacity and improve drainage of local agricultural areas.

(ii) they structurally are marginally stable in areas, experiencing periodic slips and small breaches.<sup>6</sup>

8. GoG is undertaking additional investments to increase drainage from the EDWC including the construction of a Northern Drainage Relief Channel and the rehabilitation of the Cunha Canal<sup>7</sup>. When operational these two canals are estimated to limit the need to operate above safe operating levels during storm events with return periods less than 50 years. In addition to these investments, complementary investments to strengthen the dams and establish systems for operation, monitoring and maintenance are needed to upgrade the structural stability and improve the long term maintenance of the dams.

9. *Coastal Drainage Infrastructure*: Similarly, the coastal drainage system has been upgraded since 2005 but is inadequate, resulting in annual flooding in Region 4. The poor performance of the coastal drainage system in 2005 led to catastrophic flooding lasting from 1 to over 3 weeks in some areas, the loss of 34 lives, a disease outbreak, population displacement and infrastructure damage. Since 2005, GoG with assistance from the Inter-American Development Bank (IDB) and JICA has been investing in the drainage systems in Region 4 that includes constructing, maintaining and rehabilitating drains, canals, pump stations and intake and outfall structures<sup>8</sup>. However, the system currently has inadequate drainage, pump and channel capacity, and compromised efficiency since it is combined with agricultural drainage. Investments in infrastructure to improve drainage capacity and efficiency are needed to reduce the impacts of floods in this area.

10. *Planning*: Following the 2005 and 2006 floods, GoG recognized the long-term need for flood prevention by increasing the annual budget allocated to investment and operation and maintenance of the system and investing in tools for medium- and long-term planning. The planning tools were developed under the Conservancy Adaptation Project (CAP) using financing from the Global Environment Facility (GEF) Special Climate Change Fund (SCCF). The intention was to improve the understanding of the behavior of the EDWC and the coastal drainage systems the planning of investments and operation. In particular, the GoG improved the baseline monitoring and information system of the EDWC by installing systems to monitor weather, water levels and water flow and collecting topographic and land use data in the coastal area. These systems were used to simulate the behavior of the EDWC and of the coastal drainage system under different storm events. They helped identify priority interventions in the EDWC and the dams, and the coastal drainage system. These interventions are included in the GoG short and mid-term development plans, specifically in the Ministry of Agriculture's Master Drainage and Irrigation Plan for the period 2014-2030, now being finalized and its ongoing 2013-2020 Strategic Plan.

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<sup>6</sup> With the exception of 2010, the peak annual water level recorded in the conservancy was higher than the safe operating level for each year since 2005. The most recent significant incident was in 2011 when a slope failure occurred.

<sup>7</sup> The Northern Drainage Relief Channel, financed by GoG, is due to start operation in 2014. The Cunha Canal Rehabilitation Project is being proposed to be financed by the Guyana REDD+ Investment Fund (GRIF). See annex 6 for expected results of the Northern Drainage Relief Channel.

<sup>8</sup> GoG activities in the East Demerara included clearing and de-silting of canals and construction and upgrading sluices and kokers. A portion of the JICA Grant contributed to improve coastal drainage. The USD22.5 million IDB funded Agriculture Services Support Project focused on public land management policies, drainage and irrigation, and undertook rehabilitation of infrastructure, some of which was linked to the drainage of the East Demerara. The EU is also financing a USD25 million project to upgrade sea defenses including those in the East Coast Demerara.

11. Since the 2005 floods, the GoG has demonstrated its political and financial commitment to address flood risk management needs. At the same time the financial resources from GoG alone are not sufficient to undertake larger investments and long term planning. With the exception of the Northern Relief Channel, activities outside of donor funding have focused on smaller short-term investments and maintenance activities that NDIA can undertake using their existing resources.

12. Financial support from donors such as JICA, IDB, European Union (EU) and the World Bank thus provides an important source of financing to implement the larger investments and knowledge to undertake strategic planning activities that otherwise would not be completed.

### **C. Higher Level Objectives to which the Project Contributes**

13. *Country Assistance Strategy*. The project is fully consistent with the World Bank Group's Country Assistance Strategy (CAS) FY2009-12 (Report No. 47983-GY), discussed by the Executive Directors on May 26, 2009. This CAS continues to guide the Bank's assistance to Guyana, as the Bank moves towards more analytical work and the development of a new strategic engagement framework. The CAS focuses on:

- (a) Environmental resilience and sustainability, which focused on helping the country establish pilot forest areas that are protected and sustainably managed by local communities, and strengthening the country's ability to reduce its exposure to natural disasters and global climate risk.
- (b) Education quality and social safety nets through teacher training reform and better service delivery, while bolstering the Government's efforts to deliver an enhanced social protection program.

14. *Promoting Shared Prosperity and Ending Extreme Poverty*. This project would contribute to the Bank's dual objective of reducing poverty and boosting shared prosperity. Catastrophic climate risk is absorbed by the Government and agriculture producers at great cost, restricting their ability to exit from poverty and inhibiting growth and agricultural competitiveness. Climate change and natural disasters have the greatest impact on the poorest populations who generally live in higher-risk areas. In the case of Guyana, flooding from rainfall events can have crippling and cumulative effects on livelihoods<sup>9</sup>.

15. *The 2005 Guyana Poverty Reduction Strategy Paper Progress Report*<sup>10</sup> indicates that Region 4 has the largest number of people living in poverty. The report also states that the January 2005 flood was the most serious shock that the country has experienced recently and that it has possible long-term implications. The impact on poverty was evident in depleted productive capacity due to damages in road and other infrastructure networks, affecting key economic activities such as agriculture, manufacturing, retail trade and distribution. Many subsistence

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<sup>9</sup> The ECLAC 2006 "Socio-Economic Assessment of the Damage caused by the January-February 2005-2006 Flooding" supported the fact that severe rainfall events impact welfare significantly in Guyana. Although the poverty impacts were not specifically quantified, a recent detailed study of the effects of natural disasters in Guatemala on poverty provides quantitative evidence that rainfall events can cause sizable and persistent deterioration of human welfare. In Guatemala's case, it was concluded that rainfall impacts from Hurricane Agatha in urban areas could be responsible for up to 20% of the increase in poverty that occurred in affected areas between 2006 and 2011.

<sup>10</sup> IMF Country Report No. 06/364, October 2006

farmers, small business operators and vendors were affected directly and encountered severe liquidity constraints due to the closure of their operations and needed to divert resources to maintain adequate consumption during the flood. By investing in infrastructure and planning that would reduce the vulnerability of the population to similar catastrophic impacts, the project will make an important contribution to shared prosperity and ending extreme poverty.

## **II. PROJECT DEVELOPMENT OBJECTIVES**

### **A. PDO**

16. The Project Development Objective is to reduce the risk of flooding in the low-lying areas of the East Demerara.

### **B. Project Beneficiaries**

17. The project area that will benefit from reduced flood risk is the East Demerara which is comprised of the coastal area in Region 4 (“East Coast Demerara”) and the area adjoining the East Bank of the Demerara River in Region 4 (“East Bank Demerara”). The project works will improve drainage in the East Coast Demerara and strengthen the EDWC northeast dam. The estimated population directly benefitted is 113,066. The direct beneficiaries include those that would be affected by the breach of the northeast dam, which based on modelling would be the residents of the areas of the East Coast Demerara east of Georgetown. The drainage area improvements will provide additional benefits to a portion of this same population. The Project will also indirectly benefit the entire East Demerara (estimated population of 310,000) through improved operations, monitoring and emergency preparedness related to the EDWC system as a whole.

### **C. PDO Level Results Indicators**

18. The project will implement priority investments in flood protection including those in the EDWC, and the coastal drainage area as well as its management. Progress towards meeting the Project Development Objective would be measured by two outcome indicators:

- (a) Area with improved protection against breach of the EDWC dams; and
- (b) Area with improved drainage capacity;

## **III. PROJECT DESCRIPTION**

### **A. Project Components**

19. The Project provides investments and institutional strengthening to reduce the risk of flooding. It is composed of 3 components: 1. Priority Works for Flood Risk Reduction; 2. Institutional Strengthening for Flood Risk Reduction; and 3. Project Management.

- (i) Part A. Priority Works for Flood Risk Reduction.

1. Upgrading critical sections of the EDWC Dams selected pursuant to the criteria set forth in the Construction Supervision and Quality Assurance Plan;
2. Carrying out priority flood risk reduction investments in the East Coast Demerara Drainage System selected pursuant to the criteria set forth in the Construction Supervision and Quality Assurance Plan.
3. Support construction supervision and quality assurance of works under Parts A.1 and A.2 of the Project.

(ii) Part B. Institutional Strengthening for Flood Risk Reduction.

1. Improvement of EDWC Dams safety systems of the Recipient, including preparation and implementation of: (a) the Construction Supervision and Quality Assurance Plan; (b) the Operation, Maintenance and Surveillance Plan; (c) the Instrumentation Plan; and (d) the Emergency Preparedness Plan.
2. Support flood modeling through the carrying out of the following activities: (a) hydraulic and hydrological modeling; (b) specialized training in hydraulic and hydrological modelling, use of remote sensing tools, and data management; and (c) information technology support for management of data.
3. Support disaster risk management, drainage and irrigation sector-related communications activities through the carrying out of the following activities: (a) carrying out of public meetings in the Project area on Project implementation progress; (b) carrying out of workshops on Project implementation activities; and (c) preparation and distribution of information materials about the progress of the Project.

(iii) Part C. Project Management and Implementation Support. Support Project management and implementation activities by the ASDU, including reporting and auditing activities.

## B. Project Financing

20. The project will be financed by IDA resources as outlined in the table below.

Project Components	Project Cost (US\$ 000)	IDA Financing (US\$ 000)	% Financing
1. Priority Works for Flood Risk Reduction	10,346	10,346	100%
2. Institutional Strengthening for Flood Risk Reduction	463	463	100%
3. Project Management and Implementation Support	1,235	1,235	100%
<b>Total Financing Required</b>	11,890	11,890	



### C. Lessons Learned and Reflected in the Project Design

The project design is benefitting from the recent closure and the Implementation Completion Report (ICR) of the CAP (see Annex 6 for details) and lessons from regional initiatives in disaster risk management. Lessons learned from these experiences are integrated into the project design.

24. *Project Procurement and Disbursement Arrangements:* The key challenges faced by the CAP, especially at its onset, were related to procurement and disbursement. Based on the CAP experience, the following will be incorporated into the design of the new project: to better support project management directly, budget will be made available through a designated account to finance the ASDU staff and its operations; to support more timely procurement, procurement planning and training will be emphasized as part of implementation; and to avoid overwhelming the limited procurement capacity, the number of contracts will be minimized as is appropriate.

25. *Technical Support:* The technical supervision and quality control provided through consultants for the CAP proved instrumental to the satisfactory completion of the project. At the same time, gaps in this supervision caused delays in project implementation. As a result, the following will be incorporated into the design of the new project: technical supervision contracts, including quality control, will be included with a contract period that adequately covers the period of the works and studies; and technical trainings will be incorporated throughout the life-span of the Project.

26. *Communications and Dissemination:* The CAP communication plan helped to regularly disseminate the results of the project, facilitated knowledge transfer, boosted coordination and informed future activities. The Flood Risk Management Project will incorporate a communications and dissemination plan as well and inter-institutional coordination will be encouraged through the establishment of a Project Coordination Committee.

27. *Regional Knowledge Exchange:* Disaster risk management activities in the Caribbean have benefitted from regional exchanges. Sharing the knowledge from the Project can be mutually beneficial for Guyana and other Caribbean or Latin American countries. As part of the Bank supervision and the regional program on disaster risk management, these opportunities will be pursued.

28. *Donor Coordination:* Improving donor coordination was found to be one of the cornerstones of implementation success of the CAP. In the case of the Flood Risk Management Project, it is expected that other donors will be pursuing similar investments in flood management. As a result, donor coordination will be incorporated into the design and supervision of the Project.

29. *Monitoring and Planning:* The CAS and CAP respectively highlighted the need for better systems for monitoring of social and poverty indicators and the utility of establishing a technical baseline for hydrologic systems. Dependable data on socio-economic conditions in the country has limited project impact assessments. At the same time, data on hydrology established under the CAP has been useful in understanding the risks of flooding in Region 4. The Project will

expand the use of the hydrologic baseline under the CAP to cover upstream areas and will include surveys to better understand the socio-economic impacts of the works as part of project monitoring and evaluation.

#### **IV. IMPLEMENTATION**

##### **A. Institutional and Implementation Arrangements**

28. Ministry of Agriculture (MoA): MoA is the lead implementing agency for the project and will have overall responsibility for reporting on fiduciary matters and overall project progress to the Ministry of Finance (MoF) and the World Bank. Within the MoA, ASDU functions and responsibilities will be: (a) the carrying out of monitoring, coordination and supervision of Project activities; and (b) the fiduciary, procurement, safeguards and administrative aspects of the Project (including but not limited to issuance of the tenders, undertaking financial reporting for the Project and making payments to contractors. Technical oversight of drainage and dam works will be provided by the ASDU. The project will also finance construction supervision. Once these works are complete, the NDIA will take over operations and maintenance in accordance with their mandate. NDIA will participate in PCC, and bi-monthly meetings with contractors.

29. Ministry of Public Works (MoPW): In some cases the works will affect or require upgrading of roads or sea defenses which are under the responsibility of the MoPW. In these cases, ASDU will manage the fiduciary, safeguards and administrative tasks and the MoPW will provide technical oversight, including construction design approval. Supervision will be undertaken jointly with ASDU. Once the works are complete, MoPW will take over operations and maintenance in accordance with their mandate.

30. A Project Coordination Committee (PCC) is to be created coordinate on drainage and flood protection activities among government agencies and provide strategic leadership and direction for the Project. The Committee will be chaired by the Minister of Agriculture and will have statutory, quarterly meetings for the purpose of communication and coordination among the relevant agencies (MoA, MoF, Civil Defense Commission (CDC), MoPW, NDIA, Sea and River Defense Division in the MoPW, Environmental Protection Agency (EPA), and the Hydromet Department).

31. The institutional arrangements are similar to those under the CAP. The shortcomings under the CAP included the challenges of coordination among agencies and capacity constraints in ASDU. These are being addressed under the Project through improved coordination mechanisms (via the Project Coordination Committee and communications program), by providing funding for project management in ASDU directly under the project, and providing continuous technical supervision and training.

32. A Project Operations Manual (OM) was developed describing the operations of the Project. The purpose of the OM is to provide an ordered set of instructions on the organization, procedures, and resources dedicated to the efficient and effective achievement of the aims of the Project. The Project Operations Manual will be adopted by the Recipient as a condition of effectiveness.

## **B. Results Monitoring and Evaluation**

33. The overall results and monitoring framework for the project are summarized in Annex 1. ASDU will have overall responsibility for monitoring and evaluation of the Project and will consolidate all reports and report to the Bank on the Project's performance indicators, on the Project's progress and execution, quality control and environmental and social safeguards (see Annex 3 for details). Project monitoring will be undertaken by ASDU as part of their daily activities and maintenance of records. They will provide quarterly financial reporting, semi-annual project progress reporting and annual audits.

## **C. Sustainability**

34. *Ownership:* Flood prevention has been high on the GoG agenda since the 2005 floods and subsequent flooding events have served to reinforce this need. The GoG has already signaled its strong commitment to and ownership of this project, as reflected by the prominence of drainage and flood control strategies in its planning, and government budget<sup>11</sup>.

35. *Operations and Maintenance:* The operation and maintenance of the drainage works and the EDWC is under the responsibility of the NDIA. Before 2005, maintenance of both systems was distinctly limited. Since that time, NDIA has focused on undertaking deferred maintenance and improving regular maintenance procedures. The maintenance is not comprehensive and systematic and therefore there are still opportunities for improvement. The Project will build on this work by further improving maintenance to help ensure sustainability of the investments.

36. More specifically, maintenance of the canals in the East Coast Demerara includes manual cleaning, de-silting, de-weeding, trimming and shaping and pump stations require regular maintenance to ensure that they are in optimal working condition. Financing for this maintenance comes primarily from annual government appropriations which have increased in recent years. As a result of the IDB financed Agricultural Support Services Project, a funding scheme from fees charged to the water users associations that benefit from irrigation and drainage systems is also being developed. Under the project, maintenance procedures will be further strengthened through technical assistance to NDIA.

37. Maintenance of the EDWC dams includes managing vegetation; and strengthening and maintaining the dam structure, including in response to slips and breaches. Dam maintenance is financed through general government appropriations which have increased in recent years and through user fees from irrigation services and for water supply provided by the EDWC. Considering the condition of the dams and systems in place, current maintenance is able to make gradual improvements and react to emergency maintenance needs. However, the dams do not sufficiently meet international standards of safety. The Project will upgrade the northeast dam, reducing the need for emergency maintenance of slips and breaches. This will allow more effort to be expended on regular monitoring and maintenance of the dams using the surveillance system to be introduced under the Project.

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<sup>11</sup> Government budget allocations for drainage and irrigation ranged from GYD6-8 billion between 2010 and 2014, a two fold increase of the allocation in 2007. The Master Drainage and Irrigation Plan is being finalized in 2014 and drainage and flood protection are important elements of the country's Low Carbon Development Strategy update (2013) and Integrated Disaster Risk Management Plan (2013).

## V. KEY RISKS AND MITIGATION MEASURES

### A. Risk Ratings Summary Table

<b>Risk Category</b>	<b>Rating</b>
<b>Stakeholder Risk</b>	<b>Moderate</b>
<b>Implementing Agency Risk</b>	
- Capacity	<b>Substantial</b>
- Governance	<b>Moderate</b>
<b>Project Risk</b>	
- Design	<b>Moderate</b>
- Social and Environmental	<b>Moderate</b>
- Program and Donor	<b>Moderate</b>
- Delivery Monitoring and Sustainability	<b>Moderate</b>
<b>Overall Implementation Risk</b>	<b>Moderate</b>

### B. Overall Risk Rating Explanation

38. Implementation risk is most significantly related to capacity constraints in the ASDU, particularly related to fiduciary responsibilities. This will be mitigated by providing funding to ASDU staff within the Project. Under the CAP, ASDU's capacity for financial management was built but to a lesser extent, for procurement. The inclusion of qualified financial management and procurement specialists that are familiar with Bank financial management and procurement rules in the ASDU under the Project, along with Bank trainings will help to reduce this risk.

## VI. APPRAISAL SUMMARY

### A. Economic Analysis

39. A comprehensive cost-benefit analysis was carried out for the priority works included in the Flood Risk Management Project. Expected benefits and costs attributable to the Project were measured by comparing two scenarios: with and without the project. The Avoided Cost Method was used to estimate benefits and the evaluation was complemented with a sensitivity analysis.

40. The results of analysis of representative drainage works show an economic return of 12% related to the execution of drainage works with the residential sector benefitting most significantly.

Economic Evaluation of Works in 2 Drainage Areas

Drainage Area	Present Value of Flows (million USD)			IRR
	Costs	Benefits	Net Benefit	
Enterprise Paradise	16.4	18.7	2.3	12%
Ogle	1.6	2.4	0.8	15%
<i>Total Drainage</i>	18.0	21.1	3.1	12%

**B. Technical**

41. Project design benefitted from the studies undertaken under the CAP, which included a safety assessment and rehabilitation feasibility study of the EDWC dams based on inspection, site investigation and modeling analysis using an experienced consultant team and following internationally accepted practices.

42. A geotechnical stability analysis of the entire EDWC dams identified the northeast dam as the most fragile part and therefore this section was prioritized for rehabilitation under the Project. Several options were examined and evaluated including the strengthening and raising the level of the dam and the rebuilding the weak portions of dam. The output of that exercise forms the basis of the proposed rehabilitation of the dam to be enacted as a priority.

43. Before the bidding of the works and equipment for the rehabilitation of the northeast dam and investments in drainage areas, a Construction Quality Assurance Plan will be prepared. As part of preparation of the Plan, the ongoing construction practices and works and the proposed construction designs will be reviewed and a plan for construction including technical criteria and quality control will be developed for use in the bidding and supervision of the works. This plan will be adopted by MoA for all the East Coast Demerara drainage works financed under the Project and those to be undertaken in the northeast dam. Consultants will be engaged for supervision of the construction activities as per the Construction Quality Assurance Plan. These consultants will supervise the Project drainage and dam works and monitor all other works undertaken in the northeast dam during the Project period.

44. Complementing the work on the northeast section of the dam, a dam safety management program will be implemented for all the EDWC dams, including the development and implementation of operation and maintenance, monitoring, visual inspection and emergency management procedures, in connection with the development of related dam safety plans. The capacity of the operational team will be strengthened through targeted and on-the-job training, and with the addition of essential maintenance facilities. Non-structural flood risk reduction measures such as raising public awareness of flood risk, flood warning and emergency preparedness planning will also be implemented under the Project.

45. Six drainage areas in Region 4 along the East Coast Demerara were identified as priority areas for intervention based on site visits, stakeholder discussions, multi-criteria analysis and modelling. A number of interventions which would improve drainage and reduce the area prone to flooding were tested and on that basis, a set of priority investments were identified. The Project will pursue several interventions from this group of priority interventions. As in the dam

intervention; the Project will finance supervision by qualified civil engineers managed by ASDU to help ensure quality of design and implementation.

46. Institutional strengthening activities will comprise training and capacity building to expand the monitoring and modelling undertaken under the CAP. These interventions are based on the results of and gaps in the CAP modelling work; and the capacity, data and modelling needs of the MoA that were identified during project preparation.

### **C. Financial Management**

47. The financial management (FM) responsibilities under the Project will be undertaken by the ASDU. The ASDU has considerable experience in implementing the CAP, which had a satisfactory rating for its FM responsibilities. An additional financial management capacity assessment of the ASDU was carried out during preparation of the Project to ensure that the systems to be used to manage the funds satisfy the Bank's minimum FM requirements under OP/BP10.00, and that they are adequate to provide, with reasonable assurance, accurate and timely information on the progress for implementation of the Project. The assessment concluded that the ASDU has adequate staff with experience in implementing Bank-financed projects and also has familiarity with environmental rules, procedures and systems. The ASDU is also utilizing a computerized accounting system which will be able to generate reliable and timely financial reports. To help manage any residual risks, FM supervision will be undertaken.

### **D. Procurement**

48. The ASDU will be responsible for managing procurement for the Project. A qualified Procurement Officer, will be responsible for all procurement activities. Additionally, a civil engineer and other technical consultants may be hired to provide technical assistance in the process of procurement and contract management, as needed. The main procurement challenges relate to delays in procurement due to processing time and capacity constraints in the ASDU and the limited number of qualified engineering firms and contractors working in Guyana. Under the project ASDU will include a qualified procurement specialist with experience in World Bank procurement procedures and/or equivalent international-donor procurement experience. The Bank will provide training on procurement and on-the-job training for the procurement and the other ASDU staff involved in the procurement process.

49. A procurement plan for the first 18 months was agreed by ASDU. The Operational Manual (OM) that was prepared and used under the CAP was updated accordingly to clearly spell out the procurement implementation arrangements, including detailed steps and the respective stakeholders' responsibilities in the procurement process. Subject to the implementation of the above mentioned measures (i.e. hiring of a qualified procurement and other technical staff, providing procurement training and capacity building, timely implementation of the procurement arrangements spelled out in the updated OM, realistic procurement implementation planning, etc.) the risk for the procurement under the project is assessed as moderate.

## E. Social (including Safeguards)

50. The project's primary stakeholders are the approximately 310,000 inhabitants of the coastal areas in Region 4 that will be positively impacted by improved ability to drain agricultural areas and reduced exposure to flooding in both agricultural and urban environments. The project will benefit the primary economic activities of the Region's inhabitants including subsistence and commercial farming (especially rice and sugar cane), businesses and government jobs and fisheries.

51. Given the potential for land acquisition (temporary and permanent) as well as impacts on assets, in projects involving civil works of this nature, the Involuntary Resettlement Policy (OP/BP 4.12) has been triggered and a Resettlement Policy Framework (RPF) has been developed. The RPF has been disclosed prior to project appraisal. Any impacts are likely to be limited and sub-project level Resettlement Plans will be developed and disclosed prior to sub-project financing. The GoG prepared the RPF in consultation of key stakeholders (i.e. civil society, private and public sectors, and NGOs). During project implementation it is expected that these key stakeholders will have access to weekly open meetings with the MoA to voice any views and concerns on project progress, monitoring and evaluation.

## F. Environment (including Safeguards)

Safeguard Policies Triggered by the Project	Yes	No
<a href="#">Environmental Assessment (OP/BP 4.01)</a>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Natural Habitats ( <a href="#">OP/BP 4.04</a> )	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Pest Management ( <a href="#">OP 4.09</a> )	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Indigenous Peoples ( <a href="#">OP/BP 4.10</a> )	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Physical Cultural Resources ( <a href="#">OP/BP 4.11</a> )	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Involuntary Resettlement ( <a href="#">OP/BP 4.12</a> )	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Forests ( <a href="#">OP/BP 4.36</a> )	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Safety of Dams ( <a href="#">OP/BP 4.37</a> )	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Projects on International Waterways ( <a href="#">OP/BP 7.50</a> )	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Projects in Disputed Areas ( <a href="#">OP/BP 7.60</a> )	<input type="checkbox"/>	<input checked="" type="checkbox"/>

52. The Project is a category B investment under the World Bank's Operational Policy on Environmental Assessment (OP/BP 4.01) as the impacts of the works are expected to be moderate in nature and will be managed through the application of appropriate engineering and management measures. Other World Bank environmental safeguards policies were triggered to manage potential project impacts including Natural Habitats (OP/BP 4.04) and Physical Cultural Resources (OP/BP 4.11) (See table above).

53. The anticipated impacts of the works will require management of construction impacts such as noise, management of construction waste and debris, and worker safety, and mitigating some low to moderate impacts related to the management and rehabilitation of the clearing of vegetation during construction and maintenance so as to maintain its role to prevent erosion and as a natural habitat. In relation to Natural Habitats, impacts to the biophysical and socio-

economic environments are expected to be limited in nature, as much of the EDWC dams and drainage system, and the East Coast Demerara drainage systems are located in areas that have already been subjected to significant human interventions. There is no indication of important physical cultural resources in the anticipated project sites.

54. An Environmental and Social Management Framework (ESMF) was developed, that included a process for sub-project screening and delineation of the Environmental Assessments (EAs), Environmental Management Plans (EMPs) or a Resettlement Action Plan (RAP) appropriate to the types and scale of the impacts. Safeguards documentation will comply with both World Bank safeguards policies and Guyana's national policies and cover potential impacts on Natural Habitats and Physical Cultural Resources as a precautionary measure in case the identified works may result in these impacts. This procedure (including a grievance mechanism) is detailed in Annex 3. In addition to the ESMF, EMPs for the first year's works on the dam have been completed and are acceptable to the Bank. There is no resettlement expected due to these works and therefore no RFP was necessary.

55. Borrower's Capacity to Implement Safeguards: Technical staff from the NDIA and ASDU will be assigned to the Project to oversee the preparation and implementation of ESMF and RPF and ensuing Resettlement and Environmental Management Plans. Capacity for safeguards implementation is acknowledged to be limited however a review of practices for ongoing works (Northern Drainage Relief Channel) and the management of the EDWC indicated some basic capacity exists. In particular appropriate environmental mitigation measures are practiced in the construction of the Northern Drainage Relief Channel and the Guyana Amazon Tropical Birds Society and the Guyana Environmental Protection Agency also confirmed that, in their opinion, the EDWC has been sustainably managed. Training will be provided to the ASDU through the project and through regional World Bank training to develop their capacity further for implementation of the Environmental and Social Assessment Framework and the Resettlement Policy Framework.

56. Consultations and Disclosure of Safeguards Documents: Consultations on the ESMF and RPF were held with concerned stakeholders on March 7, 2014. Minutes of these consultations have been incorporated into the ESMF, along with any suggested revisions to the ESMF, as appropriate. Prior to start appraisal, the RPF and ESMF were disclosed in country on March 25, 2014, and on the World Bank website on March 18 and 26, 2014 respectively. The final version of the ESMF was then disclosed in country and on the World Bank website on April 11, 2014.

57. OP/BP 4.37 – Safety of Dams is also triggered by the project. The embankment dams for the EDWC are all significantly less than 10 meters in height. They therefore are defined as small dams under OP 4.37. However, because the EDWC has an extensive surface area; provides water and protects a significant population from flooding; is adjacent to natural habitats along the adjoining rivers; and there is a risk of significant adverse impacts due to potential failure of the dam on local communities and assets, the policy was triggered under the project.

58. As part of the Conservancy Adaptation Project (CAP), an evaluation of the EDWC dams was undertaken covering the safety status, performance history and operation and maintenance procedures. Necessary remedial work and safety-related measures were identified in order to



upgrade the safety status of the dam including immediate priority works on the northeast dam for which the Project will be providing financing (see Annex 6 for details).

59. The Bank has agreed on appropriate safety measures with the Borrower, considering the importance of the EDWC system in flood risk management and water supply. Basic monitoring instruments such as piezometers, settlement monuments and gauging stations are included in the engineering design. The works will be undertaken by qualified engineers with experience in these types of works, and the construction quality, cost and time control will be supervised by qualified engineers.

60. In order to ensure the works quality of the rehabilitation of the EDWC northeast dam and sustainability of all EDWC dams, the following plans will be prepared/improved and/or implemented: (a) a Plan for construction supervision and quality assurance; (b) an Operation, Maintenance and Surveillance (OMS) Plan; (c) an Instrumentation Plan; and (d) an Emergency Preparedness Plan (EPP). During project preparation and negotiations, the Bank and GoG agreed on appropriate dam safety measures in line with Bank safeguards. Information on the status of the plans and their delivery schedule is provided in Annex 3.

**Annex 1: Results Framework and Monitoring**  
**Guyana: Flood Risk Management Project**

**Results Framework**

PDO: The Project Development Objective is to reduce the risk of flooding in the low-lying areas of the East Demerara.

**Project Development Objective Indicators**

Indicator Name	Core	Unit of Measure	Baseline	Cumulative Target Values					Frequency	Data Source/ Methodology	Responsibility for Data Collection
				YR1	YR2	YR3	YR4	End Target			
Area with improved protection against breach of EDWC dams.		ha	0	0	15,700	15,700	15,700	15,700 <sup>12</sup>	Semi-annual	Semi-annual progress reports	ASDU
Area provided with improved irrigation and drainage services	☒	ha	0	0	0	3,240	7,864	7,864 <sup>13</sup>	Semi-annual	Semi-annual progress reports	ASDU

**Intermediate Results Indicators:**

(Note: See 2 next pages for Intermediate Results Indicators under component 1 and 2.)

<sup>12</sup> The benefitting area is the area of inundation of a simulated breach of the northeast dam (CAP pre-investments studies).

<sup>13</sup> The benefitting area is the area of the drainage catchment within which the works are located. The estimates are based on 3,240 ha area for Mon Repos-Annandale drainage area and 4,624 ha area for Strathspey-Enterprise-Paradise drainage area which are the areas for the proposed interventions.

### Component 1: Priority Works for Flood Risk Reduction

Indicator Name	Core	Unit of Measure	Baseline	Cumulative Target Values					Frequency	Data Source/ Methodology	Responsibility for Data Collection
				YR1	YR2	YR3	YR4	End Target			
Direct project beneficiaries	<input checked="" type="checkbox"/>	number	0	0	113,066	113,066	113,066	113,066 <sup>14</sup>	Annual	Census (to be updated 2012)	ASDU
Female project beneficiaries	<input checked="" type="checkbox"/>	%	0	0	51	51	51	51 <sup>15</sup>	Annual	Census (to be updated 2012)	ASDU
Water users provided with new/improved irrigation and drainage services (female and male)	<input checked="" type="checkbox"/>	number	0	0	0	47,638	47,638	47,638 <sup>16</sup>	Annual	Census (to be updated 2012)	ASDU
Water users provided with irrigation and drainage services (female)	<input checked="" type="checkbox"/>	number	0	0	0	24,010	24,010	24,010 <sup>17</sup>	Annual	Census (to be updated 2012)	ASDU
Length of dam upgraded		km	0	0	2	4	4	4	Semi-annual	Confirmation of completion with adequate quality by construction supervision consultant.	ASDU
Increased drainage capacity (capacity of drainage pumps or canals)		m <sup>3</sup> /s	0	0	0	1.5	5	5	Semi-annual	Semi-annual progress reports	ASDU

<sup>14</sup> Based on 2002 census population data for Region 4, East Coast Demerara only (excluding Georgetown), to be updated based on 2012 census.

<sup>15</sup> Based on 2002 census population data for Region 4, East Coast Demerara only (excluding Georgetown), to be updated based on 2012 census.

<sup>16</sup> Based on 2002 census population data Mon-Repos-Annandale and Strathspey-Enterprise-Paradise drainage area, to be updated based on 2012 census.

<sup>17</sup> Based on 2002 census population data Mon-Repos-Annandale and Strathspey-Enterprise-Paradise drainage area, to be updated based on 2012 census.

**Component 2: Institutional Strengthening for Flood Risk Reduction**

	Core	Unit of measure	Baseline	Cumulative Target Values					Frequency	Data Source/ Methodology	Responsibility for data collection
				YR1	YR2	YR3	YR4	End target			
Adoption of operational procedures and surveillance systems for the EDWC dams		completed	No systems			Systems in place			Semi-annual	Semi-annual progress reports	EDWC management unit/ NDIA / ASDU
Adoption of dam safety measures including procedures for emergency preparedness in case of dam breach.		completed	No procedures			completed			Semi-annual	Semi-annual progress reports	EDWC management unit/ NDIA / ASDU
Expanded meteorological, hydrological monitoring network installed and active		yes/no	no	no	no	yes	yes	yes	Annual	Semi-annual progress reports	ASDU/ Hydromet

**Annex 1: Results Framework and Monitoring  
Guyana: Flood Risk Management Project**

**Results Framework**

<b>Project Development Objective Indicators</b>	
Indicator Name	Description (indicator definition etc.)
Area with improved protection against breach of EDWC dams.	Number of hectares (ha) better protected from flood due to dams' breach, as simulated under the Conservancy Adaptation Project pre-investments studies.
Area provided with improved irrigation and drainage services.	Number of hectares (ha) with better drainage, measured as the drainage catchment within which the works are located.
<b>Intermediate Results Indicators</b>	
Indicator Name	Description (indicator definition etc.)
Direct project beneficiaries	Number of people who directly derive benefits from project interventions to improve protection against breach of EDWC dams. This includes population reported in the census for Region 4, East Coast Demerara only (excluding Georgetown).
Female project beneficiaries	Percentage of women who directly derive benefits from project interventions to improve protection against breach of EDWC dams. This includes population reported in the census for Region 4, East Coast Demerara only (excluding Georgetown).
Water users provided with new/improved irrigation and drainage services (female and male).	Number of people who directly derive benefits from project interventions to achieve better drainage. This includes population reported in the census for Mon-Repos-Annandale and Strathspey-Enterprise- Paradise drainage area.
Water users provided with irrigation and drainage services (female).	Number of women who directly derive benefits from project interventions to achieve better drainage. This includes population reported in the census for Mon-Repos-Annandale and Strathspey-Enterprise- Paradise drainage area.
Length of dam upgraded.	Number of kilometers (km) of dams that will be rehabilitated with adequate quality.
Increase drainage capacity (capacity of drainage pumps or canals).	Increase number of cubic meters per second m <sup>3</sup> /s drained by pumps or canals.
Adoption of operational procedures and surveillance systems for the EDWC dams.	Systems in place to monitor EDWC dams' behavior.

Adoption of dam safety measures including procedures for emergency preparedness in case of dam breach.	Procedures of emergency preparedness in case of dam breach.
Expanded meteorological, hydrological monitoring network installed and active.	Dams' meteorological and hydrological monitoring network in operation.

## **Annex 2: Detailed Project Description**

### **Guyana: Flood Risk Management Project**

1. The Flood Risk Management Project provides investments to reduce the risk of flooding in Region 4, a region that contains most of the population and economy of Guyana. Flood prevention in Region 4 is dependent upon two systems. The first system consists of the East Demerara Water Conservancy (EDWC), a seawall and connecting drainage relief channels that maintain the urban and agricultural areas. The second system is separate from the first and consists of individual drainage areas with canals draining by gravity or by pumps that drain rainfall and associated runoff that directly affect this area. The project will provide investments to reduce the risk of flooding by addressing inadequacies in these two systems. In particular, the Project will reduce the risk of flooding due to failure of the EDWC dams and due to rainfall and runoff in individual drainage areas. It will also include complementary institutional strengthening and planning to support these goals.

2. The Project is a continuation of Government and donor-financed upgrading of these systems that began after the severe flooding in 2005 caused loss of life, relocation, disease and infrastructure damage, significantly affecting the economy of Guyana. It also benefitted from the planning and technical assessments undertaken as part of the Conservancy Adaptation Project (CAP), financed by the Global Environment Facility Special Climate Change Fund (GEF SCCF), which identified priority areas for investment in the Region and established a technical foundation for planning and managing these systems.

#### ***Project Development Objective***

3. The Project Development Objective is to reduce the risk of flooding in the low-lying areas of the East Demerara.

#### ***Project Components***

4. The Project is composed of 3 components: 1. Priority Works for Flood Risk Reduction; 2. Institutional Strengthening; and 3. Project Management.

5. Component 1: Priority Works for Flood Risk Reduction (USD 10.3 million)

6. This component will include the upgrading of critical sections of the EDWC dams and the purchase of heavy equipment to facilitate the upgrade, the priority flood risk reduction investments in the East Coast Demerara drainage system, and the construction supervision and quality assurance of these works.

7. *Subcomponent 1.1 – Upgrading Critical parts of the EDWC dams.* The EDWC dams are 130 year old earthen dams that regularly experience minor slope failures and temporary breaches and could be compromised to the point of failure in extreme storm events. A recent assessment of the dams has shown that they are marginally stable in certain areas under certain conditions and do not meet international standards. The northeast dam is the most fragile part of the dam and is a priority for rehabilitation. The component will involve the following: (i) purchase of

equipment (including but not limited to excavators, rollers, and barges) to upgrade and maintain the dam; and (ii) contracting of works for upgrading portions of the northeast dam including rehabilitation of the embankment and associated irrigation regulators and installation of surveillance equipment. The dam upgrading will include reinforcing areas of critical need and upgrading of sections of the dam including widening and strengthening the dam in accordance with established design and construction standards for dams.

8. *Sub-Component 1.2 – Investments in the East Coast Demerara Drainage System.* The drainage system consisting of a series of canals, culverts and pumps, provides drainage for rainfall and runoff in this area, known as the East Coast Demerara. The poor performance of the system during the 2005 storm directly contributed to the catastrophic impacts of this event. The system has progressively improved since that time. However, it is currently not adequate to drain excess water during annual storm events and to avoid significant damage in more extreme storm events, leading to frequent flooding.

9. The project will work in priority drainage areas along the East Coast Demerara that were identified based on a multi-criteria analysis. The drainage areas identified include: Liliendaal; Ogle; Montrose-Sparendam; Mon Repos-Annandale; Strathspey-Enterprise-Paradise; and Beehive-Clonbrook, all of which are located east of Georgetown along the coast. The project will implement priority investments across several drainage areas in order to target key weaknesses in the system. The specific interventions will be finalized during project implementation based on a long list of prioritized interventions identified using hydraulic modeling under the CAP. The potential interventions include investments to improve pumping capacity, upgrading and constructing culverts, widening and upgrading channels and separating urban and agricultural drainage systems. The proposed investments under this subcomponent are additional pumping capacity in Mon Repos and Enterprise-Strathspey-Paradise drainage areas. These will be pursued subject to confirmation during implementation including completion of the designs, geotechnical analysis and safeguards requirements.

10. *Sub-Component 1.3 - Construction Supervision and Quality Assurance.* This will include the procurement of an experienced consultant team to supervise the construction, supervision and quality assurance for the investments based on the Construction Quality Assurance Plan (see component 2.1). The supervision consultants for the dam works will supervise all works on the northeast dam financed by the Project. The consultants will also report on compliance with the Construction Quality Assurance Plan of those works on the northeast dam financed through other resources during the project period.

11. Component 2: Institutional Strengthening for Flood Risk Reduction (USD 0.5 million) This component is to support the MoA in improving dam safety systems, including preparation and implementation of: (a) the Construction Supervision and Quality Assurance Plan; (b) the Operations, Maintenance and Surveillance Plan; (c) the Instrumentation Plan; and (d) the Emergency Preparedness Plan. It will also finance flood modeling and disaster risk management, drainage and irrigation sector-related communications activities.

12. *Sub-component 2.1 Dam Safety Improvement:* These activities are designed to establish systems for construction, management and maintenance of the EDWC dams and to establish the necessary instrumentation to monitor dam integrity and behavior. It also includes the



development of an emergency preparedness plan in case of dam failure developed through a consultative process among stakeholders and government agencies.

13. **Construction Supervision and Quality Assurance Plan.** The preparation of a Construction Supervision and Quality Assurance Plan that will become part of the scope of works of the Construction Supervision Consultants, the Contractors and the NDIA dam (with approval of the NDIA Board of Directors) for all current and future works on the northeast dam. This activity will review the NDIA construction practices and works on the northeast dam and the proposed construction designs and develop a plan for construction including technical criteria and quality control for use in bidding and supervision. This plan which will contain all performance criteria, standards, methodologies, testing and inspection requirements and protocols will be adopted for all the works to be undertaken in the northeast dam using Project financing and other resources.

14. **Operation, Maintenance and Surveillance (OMS) manual and plan.** This activity will finance consultancies to refine and finalize the EDWC dams OMS manual and plan. It will also finance training to build capacity to inspect, identify and intervene to ensure safe and sustainable operation of the EDWC, and to improve quality and health, environmental and safety standards.

15. **Instrumentation plan for surveillance and forecasting.** This activity includes the procurement of equipment and consultant services needed for: (i) installation and improvement of instruments to monitor and recording dam behavior for all the EDWC dams; and (ii) purchase of instrumentation for expansion of the system of hydro-meteorological data in the EDWC to include upstream watershed areas.

16. **Emergency Preparedness Plan (EPP).** A plan will be developed to specify the roles of responsible parties and procedures to respond in the case of dam failure both from the perspective of dam operations and the response of downstream communities. It will define responsibility for dam operations decision-making and for related emergency communications; elaborate maps outlining inundation scenarios; define flood warning system characteristics; and establish procedures for evacuating threatened areas and mobilizing emergency forces and equipment.

17. *Sub-component 2.2 Support to flood modelling.* This sub-component will support MoA in the use and expansion of the hydrology and hydraulic modelling of the EDWC and coastal drainage system that began under the CAP. In particular, this sub-component will support: (i) hydraulic and hydrologic modelling; (ii) specialized training in hydrology and hydraulic modelling, use of remote sensing tools, and data management; and, (iii) IT support for data management.

18. *Sub-component 2.3 Communications* This activity will support a series of communications activities as part of the MoA's ongoing efforts in the disaster risk management and the drainage and irrigation sectors, including activities implemented under this project. These activities will, among other things, include: (i) public meetings in the project area; (ii) coordination meetings with development partners; and (iii) information materials on the project.

19. Component 3: Project Management and Implementation Support (USD 1.2 million). This component will finance the provision to support the ASDU in the MoA to strengthen and develop their institutional capacity to conduct project management and coordination; implementation, supervision, monitoring and evaluation, including reporting and auditing activities. This sub-component will support: (i) the hiring of specialized staff; (ii) consultants to collect socio-economic data for monitoring and evaluation; (iii) preparation of designs and tender documents for execution and supervision of works, purchase of goods, and contracting of training activities and audits; (iv) consultant services for supervision of contracts; (v) consultants for preparation of technical and financial project reporting, and mid-term and ex-poste evaluation of project activities; (vi) project audits; (vii) contracting of environmental and social safeguard consultants to develop, implement and supervise relevant plans and guide on any mitigation measures; (viii) trainings on areas such as procurement, safeguards, monitoring and evaluation, and financial management to strengthen the ASDU in their role as PIU; (ix) operating costs for the ASDU; and (x) computers and equipment for the ASDU. TORs for ASDU key staff were ready by appraisal and it is expected that hiring process will be advanced by approval.

## **Annex 3: Implementation Arrangements**

### **Guyana: Flood Risk Management Project**

#### **Project Institutional and Implementation Arrangements**

1. *Project administration mechanisms.* The Ministry of Agriculture (MoA) is the lead implementing agency for the project and will have overall responsibility for reporting on fiduciary matters and overall project progress to the Ministry of Finance (MoF) and the World Bank.

2. Agriculture Sector Development Unit (ASDU): Within the MoA, ASDU functions and responsibilities will be: (a) the carrying out of monitoring, coordination and supervision of Project activities; and (b) the fiduciary, procurement, safeguards and administrative aspects of the Project (including but not limited to issuance of the tenders, undertaking financial reporting for the Project, and making payments to contractors based on recommendations from the supervising consultants and overseeing the work of the supervising consultants). Within ASDU, the Project will include an implementation team, with adequate resources, and qualified staff, including a Project coordinator, a senior civil engineer, a financial management specialist, a procurement specialist, and a junior accountant. Additionally, the ASDU will be the focal point to liaise with the relevant stakeholders such as the National Drainage and Irrigation Authority (NDIA), Ministry of Public Works (MoPW), the Regional Democratic Councils (RDCs) and Neighborhood Democratic Councils (NDCs).

3. National Drainage and Irrigation Authority (NDIA): NDIA, under MoA, is the national authority responsible for management and maintenance of drainage and irrigation channels. The main function of the NDIA during this project will be to coordinate with ASDU, the supervising consultant, contractor and all other relevant stakeholders during supervision of the works, including engineering inputs. They will also assume management and maintenance responsibility of the completed structure. These are all consistent with institutional mandates within the MoA and no separate agreements are necessary to formalize this arrangement. NDIA will also undertake works on the northeast dam using resources other than the Bank financing as parallel co-financing. These will be expected to conform to the requirements of the Quality Assurance Plan and will be monitored and reported on by the consultants financed under the Project.

4. Ministry of Public Works (MoPW): For ancillary works that affect sea defense structures, roads and bridges; the Ministry of Public Works (MoPW) will be involved. Their responsibilities will include construction and design approval and coordination with ASDU on supervision. Upon completion of the works, responsibilities will be transferred to the MoPW who will maintain the relevant structures after construction is complete. In cases where these types of works are undertaken, the MoA and the MoPW will sign a MoU outlining the arrangements for the construction design approval and supervision, maintenance and operation of the proposed works.

5. A Project Coordination Committee (PCC) will be convened by the MoA and comprised of relevant departments and agencies including but not limited to NDIA, Civil Defense Commission (CDC), Sea and River Defense Division, MoF, Guyana Environmental Protection

Agency (EPA), Ministry of Public Works and the Hydromet Department . The Committee will have statutory meetings that will be held at a minimum on a quarterly basis and chaired by the Minister of Agriculture with the Permanent Secretary of the Ministry of Agriculture as Deputy Chair. The Chair and/or Deputy Chair will attend the Committee meetings to provide strategic leadership and direction to the Project. The TORs for the Committee, including the membership and meeting frequency, will be included in the Operations Manual (OM).

## **Financial Management, Disbursements and Procurement**

6. *Financial Management Responsibilities:* The Financial management (FM) of the Project will be undertaken by the ASDU which will be staffed by a Project Accountant who will be responsible for the day to day management. The ASDU has considerable experience in implementing the CAP, which had a satisfactory rating for financial management. A financial management capacity assessment of the ASDU was carried out during preparation of the Flood Risk Management Project to ensure that the systems to be used to manage the funds satisfy the Bank's minimum FM requirements under OP/BP10.00, and that they are adequate to provide, with reasonable assurance, accurate and timely information on the progress of implementation of the Project. The assessment concluded that the ASDU has adequate staff with experience in implementing Bank-financed projects and adequate control of environmental rules, procedures and systems. The ASDU is also maintaining a computerized accounting system, which will be able to generate reliable and timely financial reports. To help manage any residual risks, financial management supervision of the Project activities will be undertaken twice in a year. In addition to annual external audit of Project accounts, the internal auditors of the Government will conduct annual internal audits of Project expenditures and share the report with the Bank and external auditors.

7. *Staffing:* Currently, ASDU have a single designated staff responsible for accounting of the World Bank projects. In addition, ASDU is planning to hire a junior accountant, administrative assistant, project coordinator and procurement officer. Training will be provided by the Bank's financial management and procurement specialists as needed. The Bank team will also support strengthening financial management capacity to adequately support the project implementation process.

8. *Budgeting Process.* An annual budget would be prepared by the ASDU on the basis of an annual investment plan developed by the ASDU.

9. *Accounting Policies and Procedures:* ASDU uses a cash basis of accounting and its financial statements are prepared in accordance with International Financial Reporting Standards. ASDU uses Quick Books accounting software for recording transactions, maintaining the books of accounts and producing financial statements. The system allows for the tracking of inflows by sources of funding, and outflows by project component, sources of funding and disbursement category. The same software is being successfully used to support other World Bank finance projects.

10. *Internal Controls and Internal audit:* The project will develop an Operations Manual, which will define the roles and responsibilities for implementing the project activities. The

internal auditors of MoA will conduct internal audit of the project activities and submit the internal audit report to the ASDU, the external auditors and also share the report with the World Bank. Since all transactions are recorded in the Quick Books accounting system, the internal controls associated with that software package are also applied.

11. *Reporting arrangements:* ASDU will be responsible for producing the Interim Financial Reports (IFRs) on a semi-annual basis and submitting them to the Bank. The IFRs will provide required monitoring information and include a narrative outlining the major achievements of the project for the six-month period, the sources and uses of funds, and necessary procurement tables. IFRs will be submitted to the Bank no later than 45 days after the end of each reporting period. The annual financial statements will include the project's sources and uses of funds; a detailed analysis of expenditures; a schedule of withdrawal applications presented during the year, a reconciliation of the Designated Account; the notes to the financial information; and a management representation letter. These reports will be prepared by ASDU and made available to the auditors after the end of each fiscal year.

12. *Auditing Arrangements.* Project financial statements will be audited annually in accordance with International Standards on Auditing and the World Bank's guidelines on auditing. A qualified independent audit firm acceptable to the World Bank will be hired to conduct project audits. The auditors' terms of reference (ToRs) will be prepared by the project and cleared by the World Bank before engagement of the auditor. The ToRs will include an audit of financial transactions; a review of the internal control structure and mechanisms; and a review of the project's compliance with the terms of the financing agreement(s). The annual audit reports will be prepared in a format that is in accordance with ISA and World Bank guidelines, and will include an opinion on the project financial statements, including Designated Account Reconciliation, review of the internal controls, review of the project's compliance with the terms of the financing agreement(s) and a management letter. The project's annual audit report will be submitted to the World Bank for review no later than four months following the end of the fiscal year (January-December).

13. *Disbursement Arrangements and Flow of Funds.* The following disbursement methods will be available under the Project: (a) Advances, (b) Reimbursement, (c) Direct payment and (d) Special Commitment for eligible expenditures for contracts for works, goods and consultant services, and operating costs provided upon request by ASDU to the Bank. The following supporting documentation should be provided with each withdrawal application:

- (a) Interim Financing Reports (IFR) for requests for advances and documentation of expenditures paid from the Designated Account and requests for reimbursement; and
- (b) Records for requests for direct payment: Records of eligible expenditures (e.g. copies of receipts, suppliers/contractors' invoices).

14. As all direct payments will be for contracts subject to prior review by the Bank, it is expected that, at the time of payment request, the contracts would have been reviewed by the Bank and the No Objection issued. A segregated designated account (DA) denominated in United States Dollars and managed by the ASDU will be opened at a Commercial Bank. The

ceiling of the DA will be variable based on the forecast for two quarters as provided in the quarterly Interim Financial Report. The Minimum Application Size for Direct Payments and Reimbursements will be US\$100,000 equivalent.

15. *Supervision Arrangements:* The World Bank will conduct risk-based financial management supervisions, at appropriate intervals. It is expected that in the first year of implementation there will be at least two supervision missions, including the project launch mission. These will pay particular attention to: (i) project accounting and internal control systems; (ii) budgeting and financial planning arrangements; (iii) review of the Interim Financial Reports; (iv) review of audit reports, including financial statements and the remedial actions recommended in the auditor's Management Letters; and (v) disbursement management and financial flows.

16. *Procurement Arrangements.* Procurement for the Project would be carried out in accordance with the "World Bank's Guidelines: Procurement of Goods, Works, and Non-Consulting Services under IBRD Loans and IDA Credits and Grants by World Bank Borrowers, January 2011;" "Guidelines: Selection and Employment of Consultants under IBRD Loans and IDA Credits and Grants by World Bank Borrowers, January 2011;" and the provisions stipulated in the Project's Legal Agreements. The various items under different expenditure categories are described in general below. For each contract to be financed by the Project, the different procurement methods or consultant selection methods, estimated costs, prior review requirements, and time frame are agreed between the Borrower and the Bank in the Procurement Plan. The Procurement Plan would be updated at least annually or as required to reflect the actual Project implementation needs and improvements in institutional capacity. A General Procurement Notice (GPN) in United Nations Development Business (UNDB) and Specific Procurement Notices (SPN) will be published for all international competitive bidding (ICB) procurement and consulting contracts as per Guidelines as the corresponding bidding documents and Requests for Proposal (RFPs) become ready and available.

17. Procurement of Works. Works procured under the Project would consist civil works contracts for flood protection infrastructure, including, inter alia (i) reconstruction of the northeast dam; and (ii) construction of pump stations.

18. Procurement of works will be carried out using ICB. Other methods indicated in the financial agreement (FA) (National Competitive Bidding (NCB), Shopping, DC), could be also used if needed. The procurement will be carried out using World Bank's Standard Bidding Documents and other sample documents and templates, all agreed with the Bank. The procurement methods thresholds and prior review thresholds for Works are indicated in the table below. Domestic preferences in accordance with clause 2.55 and Appendix 2 of the guidelines will not apply.

19. Procurement of Goods and non-consulting services (NCS): Procurement of goods and NCS would include: Purchase of heavy machinery for dam works; and computers and office equipment. Procurement of goods will be carried out using National Competitive Bidding (NCB). Other methods indicated in the FA (NCB, Shopping, DC) could be also used, as needed. The procurement will be carried out using World Bank's Standard Bidding Documents and other

sample documents and templates, all agreed with the Bank. The procurement methods thresholds and prior review thresholds for Goods are indicated in the table below. Domestic preferences will not apply.

20. **Selection of Consultants:** Consultants' services contracts procured under this project will include works supervision and the selection of individual consultants. The following selection methods may be used: Quality and Cost Based Selection (QCBS); Least Cost Selection (LCS); Selection Based on Consultants' Qualifications (CQ); Individual Consultants, and other selection methods indicated in the FA. The selections will be done using the Bank's Standard RFP and other sample documents and templates, all agreed with the Bank. Short lists of consultants for services estimated to cost less than US\$100,000 equivalent per contract may be composed entirely of national consultants in accordance with the provisions of paragraph 2.7 of the Consultant Guidelines.

21. **Retroactive financing:** The Ministry of Finance has indicated that it is planning on seeking access to allowable retroactive financing.

22. **Procurement Plan.** The procurement plan for implementation of the proposed Project for the first 18 months dated April 9, 2014, was agreed between the Borrower and the Bank team before negotiations. Summary of the procurement with larger international contracts to be financed under the project is presented below in Table 1. The plan shall be available at web address <http://worldbank.org/procure> within 30 days of the signature of the FA. It would be updated annually and the updated procurement plan shall be disclosed on this website after clearance by the Bank.

**Table 1: Summary Procurement Plan**

<b>Contract Type</b>	<b>Contract Name</b>	<b>Estimated Cost (US\$)</b>	<b>Procurement Method</b>	<b>Review by Bank (Prior / Post)</b>	<b>Estimated date of award</b>
<b>Consulting Services</b>	Supervision of works: Reconstruction of Northeast Dam	350,000	QCBS	Prior	July 2, 2015
<b>Consulting Services</b>	Supervision of works: Construction of Pump Stations	270,000	QCBS	Prior	January 3, 2015
<b>Consulting Services</b>	Audit services	85,000	LCS	Prior	June 15, 2015
<b>Civil works</b>	Construction of North Eastern Dams	2,000,000	ICB	Prior	July 2, 2015

<b>Contract Type</b>	<b>Contract Name</b>	<b>Estimated Cost (US\$)</b>	<b>Procurement Method</b>	<b>Review by Bank (Prior / Post)</b>	<b>Estimated date of award</b>
<b>Civil works</b>	Construction, Pump Stations: Lot 1- Lusignan, East Coast Demerara, Region No. 4; Lot 2- Buxton, East Coast Demerara, Region No. 4; Lot 3 -Hope/Enmore, East Coast Demerara, Region No. 4	5,500,000	ICB	Prior	Jan 3, 2015
<b>Goods</b>	Supply and Delivery of Earth Moving Equipment	2,000,000	ICB	Prior	May 16, 2015

23. The recommended thresholds for the use of the procurement methods specified in the FA are identified in Table 2 of this Annex as the basis for the agreed procurement plan. Supervision of procurement would be carried out through prior review supplemented by supervision missions with post review at least once a year.



**Table 2: Thresholds for Procurement Methods and Prior Review**

Expenditure Category	Contract Value (Threshold) US \$ thousands	Procurement Method	Contracts Subject to Prior Review
<b>1. Works</b>	>1,500	ICB	All
	100-1,500	NCB	The first contract and each contract more than US\$750,000
	<100	Shopping	The first contract
	Regardless of value	Direct Contracting	All
<b>2. Goods</b>	>150	ICB	All
	25-150	NCB	The first contract
	≤25	Shopping	The first contract
	Regardless of value	Direct Contracting	All
<b>3. Consulting Services</b>			
<b>-3.A Firms</b>	≥100	QCBS, QBS, FBS, LCS	All
	<100	QCBS, QBS, FBS, LCS, and CQS	The first contract
	Regardless of value	Single Source	All
<b>-3.B Individuals</b>	≥ 50	Comparison of 3 CVs in accordance with Chapter V of the Guidelines	All
	<50		None

Note: ICB = International Competitive Bidding - NCB = National Competitive Bidding

QCBS = Quality- and Cost-Based Selection - QBS = Quality-Based Selection

FBS = Fixed Budget Selection - LCS = Least-Cost Selection

CQS = Selection Based on Consultants' Qualifications

### **Environmental and Social (including safeguards)**

24. *Environmental and Social Assessment Management Framework.* As the investments under the project have not been fully identified and the designs not finalized, a scoping of the types of environmental and social impacts expected from civil works undertaken as part of the EDWC dams and drainage system, and the East Coast Demerara drainage system was undertaken. This impact assessment formed the basis for an Environmental and Social Management Framework (ESMF), that included a process for sub-project screening and a delineation of the Environmental Assessments (EAs) and/or Environmental Management Plans (EMPs) appropriate to the types and scale of the impacts. Environmental and Social safeguard documentation complies with both World Bank safeguards policies and Guyana's national policies. Sub-project EAs, EMPs, RAP's will be prepared, implemented, and monitored during the project implementation phase.

25. *Anticipated Impacts.* In general, impacts for the type of work anticipated under the project are expected to be moderate in nature and will be managed through the application of appropriate engineering and management measures.

26. Of particular importance is that impacts to the biophysical and socio-economic environments are expected to be limited in nature, as much of the EDWC dams and drainage system, and the East Coast Demerara drainage systems are located in areas that have already been subjected to significant human interventions. Although the EDWC is a man-made structure, it serves as a habitat to caiman, giant otters, and bats. Numerous species of birds nest in or migrate through the EDWC, including Muscovy Ducks, Blue-winged Teal, Pied-billed Grebes, Cormorants, Stripe-backed Bitterns, Egrets, Vultures, Snail Kites, and Great Kiskadees. Nevertheless, given the vast area of the uninhabited EDWC, the localized and short-term works proposed will not significantly affect fauna and avi-fauna, as there are large areas providing refuge to these species away from project works. Moreover, the proposed project will not result in significant degradation or conversion of natural habitats, given that the works are limited to the upgrade and rehabilitation of existing structures. Care will be taken to schedule civil works to avoid key breeding and nesting periods, as necessary. All construction sites will be rehabilitated and re-vegetated with native shrubs and trees. Re-vegetation will be undertaken along embankments and contiguous areas after works are completed. Given that the project may affect roads and bridges, road safety measures and traffic diversion plans will be adopted, and any construction waste will be disposed of appropriately, following measures delineated in the ESMF.

27. Impacts specific to potential works and proposed mitigation measures are outlined below.

28. Dam reconstruction, and widening and improving connectivity of internal channels: In addition to the management of construction impacts such as noise, management of construction waste and debris, and worker safety, some low to moderate impacts of the dam reconstruction are related to the management and rehabilitation of the clearing of vegetation during construction and maintenance so as to maintain its role to prevent erosion and as a natural habitat. The dam reconstruction may also involve very minor impacts on grazing lands and irrigation activities that can be prevented or mitigated.

29. Safety upgrading of water control structures: The impacts of these works are primarily related to the management of construction impacts such as noise, waste and debris management and worker safety.

30. Pump Stations (expansion, upgrading and installation): In addition to the management of construction impacts such as noise, waste and debris management and worker safety these works are anticipated to have low to moderate impacts related traffic disturbance in some areas and noise and air pollution during operation. A small amount of temporary or permanent land acquisition may also be necessary for which Resettlement Action Plans will be developed prior to sub-project financing in accordance with the Resettlement Policy Framework (RPF).

31. Upgrading and construction of new embankments, channels and culverts for the coastal drainage systems: In addition to the management of construction impacts such as noise, waste and debris management and worker safety the works are expected to have low to moderate impacts related to traffic disturbance in some areas and related to the management and rehabilitation of the clearing of vegetation during construction and maintenance so as to maintain

its role to prevent erosion and as a natural habitat. A small amount of temporary or permanent land acquisition may also be necessary for the East Coast Demerara drainage area for which land acquisition plans will be developed prior to sub-project financing in accordance with the RPF.

32. Sluice upgrading and channel widening for EDWC drainage to the Demerara River: In addition to the management of construction impacts such as noise, waste and debris management and worker safety and the aforementioned vegetative rehabilitation, the works are anticipated to have moderate impacts related to traffic disturbance and land acquisition. Depending on the design, it may affect the traffic along the East Bank Demerara Public Road, which is a main throughway along the Demerara River. In addition, widening and upgrading the channel may involve land acquisition from primarily industrial land, which will be addressed in accordance with the RPF.

33. *Applicable Safeguards Policies.* Based on this scoping the following World Bank safeguards policies were triggered: Environmental Assessment (OP/BP 4.01); Natural Habitats (OP/BP 4.04); and Involuntary Resettlement (OP/BP 4.10) are likely to apply to individual subprojects. In addition, Physical Cultural Resources (OP/BP 4.11) is triggered. While activities to be carried out under the Project are not expected to impact any known cultural heritage sites, technical specifications for works will include "chance find procedures" to be followed in the event that culturally significant materials are discovered during the execution of civil works.

<b>Safeguard Policies Triggered by the Project</b>	Yes	No
<a href="#">Environmental Assessment (OP/BP 4.01)</a>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Natural Habitats ( <a href="#">OP/BP 4.04</a> )	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Pest Management ( <a href="#">OP 4.09</a> )	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Indigenous Peoples ( <a href="#">OP/BP 4.10</a> )	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Physical Cultural Resources ( <a href="#">OP/BP 4.11</a> )	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Involuntary Resettlement ( <a href="#">OP/BP 4.12</a> )	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Forests ( <a href="#">OP/BP 4.36</a> )	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Safety of Dams ( <a href="#">OP/BP 4.37</a> )	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Projects on International Waterways ( <a href="#">OP/BP 7.50</a> )	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Projects in Disputed Areas ( <a href="#">OP/BP 7.60</a> )	<input type="checkbox"/>	<input checked="" type="checkbox"/>

34. OP/BP 4.37 – Safety of Dams is also triggered by the project. The embankment dams for the EDWC are all significantly less than 10 meters in height. They therefore are defined as small dams under OP 4.37. However, because the EDWC has an extensive surface area; provides water and protects a significant population from flooding; is adjacent to natural habitats along the adjoining rivers; and there is a risk of significant adverse impacts due to potential failure of the dam on local communities and assets, the policy was considered triggered under the project.

35. As part of the Conservancy Adaptation Project, an evaluation of the EDWC dams was undertaken covering the safety status, performance history and operation and maintenance procedures. Necessary remedial work and safety-related measures were identified in order to upgrade the safety status of the dam including immediate priority works on the northeast dam for which the Project will be providing financing (see Annex 6 for details).

36. The task team has agreed on appropriate safety measures with the Borrower, considering the importance of the EDWC system in flood risk management and water supply. Basic

monitoring instruments such as piezometers, settlement monuments and gauging stations are included in the engineering design. The works will be undertaken by qualified engineers with experience in these types of works and the construction quality, cost and time control will be supervised by qualified engineers.

37. In order to ensure the works quality of the rehabilitation of the EDWC northeast dam and sustainability of all EDWC dams, the following plans will be prepared and/or revised: (a) a Plan for construction supervision and quality assurance; (b) an Operation, Maintenance and Surveillance (OMS) Plan; (c) an Instrumentation Plan; and (d) an Emergency Preparedness Plan (EPP). Details are provided below.

38. Construction Supervision and Quality Management. The approach to construction supervision and quality management of ASDU and NDIA was reviewed during preparation and an improved approach was agreed. ASDU and NDIA had proposed to follow the same approach to construction supervision and quality management as was undertaken in ongoing and previous works. During preparation this planned approach was reviewed in order to assess the need to adjust it and to provide support during implementation to ensure that dam-safety-related elements of the design are implemented during construction. The review covered the planned organization, staffing, and equipment for supervision of the works. The proposed construction methodology and technical specifications that would form the basis for the supervision of the dam safety aspects were also reviewed along with the qualifications and equipment needed for supervision.

39. The organizational approach was adjusted to improve staffing, to include the use of a consulting firm with expertise in dam construction for supervision and to improve accountability and eliminate potential conflicts of interest in the contractual arrangements. The approach is described under the institutional arrangements and monitoring and evaluation section. The project also includes the necessary budget for supervision and quality assurance. To raise the standard of the approach for construction, supervision and quality assurance, the agreed changes will be included as part of the plan for construction supervision and quality assurance that will guide the recruitment of the construction supervision consultants for the dam works and will be completed before construction starts. A draft TOR for this update has been developed.

40. Operation, Maintenance and Surveillance (OMS) Plan. This Plan addresses the procedures and practices for the EDWC dams and affiliated structures - the operation, maintenance, monitoring and inspection required to ensure safe and sustainable operations. This plan will cover organizational structure, staffing, technical expertise, and training required; equipment and facilities needed to operate and maintain the dams; operation and management (O&M) procedures including standing operating procedures (SOP); and arrangements for funding O&M, including dams maintenance and safety inspections. An OMS Plan was prepared by an international consultant based on the existing O&M practices and dam improvement design. The existing OMS will be refined and finalized during project implementation before completion of the works.

41. Instrumentation Plan. The dam improvement design already prepared by the international consultants includes basic dam monitoring instruments. This will be elaborated as a plan before

bidding of the works and included as part of the construction technical specifications. These instruments will be procured and installed as part of the construction contract to monitor and record the behaviors of the EDWC dams. In addition, essential hydrometeorological stations required for dam and affiliated structures operations and flood emergency management, will be procured and installed under the project.

42. Emergency Preparedness Plan (EPP). This is required to improve the preparedness and resilience of the communities and assets in the influence zone, and reduce the related damages and losses in the cases of extraordinary floods in the catchment of EDWC and in the event of EDWC dam failure. The GoG team has drafted a TOR that will be used for recruiting consultants to develop the EPP. The plan will specify the roles of responsible parties when dam failure is considered imminent, or when expected operational flow release threatens downstream life, property, or economic operations. It includes the following items: clear statements on the responsibility for dam operations decision making and for the related emergency communications; maps outlining inundation levels for various emergency conditions; flood warning system characteristics; and procedures for evacuating threatened areas and mobilizing emergency forces and equipment. The ASDU will liaise with CDC for the preparation of this plan.

43. *Safeguards Compliance Procedure during Implementation*. As subprojects are finalized, the following process will be undertaken:

44. Screening: For each of the subprojects, screening will be undertaken based on an analysis of impacts, World Bank safeguards policies and Guyana National Legislation. On that basis requirements for an Environmental Impact Assessment (EIA) and/or an Environmental Management Plan (EMP) and Resettlement Action Plan (RAP) will be identified.

45. Preparation of Documentation: After screening of the subproject, the EMP, EIA and/or RAP will be prepared in order to analyze and develop mitigation measures for any impacts identified. RAP's will need to be submitted and cleared by the Bank, and associated compensation paid, prior to sub-project financing.

46. Review and clearance: In addition to the issuance of the environmental permit by the EPA, the ASDU will be in charge of assessing whether the draft EIA/EMP responds adequately to the requirements of this framework. The World Bank will undertake review of the implementation of the framework including the quality of the EMPs as part of the regular supervision.

47. Implementation: The applicable mitigation measures identified in the EIAs/EMP(s) will be incorporated into the bidding and contract documents. ASDU and the contracted construction supervisor will supervise the implementation of the provisions related to the mitigation measures. RAPs will be implemented by the MoA. Projects will commence works only after sub-project RAPs have been cleared by the Bank and compensation has been paid.

48. Consultation and Disclosure: Consultations will be undertaken as part of the development of the subproject documentation, and consultations will be held with concerned stakeholders

prior to approval of the individual EA/EMP. In addition, a mechanism for grievance redress will be included in the EMP to allow for feedback during its implementation. This framework and the individual EMPs as they become available will be made available to the public through ASDU.

49. Grievance procedures: Grievances will be addressed first through discussions between the affected persons and the ASDU. If consensus is not agreed, a mediator will be appointed from an agreed list of suitable persons, and finally if parties fail to concur, the matter will go through the courts. The procedure is delineated in the ESMF. The RPF outlines a process of grievance redress related to land acquisition.

50. Monitoring and Reporting: Supervision reports for individual works and consolidated bi-annual reports will be developed. The World Bank team will supervise implementation of the agreed plans during regular missions to Guyana twice a year

51. Training and Capacity Building: A training and capacity building program will complement the implementation of the Environmental and Social Assessment Framework and the RPF. The World Bank team will supervise implementation of the agreed plans during regular missions to Guyana twice a year.

52. *Borrower's Capacity to Implement Safeguards.* The agency responsible for the overall implementation of the Project is the ASDU within the MoA; consequently, management and/or mitigation of the potential environmental and social impacts will be implemented by the MoA by the contractors and monitored by the MoA. Technical staff from the NDIA and ASDU will be assigned to the Project to oversee the implementation of the RPF and to supervise activities carried out during preparation and implementation of the civil works.

53. Capacity to prepare safeguard documentation and adequately report on safeguards implementation is acknowledged to be limited. However, in the actual implementation of safeguards (such as re-vegetation and rehabilitation of riverbanks, disposal of construction waste) surveys of ongoing works in late 2013/early 2014 indicate that appropriate environmental mitigation measures are largely followed, especially taking into account that the project area is already subject to a high level of human intervention. The Guyana Amazon Tropical Birds Society and the Environmental Protection Agency confirmed in late 2013 that, in their opinion, the EDWC has been sustainably managed.

54. *Consultations and Disclosure of Safeguards Documents.* Consultations on the ESMF were held with concerned stakeholders on March 7th, 2014. Minutes of these consultations will be incorporated into the ESMF, along with any suggested revisions to the ESMF, as appropriate. Thereafter, the ESMF will be disclosed in the Infoshop and on the MoA's website prior to the start of appraisal. The RPF was publicly disclosed by appraisal.

## **Monitoring and Evaluation**

55. The results framework in Annex 1 would be used to monitor and evaluate the achievement of the PDO and the outcome indicators. Project monitoring will be undertaken by

ASDU as part of their daily activities and maintenance of records. They will provide quarterly financial reporting, bi-annual project progress reporting and annual audits.

56. Thematic areas that would be supervised and monitored include the following: (i) Social and Environmental safeguards monitoring; (ii) monitoring and quality assurance of construction contracts; (iii) monitoring and quality assurance of studies and plans; and (iv) physical and financial progress monitoring.

57. Social and Environmental Monitoring: This would comprise monitoring compliance with environmental and social safeguards including the Environmental and Social Assessment Management Framework, and as appropriate environmental management and resettlement action plans. This will be undertaken by the ASDU based on their internal processes and inputs from construction supervision.

58. Monitoring and Quality Assurance of Construction Contracts: As the works will involve the upgrading of an important dam and the construction of drainage infrastructure, supervision will need to be undertaken to ensure quality and timeliness of the works. These will be done in accordance with the Construction Management Quality Plan. Consultants qualified in construction of this type will be hired to review design, qualifications and the implementation of construction. The supervision for the dam works will cover all works undertaken in the northeast dam during the project period both using project financing and those undertaken using other resources. They will report regularly to NDIA and ASDU on the status of the works, results of their review, and changes made.

59. Monitoring and Quality Assurance of Studies and Plans: As with the supervision of the works, ASDU will hire qualified consultants to review the studies and plans developed under the Project. The firm will review the TORs and the outputs of the plans, studies and training financed under the Project. They will report regularly to ASDU on the results of their review.

60. Periodic Physical and Financial Progress Monitoring: Physical progress monitoring would be carried out by the ASDU supervisors on a monthly basis. ASDU would in turn share the reports on a monthly basis with the World Bank. Financial progress would be reported by the ASDU through the quarterly IFRs.

61. Overall responsibility for monitoring and evaluation of the Project would lie with ASDU that would consolidate all reports and report to the Bank on performance indicators defined for the Project, on the Project's progress and execution, quality control and environmental and social safeguards. The Project's OM would provide specific details regarding monitoring and evaluation responsibilities, including data collection requirements, timing, and use of the information.

### **Dam Safety and Quality Assurance and Quality Control**

62. Before bidding of equipment and works begins, a Construction Quality Assurance Plan will be prepared that will become part of the scope of works of the Construction Supervision Consultants, the Contractors and the NDIA for works on the northeast dam. This plan which will

contain all performance criteria, standards, methodologies, testing and inspection requirements and protocols will be adopted for all the works to be undertaken in the northeast dam both by NDIA (with approval of its Board of Directors) through parallel co-financing and through project financing.

63. To ensure the quality of the rehabilitation works and safe operation of all EDWC dams, the dam safety plans will be prepared during the project preparation and implementation stages respectively. This includes the Instrumentation Plan which forms part of the engineering design; the initial outline of the Operation, Maintenance & Surveillance (OMS) plan and the Emergency Preparedness Plan (EPP). These will be fully developed, finalized and reviewed before the completion of dam rehabilitation.

### **Coordination and Communication with Other Government Agencies and Donors**

64. As many Government agencies work on issues related to flood prevention and disaster risk management in the country, the Project Management Committee (see Project Institutional and Implementation Arrangements for full description of composition and role of the Project Coordination Committee) will be used to communicate and coordinate project activities, in addition to their role in providing strategic direction under the project. Dissemination and communication will also be done with donors working in drainage, flood protection and disaster risk management such as the IDB, EU, and JICA.

### **Operations Manual**

65. A Project Operations Manual (OM) will be developed for the project to describe the operations of the Project. The purpose of the OM is to provide an ordered set of instructions on the organization, procedures, and resources dedicated to the efficient and effective achievement of the aims of the Project. The operations manual is intended to achieve the following objectives:

- a. To enable stakeholders to understand the scope, content, organization, and activities of the project;
- b. To indicate the performance expected of the management, operating, support, and beneficiary personnel;
- c. To ensure that the requirements for transparency, equity, compliance and accountability are met; and
- d. To guide the operations of the functions to be performed under the project to ensure consistency, timeliness and accuracy of information.

66. The OM will elaborate the responsibilities and processes under the project including financial management; disbursements; procurement; environmental and social safeguards; monitoring & evaluation; technical supervision and quality control including dam safety; and coordination and communication. The manual's contents and procedures are to be made consistent the Project Appraisal Document (PAD) and the financing arrangements between the Government of Guyana and the World Bank.



67. In line with Bank guidelines and following good practices in the Caribbean sub-region, the GoG drafted an OM by appraisal. The draft OM would be a condition of negotiations and it is expected that the final OM will be a dated covenant.

## Annex 4: Operational Risk Assessment Framework (ORAF)

### Guyana: Flood Risk Management Project

#### Risks

Project Stakeholder Risks						
Stakeholder Risk	Rating	Moderate				
<p>Risk Description: As flood protection is a high profile issue in Guyana, Press attention, positive and negative is likely related to the flood prevention measures of GoG in general. As the Project itself will carry out works perceived as necessary infrastructure improvements, the particular works under the project are not likely to provoke major resistance among the population.</p> <p>There is some chance of resistance from stakeholders near the project works site, due to impacts of construction activities or land ownership issues relating to East Coast Demerara drainage works.</p>	<p><b>Risk Management:</b> Under the Conservancy Adaptation Project, communications were effective in engaging the media and stakeholders on the process and results. The materials developed will continue to be useful and under the new project, workshops and other materials will be used to reach out to the media and stakeholders on the work going on in the project and on flood protection in general.</p> <p>For stakeholders near the project area, affected communities will be consulted and informed through the environmental assessment process and for works necessitating land acquisition and resettlement will be managed through the development of a Resettlement Policy Framework with consultations with affected stakeholders held on the compensation plans developed.</p>					
	Resp: Client	Status: Not Yet Due	Stage:	Recurrent:	Due Date: During	Frequency: Continuous

					implementation	
<b>Implementing Agency (IA) Risks (including Fiduciary Risks)</b>						
<b>Capacity</b>	Rating	Substantial				
<p>Risk Description:</p> <p>Poor implementation capacity including limited capacity in procurement could delay project execution.</p> <p>Capacity constraints related to meeting standards for dam construction and adopting modern surveillance systems may reduce the quality of the interventions.</p>	<b>Risk Management:</b>					
	<p>The project includes financing of qualified procurement and other technical staff in ASDU, and regular World Bank training will be provided to ensure that there is knowledge of World Bank procedures.</p> <p>The project will include a supervision consultant to oversee the dam construction and the Bank will have a dam safety specialist on the team. It will also include technical assistance and equipment and continuous training to ensure adoption of surveillance systems.</p>					
	Resp: Both	Status: Not Yet Due	Stage: Both	Recurrent:	Due Date:	Frequency:
<b>Governance</b>	Rating	Moderate				
<p>Risk Description:</p> <p>Operational responsibilities for drainage and the EDWC under NDIA have some autonomy from MoA and there is a risk that work by the ASDU and decisions by MoA may conflict with actual implementation by NDIA on the ground.</p>	<b>Risk Management:</b>					
	<p>During preparation the project has proactively involved NDIA as part of the project to ensure good coordination and a role in the project. This will continue during implementation</p>					
	Resp: Both	Status: Not Yet Due	Stage: Both	Recurrent:	Due Date:	Frequency:
<b>Project Risks</b>						
<b>Design</b>	Rating	Moderate				
<p>Risk Description:</p> <p>As the project will not eliminate the risk of catastrophic flooding, there is a risk that an incident will occur causing damage to the works and</p>	<b>Risk Management:</b>					
	<p>The execution of the works in a timely manner and engagement in planning and monitoring under the project as well as engagement with other donors to leverage the investments will be part of the project.</p>					
	Resp: Both	Status: Not Yet Due	Stage: Both	Recurrent:	Due Date:	Frequency:

discrediting the results of the project.						
<b>Social and Environmental</b>	Rating	Moderate				
Risk Description: The Project is a category B - Partial Assessment - assigned to projects that are likely to have localized, limited and reversible environmental impacts that can be mitigated. The Project will have a largely positive social and environmental (health and safety) impact.  Land acquisition and resettlement issues related to the East Coast Demerara drainage works may cause delays.	<b>Risk Management:</b> An Environmental and Social Management Framework (ESMF) was prepared along with environmental assessment documents for the first year's investments.  A Resettlement Policy Framework (RPF) was prepared for affected areas during the project in case an issue arises during preparation of the drainage works.					
	Resp: Both	Status: Not Yet Due	Stage: Both	Recurrent:	Due Date:	Frequency:
<b>Program and Donor</b>	Rating	Moderate				
Risk Description: Insufficient donor coordination and funding could delay progress on other needed investments in drainage and reduce the effectiveness of disaster risk management planning.	<b>Risk Management:</b> The Bank team with ASDU and MoF will work in close coordination and collaboration with other development partners/donors (and particularly IDB, JICA and the EU) to communicate the results of the project including the investment opportunities identified under the Conservancy Adaptation Project.					
	Resp: Both	Status:	Stage:	Recurrent:	Due Date:	Frequency:
<b>Delivery Monitoring and Sustainability</b>	Rating	Moderate				
Risk Description: The EDWC and East Coast drainage systems require ongoing maintenance and support from the GoG. There is a risk that support will be withdrawn.	<b>Risk Management:</b> Assurances will be made at project inception that the GoG will allocate sufficient resources to maintain the improvements being made under the project.  The financing for maintenance of the drainage system comes primarily from annual government appropriations which have increased in recent years and funding through the water user associations benefitting from irrigation services provided by the drainage system are also being developed as a result					

<p>The adoption of the planning instruments of the TA component could be limited by the capacity and interest of MoA in planning and modelling.</p>	<p>of the IDB Agricultural Support Services Project. The dam maintenance is financed through general government appropriations which have increased in recent years and through user fees from irrigation services and for water supply.</p> <p>The engagement under the planning component will be done with active engagement of NDIA to allow them to learn to use them as tools in their work. The results of the planning will be communicated at the level of decision makers to ensure it is considered in decision making.</p>					
	Resp: Both	Status: Not Yet Due	Stage: Both	Recurrent:	Due Date:	Frequency:

**Overall Risk**

**Risk Description: Moderate**

**Annex 5: Implementation Support Plan**  
**Guyana: Flood Risk Management Project**

**Strategy and Approach for Implementation Support**

1. The purpose of this Implementation Support Plan (ISP) is to elaborate the inputs and actions required to facilitate timeliness, quality of outputs and increased institutional development, while ensuring compliance with the Bank’s fiduciary, safeguards and other obligations under the financing agreement. In particular, emphasis is placed on monitoring and evaluation results on the ground, facilitating the timely implementation of risk mitigation measures identified in the ORAF, and providing the necessary technical advice to the MoA to ensure quality of works, build capacity and promote project implementation. In particular, because of the importance of international dam safety practices and complexity of the civil works and water resources planning tools, experts in this field, unless they are residents of Guyana, they will need to make frequent trips to Guyana. In addition, communication of results and coordination with donors will necessitate a communications specialist. The ISP described below would be reviewed on an annual basis as part of Implementation Supervision Missions, and revised as necessary to ensure that it continues to meet the implementation support needs of the project.

**Implementation Support Plan**

2. Table 5.1 below indicates the main areas of implementation support during different phases of the project.

**Table 5.1: ISP Matrix**

<b>Time</b>	<b>Focus</b>	<b>Skills Needed</b>	<b>Resource Estimate</b>	<b>Partner Role</b>
First twelve months	Project start-up, execution of Procurement Plan, hiring of auditors, bidding for implementation of dam works and associated technical assistance, identification and preparation of drainage works investments. Communication of results of CAP project; Donor coordination;	Task team leader Procurement Specialist FM Specialist Dam expert Environmental Specialist. Social specialist Civil Engineer Communication specialist Water resource specialist	6 weeks 2 weeks 1 week 4 weeks 2 weeks 1 week 3 weeks 6 weeks 3 weeks	Coordination with Donors
12-24 months	Contracting and execution of dam works and technical assistance; Bidding of drainage works. Training and communication. Donor coordination;	Task team leader Procurement Specialist FM Specialist Dam expert Environmental Specialist. Social specialist Civil Engineer Communication specialist Water resource specialist	6 weeks 3 weeks 1 week 3 weeks 1 week 1 week 3 weeks 3 weeks 6 weeks	Coordination with Donors
24-48 months	Completion of dam and drainage works;	Task team leader Procurement Specialist	6 weeks/yr 1 week/yr	Coordination with Donors

	Completion of technical assistance and dissemination; Training and communication; Donor coordination;	FM Specialist Dam expert Environmental Specialist. Civil Engineer Social specialist Communication specialist Water resource specialist	2 weeks/yr 4 weeks/yr 1 weeks/yr 2 weeks/yr 1 week/yr 5 weeks/yr 5 weeks/yr	
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*Skills Mix Required*

<i>Skills Needed</i>	<i>Number of Staff Weeks</i>	<i>Number of Trips</i>	<i>Comments</i>
Task Team Leader	24	10	
Procurement Specialist	7	10	
FM Specialist	6	4	
Dam safety	15	10	
Environ. Specialist	5	4	
Social specialist	4	4	
Civil Engineer	10	8	
Communications Specialist	19	5	
Water Resource Specialist	19	5	

*Partners*

<i>Name</i>	<i>Institution/Country</i>	<i>Role</i>
NA	IDB	Donor Coordination
NA	European Union	Donor Coordination
NA	JICA	Donor Coordination

## **Annex 6: Results of Conservancy Adaptation Project Guyana: Flood Risk Management Project**

1. The Conservancy Adaptation Project (CAP) was designed to help Guyana adapt to climate change by reducing the vulnerability of the low-lying coastal areas to catastrophic flooding. The CAP, a Global Environment Facility-Special Climate Change Fund grant of US\$ 3.8 million that was developed after the devastating 2005 flood and implemented from 2007 until 2013. The fundamental focus of the project was to reduce flood disaster risk and responded to the need to develop a technical baseline as a basis for making rational investment decisions. On this basis, the project design emphasized understanding the hydrological behavior of the EDWC and East Coast Demerara drainage systems, and the technical stability of the EDWC dams in order to identify investment options. It also undertook some priority works and purchased equipment to reduce vulnerability of the system to catastrophic flooding.

### **I. PROJECT COMPONENTS**

2. *Pre-investment studies for engineering works:* This component aimed to strengthen understanding of the EDWC and coastal plain drainage systems and identify key areas for follow-on intervention. A hydrological engineering foundation was created using a combination of state of the art aerial surveys and *in-situ* monitoring techniques.

- a. Detailed aerial surveys of the area using LiDAR technology and ortho-photography have been used to produce a high-resolution topographic map suitable for understanding water flow over the relatively flat terrain. These aerial surveys have been accompanied by extensive ground-based surveys to establish channel profiles and water depths.
- b. A new hydro-meteorological monitoring system has been installed in and around the EDWC, and flow measurements have been carried out to help understand the hydrological behavior of the EDWC system.
- c. Computer models of the EDWC system and East Coast Demerara drainage areas have been set up to help understand how the hydrological system varies under extreme weather scenarios and for testing the impact of various proposed interventions.

3. The CAP modelling studies has identified strategic key areas where interventions would provide improvements to the EDWC discharge capacity and East Coast Demerara drainage systems. A set of prioritized investments were identified that would significantly reduce the vulnerability of the system to sea level rise and extreme rainfall.

4. *Investments in specific adaptation measures:* The CAP funded specific infrastructure investments aimed at helping manage water levels in the EDWC and increase drainage capacity. In particular the two sluices at Lama, on the eastern side of the EDWC, were rehabilitated helping to lower water levels in times of need, and a pontoon and hydraulic excavator were purchased under the project, to make it easier and faster to reach areas of the dam in need of



repair.

5. *Institutional strengthening:* Training has been provided in hydro-meteorological monitoring, use and application of LiDAR datasets, data management and computer-based hydrological modelling. Furthermore, a series of workshops have brought together various government agencies involved in the management of the complex drainage system, as well as stakeholders, donors, practitioners and others, to ensure broader consensus and coordination on future action.

## II. KEY TECHNICAL ACHIEVEMENTS

6. *Hydrological Data Collection:* To thoroughly understand the hydrological behavior of the drainage system, an extensive network of automatic hydro-meteorological instrumentation has been installed at several locations in and around the EDWC. Instrumentation is programmed to send data regularly to an online central database using a telemetry system, making it easier and more efficient to manage water levels in the EDWC on a near real-time basis. Text message warnings can also be sent to mobile phones when the water levels are too high. The instrumentation is composed of rain gauges, water-level sensors and a current profiler.

7. *LiDAR and Bathymetric Surveys:* Detailed topographic and land-use maps are needed in addition to hydro-meteorological data in order to better define the drainage areas, storage capacity and depth of the EDWC more accurately. In the CAP, these were obtained using a combination of LiDAR, bathymetry and aerial photography.

- a. LiDAR (Light Detection And Ranging) is an airborne laser mapping and altimetry system which produces accurate and spatially geo-referenced land elevation data. It works by sending a laser light signal to the ground and measuring how long the pulse takes to return. For the CAP, LiDAR was flown over the EDWC, East Coast Demerara and Georgetown area, covering 1100 km<sup>2</sup>. A vertical accuracy of  $<\pm 9$  cm at the 95% confidence limit was achieved. A DEM was produced using the LiDAR data and was supplemented by aerial photography, collected at the same time as the LiDAR data.
  - b. Bathymetric surveys: The LiDAR beam does not penetrate water surfaces, so to understand the depths in different parts of the EDWC, LiDAR data was supplemented with extensive bathymetric surveys. Bathymetry is the measurement of underwater relief (depth). In the CAP, depths of areas of standing water were measured manually from a boat, along a 500 m grid across the whole of the EDWC and with a portable echo-sounder.
8. These datasets provide essential baseline information and have many uses, e.g. topographic data is necessary for land-use and drainage planning, preliminary designs for infrastructure projects and flood risk management, and will help decision makers to manage Guyana's water-resources.

9. *Modelling of the EDWC:* Computer models were developed to test how the system works under different climate or land-use scenarios. A hydrological model was used to provide the inputs necessary for running a hydraulic model which gave a two-dimensional representation of the EDWC system. To set up the models, data on topography, land use, soil types and properties, water-ways and infrastructure was provided from LiDAR and other surveys. To run and calibrate the models, inputs such as rainfall, climate data, and river flow, were obtained from the hydro-meteorological monitoring system and existing tidal datasets. The models were run for rainfall return periods of 50, 100, 1000 and 10,000 years, with storm-durations of up to 40 days. The models were calibrated and validated using historical data collected during the 2005 floods and new data collected during the CAP. The calibrated models were used to undertake the following simulations:

- a. Under 2005 conditions, where only the Land of Canaan sluice was the only relief channel that could drain water into the Demerara river;
- b. Under current conditions, with the Cunha and Kofi sluices operational; and
- c. Under near-future conditions with the new Northern Drainage Relief Channel operational, draining into the Atlantic Ocean.

10. The results of the models show that in 2005, even a 50-year rainfall event would have meant that water-levels throughout most of the EDWC would have been above the safe operating level of the dam. However, the improvements made since 2005 have reduced this risk, except along parts of the northern perimeter dam. The models also showed that with the Northern Drainage Relief Channel drainage from the EDWC will be able to avoid overtopping even in extreme 10,000 year rainfall event (an event much more severe than in 2005). It will also allow water levels in the EDWC will also be maintained below safe operating levels for less severe events, however will remain above safe operating levels for events more severe than a 50 year storm event.

11. The models were also able to test the impact of potential new interventions aimed at improving drainage capacity in the EDWC. The models show that water levels in the EDWC are generally shallowest in the vicinity of Land of Canaan. Increasing the conveyance of internal channels combined with increasing the discharge capacity to the Demerara River will therefore help lower water levels in the rest of the EDWC even further.

12. *Modelling East Coast Demerara Drainage System:* Hydraulic modeling of the coastal lowlands of Region 4 was carried out to assess the drainage capacity and to test options for improving the system. Several drainage areas along the East Coast Demerara were identified as being vulnerable to flooding following a series of site visits and stakeholder discussions. To select priority areas for detailed modeling, a multi criteria analysis was used which considered the frequency of flooding, rate of dissipation, population, affected agricultural areas and key areas of infrastructure and agricultural significance. Following the analysis, 6 priority drainage areas were identified. These drainage areas include: Liliendaal; Ogle; Montrose-Spendaam; Mon Repos-Annandale; Strathspey Enterprise Paradise; and Beehive Clonbrook all of which are located east of Georgetown along the coast. The modeling prioritized the modeling of the main drainage network above the secondary and tertiary drainage systems. Walkover surveys and LiDAR surveys were used to identify the complex network of drains, inter-linkages, flow

directions and other characteristics of the drainage regime needed for building the models. Six models were set-up, one for each drainage area; however as canal water levels have not been recorded or monitored, the models are necessarily uncalibrated. The models were used to test a number of interventions which would improve drainage and reduce the area prone to flooding.

13. Options considered for interventions included increased pump capacities, increased culvert widths, adding water storage areas, channel improvements and separating urban and agricultural drainage systems. Recommendations included additional pumping capacity in many areas, and resizing of outlet systems and culverts. In addition, it became evident during the modeling that many of the key components of existing drainage facilities were designed for agricultural drainage and not for the mixed urban and agricultural land uses that now exists in many areas. The results indicated that in many cases, separation of urban and agricultural drainage areas, providing different levels of service to both, is an important intervention.

14. *Evaluation of dam safety status, performance history and operation and maintenance procedures:* The study conducted geotechnical investigations and provided a comprehensive evaluation of the structural integrity of the EDWC dams, their performance history and operation and maintenance procedures. It also assessed the condition of the relief structures and irrigation offtakes associated with the dams. The existing EDWC dams are over 130 years old. The performance history of the dam highlights the fact that it operates above safe operating levels almost every year and has had many minor slope failures, which have generally been repaired without substantial consequences. For most of the dams, the study supports the historical evidence which suggests that under design operation conditions the stability of certain dam sections becomes marginal, as evidenced by the historical incidence of localized instability. The operation and maintenance procedures were evaluated and found to lack formalization, leading to the development of an operations manual that included formal monitoring and inspection practices.

15. *Necessary remedial work and safety-related measures:* The results of the study show that the northeast dam is the most fragile dam and in need of rehabilitation. Its foundation is comprised of pegasse (peat), and the dam itself is made of very soft clays with a high pegasse content. The north dam and the northeast dam have also been found to have marginal stability. The west dam on the east bank of the Demerara River is built on and constructed of better clays, however the side slopes are steep, the crest is narrow and the vegetation is overgrown. It therefore does not meet international standards, but it is still considered stable. The water control and offtake structures were found to need some work on the reconstruction of the downstream revetments and upgrading of the support infrastructure to allow for a safe operating environment for the workers. In order to meet an acceptable standard of safety, a set of works and measures were recommended. These included: (i) immediate term works to rehabilitate the weak sections of the northeast and north dams; (ii) safety improvements to existing water control structures and offtakes; and (iii) medium term works to rehabilitate the east and west dams to upgrade them to international standards.

16. *Construction methodology and program:* The study also detailed the approach to the remedial works identified above including the necessary equipment, materials sourcing, labor, phasing of works, costs and schedule. It also includes the necessary technical specifications and

constructing procedures to ensure quality of the work, the safety of the structures and safety during construction. These can be used in the bidding documents and as a basis for supervision of the works.

17. *Operations and Maintenance Manual:* The study developed a manual for operation and maintenance of the EDWC system. It included operational procedures for flood management operation; water supply operation; maintenance of the waterways, dam, control structures, and monitoring. It covered the organizational structure, staffing, technical expertise and training as well as the necessary equipment and facilities. It also addresses the current and additional resources needed to implement these procedures.

18. *Works and Equipment for Risk Reduction:* In addition to the non-structural flood risk reduction measures (i.e. data collection, engineering studies, drainage modelling, dam designs etc.), the CAP has funded the rehabilitation and upgrading of the two sluices at Lama on the eastern side of the EDWC. A long-boom excavator was also purchased and a floating punt and pontoon were designed and constructed under the project. This has improved drainage and helped to rapidly mobilize equipment to areas of the dam in need of repair and respond to dam breaches, thereby improving dam safety. The purchase and installation of the hydrological instrumentation has also helped manage the EDWC water levels on a near real-time basis, and contributed to the national weather-forecasting system. Finally, other essential surveying equipment, office supplies and computing equipment were also purchased under the project.

19. In parallel, GoG has been carrying out several improvements to the drainage system. For instance, the EDWC dams have been reinforced in several places, maintenance and repairs have been carried out and several sluices, relief-structures and channels have been rehabilitated, including those at Cunha and Kofi. Also, a new channel was excavated from the northern borrow channel near Flagstaff to the Kofi waterway to improve conveyance within the EDWC. The modeling results show that these improvements have increased outflow capacity of the EDWC by 25% during 50 and 100-year flood scenarios. Additionally, and importantly, a Northern Drainage Relief Channel to help relieve discharge pressure on the eastern side of the EDWC during times of flood. The construction includes a new intake regulator, a bridge over the public road and a sluice at the Atlantic Ocean. The CAP modeling results show that this relief channel, once operational, will lead to a significant reduction in water levels in the EDWC, particularly in the north-eastern corner of the EDWC.

### **III. LESSONS LEARNED**

20. The following lessons were provided in the Implementation Completion Report for the CAP project:

21. *Project design:* (i) It is recommended that all future projects enable the use of a Designated Account as a mode of disbursement and budget should be made available to directly fund staff under the project; (ii) a detailed procurement plan should be established at appraisal for all key components of the project, especially those that directly impact the timing of other project components (such as equipment purchase, key contracts); (iii) TOR specifications should incorporate close and continued technical supervision to avoid delays and/or misunderstandings;

and (iv) technical review of the project should run throughout project implementation and include aspects for quality control.

22. *Contract awards:* Use of a single contract award, to implement large parts of the project, facilitated implementation and ensured consistency across deliverables.

23. *Training:* Provisions for continuous training, practice and supervision (e.g. data acquisition, hydrological modelling, GIS) should be incorporated throughout the life-span of the project minimizing the use of one-off workshops or training events.

24. *Communication:* The CAP communication plan was funded by a GFDRR grant. It helped regularly disseminate the results of the project, facilitated knowledge transfer, boosted coordination and informed future activities. It is recommended that all future projects incorporate a communication/dissemination plan.

25. *Technical baseline:* The remote sensing technologies and modelling were tested in the CAP and can be replicated for other regions in Guyana or in other Caribbean countries with similar situations. Development of a technical foundation for risk analysis conducive to rationalizing key-investment strategies is a necessary step in reducing flood risk.

## Annex 7: Economic Analysis

### GUYANA FLOOD RISK MANAGEMENT PROJECT

#### Summary

1. A comprehensive economic evaluation was carried out for the activities included in the *Disaster Risk Management (DRM) Project*, which consist of: a) upgrading and rehabilitation of the northeast EDWC dam and strengthened monitoring and surveillance for all the EDWC dams; and b) drainage works in the East Coast Demerara. A cost benefit analysis was conducted with net economic benefit corresponding to the difference of incremental economic benefits and incremental costs resulting of two scenarios: *with* and *without* project. Avoided Cost method was used to estimate benefits. The evaluation was complemented with sensitivity analysis.

2. The project will impact positively the socio-economic development of Guyana, as it will generate benefits higher than the associated costs. Results show economic returns of 12% in the drainage works, which is very reassuring as only a portion of the benefits were included. The residential sector shares the biggest portion of the benefits from these drainage investments.

**Table 1: Results of Economic Evaluation of Drainage Works in Enterprise Paradise and Ogle (Sub-Component 1.2)**

	Present Value of Flows (million USD)			IRR
	Costs	Benefits	Net Benefit	
Enterprise Paradise	16.4	18.7	2.3	12%
Ogle	1.6	2.4	0.8	15%
<i>Total Drainage</i>	18.0	21.1	3.1	12%

3. Results of the sensitivity analysis for drainage shows that the variables under management control convey medium to high risk: a) if the investment cost in Enterprise Paradise increases more than 14%, the economic results would be negative; and b) the project delay has to be lower than 2 years to show positive results.

4. Regarding the EDWC dams component, the evaluation was conducted measuring different scenarios of risk reduction, as the actual impact of the project interventions is not very easy to quantify. Results show that if works and institutional strengthening reduce the likelihood of a dam breach at least 6%, the project will be feasible. The higher the reduction in risk the higher the benefits; specifically, for a 20% risk reduction the expected net benefits would be about USD 12 million with an internal rate of return of 32%. The results are reassuring as the EDWC dam will be repaired at the most fragile points and with the improved surveillance and monitoring the risks of a breach or overtopping will be much lower.

**Table 2: Results of Economic Evaluation for the Works on the Dam (Sub-Component 1.1)**

Risk Reduction	Present Value of Flows (million USD)			IRR
	Costs	Benefits	Net Benefit	
6.0%	4.9	5.2	0.3	11%
15.0%	4.9	12.9	8.0	25%
20.0%	4.9	17.2	12.3	32%

5. **Rationale for Public Sector Provision/Financing.** Given the vulnerability to climatic variability and natural hazards, Guyana has undertaken a number of initiatives to respond to the threats posed by climate change as well as to mitigate the potential impacts of natural disasters. Public financing is crucial to strengthen, reconstruct, and rehabilitate key economic and social infrastructure and facilities following disasters; and also to strengthen the country's institutional capacity to prepare for and respond to disaster emergencies in an efficient and effective manner.

6. **World Bank Value Added.** After the event of 2005, the World Bank has worked with the GoG to reduce vulnerability of the country to climate change events. The project is a continuation of Government and donor-financed upgrading of these systems that begun after severe flooding in 2005 caused loss of life, relocation, disease and infrastructure damage, significantly affecting the economy of Guyana. It also benefitted from the planning and technical assessments undertaken as part of the Conservancy Adaptation Project, financed by the GEF Special Climate Change Fund, which identified priority areas for investment in the East Demerara and established a technical foundation for planning and managing these systems.

### Objective

7. The objective of the project is to reduce the risk of flooding in the low-lying areas of the East Demerara by reducing the risk of dam failure and improving drainage. The Project provides investments to reduce the risk of flooding in the East Demerara, an area that contains most of the population and economy of Guyana. Using this objective as a basis, the economic analysis assesses the expected benefits and compares them with the expected costs. The evaluation was carried out for each the works and institutional strengthening activities, which are: a) upgrading and rehabilitation of the northeast EDWC dam and strengthened monitoring and surveillance for all the EDWC dams; and b) drainage works in the East Coast Demerara. Given that the Component on project management is crucial for a successful Project implementation; its costs were added proportionally to the investment cost of each subcomponent.

### Methodology

8. A cost benefit analysis was carried out to evaluate the Project. Expected benefits and costs attributable to the project were measured by comparing two scenarios: *with* and *without* the Project. Net benefits corresponded to the difference between incremental benefits of each scenario. Benefits were estimated using the avoided cost method. The evaluation was complemented by a sensitivity analysis.

9. At time of appraisal, the specific interventions for drainage works and their locations were not finalized. This evaluation was therefore carried out for two of the 6 priority drainage areas<sup>18</sup> to show the potential benefits that this type of works can achieve. The two areas selected for the evaluation were Ogle, and Enterprise Paradise.

10. Costs and benefits were expressed at 2003 prices; the lifetime of the works was assumed to be 30 years. The discount rate used was 10%.

### Costs

11. Costs included in the evaluation consist of the project investment and operating costs. The investment cost for Subcomponent 1.1: upgrading the EDWC, consists of equipment and works estimated in the project (USD 4.2M) plus a proportion of the costs of institutional development and project management (12%) as they are required for successful implementation. The investment for subcomponent 1.2: drainage intervention consists of the costs estimated by Mott MacDonald in the selected drainage areas. The operation and maintenance costs are assumed to be 2% of investment.

**Table 3. Project Costs By Component**

	Project Costs Million USD	<u>Cost Used for the Evaluation</u> Million USD
Component 1: Priority Works	10.3	
Upgrade EDWC Dam	4.0	4.2
Drainage Works	6.3	
Enterprise Paradise		14.5
Ogle		1.4
Component 2: Institutional Strengthening	0.4	
Component 3: Project Management	1.2	
Total	11.9	20.1

### **Evaluation of the Drainage Works**

12. The Project will implement priority investments across one or more drainage areas in order to target key weaknesses in the system. The specific interventions will be finalized during project implementation. To evaluate the potential benefits of this type of intervention, the economic analysis was conducted for two of the six drainage areas<sup>19</sup> identified as priority by Mott

<sup>18</sup> The identified drainage areas include: Liliendaal; Montrose-Sparendaam; Ogle; Mon Repos-Annandale; Strathspey Enterprise Paradise; and Beehive Clonbrook all of which are located east of Georgetown along the coast.

<sup>19</sup> The identified drainage areas include: Liliendaal; Montrose-Sparendaam; on Repos-Annandale; Strathspey Enterprise Paradise; and Beehive Clonbrook all of which are located east of Georgetown along the Atlantic coast.



MacDonald: Enterprise Paradise, and Ogle. The GoG has indicated that these drainage areas would require some interventions.

13. *Cost Benefit Analysis.* Expected costs and benefits attributable to the Project were projected for two scenarios: *with* and *without* the project. For the *without* project scenario it was assumed that current flooding situation will remain. For the *with* project scenario, the expected reduction of floods was included.

#### *Benefits*

14. *Benefits of drainage works* were measured in the form of losses that are averted when the risk of flooding is reduced. Damage costs caused by flooding were estimated for urban and agricultural land, which characterize the East Demerara area. Damage varies according to flood intensity, water level, and extension of flooded area. Associated costs were calculated in probabilistic terms, using damage assessments of previous events and hydrological model for storm simulation. For each scenario (with and without project), flooding maps were drawn, indicating the water level caused by rainfall for different recurrence period (2, 25, 100, and 1000 years). The works selected in the Project correspond to a critical storm with a 50 years return period.

15. Region 4 has a total area of 1,873 km<sup>2</sup>. The vast majority of its populated area is found in the East Demerara and comprises a population of 310,000 and 80,000 dwellings. The number of business, not including informal establishments, is 1,874, according to the Bureau of Statistics of Guyana. ECLAC estimated that when including informal sector, this number could be between 4,000 or 8,000 not including Georgetown.

16. Enterprise-Paradise has an area of 46.2 km<sup>2</sup> (4,624 ha). About 28% of the area is urban or peri-urban and the remaining 72% is agricultural. It is estimated to have a population of 7,600 people and contain 2,000 dwellings and 197 commercial and manufacturing establishments. Ogle has an area of 152 km<sup>2</sup>. It is estimated to have a population of 2,500 and contain 661 dwellings and 66 commercial and manufacturing establishments.

**Table 4. Area and Number of Establishments in Region 4, Enterprise-Paradise and Ogle**

	Region 4	Enterprise Paradise	Ogle	Units per ha
Population	310,000	7,629	2,538	1.65
Area (km <sup>2</sup> )	1,873	46	15	
Area (ha)	187,300	4,624	1,538	
Number of commercial and manufacturing	8,000	197	66	0.04
Number of houses	80,445	1,986	661	0.43

17. Enterprise-Paradise According to the CAP pre-investment studies<sup>20</sup>, Enterprise-Paradise currently has a pumping system with a capacity of 24.9 m<sup>3</sup>/s that provides drainage at a rate of 46.5 mm/day. This is insufficient for drainage in urban areas and regular flooding is common. Peak water levels in more severe events than the 2-year event are high. In a 50-year storm event, 52% of the area is flooded, and it is 55% in the 100-year event. In an annual average year event 26% of the area is flooded as presented in Table 3.

**Table 5. Area flooded in Enterprise-Paradise**

Current Situation	Total	Heavily urbanized	Part urbanized	Agricultural
Total area (ha)	4,624	296	993	3,335
		% of area flooded		
Flood return period (years)				
2	26%	6%	23%	29%
25	44%	46%	68%	36%
50	52%	62%	77%	43%
100	55%	66%	80%	46%
1,000	68%	87%	88%	60%

18. Insufficient pump station capacity is the main cause of flooding in Enterprise-Paradise. The existing pumping stations were established for agricultural drainage and do not adequately provide drainage in urban and peri-urban areas. The existing drainage regime provides adequate relief for the agricultural land, and the economic benefits of flood protection for agricultural lands would thus be marginal. Therefore, damage cost was estimated only for the urban areas.

19. According to findings of the CAP pre-investment studies, in Enterprise-Paradise the urban area flooded ranges from 19% for a 2-year storm recurrence period to 88% for a higher than 100-year storm recurrence period. For agricultural land the share of flooded area ranges from 29% to 60%. When interventions are implemented, no area will flood for storm recurrence periods of up to 25-years, and for more severe events, only 8% of the area will flood. For agricultural land the situation will be similar, as the existing drainage regime provides adequate relief for the agricultural land (Table 4).

<sup>20</sup> CAP. Task 4. Modeling Report Issue B-draft final. February 2013

**Table 6. Flooded Area in Enterprise-Paradise without and with project.  
Enterprise-Paradise**

Recurrence period	Without project		With project	
	Urban area	Agricultural land	Urban area	Agricultural land
Total area	1,289	3,335	1,289	3,335
Flooding area				
2	246	967	-	967
25	811	1,201	-	1,201
50	948	1,434	104	1,434
100	990	1,534	99	1,534
>100	1,131	2,001	99	2,001
% Flooding area				
2	19%	29%	0%	29%
25	63%	36%	0%	36%
50	74%	43%	8%	43%
100	77%	46%	8%	46%
>100	88%	60%	8%	60%

20. For Enterprise-Paradise, the evaluation was carried out only for urban areas. However in Ogle, the agricultural land will also benefit from the intervention and so the damage was quantified as well. Averted damage cost was calculated as the difference between the damage costs with and without the project. Damage for the urbanized areas was measured for: a) commerce and manufacturing sectors; b) housing; c) infrastructure; and d) agriculture. Damage cost estimates were based on the assessment carried out by ECLAC<sup>21</sup> (2006) of damages generated by flooding during January-February 2005, which was an event with a recurrence period of higher than 50 years. The evaluation included the following costs:

- a. Damage to the commercial and manufacturing sector including damages to infrastructure; repair of equipment; damage to inventory; losses of revenue; and expenditure increases.
- b. Damage to housing including damages to the infrastructure as well as to the equipment inside the properties.
- c. Damages to agricultural land including damages to all crops that are present in the flooded areas.
- d. Damage on infrastructure including damages to water systems, telecommunication, and roads.

21. Total damage costs in each of the sectors were calculated as the damage cost per unit area multiplied by number of establishment flooded. Damage cost per unit area for the 2005 event was adjusted to estimate the damages for the other storm recurrence periods. The adjustments were as follows: 20% of damage for 2-year recurrence; 40% of damage for 25-year recurrence period; 80% for a 50-year recurrence period, and 100% for 100-year recurrence period. The number of establishments affected with floods was estimated based on number of units per

<sup>21</sup> ECLAC. Guyana (2006). *Socio-Economic Assessment of the Damage caused by the January-February 2005-2006 Flooding*.

hectare. The results for Enterprise-Paradise are presented in Table 5. For Ogle the same methodology was used.

**Table 7. Flooded Area without and with project for Enterprise-Paradise**

Recurrence period	Without project		Damage cost per unit (000 USD)
	w/o project # Establishment	with project # establishments	
	Commercial and manufacturing		
2	38	-	2.99
25	124	-	5.99
50	145	16.0	11.97
100	152	15.2	13.47
>100	173	15.2	14.97
No of houses			
2	379	-	1.21
25	1,250	-	2.42
50	1,461	161	4.84
100	1,525	152	5.45
>100	1,743	152	6.05

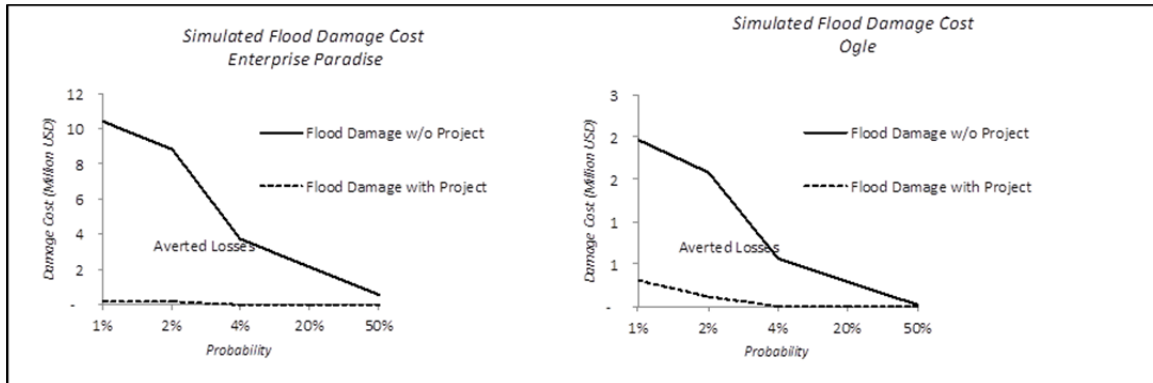
22. Total Damage Cost was calculated as the sum of the costs of: a) damage to commercial and manufacturing establishment; b) damage to housing; c) damage to agricultures; and d) damage to infrastructure. The cost is calculated both with and without the project, and for different recurrence periods. It is expected that damage will grow over time due to: improvement of dwellings in the area as well as their contents; expansion and improvement of non-residential activities; and income growth. For this evaluation, the damage was projected using an annual growth of 2% (estimated), which corresponds to half of the GDP growth in the last five years.

23. Table 6 shows the results of the expected damage cost per year in Enterprise-Paradise and Ogle, for each recurrence period and for both scenarios. The effect of the damages was most visible in housing and infrastructure.

**Table 8. Expected Damage cost for different recurrence period**

Recurrence period	Expected damage costs (million USD)			
	Enterprise Paradise		Ogle	
	Without project	With project	Without project	With project
2 years	0.57	-	0.01	-
25 years	3.77	-	0.56	-
50 years	8.81	0.19	1.58	0.11
100 years	10.35	0.21	1.98	0.32

24. To estimate the averted loss from the project interventions, a curve was built for damage costs versus the probability of occurrence (see Figure below). The area<sup>22</sup> under the curve corresponds to the expected damage cost for each scenario. The difference between the area of expected damage cost with and without the Project corresponds to the expected averted losses, or expected benefits of the Project.



## Results

25. Results show that the drainage works are economically sound with economic returns of 12% and 15% for Enterprise-Paradise and Ogle respectively. The residential sector will benefit the most, as flooding would cause significant damages to their houses and contents.

26. The two selected drainage areas will generate economic benefits of USD 3 million. Results are very assuring as many other benefits that will come along were not quantified, such as the impact on: a) disruption of traffic; b) time loss due to increase of travel time or inability to travel to work; c) health; and d) reduction of other nuisances that come along with floods.

**Table 9. Economic Evaluation in Enterprise Paradise and Ogle Drainage Areas**

	Present Value of Flows (million USD)			IRR
	Costs	Benefits	Net Benefit	
Enterprise Paradise	16.4	18.7	2.3	12%
Ogle	1.6	2.4	0.8	15%
<i>Total Drainage</i>	18.0	21.1	3.1	12%

## Sensitivity Analysis

27. The sensitivity analysis allows comparison of the base case scenario to other scenarios in response to a change in a given variable. A break-even analysis allows the identification of the value of a given variable that makes the Project to exactly break even. The variables tested to

<sup>22</sup> The area under the curve is calculated as the sum of trapezoids whose areas are equal to the average of the bases times the height. The average of the bases is the average of the damage cost, and the height is the difference between the probabilities.

evaluate their impact on the project's outcome were: a) investment cost overrun; and b) project delays.

28. Results of the sensitivity analysis show that variables under management control convey medium to high risk. In particular: a) if the investment cost in Enterprise-Paradise increases more than 14%, the economic return would be negative; and b) the delays in the project would have to be lower than 2 years to show positive results.

### **Evaluation of Works to Upgrade Critical Parts of the EDWC Dam**

29. The existing EDWC dams are a 130-year-old earthen structures that regularly experience minor slope failures and temporary breaches and could be compromised to the point of failure in extreme storm events. A recent assessment of the entire EDWC dams has shown that it is only marginally stable in certain areas and does not meet international standards. It is an ongoing maintenance liability and has a history of localized earthwork failures and breaches. The northeast dam is the most fragile part of the dam and is a priority for rehabilitation.

30. There have been six events of dam breaches, slips, or overtopping in the last 13 years (three events during 2000 and 2001 and one event in 2003, 2005, and 2011). The records found of damage caused by these events are not complete or consistent. The existing records show that: a) the three major embankment failures during 2000 and 2001 were at Hope, Maduni and Lusignan (2000); and at Bonne Mere (2001). Roads had to be rehabilitated due to damage caused by the flooding (GYD\$5M), damages to residents were significant as most of the access roads and houses were under water for several hours (up to 48 hours for some). The damage costs for residents were not estimated at that time. The Government invested GYD\$20M to compensate residents and GYD\$18M for emergency relief and supplies and assistance. Corrective works were GYD\$31.4M at Maduni, and GYD\$18M in Lusignan. Maintenance required was about GYD\$30M, which was reinforced with additional contracts to strengthen the EDWC at a value of GYD\$360 M<sup>23</sup>; b) In 2003 some sections of the EDWC collapsed and some repairs were needed to avoid severe flooding in villages in front of the damaged sections. The Government allocated GYD\$6M for remedial work.<sup>24</sup> No estimation of additional damages costs was found.

31. During a major rainstorm in January 2005, the EDWC was stressed due to sustained high water levels and several slip failures were noted though no breach occurred. Widespread overtopping and breaching would have occurred in January 2005 had flood levels been only 60 mm higher. Detailed information on damages of this event was assessed by ECLAC (2006) and the findings will be used in this evaluation as explained below.

32. The peak EDWC water level recorded in January 2005 at Flagstaff were 17.92 mGD. Annual records of EDWC water levels show that every year since 2005, except 2010, the maximum water level at Flagstaff has exceeded 17.83 mGD, which is considered as the safe

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<sup>23</sup> Stabroek News. December 20, 2001, November 2001, and July 12, 2002

<sup>24</sup> Starbock News. March 19, 2003 and April 2, 2003.

maximum water level for the EDWC. These data underscore the concern that the EDWC has insufficient flood relief capacity, and that a higher than acceptable risk of overtopping and embankment breaching exists.

**Table 10. Maximum Water Level in the EDWC (mGD)**

	Flagstaff	Lama
2005	17.92	17.92
2006	17.95	17.85
2007	17.91	17.92
2008	17.91	17.83
2009	17.91	17.80
2010	17.66	17.65
2011	17.97	17.66
2012	17.83	17.72

Source: CAP Pre-investment studies

33. To understand the magnitude of the impact that a failure of the EDWC dam could cause, Mott MacDonald conducted a modeling of a catastrophic failure of the EDWC under full conditions. The modeling however does not give an absolute answer to what will occur in the event of a dam breach, as it is not possible to predict the precise nature and location of a particular dam breach event. Two locations were chosen for building the scenarios: location 1 on the Northeast dam is near a recent slip failure; and location 2 where the dam conditions are poor, and where there is the greatest density of population downstream. Results for location 1 were used for this evaluation since the project will focus on reconstruction of the northeast dam.

34. The following assumptions were made by Mott MacDonald for the dam breach modeling: a) the breach occurred at bank full capacity (18.29 mGD); b) there is a 50 m wide breach in the embankment; and c) the embankment collapses down to a level of 16.46 mGD.

35. Results of the modeling are only estimates. Specific impacts such as water depth at a particular location depend on the exact location and nature of the breach. No breach will occur in exact the same way as assumed in the assessment. However, as the topography of the area is relatively uniform and the natural terrain gradient is towards the coast, the impacts will generally follow a similar pattern.

36. Mott MacDonald presented flood hazard maps, as well as depth and velocity maps. The Hazard Rating was calculated as  $HR = dx(V+0.5) + DF$ . Where, HR is hazard rating; d is depth of flooding (m); v is the velocity of floodwaters (m/s) and DF is the debris factor. Mott MacDonald used the conservative approach for the debris factor as follows:

**Table 11. Debris Factor According to Depth of Flooding**

	Pasture/Arable	Woodland	Urban	Conservative
0 to 0.25 m	-	-	-	0.50
0.25 to 0.75 m	-	0.50	1.00	1.00
D>0.75m or V>2.0 m/s	0.50	1.00	1.00	1.00

37. Critical values of Flood Hazard are shown in Table 10. They are used to categorize the hazard in terms of danger.

**Table 12. Hazard Rating**

Hazard Rating	Degree of Flood Hazard	Description
<0.75	Low	Caution "Flood zone with shallow flowing water or deep standing water"
0.75 to 1.25	Moderate	Dangerous for some (eg. children) Danger: Flood zone with deep or fast flowing waters
1.25 to 2.0	Significant	Dangerous for most people Danger: flood zone with deep fast flowing water
>2.0	Extreme	Dangerous for all Extreme danger: flood zone with deep fast flowing water

38. Results of a breach in the Northeast section of the dam (location 1) show that the water levels would exceed 1m depth at numerous locations. It is expected that the existing pumps and gravity outlet structures would not be able to handle the large volume accumulating in the coastal area, particularly as a breach is most likely to occur during the rainy season when many of the coastal pumps will already be working to capacity. As a result, the water escaping from the EDWC will remain standing for a long period. Mott MacDonald also found that the water escaping would take some time to reach the populated areas, and the full effects of the flooding will not be felt until more than 72 hours after the breach has occurred.

39. According to the depth map, maximum velocity map, and maximum hazard map from a dam breach at location 1, the following results are obtained for the flooded area. Based on this the damage cost was estimated for this kind of event.



**Table 13. Results of the Modeling of a Dam Breach in Location 1 (Northeast Dam)**

Depth (m)	% of affected area	Maximum velocity (m/s)	% of affected area	Hazard rating	% of affected area
0-25	10%	0-25	90%	0.5-0,75 (Low)	3%
0.25-0.5	13%	0.25-0.5	9%	0.75-1.25 (Moderate)	7%
0.5-1	55%	0.5-1	1%	1.25-2 (Significant)	90%
1-5	20%	1-2	0%	>2 (Extreme)	0%
5-10	2%	>2	0%		
10-15	0%				
	100%		100%		100%

40. According to the flooding maps, it is estimated that about 50% of Region 4 will be affected. For this evaluation, damage cost of the dam breach under this scenario, was based on assessment carried out by ECLAC<sup>25</sup> (2006) of damages generated by flooding during January-February 2005, which was an event with recurrence period higher than 50-years. For this evaluation, damage cost was adjusted according to depth of flooding with the following percentages: 20% of damage for less than 0.25 m; 50% of damages for depth between 0.25 and 0.50 m, and 100% of damages for depth higher than 0.5m. The damages were applied to the affected area (Table 11), according to their economic activity, namely: a) commerce and manufacturing sectors; b) housing; c) infrastructure; and d) agricultural.

**Table 14. Damages Applied to the Flooded Area According to Depth**

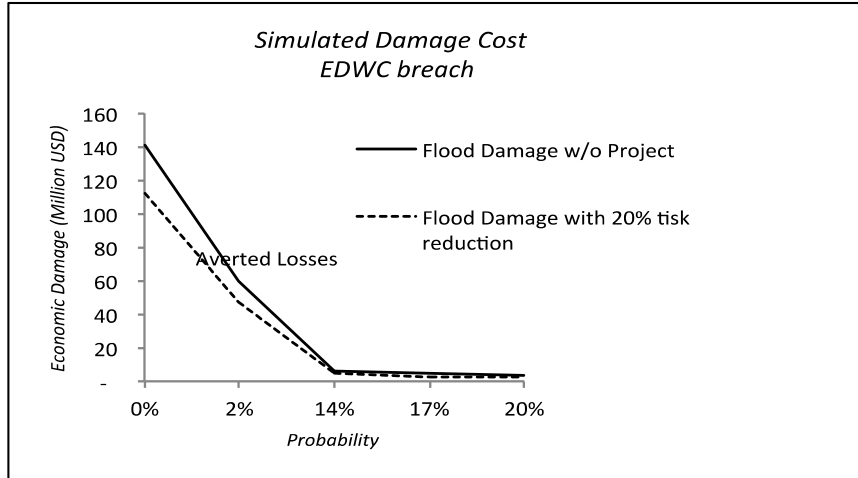
Depth of Flooding (m)	Share of Damage	% of Area Affected
0-25	20%	10%
0.25-0.5	50%	13%
0.5-1	100%	55%
1-5	100%	20%
5-10	100%	2%

41. The estimation of the damage in each sector used the same methodology applied for drainage component. Results show that under the scenario of a catastrophic dam breach the damage per unit equals to 86% of the assessed for 2005-flooding event.

42. These results corresponded to the catastrophic scenario, which was assumed to occur with a probability of 0.1%. For dam breaches of lesser magnitude, historical information of frequency and damages was used. To estimate the avoided damage cost, a curve was built for damage cost versus probability of occurrence for both *with* and *without* project. The area under the curve corresponds to the expected damage cost of each scenario. The difference between the areas corresponds to the expected averted cost of benefits of the Project. Given that lack of information to determine the impact that the project will have on reducing the risk of a dam failure, the *with*

<sup>25</sup> ECLAC. Guyana (2006). *Socio-Economic Assessment of the Damage caused by the January-February 2005-2006 Flooding*.

project scenario was built using different simulations of risk reduction. Graph 2 below shows the scenario for 20% of risk reduction.



43. Results show that risk reduction has to be at least 6% to make the Project viable. The higher the risk reduction the better the results. For 20% risk reduction, net benefits are USD 12M and the return of 32%.











**Table 15. Results of Economic Evaluation for Works on the Dam (Component 1.1)**

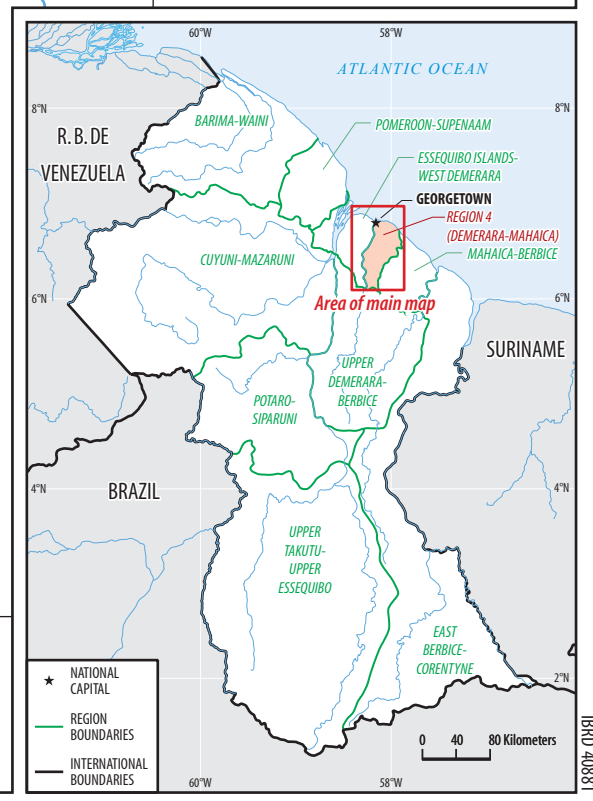
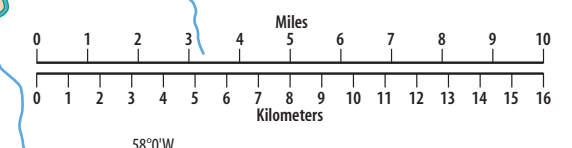
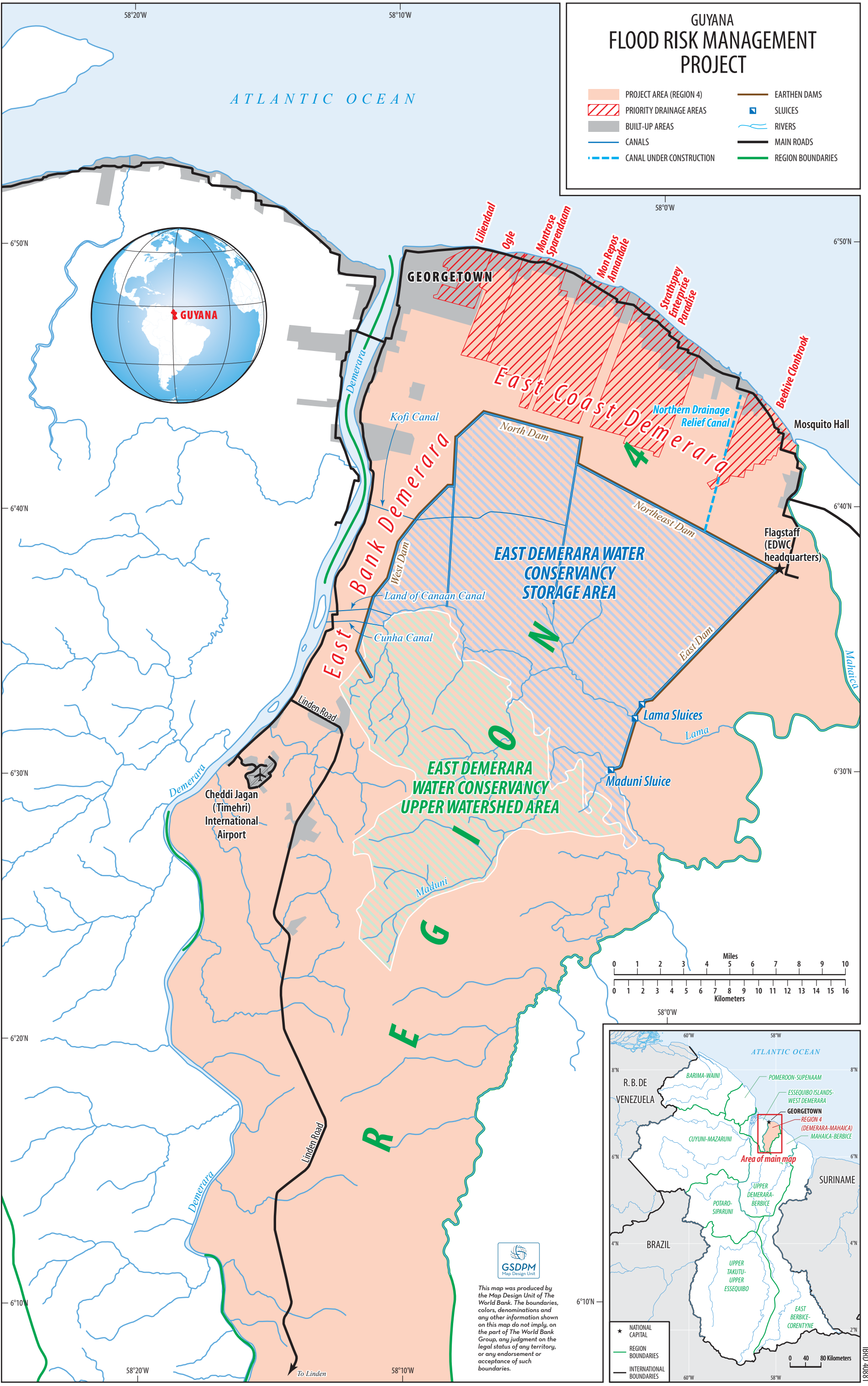
Risk Reduction	Present Value of Flows (million USD)			IRR
	Costs	Benefits	Net Benefit	
6.0%	4.9	5.2	0.3	11%
15.0%	4.9	12.9	8.0	25%
20.0%	4.9	17.2	12.3	32%

44. Results are reassuring as the EDWC dams will be repaired at the most fragile points and it is expected that their performance as a flood mitigation facility will improve substantially and the risks of a breach or overtopping will be much lower. The project intend to increase the safety level of the dams to the design standard of 1/1000 year flood (while the 2005 food was a flood around 1/100 year frequency) through strengthening priority dam portions and operationalization of sound dam safety management practices.

45. In addition, besides the benefits of avoided damage, there are other benefits from avoided interruptions of water supply to Georgetown and irrigation water supply for the command area, plus the dam rehabilitation costs in case of dam failure, which were not taken into account in the analysis, further supporting the economic viability of the investments.

# GUYANA FLOOD RISK MANAGEMENT PROJECT

- |  |   |
|--|---|
|  PROJECT AREA (REGION 4)  |  EARTHEN DAMS      |
|  PRIORITY DRAINAGE AREAS  |  SLUICES           |
|  BUILT-UP AREAS           |  RIVERS            |
|  CANALS                   |  MAIN ROADS        |
|  CANAL UNDER CONSTRUCTION |  REGION BOUNDARIES |



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