

**PROJECT INFORMATION DOCUMENT (PID)  
APPRAISAL STAGE**

Report No.: AB2762

<b>Project Name</b>	Conservancy Adaptation Project
<b>Region</b>	LATIN AMERICA AND CARIBBEAN
<b>Sector</b>	Flood protection (100%)
<b>Project ID</b>	P103539
<b>GEF Focal Area</b>	Climate change
<b>Borrower(s)</b>	GOVERNMENT OF GUYANA
<b>Implementing Agency</b>	
<b>Environment Category</b>	<input type="checkbox"/> A <input checked="" type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> FI <input type="checkbox"/> TBD (to be determined)
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## 1. Country and Sector Background

### Introduction

Over three-quarters of the Guyanese population live in a 30 kilometer band along the Atlantic coast. This is an area of reclaimed lands, much of it below the regional mean sea level, situated between a water storage basin and a protective seawall complex. The coastal zone is transected by a dense network of drainage and irrigation canals. These canals link up to the East Demerara Water Conservancy (EDWC), a water storage system that provides regional agricultural lands and urban areas with irrigation and drinking water. During times of heavy rainfall this system functions as a regional drainage and flood control mechanism.

Present rates of sea level rise associated with global climate change pose a significant threat to the country and its economy. Recent flooding demonstrated the increased vulnerabilities of the existing drainage system and shortcomings in the current infrastructure. This project has been developed to guide a comprehensive upgrading program of the EDWC aimed at increasing discharge capacity and improving water level management. It will provide a framework for future donor intervention. In addition to developing the technical baseline for adaptation measures, the project will include pilot infrastructure improvements to help cope with the immediate threats to the system.

### Global Climate Change

The 2001 Third Assessment Report of the Intergovernmental Panel for Climate Change (IPCC) concluded that, with the continuing emission of greenhouse gases (GHG), the global mean surface temperature may increase between 1.5 and 5.8 degrees Celsius over the next 100 years. Documentation being used in the preparation of the Fourth Assessment Report, due to be released by the year 2007 corroborates the range of the projected temperature increase. A change of this magnitude is unprecedented and will result in significant impacts on a global scale. These will come in the form of increases in sea level and modifications to global and regional weather patterns.

### Climate Change in Guyana

#### *Sea Level Rise*

While sea levels are rising worldwide at a rate of 2-4 mm/year, Guyana's United Nations Framework Convention on Climate Change (UNFCCC) Initial National Communications Report (2002) and the Guyana National Vulnerability Assessment (2002) forecast a more severe impact locally. Analysis of tide gauge records from 1951 to 1979 shows the trend in sea level rise for Guyana to be in excess of 10 mm/year, which implies a net change in sea level of 0.9 feet over the 28 year period examined. If one assumes the rate to be constant to date, the net change in sea level from 1951 to 2005 is estimated at 1.8 feet. This projection is consistent with the work conducted by Douglas (1995) and Smith et al (1999) which indicates that sea level in the region of Guyana is increasing at a rate of more than 10 mm/year - or 2 to 5 times faster than the global estimate. This is corroborated by the estimates presented by Singh (1997) in his work on neighboring Trinidad and Tobago, which finds sea level rise in the Caribbean to be being significantly higher than the globally observed levels. New analysis by Miller (2006) confirms the gradual increase in sea level rise in the Caribbean basin.

Using the commonly accepted Atmospheric - Ocean General Circulation Model (A-O GCM) approach to analyze future sea level changes, the forecast rise of the mean sea level, ignoring melt water runoff from land areas, is projected to be 40 cm by the end of the 21st century. The analysis of local tide gauge data suggests greater increases in mean sea level in Guyana. The rate of sea level rise will continue to be tracked through a network of monitoring stations employing geo-referenced gauges (archived at UWICED). This network was funded under the GEF financed Caribbean Project on Planning for Adaptation to Climate Change (CPACC), whose objective was to support Caribbean countries in preparing to cope with the adverse effects of global climate change.

#### *Decrease in Average Rainfall; Increase in Rainfall Intensity*

The Initial National Communications Report and National Vulnerability Assessment (2002) also found evidence that, since 1960, there has been a tendency for below normal rainfall, as well as increased intensity of rainfall events. To forecast future trends, both studies employed the (A-OGCM) of the Canadian Climate Centre (CGCM 1) to develop predictions of rainfall, temperature, evaporation and water deficit for a doubling of carbon concentration. Under this scenario, temperature is expected to rise by an average of 1.2°C in the period 2020 to 2040 from the present. Increases in excess of 1.5°C are expected in southern Guyana in the Second Dry Season (August to October). Rainfall is expected to decrease by an average of 10 mm per month but the decrease in the First Wet Season and Second Dry Season (May to October) will be 12 mm per month or higher.

Estimates from climate models developed by the United Kingdom's Meteorological Office's Hadley Centre, support the prediction that Guyana will be experience a general drying trend. In fact these models predict that Guyana will be among the most affected countries in the world, with average precipitation decreasing by roughly 1 mm/day by 2050. A drying trend of this nature would lead to not only increased intensity of rainfall events, but also to a greater reliance on the EDWC water storage system during dry seasons. To meet this need, storage levels would have to be kept at high levels to support agriculture and urban centers on the coastal plain, exacerbating the need for effective capacity to manage water levels in the EDWC system.

#### Guyana Coastal Drainage and Flood Control

Guyana's drainage and irrigation system has its origins during the Dutch colonial period beginning in the late 1600's. Land reclamation began under their tender and continued through the British colonial period until Guyana gained independence on May 26, 1966.

The country's coastal zone (Map 1) consists of a low-lying system of marine and riverine deposits which formerly comprised an extensive network of tidal deltas. Much of the land now in use in northern Guyana lies in this coastal zone below the mean high tide level of around 54 ft Guyana Datum (GD), as shown in

Figure 1. This land was reclaimed from tidal areas, beginning in the 1600's by the Dutch, and is protected by an intricate network of seawalls, dykes, polders and drainage structures, including the EDWC system. Guyana's agrarian economy, which accounts for over 35 percent of GDP, is highly dependent on this coastal drainage and irrigation system that, among other benefits, allows for bi-annual harvests of rice and sugar.

Human settlement and infrastructure is concentrated in the reclaimed coastal plain where approximately 75 percent of the nation's population resides. The population is distributed in locations determined by the availability of suitable land for housing and services. The areas of the Essequibo Islands – West Demerara (Region 3), Demerara – Mahaica (Region 4) and the Mahaica – Berbice (Region 5) are the most densely populated areas, with the majority of Guyana's citizens located in Region 4. The highest population densities are found in the vicinity of the capital, Georgetown, and adjoining areas.

Drainage during rainfall events has been managed through the use of gravity based systems augmented with pumps. This system is under increasing stress and suffering from the impacts of sea level rise because an adequate discharge window is no longer guaranteed. The maximum safe operating level of the EDWC was about five feet above the peak 1951 sea level, which left a narrow operating window for emergency discharges during times of heavy rain. This maximum safe level has closed to three feet since then. As the sea level continues to rise and the discharge window continues to shrink, the ability to manage water levels is being compromised.

Today's problems stem from the fact that the coastal drainage and irrigation systems in Guyana were largely constructed some 150 years ago. The additional stress on the system raises posed by sea level rise raises concerns about the possible collapse of the EDWC. If the discharge flow is not amplified, and the system continues to be managed without regard to climate change related rises in sea level, rainfall collection in the system will outpace the ability to release excess water (because the period available to discharge continues to shrink), causing the EDWC to overtop and the levees to breach.

Considering the accumulated and expected impact of sea level rise, the current ad-hoc approach to flood control is no longer viable. It is also clear that any program to strengthen and upgrade the system will have to take into account the impact of climate change. Given the forecast impacts of sea level rise, the risk of future flooding - even during normal weather events - is increasing year after year. It is critical that the Government of Guyana (GoG) and the donor community embark in earnest on a comprehensive program to strengthen the current system. This project constitutes the first step in this process.

## 2. Objectives

The objective of the CAP is to reduce the vulnerability of catastrophic flooding in Guyana's low-lying coastal area that is currently threatened by sea level rise resulting from global climate change.

This objective will be achieved through a) strengthening the GoG's and donor understanding of the EDWC system and coastal plain drainage regimes while identifying key drainage regimes for follow-on intervention; b) implementing infrastructure investments aimed at increasing the drainage capacity of the EDWC; c) strengthening institutional capacity of the GoG to manage water levels in the EDWC and to guide interventions aimed reducing Guyana's vulnerability to floods.

At project completion, the GoG will be in possession of a master plan for future upgrading of the EDWC. Possible interventions for at least 10 key drainage regimes will be identified and presented to the donor

community, and the drainage relief capacity of the EDWC to the Demerara River by will be increased by at least 35 percent.

### 3. Rationale for Bank Involvement

The World Bank has been assisting the GoG in the identification of a possible project to reduce the vulnerability of the country since the dramatic floods of January 2005. Over the course of the past 18 months the team has been working in close collaboration with the National Drainage and Irrigation Authority (NDIA) to identify sources of repetitive flooding affecting the country in recent years. This work has been done with the involvement of the Sea and River Defense Division, Ministry of Works and the Lands and Surveys Commission and included consultation with the Office of the President, the Guyana Environmental Protection Agency; the Ministry of Finance; Conservation International, the Citizens Defense Initiative, and the Civil Defense Council.

During each visit, the World Bank team presented the result of its findings and sought feedback from the donor community in Guyana, including the Inter-American Development Bank (IDB), European Union (EU), United Nations Development Program (UNDP), United Kingdom's Department for International Development (DfID), Canadian International Development Agency (CIDA), and the United States Agency for International Development (USAID). A thematic group on flood control was proposed in June 2006 and should mobilize, shortly. In June, the donor community agreed to work jointly with the GoG to develop a comprehensive strategy to assist the government in increasing the drainage capacity of the country's water control systems, particularly the EDWC. The proposed GEF SCCF Conservancy Adaptation Project (CAP) will support this approach by providing donors with pre-identified works to increase drainage capacity of the EDWC a tool to identify future interventions.

The CAP was not included in the last Guyana Country Assistance Strategy (CAS), which was issued on September 19, 2002. However, the dramatic floods of 2005 and 2006 have shown the need for serious intervention. Strengthening the EDWC system is now a top priority of the GoG, which has requested World Bank assistance in accessing GEF resources and in supporting its effort to work with the donor community in the development of a comprehensive strategy to adapt the EDWC to the impact of sea level rise.

### 4. Description

The project will finance the development of the technical foundation for a master plan of future interventions within the EDWC and lowland drainage systems, as well as specific upgrading works and operational improvements aimed at enhancing the flood control capacity of the EDWC. The tools developed under the analytical component of the CAP will be used by the GoG and donor agencies to guide future investments.

- *Component 1 – Pre-investment studies for engineering design of works (US\$2.0 mil):* The objective of this component is to provide the hydrologic baseline necessary for contemplating rational interventions aimed at increasing the current discharge capacity of the flood control system. This objective will be achieved through:
  - *Detailed topographic and landuse mapping*
  - *Hydrologic modeling of coastal lowlands*
  - *Assessment of EDWC system integrity*
  - *EDWC hydraulic modeling*
  - *Pre-feasibility studies for coastal lowland interventions*
  - *Operational capacity building*

The key outcome of these pre-investment studies will be a topographic model of the inhabited coastal plain to be used as the basis for hydrologic analysis of the region under projected climate scenarios. The results from this component will pinpoint key areas of intervention to increase discharge capacity critical for flood zone management. Pre-engineering designs will be completed for a set of prioritized interventions. Specialized staff within the following agencies will be trained in the application of the analytical tools produced: NDIA, the Lands and Surveys Commission, the Ministry of Works' River and Sea Defense Division, the Guyana Environmental Protection Agency and the Civil Defense Commission.

- *Component 2 – Investments in specific adaptation measures (US\$1.5 mil of GEF financing and US\$1.2 million to be financed by donor to be identified):* The objective of this component is to counteract the effects of sea level rise, which has decreased the GoG's ability to manage water levels of the EDWC system. The investments will improve the ability of the Government to manage water levels behind the EDWC dam during heavy rains by improving internal water flows in the EDWC and increasing EDWC drainage relief capacity to the Demerara River and eventually the Atlantic Ocean. This objective will be achieved through:
  - *Widening of key drainage relief canals*
  - *Improvement of water flow system within EDWC*
  - *Upgrading of water control structures*
  - *Selected equipment purchase and installation*
  - *Major infrastructure civil works and operational improvements*

By the end of project, activities under this component should result in an increased drainage capacity of the EDWC to the Demerara River by roughly 35 percent (the exact figure will be finalized during the first year of implementation). The GoG, through the NDIA, will direct additional investment in the strengthening of drainage and irrigation infrastructure based on the engineering foundation to be developed under Component 1.

- *Component 3 – Institutional Strengthening and Project Management (US\$.1 million):* The objective of this component is to strengthen the institutional framework for flood control within the context of the national emergency management sector headed by the Civil Defense Commission. Also, through the Implementation Secretariat, all key actors involved in the flood control will be consolidated and under a framework of Memoranda of Understanding, will work together, coordinate activities and share information to promote a more streamlined approach to hazard and risk management in the country. Project management activities of the PEU will also be partially funded by the project. Specific outputs of this activity will include:
  - *Contingency plan for flood events*
  - *Memoranda of Understanding among Implementation Secretariat members*
  - *Monitoring and evaluation of project progress*
  - *Project management*

Through this component, the Government will be better positioned to respond to flood emergencies. Moreover, through the Implementation Secretariat, flood control work will begin to be consolidated in the country, which is expected to lead to greater information sharing and institutional memory throughout the government.

## 5. Financing

Source:	(\$m.)
BORROWER/RECIPIENT	0
GLOBAL ENVIRONMENT FACILITY	3.8
Total	3.8

## 6. Implementation

An implementation structure would be put in place that maximizes cost effectiveness, timely execution, ownership and transparency amongst stakeholders. This implementation structure will be made of two main components, a Steering Committee (SC) responsible for project oversight and coordination and a Project Execution Unit (PEU) responsibility for all administrative and fiduciary aspects.

### Steering Committee

The SC will be formed through an inter-agency agreement between the participating members and will be chaired by the Permanent Secretary of the Ministry of Agriculture. The Minister of Agriculture will serve as an Advisor to the Permanent Secretary. In this role, issues outside of the prevue of the SC will be referred to the Minister of Agriculture. Furthermore, the Advisor will be responsible for promoting this initiative at the national and regional level.

Aside from the two previously mentioned members, the SC will consist of senior representatives from the following agencies: The National Drainage and Irrigation Authority, The River and Sea Defense Division of the Ministry of Public Works; The Lands and Surveys Commission; the Civil Defense Commission, The Ministry of Finance; The Guyana Environmental Protection Agency, Hydromet. Donor representatives will sit as observers to the SC, and when requested, a representative of the contracted engineering firm will attend the meetings to support the SC decision making processes.

The Chairman of the SC, the Permanent Secretary of Agriculture, is responsible for convening the SC and for receiving the analytical outputs produced by the engineering firm. Once the SC validates the analytical outputs, the Chairman of the SC is responsible for officially accepting the work, thereby allowing the PEU to disburse payment to the contracted firm.

### Project Execution Unit

The Agricultural Support and Development Unit (ASDU), which will be housed within the MoA will manage the fiduciary and administrative aspects of the project. The Project Execution Unit (PEU) that the IDB is currently utilizing for the implementation of the Agricultural Services Project is expected to form the core of the new ASDU. A procurement assessment of the PEU was completed in October by a World Bank Procurement Specialist. The assessment indicated that while in need of additional support, the PEU was capable of managing the project. The MoA has provided the World Bank with a report outlining the composition and structure of the ASDU. The IDB is working with the MoA to finalize this transition document.

To simplify the role and responsibilities of the PEU/ASDU, project procurement and fiduciary activities will be limited as the project will comprised of two contracts. The first contract will be for an engineering firm to complete the analytical work and to design and supervise the physical works, while the second contract will be for a construction firm to execute the near-term physical works.

## 7. Sustainability

The key indicator for sustainability of project activities is follow-on financing to climate change-proof the EDWC and other conservancy systems. The project is expected to serve as a catalyst for follow-on donor investment.

Donor community participation was initiated during a June 2006 meeting hosted by the UNDP. Representatives from the IDB, DfID, USAID, CIDA, and EU participated in the discussion and expressed support for the joint strategy proposed by the World Bank team and Guyanese authorities. Coordination with the Donor community continued during the December pre-appraisal mission. Members of the Donor community were informed of progress in the development of the project since the June 2006 meetings. Based on the December meetings, it is expected that the IDB, along with the EU and CIDA will participate in follow-on physical interventions to improve flood control. The donor dialogue, which will be spearheaded by the World Bank country office in Guyana, will be sustained through regular meetings to discuss progress achieved and challenges remaining in the sector.

Also crucial to the sustainability of the project is a comprehensive program to build the capacity of Guyanese engineers to use the information developed under the analytical portion of the project. The NDIA, Lands and Surveys Commission and River and Sea Defense Unit have received extensive technical support from previous EU projects. These agencies support modern Geographic Information System (GIS) capabilities and have been trained in data collection, management and analysis as well as in precision geodetic surveying techniques to improve their technical capabilities. These entities have played a critical role in the development of the project and will be at the core of implementation. Additional training will strengthen the ability of these engineers to run 1D-2D Flow Models and utilize 3D high resolution topographic data for analysis of local drainage regimes.

## 8. Lessons Learned from Past Operations in the Country/Sector

Under previous projects, important documentation was lost to accidents and fires. For example, after the 2001 national election, the NDIA headquarters was destroyed by fire. To prevent similar occurrences, all analytical work developed under the project will be distributed to three GoG agencies: the NDIA, the Lands and Surveys Commission and the Sea and River Defense Division of the Ministry of Works. These agencies will be trained in data management and analysis.

Project implementation in Guyana often suffers significant procurement delays due to several factors, including: i) re-bidding because of poor response; ii) bid costs that are much higher than original estimates; iii) inconsistency between some bid-evaluation reports and recommendations; iv) the small pool of able contractors; v) system deficiencies (little or no penalties for late mobilization, poor quality of work, etc.); and vi) slow decision making at all levels of government. Due to the urgent need of implementing project activities, the number of tenders under the project will be limited to two, which should limit overall procurement delays and attract wider competition.

Recent projects in Guyana have highlighted several institutional and other basic deficiencies affecting the absorptive and implementation capacity of the country. In limiting the number of contracts in the project, implementation should be streamlined and in the hands of international experts. The World Bank team will provide significant support to assist in the drafting of Tender Documents and an expert in flood management will be retained by the Bank team for quality control.

Earlier attempts have been made to strengthen the capacity of the Hydromet office, notably under the 1998 El Nino Emergency Assistance Project. Under this Bank financed project, 9 weather stations were installed and located throughout the country. Similar efforts have also been made by other donor agencies. However, high turnover, lack of knowledge and the poor physical condition of Hydromet's facilities have reduced its effectiveness substantially. Nevertheless, the CAP does not contemplate providing any assistance to the Hyrdomet Office because the sustainability of such an intervention is judged to be highly unlikely.

## 9. Safeguard Policies (including public consultation)

No relief is sought from Bank safeguard policies and those that will apply to the project which include Environmental Assessment (OP/BP 4.01), Natural Habitats (OP/BP 4.04), Physical Cultural Resources (OP/BP 4.11), Forests (OP/BP 4.36) and Safety of dams (OP/BP 4.37).

### Environmental Assessment (EA) (OP/BP4.01)

Civil works funded under this project may include the widening of the Cuffy and/or Cuhna outlet structures. These activities will require the construction of a bridge along a major north-south thoroughfare. Environmental impacts will be limited to the construction sites and will result in a temporary impact to local traffic. An Environmental Assessment will be conducted during the engineering design stage of the project component to address these issues. These two structures lead directly to the Demerara River. The only function of these canals is to provide relief capacity to the EDWC system to protect the EDWC dam during the two rainy annual seasons. These canals are not associated with the irrigation or potable water supply functions of the EDWC system. While not expected to have an adverse impact on conservancy, an additional site-specific EA will be completed for the improvement of water flow systems within the EDWC. Remaining civil works are limited to repairs to existing structures and are classified as category C. These works will be contracted using appropriate environmental management clauses to assure contractor compliance with accepted environmental practices.

A key output of the analytical work will be an engineering tool that is to be used to as a foundation for determining the environmental impacts of follow-on interventions. With the development and use of a detailed digital elevation model, local watershed characteristics and drainage regimes will be mapped and modeled, creating the basis for future engineering interventions. A separate report will be developed, based on the analytical work undertaken in the project, which will specifically addresses the likely environmental impacts of future interventions. Expected hydraulic impacts, as well as changes in water quality, natural habitats, land use, livelihoods and analysis of alternative strategies will be considered. Based on this information, an intervention strategy will be developed.

### Natural Habitats (OP/BP 4.04)

A portion of the project takes place within the East Demerara Water Conservancy. This is a man made structure that is considered a natural habitat. No adverse impacts to the conservancy are envisioned under the project. At the same time, by improving the drainage capacity of the EDWC and assessing the weak portion of the EDWC Dam, the project aims to ensure that this natural habitat remains in tact.

### Physical Cultural Resources (OP/BP 4.11)

While activities to be carried out under the project are not expected to impact any known cultural heritage sites, technical specifications for works and the Operation Manual will include "chance find procedures" to be followed in the event that culturally significant materials are discovered during the execution of civil works.

#### Forests (OP/BP 4.36)

The southern portion of the East Demerara Water Conservancy is bordered by a forest. No physical work is envisioned within 10 miles of this forest and no adverse impacts to the forest are envisioned under the project. Moreover, improvements in water flows within the EDWC are expected to have no impact on the bordering forest.

#### Safety of Dams (OP/BP 4.37)

The EDWC is bordered to the north by a 30 mile long earthen dam constructed some 150 years ago. The dam has been heavily stressed particularly during the past two flood events (2004-5, 2005-6). While no civil works are to be conducted on the dam, a detailed engineering assessment of the dam and its associated drainage structures is to be completed under the project. This will provide the engineering and safety guidance to the GoG for the design and development of any dam strengthening programs.

The engineering analysis developed under the present project will provide the technical basis for the Government to fulfill the requirements for an expert assessment of the weakened portion of the EDWC Dam provided under this safeguard. Upon receipt of the dam safety assessment, and as part of implementation of the project, the World Bank will contract independent experts to assess and to validate the quality of the report.

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