

## EXECUTIVE SUMMARY

### I. Introduction

The Commonwealth of Puerto Rico will support the Federal Emergency Management Agency's (FEMA's) Multi-Hazard Flood Map Modernization Program (MHFMMP) by contributing to each of the MHFMMP objectives:

- Establish and maintain a premier data collection and delivery system;
- Achieve effective program management;
- Build and maintain mutually beneficial partnerships; and
- Expand and better inform the user community.

This plan discusses how we anticipate that our program will foster these goals.

### II. Vision for Supporting Multi-Hazard Flood Map Modernization

The Puerto Rico Planning Board (PRPB) is the Commonwealth agency responsible for the overall coordination and integration of the government's policy concerning the National Flood Insurance Program (NFIP). We would like to take increased responsibility for project management, hydrologic and hydraulic data development, data sharing, and outreach within the Commonwealth, expanding our role as a Cooperating Technical Partner (CTP). This plan describes what activities we would like to participate in as a CTP, and how those activities will help FEMA towards its Map Modernization goals:

- Project Management;
  - Project Prioritization;
  - Project Scoping;
  - Contractor Oversight;
- Hydrologic and Hydraulic Data Development;
- Data Sharing; and
- Outreach.

We are currently in the process of integrating our mapping program with FEMA's mapping program by having the Commonwealth land use ordinances refer to the FEMA Digital Flood Insurance Rate Map (DFIRM), and not to the Puerto Rico floodplain maps. We have already started this process and hope to finalize this integration within the next year to make Map Modernization in the Commonwealth as efficient and productive for the stakeholders as possible.

Although the Commonwealth of Puerto Rico is a NFIP community in its entirety, there are currently also two other NFIP communities within Puerto Rico – the municipios of Bayamon and Ponce. While each municipio is recognized as an individual NFIP community, and each municipio has the authority to implement the floodplain regulations according to the Municipal Autonomous Law, the Commonwealth has retained the authority to evaluate the amendments and revisions to the floodplains and the floodplain ordinance. We envision over the next five years that there will be a greater number of individual municipios joining the NFIP, and we will encourage those municipio NFIP communities to become CTPs if they have the interest and technical capability. In fact, Ponce has already taken the initiative to request admission into the CTP program. We will work with FEMA to coordinate with the municipio shortly to outline

their responsibilities and contributions to the program as a CTP, and to formalize that partnership.

### **III. Five-Year Strategy**

Due to recent disaster events in Puerto Rico, we have been able to use Disaster Relief funds to make progress in modernizing the maps in Puerto Rico. A DFIRM meeting current FEMA specifications is underway, and a final DFIRM should be available to the public by FY 2005. We updated the existing effective maps into this digital format so we could use this DFIRM and its associated database as a platform to easily incorporate updated flood hazard data as it is developed. Our five-strategy builds upon this platform to incorporate updated coastal and riverine restudies.

Because Puerto Rico is a high flood risk commonwealth, it is essential that flood hazard mapping is updated and can accurately inform floodplain management decisions. There have been 55 Federal Disasters declared in Puerto Rico and the most recent disasters have shown that the flood hazard data shown on the existing FIRMs are out of date and inaccurate. The most pressing need in Puerto Rico is to update the coastal analyses and mapping, which is one of the areas where severe flooding damage occurs. There is also a need to update riverine analyses throughout the Commonwealth, some of which is already underway. We understand that in addition to the riverine restudies already underway, FEMA Region II anticipates allocating FY04 funds toward additional restudies in Puerto Rico. Our funding request includes the FY04 restudies, but assumes that the FY03 restudies are already completely funded.

In order to provide the focus and expertise required for this program, we need to expand the capacity of the PRPB to oversee the program in Puerto Rico. To accomplish the above tasks in an efficient manner and at the anticipated volume, we have identified the need for 4 additional full time staff members: 1 Senior Engineer, 1 Engineer, and 2 Mapping Technicians. These 4 staff will be responsible for supporting the Floodplain Management Section in the technical and data sharing aspects of the programs.

PRPB anticipates procuring our own study contractor to carry out some of the restudies required in Puerto Rico. PRPB will provide the project management in overseeing this contractor and reviewing the analyses and mapping before submission to FEMA.

### **IV. Performance Measures and Goals**

The Commonwealth of Puerto Rico has already made significant strides towards meeting FEMA's Government Performance and Accountability Act (GPRA) goals for MHFMMP. Because a DFIRM for the entire Commonwealth was funded for under the Disaster Relief Fund, the Commonwealth was able to provide 100% of its population with a digital map on February 3, 2004, to be delivered online by the National Service Provider shortly, thus meeting FEMA's 5-year GPRA Goal 1 early.

Fiscal Year	FEMA GPRA Goal 1: Population of Puerto Rico with Digital Map Online	
	Puerto Rico Actual	FEMA Goal
2004	<b>100%</b>	20%
2005	100%	50%
2006	100%	65%
2007	100%	75%
2008	100%	85%
2009	100%	100%

Currently, the preliminary Puerto Rico DFIRM is being reviewed by affected stakeholders, and the 90-day appeal period has already started. We anticipate that all DFIRM panels will be adopted by the Commonwealth and be used for floodplain management and insurance purposes by FY2005, thus meeting FEMA’s 5-year GPRA Goal 2 early.

Fiscal Year	FEMA GPRA Goal 2: Population of Puerto Rico with Modernized Maps Adopted	
	Puerto Rico Projection	FEMA Goal
2004	0%	10%
2005	<b>100%</b>	20%
2006	100%	35%
2007	100%	50%
2008	100%	70%
2009	100%	90%

We have built upon support from Federal agencies to forge the partnerships necessary to achieve our vision. To date, we have been able to form partnerships and utilize data from several agencies.

- High-resolution LiDAR data for approximately 0.5km-1.0km along the entire Puerto Rico coastline collected in 2000 through the National Oceanic and Atmospheric Administration (NOAA), the National Aeronautics and Space Administration (NASA), and the U.S. Geological Survey (USGS);
- Digital bathymetric data by NOAA; and
- USGS Digital Orthophotography QuarterQuadrangle (DOQ).

In addition, for future updates to the DFIRM, we hope to use Commonwealth-wide orthophotography developed by the U.S. Army Corps of Engineers (USACE), St. Louis District, which is currently underway. This will serve as a high quality base map for all updates to the DFIRM in the future.

In considering the data that we have been able to gather to this point, we hope to continue this success and help FEMA meet its GPRA goal of increasing the leveraged effort towards GIS flood hazard data over the next 5 years. Without known data that can be leveraged, the overall project leveraged cost is currently projected to be 11%.

<b>FEMA GPRA Goal 3: Leveraged Effort Towards GIS Flood Hazard Data</b>					
<b>Leveraged Contribution</b>				<b>Total Project Cost</b>	<b>% Leverage</b>
<b>Fiscal Year</b>	<b>Base Map Data</b>	<b>Topographic Mapping</b>	<b>Bathymetric Data</b>		
2004	\$64,070	\$220,592	\$110,296	\$2,697,457	15%
2005	\$12,900	\$0	\$0	\$789,803	2%
2006	\$14,620	\$0	\$0	\$689,036	2%
<b>Overall</b>	<b>\$91,590</b>	<b>\$220,592</b>	<b>\$110,296</b>	<b>\$4,176,873</b>	<b>11%</b>

As mentioned previously, PRPB is currently a CTP with FEMA. In addition, the municipio of Ponce is pursuing becoming a CTP to take on a greater role in Map Modernization and in the NFIP. In this way, any funding that FEMA obligates to Puerto Rico staff for implementing Map Modernization will help towards its goal of putting increased funding through CTPs.

As part of our Outreach effort, we will seek out and identify other potential CTP partners through which Puerto Rico can leverage even more than it is proposing. Through those efforts, we hope to establish other CTPs to support FEMA in meeting its GPRA Goal 4.

## **V. Program Funding**

There are three elements that will require funding from FEMA over the next five years:

- Initial Remapping of the Commonwealth;
- Map Maintenance; and
- Program Administration/Management.

Under the full funding scenario discussed in this plan, the projected annual program costs, in constant FY 2004 dollars, are summarized below. Detailed costs on the initial remapping for a fully funded program are shown in Appendix C.

Program Element		FY04	FY05	FY06	FY07	FY08	Total
Initial Remapping	Funding Requirement	\$2,697,457	\$789,803	\$689,036	\$0	\$0	\$4,176,296
	<b>Requested FEMA Funding</b>	\$2,302,499	\$776,903	\$674,416	\$0	\$0	<b>\$3,753,819</b>
Maintenance	Funding Requirement	\$0	\$0	\$259,070	\$169,526	\$145,217	\$573,813
	<b>Requested FEMA Funding</b>	\$0	\$0	\$259,070	\$169,526	\$145,217	<b>\$573,813</b>
Program Administration/ Management	Funding Requirement	\$131,000	\$108,000	\$108,000	\$108,000	\$108,000	\$563,000
	<b>Requested FEMA Funding</b>	\$98,250	\$81,000	\$81,000	\$81,000	\$81,000	<b>\$422,250</b>
<b>Total Requested FEMA Funding</b>		<b>\$2,400,749</b>	<b>\$857,903</b>	<b>\$1,014,486</b>	<b>\$250,526</b>	<b>\$226,217</b>	<b>\$4,749,882</b>

We have developed alternative funding scenarios, and they are outlined in Section IV. However, each of these funding scenarios decreases the level of up-to-date, accurate data that can be published on the DFIRM. This clearly increases the risk to the population of Puerto Rico by not providing the level of detail needed for sound floodplain management.

## ACRONYMS AND ABBREVIATIONS

<b>ADCIRC</b>	Advanced Circulation Model
<b>ARPE</b>	Administration of Regulations and Permits
<b>CTP</b>	Cooperating Technical Partner
<b>DFIRM</b>	Digital Flood Insurance Rate Map
<b>DOQ</b>	Digital Orthophotography QuarterQuadrangle
<b>FEMA</b>	Federal Emergency Management Agency
<b>FIS</b>	Flood Insurance Study
<b>FIRM</b>	Flood Insurance Rate Map
<b>GIS</b>	Geographic Information System
<b>GPRA</b>	Government Performance and Accountability Act
<b>HMGP</b>	Hazard Mitigation Grant Program
<b>LiDAR</b>	Light Detection and Ranging
<b>MHFMMP</b>	Multi-Hazard Flood Map Modernization Program
<b>MNUSS</b>	Mapping Needs Update Support System
<b>NASA</b>	National Aeronautics and Space Administration
<b>NFIP</b>	National Flood Insurance Program
<b>NOAA</b>	National Oceanic and Atmospheric Administration
<b>USACE</b>	United States Army Corps of Engineers
<b>USGS</b>	United States Geological Survey
<b>PRPB</b>	Puerto Rico Planning Board

# TABLE OF CONTENTS

**EXECUTIVE SUMMARY ..... i**

**ACRONYMS AND ABBREVIATIONS .....vi**

**I. VISION FOR SUPPORTING MULTI-HAZARD FLOOD MAP MODERNIZATION.....1**

CURRENT PUERTO RICO COMMONWEALTH FLOOD MAPPING PROGRAM .....1

PUERTO RICO COMMONWEALTH FLOOD MAPPING PROGRAM VISION .....3

*Project Management* .....4

*Hydrologic and Hydraulic Data Development* .....5

*Data Sharing* .....5

*Outreach* .....6

**II. CURRENT NEEDS AND FIVE-YEAR IMPLEMENTATION STRATEGY .....7**

CURRENT NEEDS .....7

FIVE YEAR IMPLEMENTATION STRATEGY .....7

*Establish and Maintain a Premier Data Collection and Delivery System* .....8

*Achieve Effective Program Management* .....9

*Build and Maintain Mutually Beneficial Partnerships* .....9

*Expand and Better Inform the User Community* .....9

FIVE YEAR MAPPING PLAN .....9

**III. PERFORMANCE GOALS .....11**

FEMA GPRA GOAL 1 – POPULATION OF PUERTO RICO COMMONWEALTH WITH GIS FLOOD HAZARD DATA ONLINE .....11

FEMA GPRA GOAL 2 – POPULATION OF THE PUERTO RICO COMMONWEALTH WITH MODERNIZED GIS MAPS ADOPTED .....11

FEMA GPRA GOAL 3 – PERCENT LEVERAGE TOWARDS GIS FLOOD HAZARD DATA .....12

FEMA GPRA GOAL 4 – MAP MODERNIZATION FUNDING PUT THROUGH TO CTPS .....13

**IV. PUERTO RICO MAP MODERNIZATION FUNDING / ALTERNATIVE FUNDING LEVELS....14**

FULL FUNDING .....14

*Initial Remapping* .....14

*Program Administration/Management* .....16

*Map Maintenance* .....17

MEDIUM FUNDING ALTERNATIVE .....17

*Initial Remapping* .....18

*Program Management and Administration* .....18

*Map Maintenance* .....19

LOW FUNDING ALTERNATIVE .....19

*Initial Remapping* .....19

*Program Management and Administration* .....20

*Map Maintenance* .....20

**APPENDIX A: FULL FUNDING RIVERINE RESTUDY PRIORITY LIST**

**APPENDIX B: FULL FUNDING PROJECT SCHEDULE**

**APPENDIX C: FULL FUNDING PROJECT COSTS**

**APPENDIX D: MEDIUM FUNDING PROJECT COSTS**

**APPENDIX E: LOW FUNDING PROJECT COSTS**



## I. Vision for Supporting Multi-Hazard Flood Map Modernization

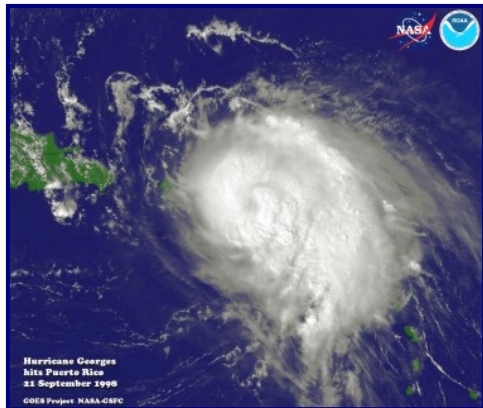
The Commonwealth of Puerto Rico will support the Federal Emergency Management Agency's (FEMA's) Multi-Hazard Flood Map Modernization Program (MHFMMP) by contributing to each of the MHFMMP objectives:

- Establish and maintain a premier data collection and delivery system;
- Achieve effective program management;
- Build and maintain mutually beneficial partnerships; and
- Expand and better inform the user community.

This plan discusses how we anticipate that our program will foster these goals.

### *Current Puerto Rico Commonwealth Flood Mapping Program*

Floods can occur in Puerto Rico any time during the year; however, they are most frequent from June through November. The most severe flooding generally occurs when hurricanes and tropical storms pass through or near the area. Cloudburst storms can occur any time during the year and, because of the steep slopes of the tributary streams, the excess rainfall is delivered

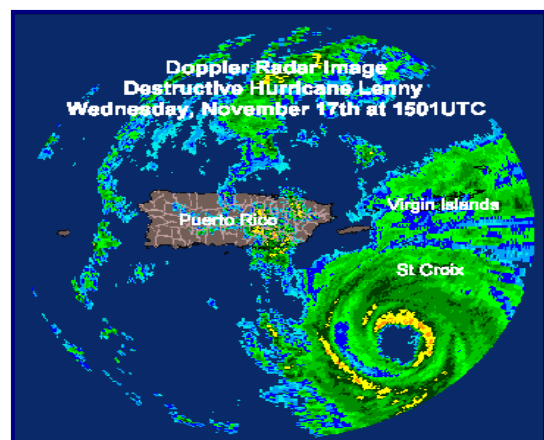


downstream quickly, producing flash floods. Periodic flood damage to agricultural lands, infrastructure, and structures is significant. For example, in the main Río Grande de Añasco floodplain, floodwaters have inundated the 1% annual chance floodplain 17 times in a period of 31 years, an average of approximately once every 2 years. According to FEMA, five of the top 35 costliest hurricane disasters, in terms of damage, affected Puerto Rico. In addition, four of the top ten costliest hurricane disasters, in terms of relief provided by FEMA, affected Puerto Rico.

Because Puerto Rico is a mountainous island, much of the development over the past 45 years on the island has occurred in the coastal areas and within floodplains. When severe flooding events occur, both population and properties are at risk without proper mitigation and planning beforehand. There have been several recent flooding disasters in Puerto Rico:

- Hurricane Hugo in 1989;
- Severe Floods in 1992;
- Hurricane Marilyn in 1995;
- Hurricane Hortense in 1996;
- Hurricane Georges in 1998;
- Severe Floods in 2001; and
- Severe Floods in 2003.

All of these disasters have shown the importance of the FEMA Flood Insurance Rate Maps (FIRMs) and Flood Insurance Studies (FISs) in both responding to the disaster and in flood hazard mitigation. In addition, these disasters have shown how important it



is to be able to easily access up-to-date and accurate maps reflecting existing conditions flood risk. The flood hazard data shown on the current FIRMs are out of date and are in need of restudy.

Hurricane Hortense was declared a Federal Disaster on September 11, 1996, thus making the Federal Funds available for response and recovery. As part of the Hazard Mitigation Grant Program (HMGP), funds were also made available for a restudy of five riverine basins that were shown to be out of date on the FEMA FIRMs:

- Río Bayamon;
- Río Coamo;
- Río Guamani;
- Río de la Plata; and
- Río Nigua of Salinas.

These reaches were studied in detail for FEMA. Revised hydrologic and hydraulic analyses were prepared for the 10%-, 2%-, 0.1%-, and 0.2%-annual chance floodplains and floodway. Work maps were also prepared showing the revised floodplains in these areas.

In 2001, it was determined that Disaster Relief Funds could be used towards Map Modernization efforts if the following criteria could be met:

- There is an open Presidential disaster declaration;
- There is demonstrated need that the FIRMs warrant updating;
- The community has agreed to partnered activities, and
- Digital FIRM (DFIRM) specifications will be met or exceeded through this project.

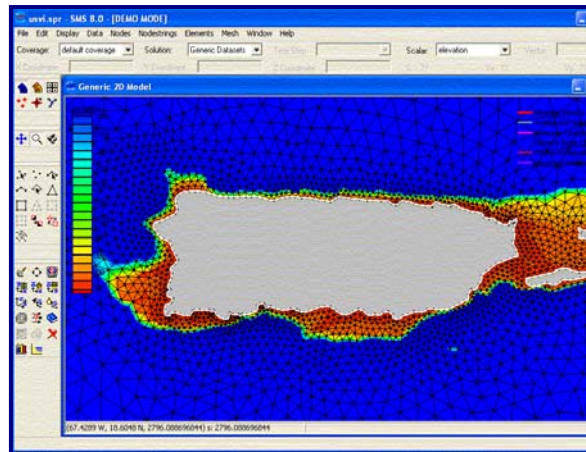
With several recent disasters in Puerto Rico, and two Presidential disaster declarations still open at the time, funds were approved to be allocated towards updating the Puerto Rico FIRMs to current DFIRM specifications. As part of this effort, the Puerto Rico Planning Board (PRPB), the Commonwealth agency responsible for the overall coordination and integration of the government's policy concerning the National Flood Insurance Program (NFIP), became a Cooperating Technical Partner (CTP) with FEMA on July 23, 2001, to develop a partnership under Map Modernization. As part of this partnership, we shared data, such as digital topographic mapping, digital bathymetric data, and Geographical Information Systems (GIS) data layers, with FEMA for use in developing updated flood hazard information. With this commitment towards Map Modernization in Puerto Rico, production began to complete a digital upgrade for the entire Commonwealth in order to modernize the FIRM. This included:

- Incorporating five basin restudies from the HMGP project;
- Utilization of updated base map and GIS data from the Commonwealth;
- Incorporating hundreds of Letters of Map Change;
- Creation of a GIS-enabled DFIRM Database; and
- Outreach to the community in making the maps user-friendly.

The Puerto Rico DFIRM was issued preliminary to the Commonwealth on February 3, 2004, and is currently in the 90-day Appeal Period. We anticipate that this DFIRM will be finalized and adopted by 2005.

Currently, Puerto Rico floodplain management ordinances refer to the Commonwealth of Puerto Rico maps, not directly to the FEMA FIRMs. With this latest revision, the Commonwealth is in the process of integrating its mapping program with the FEMA program so that there is only one set of flood hazard maps in Puerto Rico.

In the past year, FEMA has been investigating the use of a new finite element hydrodynamic storm surge model, Advanced Circulation Model (ADCIRC), for flood hazard mapping purposes. It had been used for FEMA flood hazard mapping in site specific projects (American Samoa and Charleston, South Carolina), and it was being reviewed for inclusion in FEMA's Accepted Models list. FEMA accepted the use of AdCIRC for coastal storm surge modeling and FEMA Region II initiated a project to develop an updated storm surge model for the Caribbean area using ADCIRC. This project is currently focused



on the Virgin Islands and will be completed in Spring 2004. Although the current project is focused on the Virgin Islands and the coastal stillwater elevations developed from this model can only be applied in the Virgin Islands, much of the input data and grid setup can be transferred for use in Puerto Rico; additional refinement of the Puerto Rico conditions and additional data would need to be included for use in developing coastal stillwater elevations for Puerto Rico. In turn, this would be the starting point for a full coastal restudy of the entire Commonwealth.

There are also ongoing riverine restudies already tasked by FEMA Region II to their IDIQ contractor. FEMA Region II's IDIQ contractor has been tasked to restudy approximately 65 miles over 8 reaches throughout the Commonwealth. We will work with the IDIQ contractors to make sure that their completed analyses are accurate, cover the requested study limits, and reflect current conditions.

### ***Puerto Rico Commonwealth Flood Mapping Program Vision***

We would like to take increased responsibility for project management, hydrologic and hydraulic data development, data sharing, and outreach within the Commonwealth, expanding our role as a CTP. This plan describes what activities we would like to participate in as a CTP, and how those activities will help FEMA towards its Map Modernization goals:

- Project Management;
  - Project Prioritization;
  - Project Scoping;
  - Contractor Oversight;
- Hydrologic and Hydraulic Data Development;
- Data Sharing; and
- Outreach.

As discussed before, we are in the process of integrating its mapping program with FEMA's mapping program. The main hurdle to overcome is to have all ordinances refer to the FEMA



## **Project Prioritization**

By working through our partnership with ARPE's headquarters and local offices, PRPB is able to continually monitor mapping needs in Puerto Rico. This plan outlines the project prioritization methodology and the prioritization of restudies in Puerto Rico. Based on continual needs assessment, PRPB will continue to provide project prioritization to FEMA on an annual basis, through updated business plans.

## **Project Scoping**

At the initiation of each project in Puerto Rico, PRPB will be involved in scoping each project. This includes discussing with FEMA and its contractor(s) the following:

- Upstream and downstream limits of restudy;
- Methodology of restudy;
- Available data to may be utilized; and
- Local concerns and any politically sensitive areas.

## **Contractor Oversight**

PRPB anticipates procuring its own study contractor to carry out some of the restudies required in Puerto Rico. PRPB will provide the project management in overseeing this contractor and reviewing the analyses and mapping before submission to FEMA.

## **Hydrologic and Hydraulic Data Development**

We anticipate procuring our own contractor to develop hydrologic and hydraulic data for use in updating the DFIRM for the Commonwealth. Once the project has been completely scoped, the contractor will be responsible for gathering the topographic and survey data, developing the hydrologic and hydraulic analyses, and mapping the floodplains and floodway for incorporation into the DFIRM, as specified by FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners (April 2003).

## **Data Sharing**

We have been able to obtain several sources of data (bathymetry and digital elevation data) for use in updating the coastal analyses for Puerto Rico. In researching available data for incorporation into the DFIRM, we determined that the National Aeronautics and Space Administration (NASA) had developed Light Detection and Ranging (LiDAR) data along the shoreline of the Commonwealth and that the National Oceanic and Atmospheric Administration (NOAA) had developed bathymetric data along the coast of the Commonwealth. We have helped FEMA obtain this data, and FEMA's contractor has processed the LiDAR data for use in coastal flood hazard analyses once merged with the bathymetric data. In addition, PRPB's GIS Department holds commonwealth-wide datasets that were important for FEMA's use in updating DFIRM panels. We hope to build upon the past success, and use this data for Map Modernization. Similarly, Ponce and Bayamon have well developed GIS programs within their municipios which can provide data (orthophotography and planimetrics) and GIS support. In addition, as the

data sets are updated, we would provide the most up-to-date data for FEMA's use in its restudy efforts. We would also like to explore other potential partnering opportunities for data sharing.

### **Outreach**

An important part of successful floodplain management is outreach. We would like to continually provide a suite of outreach efforts to successfully implement FEMA's MHFMMP with the local users. For example, with the recent issuance of the preliminary DFIRM, outreach tools were used to reach as wide an audience as possible. Fact sheets, in both English and Spanish, accompanied the maps and were distributed to affected stakeholders. We will work with FEMA, ARPE, and the municipios to implement a Commonwealth-wide outreach effort, which would include both project-specific outreach and general training opportunities for the local users.

FEMA would remain responsible for developing and producing the DFIRM, and assisting us in the post-preliminary adoption process. The implementation of the fully funded scenario of the 5-year plan presented here will yield a full remapping of Puerto Rico and provide high quality multi-hazard flood data maps for the Commonwealth to use in floodplain management.

## **II. Current Needs and Five-Year Implementation Strategy**

### ***Current Needs***

Because Puerto Rico is a high flood risk commonwealth, it is essential that flood hazard mapping is updated and can accurately inform floodplain management decisions. There have been 55 Federal Disasters declared in Puerto Rico; there are 54,550 policies and 20,376 claims in Puerto Rico. Out of the 20,376 claims, 5,308 are repetitive loss claims covering 1,880 structures. As discussed previously, the flood hazard data shown on the existing FIRMs are out of date and inaccurate. The most pressing need in Puerto Rico is to update the coastal analyses and mapping, which is one of the areas where severe flooding damage occurs. Updated flood hazard data can then be used to better guide future development and mitigate existing risks in these areas.

There is also a need to update riverine analyses, some of which are currently shown on the FIRM as approximate floodplains. We request that all of these riverine analyses be restudied in detail to provide the needed information for effective floodplain management. We understand that in addition to the riverine restudies already underway, FEMA Region II anticipates allocating FY04 funds toward additional restudies in Puerto Rico. Our funding request includes the FY04 restudies, but assumes that the FY03 restudies are already completely funded.

As updated flood hazard data is developed, it is essential that it is developed in a digital environment so that Puerto Rico agencies can access and utilize them in a GIS environment. While the preliminary DFIRMs are currently being prepared for GIS accessibility, all existing backup data for the old studies are in a manual format and are not easily accessible in a GIS environment. Digital GIS flood hazard mapping data is essential and highly needed for best utilization for floodplain management. All new data to be developed for the proposed restudies will be developed in a GIS environment and will be accessible through the DFIRM Database (preferably the Enhanced DFIRM Database).

### ***Five Year Implementation Strategy***

To implement the Map Modernization plan that we are outlining for Puerto Rico, we require funding for personnel and training. Funding for mapping needs is discussed in the Five-Year Mapping Plan.

Currently, there are two PRPB staff members participating in and implementing the NFIP in Puerto Rico. They are responsible for:

- Providing technical assistance as needed to the public receiving new DFIRMs;
- Reviewing technical analyses, programmatic compliance, and revision requests for incorporation by FEMA;
- Providing general technical assistance to communities and individuals to resolve floodplain management issues;
- Participating in the development of mapping priorities, the scoping of studies, and in community meetings;

- Coordinating with other Commonwealth administered programs that impact on floodplain management such as Commonwealth land use and water resources programs, including periodic meetings among Commonwealth agencies; and
- Providing post disaster assistance and support, such as technical assistance implementing substantial damage requirements, general floodplain management technical assistance, and assistance with a variety of hazard mitigation initiatives.

In order to provide the focus and expertise required for this program, we need to expand the capacity of the PRPB to oversee the program in Puerto Rico. To accomplish the above tasks in an efficient manner and at the anticipated volume, we have identified the need for 4 additional full time staff members: 1 Senior Engineer, 1 Engineer, and 2 Mapping Technicians. These 4 staff will be responsible for supporting the Floodplain Management Section in the technical and data sharing aspects of the programs:

- Coordination with contractors regarding restudies and mapping in the Commonwealth;
- Review of technical analyses and mapping;
- Investigate potential data sharing partnerships and aid FEMA in obtaining that data; and
- Provide data from the GIS-enabled DFIRM to constituents in the Commonwealth on an as needed basis.

The Floodplain Management Section Lead will continue to oversee the program, and shift responsibilities to focus less on the technical aspects of the program, and more on the following:

- Project Management;
  - Project Prioritization;
  - Project Scoping;
  - Contractor Oversight; and
- Outreach.

There are training needs for both PRPB staff and for the general public. PRPB staff would require training on the MNUSS system (or successor system) and on how to accurately capture needs data in the system. PRPB would also require the resources to provide training for the end users on the new mapping process, revision process, and how the public can get involved in understanding and implementing sound floodplain management.

We anticipate procuring our own study contractor to carry out some of the restudies required in Puerto Rico. PRPB will provide the project management in overseeing this contractor and reviewing the analyses and mapping before submission to FEMA.

In implementing the plan outlined here, we will help FEMA achieve its four objectives for Map Modernization.

### **Establish and Maintain a Premier Data Collection and Delivery System**

Our goal is that 100% of developed data is accessible to the public. We will work with FEMA to ensure that all data is developed in compliance with any data standards required for use in the data collection and delivery system.

### **Achieve Effective Program Management**

PRPB will play an integral part in the program management of MHFMMP in Puerto Rico. By being involved in the project management of each project initiated in Puerto Rico, we will help FEMA achieve each of its GPRA performance metrics. In addition, by reviewing and updating this plan annually, we will be able to track progress against the goals.

### **Build and Maintain Mutually Beneficial Partnerships**

We already work closely with FEMA, NOAA, NASA, the U.S. Geological Survey (USGS), and ARPE to develop programs and/or data important to the program's objectives:

- Coordination of bathymetric data; and
- Coordination of elevation data.

We will help to ensure information sharing among partners and to identify potential local partners throughout Puerto Rico.

### **Expand and Better Inform the User Community**

Several initiatives will be taken to provide larger scale outreach to the end user:

- Providing training to municipios in using DFIRMs and other GIS tools for floodplain management;
- Using local ARPE staff as local resources to facilitate better floodplain management and emergency response among local officials, engineers, and planners;
- Working with communities to update and adopt a model local ordinance; and
- Developing outreach and training modules.

### ***Five Year Mapping Plan***

Many remapping initiatives are already underway. We have already made progress in developing updated storm surge data for the Caribbean Area, which can be easily updated to include Puerto Rico's shoreline. Once the storm surge analysis for Puerto Rico is completed, it can then be used to update the coastal flood hazard analyses along the entire shoreline of Puerto Rico. In addition, riverine restudies are underway, and are anticipated to be delivered to FEMA in late 2004. We understand that in addition to the riverine restudies already underway, FEMA Region II anticipates allocating FY04 funds toward additional restudies in Puerto Rico. Our funding request includes the FY04 restudies, but assumes that the FY03 restudies are already completely funded.

To evaluate the mapping needs in Puerto Rico, PRPB performed a mapping needs assessment, which included the following tasks:

- Compiling known mapping needs and future development information;
- Reviewing available community-specific data; and
- Assigning map upgrade priorities.

Additional factors that were considered when developing the mapping priority list include:

- Methodology used in the existing flood hazard analyses;
- Existing or potential local mapping partners;
- Availability of existing base map, topographic data, and/or flood hazard data (including data from other Commonwealth agencies);
- Number of Letters of Map Change processed during the last 10 years; and
- Population and population growth (U.S. Census figures).

In using the above data, we developed a priority list for the riverine reaches in Puerto Rico. A complete coastal restudy remains the highest flood hazard update priority in Puerto Rico. The results of the ranking and priority-setting process for riverine restudies are summarized in Appendix A and a tentative schedule of completion for these studies is shown in Appendix B.

### III. Performance Goals

The Commonwealth of Puerto Rico has already made significant strides towards meeting FEMA's Government Performance and Accountability Act (GPRA) goals for MHFMMP, as detailed below.

#### ***FEMA GPRA Goal 1 – Population of Puerto Rico Commonwealth With GIS Flood Hazard Data Online***

We have already provided 100% of the commonwealth's population with digital GIS flood data online, meeting FEMA's 5-year GPRA Goal 1 early. The main purpose of the mapping funded through DRF was to provide easily accessible digital data in the form of a DFIRM meeting current specifications, with the understanding that updated flood hazard studies could be easily completed and incorporated into the DFIRM at a later date. A preliminary DFIRM, comprised of 205 panels covering the entire population of Puerto Rico, was issued on February 3, 2004.

Fiscal Year	FEMA GPRA Goal 1: Population of Puerto Rico with Digital Map Online	
	Puerto Rico Actual	FEMA Goal
2004	<b>100%</b>	20%
2005	100%	50%
2006	100%	65%
2007	100%	75%
2008	100%	85%
2009	100%	100%

#### ***FEMA GPRA Goal 2 – Population of the Puerto Rico Commonwealth With Modernized GIS Maps Adopted***

Currently, the preliminary Puerto Rico DFIRM is being reviewed by the affected stakeholders, and the 90-day appeal period has already started. We anticipate that all DFIRM panels will be adopted by the Commonwealth and be used for floodplain management and insurance purposes by FY2005, thus meeting FEMA's 5-year GPRA Goal 2 early.

Fiscal Year	FEMA GPRA Goal 2: Population of Puerto Rico with Modernized Maps Adopted	
	Puerto Rico Projection	FEMA Goal
2004	0%	10%
2005	<b>100%</b>	20%
2006	100%	35%
2007	100%	50%
2008	100%	70%
2009	100%	90%

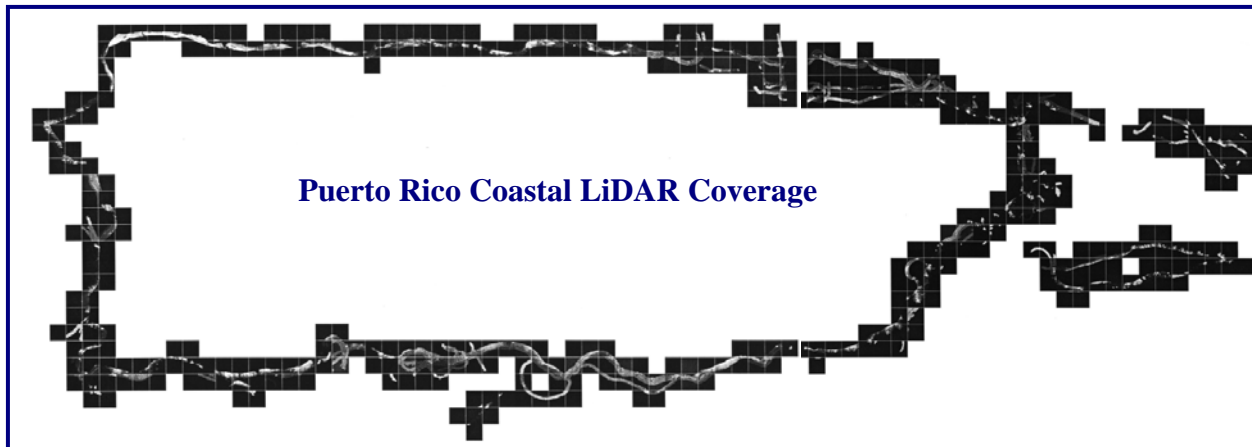
### ***FEMA GPRA Goal 3 – Percent Leverage Towards GIS Flood Hazard Data***

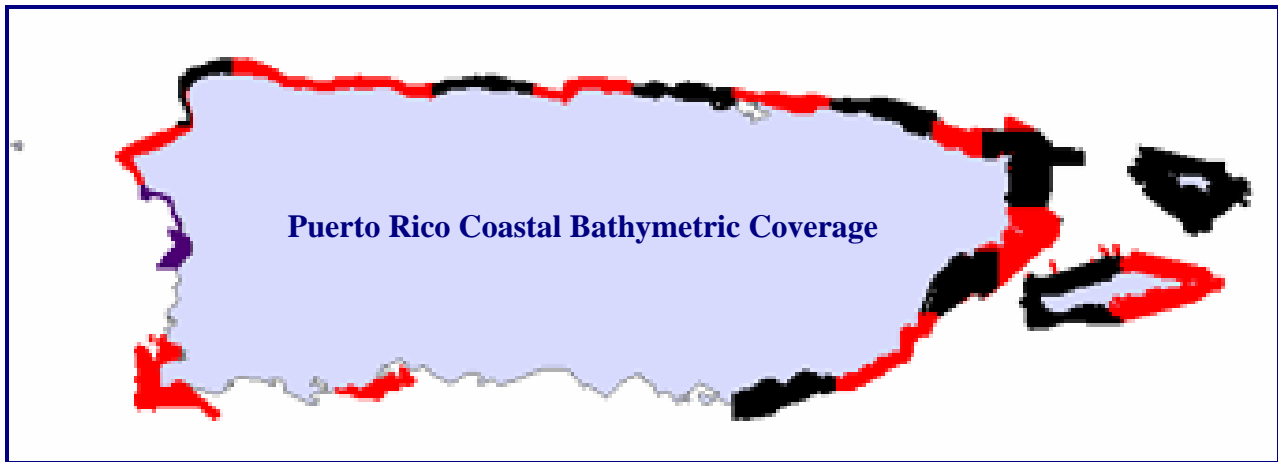
We have built upon support from Federal agencies to forge the partnerships necessary to achieve our vision. To date, we have been able to form partnerships and utilize data from several agencies.

- High-resolution LiDAR data for approximately 0.5km-1.0km along the entire Puerto Rico coastline collected in 2000 through NOAA, NASA, and USGS;
- Digital bathymetric data by NOAA; and
- USGS Digital Orthophotography QuarterQuadrangle (DOQ).

The preliminary DFIRM for Puerto Rico incorporates the use of USGS's DOQ. For future updates, we hope to use Commonwealth-wide orthophotography developed by the U.S. Army Corps of Engineers (USACE), St. Louis District, which is currently underway. This will serve as a high quality base map for all updates to the DFIRM in the future. The leveraged cost of this base map data is approximately \$100,000, as detailed in Appendix C. This is based on the FEMA Blue Book value for a base map of \$430/panel. The Commonwealth-wide paneling scheme used for the DFIRM follows the USGS DOQ paneling scheme for Puerto Rico and covers 205 panels. We anticipate that 111 panels will be revised based on the riverine restudy needs for the Commonwealth. There will be 104 panels revised based on the coastal restudy needs, many of which will overlap with the riverine panels.

As discussed before, we have been able to access digital elevation data and digital bathymetric data for the coastal restudy. This data covers the entire shoreline for Puerto Rico, thus saving the need to develop bathymetric and topographic mapping for the Commonwealth. The leveraged cost of this elevation data is approximately \$330,000, as detailed in Appendix C. This is based on the FEMA Blue Book value for 2-foot contour topographic data collected for approximately 50 square miles at a time of \$950/square mile. There are approximately 232 square miles covered by the NASA LiDAR data and approximately 116 square miles covered by the NOAA bathymetric data. The figures below shows the coverage of NASA's LiDAR data, now cleaned to bare earth by FEMA's contractor, and of NOAA's bathymetric data.





In considering the data that we have been able to gather to this point, we hope to continue this success and help FEMA meet its GPRA goal of increasing the leveraged effort towards GIS flood hazard data over the next 5 years. Without known data that can be leveraged, the overall project leveraged cost is currently projected to be 11%.

<b>FEMA GPRA Goal 3: Leveraged Effort Towards GIS Flood Hazard Data</b>					
<b>Leveraged Contribution</b>				<b>Total Project Cost</b>	<b>% Leverage</b>
<b>Fiscal Year</b>	<b>Base Map Data</b>	<b>Topographic Mapping</b>	<b>Bathymetric Data</b>		
2004	\$64,070	\$220,592	\$110,296	\$2,697,457	15%
2005	\$12,900	\$0	\$0	\$789,803	2%
2006	\$14,620	\$0	\$0	\$689,036	2%
<b>Overall</b>	<b>\$91,590</b>	<b>\$220,592</b>	<b>\$110,296</b>	<b>\$4,176,873</b>	<b>11%</b>

***FEMA GPRA Goal 4 – Map Modernization Funding Put Through to CTPs***

As mentioned previously, PRPB is currently a CTP with FEMA. In addition, the municipio of Ponce is pursuing becoming a CTP to take on a greater role in Map Modernization and in the NFIP. In this way, any funding that FEMA obligates to Puerto Rico staff for implementing Map Modernization will help towards this goal.

As part of our Outreach effort, we will seek out and identify other potential CTP partners through which Puerto Rico can leverage even more than it is proposing. Through those efforts, we hope to establish other CTPs to support FEMA in meeting its GPRA Goal 4.

#### IV. Puerto Rico Map Modernization Funding / Alternative Funding Levels

There are three elements that will require funding from FEMA over the 5-year period FY 2004-FY2008. These are:

- Initial Remapping of the Commonwealth;
- Map Maintenance; and
- Program Administration/Management.

#### *Full Funding*

Under the full funding scenario discussed in the plan, the projected annual program costs, in constant FY 2004 dollars, are summarized below for FY 2004-2008. Detailed costs on the initial remapping for a fully funded program are shown in Appendix C.

Program Element		FY04	FY05	FY06	FY07	FY08	Total
Initial Remapping	Funding Requirement	\$2,697,457	\$789,803	\$689,036	\$0	\$0	\$4,176,296
	<b>Requested FEMA Funding</b>	\$2,302,499	\$776,903	\$674,416	\$0	\$0	<b>\$3,753,819</b>
Maintenance	Funding Requirement	\$0	\$0	\$259,070	\$169,526	\$145,217	\$573,813
	<b>Requested FEMA Funding</b>	\$0	\$0	\$259,070	\$169,526	\$145,217	<b>\$573,813</b>
Program Administration/Management	Funding Requirement	\$131,000	\$108,000	\$108,000	\$108,000	\$108,000	\$563,000
	<b>Requested FEMA Funding</b>	\$98,250	\$81,000	\$81,000	\$81,000	\$81,000	<b>\$422,250</b>
<b>Total Requested FEMA Funding</b>		<b>\$2,400,749</b>	<b>\$857,903</b>	<b>\$1,014,486</b>	<b>\$250,526</b>	<b>\$226,217</b>	<b>\$4,749,882</b>

#### Initial Remapping

We would like to either restudy detail reaches or establish elevations for Zone A floodplains for those reaches that are highly flood prone and are in developing areas. Estimated total costs of the initial remapping of the Commonwealth were based on estimated project units (land area, stream miles, and DFIRM panels) and the unit costs as outlined in FEMA's Blue Book, as shown in Appendix C, except as noted below.

<b>Task</b>	<b>Unit</b>	<b>Cost Per Unit</b>	<b>Total Cost</b>
Local Orthophoto Base Map	Panel	\$430	\$91,590
Topographic Mapping (Including bathymetric mapping, 2 foot contour, 50 square mile collection)	Square Mile	\$950	\$330,888
Field Survey	Mile	\$2,200	\$515,570
Detailed Riverine Restudy (Hydrology, Hydraulics, and Mapping)	Mile	\$5,000	\$1,171,751
Coastal Restudy (Engineering and Mapping)	Mile	\$3,600	\$1,345,294
DFIRM Production	Panel	\$2,500*	\$532,500
<b>TOTAL</b>			<b>\$4,176,296</b>

\* The FEMA Blue Book value for DFIRM production is not used. A lower value of \$2,500 is used because the DFIRM for PR already meets current specifications and thus, there is a lower cost for updating these affected panels.

As discussed before, there is already an orthophoto base map available for use in producing the DFIRM, and we anticipate that a more up-to-date base map will be made available through USACE for future updates to the DFIRM. The panel units were derived by using the USGS DOQ paneling scheme. There are several reaches already being restudied and are anticipated to be completed in late 2004. However, funding for the DFIRM production and post-preliminary processing for these riverine updates has not been allocated yet (anticipate allocation with FY04 funds), so the costs associated with those tasks are included in this plan. Based on the restudy reaches, there are several panels being updated due to multiple reaches being restudied. However, for cost purposes, we assumed that the panel would only be revised once within the fiscal year that it is being initiated. For example, the panel being revised for the FY2003-initiated Rio Valenciano reach is panel 1235. However, that panel is also being revised to incorporate Rio Gurabo, so the panel cost is not included for Rio Valenciano (it is only included for Rio Gurabo).

As discussed previously, there is topographic mapping available for the coastal area in Puerto Rico. The square mileage unit for the Puerto Rico topographic mapping is approximately 232 square miles and the square mileage for the bathymetric data is approximately 116 square miles.

The riverine mile units were derived from the prioritization of restudy needs within the commonwealth. Based on this prioritization, there are approximately 235 miles of riverine reaches to be restudied in detail, of which 64 miles have already been tasked in FY2003. All of the restudy miles are listed in detail in Appendix A.

The coastal mile unit for the coastline of all of Puerto Rico is approximately 370 miles.

### Program Administration/Management

The vision described earlier in the plan describes the roles that we would like to be responsible for over the next 5 years. In order to make that happen, we are requesting funding for the resources needed to maintain its capability and to take an increased role.

Program administration and management functions to be carried out by PRPB staff include:

- Project planning (business plan updates, establishing priorities, etc.);
- Development of federal, Commonwealth agency and local partnerships; and
- Community and public outreach.

We request that 4 additional full-time positions be funded for implementing Map Modernization at \$108,000 (FY 2004 dollars) annually. These FEMA-funded positions are created directly in support of the Map Modernization effort:

- 1 Senior Engineer (\$40,000) – Professional Engineer with approximately 5 years of experience in hydrologic and hydraulic engineering;
- 1 Engineer (\$28,000) – Engineer with approximately 2-3 years of experience in hydrologic and hydraulic engineering; and
- 2 Mapping Technicians (\$20,000 each) – Technicians with experience in land use and/or geography.

These positions will be responsible for the following:

- Provide ordinance review and technical assistance as needed to the public receiving new DFIRMs;
- Review and/or update a model floodplain ordinance/regulation for dissemination to local municipalities in order to improve compliance with the NFIP;
- Conduct workshops and other training for local officials to support implementation and enforcement of community floodplain management regulations and to promote hazard identification and local Commonwealth planning initiatives;
- Provide general technical assistance to communities and individuals to resolve floodplain management issues;
- Participate in the development of mapping priorities, the scoping of studies, and in community meetings;
- Coordinate with other Commonwealth administered programs that impact on floodplain management such as Commonwealth land use and water resources programs, including periodic meetings among Commonwealth agencies; and
- Provide post disaster assistance and support, such as technical assistance implementing substantial damage requirements, general floodplain management technical assistance, and assistance with a variety of hazard mitigation initiatives.

In addition, to fully implement the vision outlined in this plan, we request that some equipment needs be funded at approximately \$23,000 the first year:

- 1 GPS Equipment (\$10,000) – For use in field verification of restudies;

- 2 GIS Software and Hardware (\$6,000 each station) – For use by mapping technicians in utilizing data developed through Map Modernization; and
- Printer and Scanner (\$1,000) – For general program support.

**Map Maintenance**

Flood data and topographic data updates will begin in 2006, after the current DFIRMs become effective and are available for about a year. Costs for flood data and framework data updates are similar to those used in the Initial Remapping costing exercise. For purposes of this estimate, it has been assumed that 10% of the engineering studies (either riverine or coastal) will require restudy updates annually and 10% of the DFIRM panels will require updates to incorporate the updated engineering data annually because of the high level of development in various areas in the Commonwealth. Because existing conditions are constantly changing, updates to the engineering studies and the DFIRM panels will be required on an annual basis. Details of these costs are shown in Appendix C.

<b>Fiscal Year</b>	<b>Engineering Restudies</b>	<b>DFIRM Production</b>	<b>Total</b>
FY 2006	\$243,770	\$15,300	\$259,070
FY 2007	\$159,326	\$10,200	\$169,526
FY 2008	\$133,657	\$11,560	\$145,217
<b>Total 2006-2008</b>	<b>\$536,753</b>	<b>\$37,060</b>	<b>\$573,813</b>

***Medium Funding Alternative***

If full funding is not available, we would limit the amount of riverine restudy. In addition, we would limit the amount of program management and outreach that we could provide. The maintenance phase would be delayed by a year. All of these factors would mean that the data being developed for Puerto Rico would not be the high quality that Puerto Rico expects and requires for sound floodplain management. Projected costs, in constant FY 2004 dollars, for the medium funding scenario are summarized below. Details of these costs are shown in Appendix D.

Program Element		FY04	FY05	FY06	FY07	FY08	Total
Initial Remapping	Funding Requirement	\$2,697,457	\$0	\$0	\$0	\$0	\$2,697,457
	<b>Requested FEMA Funding</b>	<b>\$2,302,499</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$2,302,499</b>
Maintenance	Funding Requirement	\$0	\$0	\$129,535	\$84,763	\$72,608	\$286,906
	<b>Requested FEMA Funding</b>	<b>\$0</b>	<b>\$0</b>	<b>\$129,535</b>	<b>\$84,763</b>	<b>\$72,608</b>	<b>\$286,906</b>
Program Administration/ Management	Funding Requirement	\$110,000	\$88,000	\$88,000	\$88,000	\$88,000	\$462,000
	<b>Requested FEMA Funding</b>	<b>\$82,500</b>	<b>\$66,000</b>	<b>\$66,000</b>	<b>\$66,000</b>	<b>\$66,000</b>	<b>\$346,500</b>
<b>Total Requested FEMA Funding</b>		<b>\$2,384,999</b>	<b>\$66,000</b>	<b>\$195,535</b>	<b>\$150,763</b>	<b>\$138,608</b>	<b>\$2,935,906</b>

### Initial Remapping

Because the coastal restudy is highest on our priority, the coastal restudy would still need to be funded. However, we would only study a portion of the riverine restudy needs. Only those reaches that have already been tasked by FEMA Region II in FY2003 and those that are being tasked in FY2004 will be restudied in Puerto Rico. This will limit the utility of the flood hazard data on the remaining reaches that should be restudied.

### Program Management and Administration

A medium funding scenario would only allow 2 FTEs, thereby limiting the level of project management and outreach that we could perform. This could mean lower levels of local participation and less possibility of building partnerships within Puerto Rico.

PRPB requests that 3 full-time positions be funded for implementing Map Modernization at \$88,000 (FY 2004 dollars) annually. These FEMA-funded positions will be created by Puerto Rico to support the FEMA Map Modernization effort:

- 1 Senior Engineer (\$40,000) – Professional Engineer with approximately 5 years of experience in hydrologic and hydraulic engineering;
- 1 Engineer (\$28,000) – Engineer with approximately 2-3 years of experience in hydrologic and hydraulic engineering; and
- 1 Mapping Technician (\$20,000) – Technician with experience in land use and/or geography.

In addition, to fully implement the vision outlined in this plan, PRPB requests that some equipment needs be funded at approximately \$23,000 the first year:

- 1 GPS Equipment (\$10,000) – For use in field verification of restudies;

- 2 GIS Software and Hardware (\$6,000 each station) – For use by mapping technicians in utilizing data developed through Map Modernization; and
- Printer and Scanner (\$1,000) – For general program support.

**Map Maintenance**

A medium funding scenario would limit the amount of map maintenance that can be performed each year. This would mean that not only are fewer restudies being performed through the initial remapping phase, but also that maintenance of the ever-older flood hazard data would not be occurring. In addition, we have assumed that only 5% of the engineering studies (either riverine or coastal) will receive restudy updates annually and 5% of the DFIRM panels will receive updates to incorporate the updated engineering data annually

***Low Funding Alternative***

If only minimal funds are available, we would not be able to restudy any riverine reaches, be significantly understaffed in providing program management and outreach, and not be able to perform any maintenance functions. Projected costs, in constant FY 2004 dollars, for the low funding scenario are summarized below. Details of these costs are shown in Appendix E.

Program Element		FY04	FY05	FY06	FY07	FY08	Total
Initial Remapping	Funding Requirement	\$2,033,641	\$0	\$0	\$0	\$0	\$2,033,641
	<b>Requested FEMA Funding</b>	<b>\$1,650,294</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$1,650,294</b>
Maintenance	Funding Requirement	\$0	\$0	\$0	\$0	\$0	\$0
	<b>Requested FEMA Funding</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>
Program Administration/ Management	Funding Requirement	\$66,000	\$60,000	\$60,000	\$60,000	\$60,000	\$306,000
	<b>Requested FEMA Funding</b>	<b>\$49,500</b>	<b>\$45,000</b>	<b>\$45,000</b>	<b>\$45,000</b>	<b>\$45,000</b>	<b>\$229,500</b>
<b>Total Requested FEMA Funding</b>		<b>\$1,699,794</b>	<b>\$45,000</b>	<b>\$45,000</b>	<b>\$45,000</b>	<b>\$45,000</b>	<b>\$1,879,794</b>

**Initial Remapping**

Because the coastal restudy is the highest priority, this would be all that could be accomplished in Puerto Rico. All riverine studies would remain as they are now, with only the FY2003 initiated riverine restudies to be revised.

### **Program Management and Administration**

A low funding scenario would only allow 1 FTE, thereby severely limiting the level of project management and outreach that we could perform.

### **Map Maintenance**

The map maintenance phase could not be initiated in Puerto Rico under this funding scenario.

**APPENDIX A**

**FULL FUNDING RIVERINE RESTUDY PRIORITY LIST**

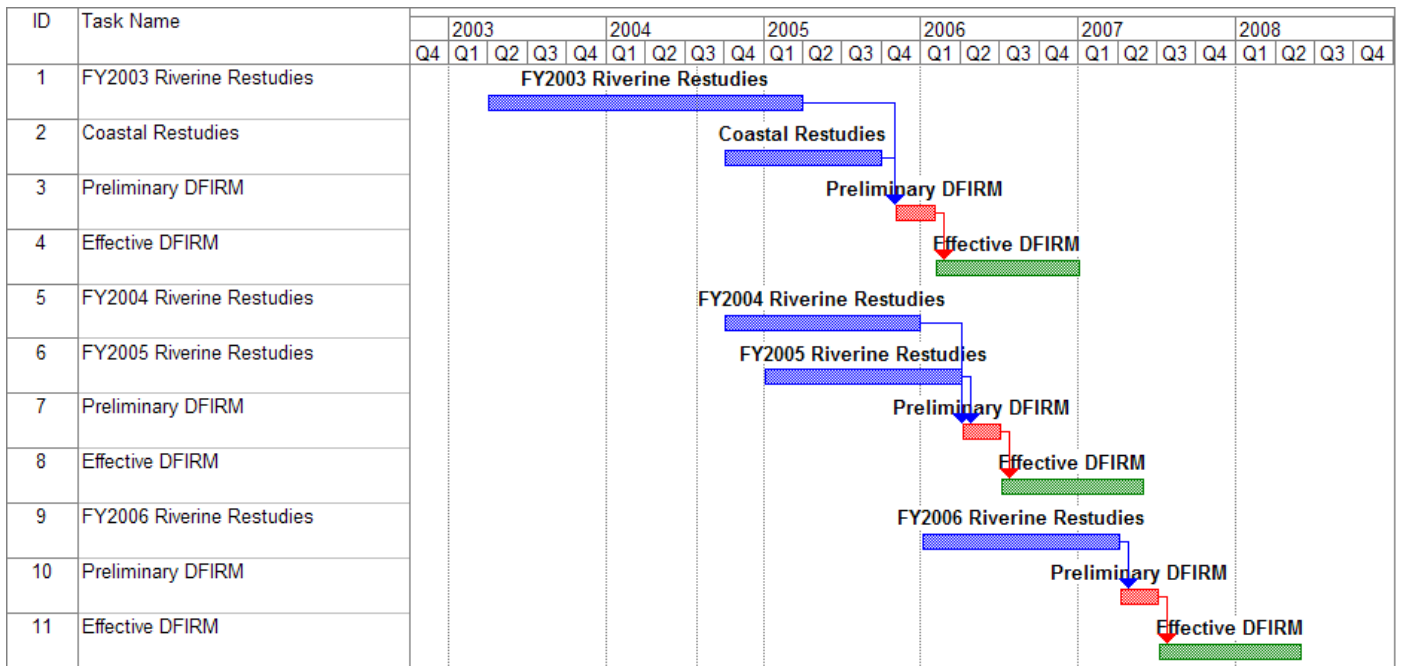
<b>PRPB Priority</b>	<b>Stream Name</b>	<b>Reach Description</b>	<b>Length (Miles)</b>
1	Rio Grande de Loiza	from confluence with the Atlantic Ocean to downstream of Loiza Dam	27.3
2	Rio Grande de Loiza	from confluence with Gurabo to 3.0 kilometers upstream of PR-183	0.0
3	Rio Gurabo (Rio Grande de Loiza FIS)	from confluence with Rio Grande de Loiza to 2.0 kilometers upstream of State Road PR-31	16.8
4	Rio Valenciano (Rio Grande de Loiza FIS)	from confluence with Rio Gurabo to 1.0 kilometer upstream of PR-31	2.2
5	Rio Caguitas (Rio Grande de Loiza FIS)	from confluence with Rio Grande de Loiza to 2.0 kilometers upstream of State Road PR-784	5.5
6	Rio Turabo (Rio Grande de Loiza FIS)	from confluence with Rio Grande de Loiza to 1.5 kilometers upstream of the detailed study	5.9
7	Rio Bairoa (Rio Grande de Loiza FIS)	from confluence with Rio Grande de Loiza to the detailed study	5.4
8	Quebrada Cambute and Tributaries (Zone A)	from confluence with Rio Canovanillas to 1.3 kilometers upstream	0.8
9	Rio Grande de Arecibo	from confluence with the Atlantic Ocean to the actual limit of detailed study	10.6
10	Rio Guaynabo (Rio Bayamon FIS)	from confluence with Rio Bayamon to 3.0 kilometers upstream of State Road PR-837	4.8
11	Rio Sabana (Zone A)	from confluence with the Atlantic Ocean to 4.0 kilometers upstream of State Road PR-3	2.9
12	Rio Guayanes (Zone A)	from confluence with the Caribbean Sea to 4 kilometers upstream of State Road PR-182	8.7
13	Rio Limones (tributary of Rio Guayanes)	from confluence with Rio Guayanes to 200 meters upstream of State Road PR-902	3.1
14	Rio Loco (Lajas Valley FIS)	from confluence with the Caribbean Sea to the actual limit of detailed study	8.6
15	Rio Guanajibo	from confluence with the Atlantic Ocean to one (1) kilometer upstream of the detailed study	19.5
16	Quebrada Honda	from confluence with Rio Guanajibo to 1.7 kilometers upstream (Zone A)	1.1
17	Rio Humacao	from the confluence with the Atlantic Ocean to the limit of the detailed study	6.6
18	Quebrada Mariana (Rio Humacao FIS)	from the confluence with Rio Humacao to the limit of detailed study	2.3
19	Tributary of Quebrada Mariana	entire reach	1.1
20	Quebrada Mabu (Rio Humacao FIS)	from confluence with Rio Humacao to 0.5 kilometers upstream of the detailed study	2.4

<b>PRPB Priority</b>	<b>Stream Name</b>	<b>Reach Description</b>	<b>Length (Miles)</b>
21	Rio Pastillo and Rio Canas (both tributaries of Rio Matilde, included)	from the confluence with the Caribbean Sea to the limit of detailed study	7.6
22	Rio Grande de Patillas	upstream from confluence with the Caribbean Sea	3.1
23	Rio Cibuco	entire reach	10.9
24	Rio Yaguez	upstream from confluence with the Caribbean Sea	1.9
25	Rio Jacaguas (Villalba)	Two (2) kilometers upstream of the detailed study and a half kilometer downstream of it	3.4
26	Rio Grande de Anasco	from the confluence with the Atlantic Ocean to 0.5 kilometers upstream of detailed study	10.1
27	Rio Culebrinas	from confluence with the Atlantic Ocean to the limit of the detailed study	7.2
28	Rio Culebrinas (at San Sebastian)	from 0.5 kilometers downstream of detailed study to one (1) kilometer upstream of PR 119 bridge	3.0
29	Tributary to Rio Culebrinas	from PR 119 bridge to 0.5 kilometer upstream (Zone A)	0.3
30	Rio Guatemala (tributary of Rio Culebrinas)	from PR 119 bridge to 2.0 kilometers upstream (Zone A)	0.0
31	Rio Nigua (Rio Grande de Patillas tributary)	from the confluence with the Caribbean Sea to the limit of detailed study	4.0
32	Quebrada Corazon	from the confluence with the Caribbean Sea to 4.0 kilometers upstream	2.5
33	Rio Tallaboa (including Rio Guayama tributary)	from the confluence with the Caribbean Sea to the limit of detailed study	8.1
34	Quebrada del Agua	from the confluence with the Caribbean Sea to 4.5 kilometers upstream	2.8
35	Rio Fajardo	from the confluence with the Atlantic Ocean to 7.5 kilometers upstream of the detailed study	7.5
36	Rio Indio	entire reach	2.8
37	Quebrada Honda	entire reach	3.4
38	Rio de los Negros	entire reach	1.0
39	Rio Camuy	upstream from confluence with the Atlantic Ocean	2.2
40	Rio Guayanilla	upstream from confluence with the Caribbean Sea	4.3

<b>PRPB Priority</b>	<b>Stream Name</b>	<b>Reach Description</b>	<b>Length (Miles)</b>
41	Rio Grande de Arecibo	upper basin, including the effective limits of the detailed study plus 0.5 kilometers upstream)	3.7
42	Rio Vivi	from confluence with Rio Grande de Arecibo	1.9
43	Rio Yauco	upstream from confluence with the Caribbean Sea	7.5
44	Quebrada Berrenchin	entire reach	1.7
45	Rio Jacaguas	upstream from confluence with the Caribbean Sea	13.5
46	Rio Inabon	upstream from confluence with the Caribbean Sea	11.0
47	Rio Guayo	upstream from confluence with Rio Inabon	5.1
48	Rio Maunabo	upstream from confluence with the Caribbean Sea	4.7
49	Rio Dagao (including Quebrada Ceiba and Quebrada Aguas Claras tributaries)	entire reach	8.5
50	Rio Blanco (including Rio Santia	entire reach	7.1
51	Rio Anton Ruiz	entire reach	5.6
52	Rio Espiritu Santo	entire reach	3.4
53	Rio Mameyes	entire reach	3.2
		<b>TOTAL:</b>	<b>298.2</b>

## **APPENDIX B**

### **FULL FUNDING PROJECT SCHEDULE**



## **APPENDIX C**

### **FULL FUNDING PROJECT COSTS**

Coastal Restudy Costs															
Priority	Fiscal Year Funding	Reach Name	Reach Description	Coastal Miles	Land Area (Sq Miles)	Bathymetric Area (Sq Kilometers)	Area (Sq Miles)	Panels	Bathymetry (\$950/sq mi)	Topographic Mapping (\$950/sq mi)	Coastal Restudy (\$3,600/mile)	Base Map (\$430/panel)	DFIRM (\$2,500/panel)	TOTAL	
1	2004	Atlantic Sea/Caribbean Sea	Entire Shoreline of Puerto Rico	373.7	232.2	300.7	116.1	104	\$110,296	\$220,592	\$1,345,294	\$44,720	\$260,000	\$1,980,901	
Riverine Restudy Costs															
Priority	Fiscal Year Funding	Reach Name	Reach Description	Length (Miles)	Approximate Width (km)	Approximate Width (mile)	Area (Sq Miles)	Yearly Panels	Surveying (\$2,200/mile)	Topographic Mapping (\$950/sq mi)	Riverine Restudy (\$5,000/mile)	Base Map (\$430/panel)	DFIRM (\$2,500/panel)		
1	2003	Rio Grande de Loiza	from confluence with the Atlantic Ocean to downstream of Loiza Dam	27.3	4	2.5	67.8	10	\$60,012	\$64,410	\$136,391	\$4,300	\$25,000		
2	2003	Rio Grande de Loiza	from confluence with Gurabo to 3.0 kilometers upstream of PR-183	0.0	0.7	0.4	0.0	1	\$0	\$0	\$0	\$430	\$2,500		
3	2003	Rio Gurabo (Rio Grande de Loiza FIS)	from confluence with Rio Grande de Loiza to 2.0 kilometers upstream of State Road PR-31	16.8	1.4	0.9	14.6	3	\$36,909	\$13,865	\$83,885	\$1,290	\$7,500		
4	2003	Rio Valenciano (Rio Grande de Loiza FIS)	from confluence with Rio Gurabo to 1.0 kilometer upstream of PR-31	2.2	0.4	0.2	0.5	0	\$4,785	\$514	\$10,874	\$0	\$0		
5	2003	Rio Caguitas (Rio Grande de Loiza FIS)	from confluence with Rio Grande de Loiza to 2.0 kilometers upstream of State Road PR-784	5.5	0.4	0.2	1.4	1	\$12,030	\$1,291	\$27,340	\$430	\$2,500		
6	2003	Rio Turabo (Rio Grande de Loiza FIS)	from confluence with Rio Grande de Loiza to 1.5 kilometers upstream of the detailed study	5.9	0.7	0.4	2.6	1	\$12,987	\$2,439	\$29,515	\$430	\$2,500		
7	2003	Rio Bairoa (Rio Grande de Loiza FIS)	from confluence with Rio Grande de Loiza to the detailed study	5.4	0.1	0.1	0.3	1	\$11,961	\$321	\$27,185	\$430	\$2,500		
8	2003	Quebrada Cambute and Tributaries (Zone A)	from confluence with Rio Canovanillas to 1.3 kilometers upstream	0.8	0.1	0.1	0.1	1	\$1,777	\$48	\$4,039	\$430	\$2,500		
<b>2003 Subtotal</b>				<b>0.0</b>			<b>0.0</b>	<b>18.0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$7,740</b>	<b>\$45,000</b>	<b>\$52,740</b>	
9	2004	Rio Grande de Arecibo	from confluence with the Atlantic Ocean to the actual limit of detailed study	10.6	1.7	1.1	11.2	6	\$23,239	\$10,600	\$52,817	\$2,580	\$15,000		
10	2004	Rio Guaynabo (Rio Bayamon FIS)	from confluence with Rio Bayamon to 3.0 kilometers upstream of State Road PR-837	4.8	0.3	0.2	0.9	3	\$10,663	\$858	\$24,233	\$1,290	\$7,500		
11	2004	Rio Sabana (Zone A)	from confluence with the Atlantic Ocean to 4.0 kilometers upstream of State Road PR-3	2.9	0.3	0.2	0.5	1	\$6,288	\$506	\$14,292	\$430	\$2,500		
12	2004	Rio Guayanes (Zone A)	from confluence with the Caribbean Sea to 4 kilometers upstream of State Road PR-182	8.7	5.3	3.3	28.6	4	\$19,138	\$27,216	\$43,496	\$1,720	\$10,000		
13	2004	Rio Limones (tributary of Rio Guayanes)	from confluence with Rio Guayanes to 200 meters upstream of State Road PR-902	3.1	1.9	1.2	3.7	0	\$6,835	\$3,485	\$15,534	\$0	\$0		
14	2004	Rio Loco (Lajas Valley FIS)	from confluence with the Caribbean Sea to the actual limit of detailed study	8.6	1.9	1.2	10.1	2	\$18,865	\$9,617	\$42,875	\$860	\$5,000		
15	2004	Rio Guanajibo	from confluence with the Atlantic Ocean to one (1) kilometer upstream of the detailed study	19.5	0.4	0.2	4.8	7	\$42,924	\$4,607	\$97,555	\$3,010	\$17,500		
16	2004	Quebrada Honda	from confluence with Rio Guanajibo to 1.7 kilometers upstream (Zone A)	1.1	0.5	0.3	0.3	1	\$2,324	\$312	\$5,282	\$430	\$2,500		
17	2004	Rio Humacao	from the confluence with the Atlantic Ocean to the limit of the detailed study	6.6	2.8	1.7	11.5	3	\$14,559	\$10,938	\$33,088	\$1,290	\$7,500		
18	2004	Quebrada Mariana (Rio Humacao FIS)	from the confluence with Rio Humacao to the limit of detailed study	2.3	0.1	0.1	0.1	0	\$4,990	\$134	\$11,340	\$0	\$0		
19	2004	Tributary of Quebrada Mariana	entire reach	1.1	0.1	0.1	0.1	0	\$2,461	\$66	\$5,592	\$0	\$0		
20	2004	Quebrada Mabu (Rio Humacao FIS)	from confluence with Rio Humacao to 0.5 kilometers upstream of the detailed study	2.4	0.7	0.4	1.0	0	\$5,195	\$976	\$11,806	\$0	\$0		
<b>2004 Subtotal</b>				<b>71.6</b>			<b>73.0</b>	<b>27.0</b>	<b>\$157,480</b>	<b>\$69,315</b>	<b>\$357,910</b>	<b>\$11,610</b>	<b>\$67,500</b>	<b>\$663,816</b>	
21	2005	Rio Pastillo and Rio Canas (both tributaries of Rio Matilde, included)	from the confluence with the Caribbean Sea to the limit of detailed study	7.6	0.7	0.4	3.3	3	\$16,746	\$3,145	\$38,059	\$1,290	\$7,500		
22	2005	Rio Grande de Patillas	upstream from confluence with the Caribbean Sea	3.1	0.8	0.5	1.5	2	\$6,835	\$1,467	\$15,534	\$860	\$5,000		
23	2005	Rio Cibuco	entire reach	10.9	1.2	0.7	8.1	4	\$23,923	\$7,703	\$54,370	\$1,720	\$10,000		
24	2005	Rio Yaguez	upstream from confluence with the Caribbean Sea	1.9	0.4	0.2	0.5	1	\$4,101	\$440	\$9,321	\$430	\$2,500		
25	2005	Rio Jacaguas	upstream from confluence with the Caribbean Sea	13.5	2.3	1.4	19.2	2	\$29,596	\$18,265	\$67,263	\$860	\$5,000		
26	2005	Rio Grande de Anasco	from the confluence with the Atlantic Ocean to 0.5 kilometers upstream of detailed study	10.1	2.3	1.4	14.4	3	\$22,146	\$13,667	\$50,331	\$1,290	\$7,500		
27	2005	Rio Culebrinas	from confluence with the Atlantic Ocean to the limit of the detailed study	7.2	1.4	0.9	6.2	3	\$15,789	\$5,931	\$35,884	\$1,290	\$7,500		
28	2005	Rio Culebrinas (at San Sebastian)	from 0.5 kilometers downstream of detailed study to one (1) kilometer upstream of PR 119 bridge	3.0	0.4	0.2	0.7	2	\$6,562	\$704	\$14,913	\$860	\$5,000		
29	2005	Tributary to Rio Culebrinas	from PR 119 bridge to 0.5 kilometer upstream (Zone A)	0.3	0.2	0.1	0.0	0	\$684	\$37	\$1,553	\$0	\$0		
30	2005	Rio Guatemala (tributary of Rio Culebrinas)	from PR 119 bridge to 2.0 kilometers upstream (Zone A)	0.0	0.5	0.3	0.0	0	\$0	\$0	\$0	\$0	\$0		
31	2005	Rio Nigua (Rio Grande de Patillas FIS)	from the confluence with the Caribbean Sea to the limit of detailed study	4.0	0.2	0.1	0.5	1	\$8,749	\$470	\$19,884	\$430	\$2,500		
32	2005	Quebrada Corazon	from the confluence with the Caribbean Sea to 4.0 kilometers upstream	2.5	0.2	0.1	0.3	0	\$5,468	\$293	\$12,427	\$0	\$0		
33	2005	Rio Tallaboa (including Rio Guayanes)	from the confluence with the Caribbean Sea to the limit of detailed study	8.1	1.2	0.7	6.1	4	\$17,908	\$5,766	\$40,700	\$1,720	\$10,000		
34	2005	Quebrada del Agua	from the confluence with the Caribbean Sea to 4.5 kilometers upstream	2.8	1	0.6	1.7	0	\$6,152	\$1,651	\$13,981	\$0	\$0		
35	2005	Rio Fajardo	from the confluence with the Atlantic Ocean to 7.5 kilometers upstream of the detailed study	7.5	0.9	0.6	4.2	3	\$16,404	\$3,961	\$37,282	\$1,290	\$7,500		
36	2005	Rio Indio	entire reach	2.8	0.3	0.2	0.5	1	\$6,152	\$495	\$13,981	\$430	\$2,500		
37	2005	Quebrada Honda	entire reach	3.4	0.3	0.2	0.6	1	\$7,519	\$605	\$17,088	\$430	\$2,500		
<b>2005 Subtotal</b>				<b>88.5</b>			<b>68.0</b>	<b>30.0</b>	<b>\$194,732</b>	<b>\$64,600</b>	<b>\$442,572</b>	<b>\$12,900</b>	<b>\$75,000</b>	<b>\$789,803</b>	
38	2005	Rio de los Negros		1.0	0.2	0.1	0.1	1	\$2,187	\$117	\$4,971	\$430	\$2,500		
39	2006	Rio Canay	upstream from confluence with the Atlantic Ocean	2.2	0.7	0.4	0.9	1	\$4,785	\$899	\$10,874	\$430	\$2,500		
40	2006	Rio Guayanilla	upstream from confluence with the Caribbean Sea	4.3	1.6	1.0	4.3	2	\$9,569	\$4,108	\$21,748	\$860	\$5,000		
41	2006	Rio Grande de Arecibo	upper basin, including the effective limits of the detailed study plus 0.5 kilometers upstream	3.7	0.2	0.1	0.5	6	\$8,202	\$440	\$18,641	\$2,580	\$15,000		
42	2006	Rio Vivi	from confluence with Rio Grande de Arecibo	1.9	0.2	0.1	0.2	0	\$4,101	\$220	\$9,321	\$0	\$0		
43	2006	Rio Yauco	upstream from confluence with the Caribbean Sea	7.5	1.5	0.9	6.9	2	\$16,404	\$6,602	\$37,282	\$860	\$5,000		
44	2006	Quebrada Berrenchin	entire reach	1.7	0.4	0.2	0.4	0	\$3,828	\$411	\$8,699	\$0	\$0		
45	2006	Rio Jacaguas (Villalba)	Two (2) kilometers upstream of the detailed study and a half kilometer downstream of it	3.4	0.2	0.1	0.4	4	\$7,519	\$403	\$17,088	\$1,720	\$10,000		
46	2006	Rio Inabon	upstream from confluence with the Caribbean Sea	11.0	2.4	1.5	16.4	3	\$24,196	\$15,582	\$54,991	\$1,290	\$7,500		
47	2006	Rio Guayo	upstream from confluence with Rio Inabon	5.1	0.4	0.2	1.3	0	\$11,210	\$1,203	\$25,476	\$0	\$0		
48	2006	Rio Maunabo	upstream from confluence with the Caribbean Sea	4.7	1.1	0.7	3.2	3	\$10,253	\$3,026	\$23,301	\$1,290	\$7,500		
49	2006	Rio Dagao (including Quebrada Ceiba and Quebrada Aguas Claras tributaries)	entire reach	8.5	0.9	0.6	4.8	3	\$18,728	\$4,523	\$42,564	\$1,290	\$7,500		
50	2006	Rio Blanco (including Rio Santiago)	entire reach	7.1	1.6	1.0	7.0	4	\$15,584	\$6,690	\$35,418	\$1,720	\$10,000		
51	2006	Rio Anton Ruiz	entire reach	5.6	2	1.2	6.9	0	\$12,303	\$6,602	\$27,962	\$0	\$0		
52	2006	Rio Espiritu Santo	entire reach	3.4	1.5	0.9	3.2	4	\$7,519	\$3,026	\$17,088	\$1,720	\$10,000		
53	2006	Rio Mameyes	entire reach	3.2	0.5	0.3	1.0	1	\$6,972	\$935	\$15,845	\$430	\$2,500		
<b>2006 Subtotal</b>				<b>74.3</b>			<b>57.7</b>	<b>34.0</b>	<b>\$163,358</b>	<b>\$54,788</b>	<b>\$371,269</b>	<b>\$14,620</b>	<b>\$85,000</b>	<b>\$689,036</b>	
<b>Riverine Subtotals</b>				<b>234.4</b>			<b>198.6</b>	<b>109.0</b>	<b>\$515,570</b>	<b>\$188,704</b>	<b>\$1,171,751</b>	<b>\$46,870</b>	<b>\$272,500</b>	<b>\$2,195,395</b>	
<b>Total</b>							<b>314.7</b>	<b>213.0</b>	<b>\$625,866</b>	<b>\$409,296</b>	<b>\$2,517,044</b>	<b>\$91,590</b>	<b>\$532,500</b>	<b>\$4,176,296</b>	
<b>FEMA Activities</b>			<b>FEMA Funding to Commonwealth</b>			<b>Commonwealth Contribution</b>									

## **APPENDIX D**

### **MEDIUM FUNDING PROJECT COSTS**

Coastal Restudy Costs														
Priority	Fiscal Year Funding	Reach Name	Reach Description	Coastal Miles	Land Area (Sq Miles)	Bathymetric Area (Sq Kilometers)	Area (Sq Miles)	Panels	Bathymetry (\$950/sq mi)	Topographic Mapping (\$950/sq mi)	Coastal Restudy (\$3,600/mile)	Base Map (\$430/panel)	DFIRM (\$2,500/panel)	TOTAL
1	2004	Atlantic Sea/Caribbean Sea	Entire Shoreline of Puerto Rico	373.7	232.2	300.7	116.1	104	\$110,296	\$220,592	\$1,345,294	\$44,720	\$260,000	\$1,980,901
Riverine Restudy Costs														
Priority	Fiscal Year Funding	Reach Name	Reach Description	Length (Miles)	Approximate Width (km)	Approximate Width (mile)	Area (Sq Miles)	Yearly Panels	Surveying (\$2,200/mile)	Topographic Mapping (\$950/sq mi)	Riverine Restudy (\$5,000/mile)	Base Map (\$430/panel)	DFIRM (\$2,500/panel)	
1	2003	Rio Grande de Loiza	from confluence with the Atlantic Ocean to downstream of Loiza Dam	27.3	4	2.5	67.8	10	\$60,012	\$64,410	\$136,391	\$4,300	\$25,000	
2	2003	Rio Grande de Loiza	from confluence with Gurabo to 3.0 kilometers upstream of PR-183	0.0	0.7	0.4	0.0	1	\$0	\$0	\$0	\$430	\$2,500	
3	2003	Rio Gurabo (Rio Grande de Loiza FIS)	from confluence with Rio Grande de Loiza to 2.0 kilometers upstream of State Road PR-31	16.8	1.4	0.9	14.6	3	\$36,909	\$13,865	\$83,885	\$1,290	\$7,500	
4	2003	Rio Valenciano (Rio Grande de Loiza FIS)	from confluence with Rio Gurabo to 1.0 kilometer upstream of PR-31	2.2	0.4	0.2	0.5	0	\$4,785	\$514	\$10,874	\$0	\$0	
5	2003	Rio Caguinas (Rio Grande de Loiza FIS)	from confluence with Rio Grande de Loiza to 2.0 kilometers upstream of State Road PR-784	5.5	0.4	0.2	1.4	1	\$12,030	\$1,291	\$27,340	\$430	\$2,500	
6	2003	Rio Turabo (Rio Grande de Loiza FIS)	from confluence with Rio Grande de Loiza to 1.5 kilometers upstream of the detailed study	5.9	0.7	0.4	2.6	1	\$12,987	\$2,439	\$29,515	\$430	\$2,500	
7	2003	Rio Bairoa (Rio Grande de Loiza FIS)	from confluence with Rio Grande de Loiza to the detailed study	5.4	0.1	0.1	0.3	1	\$11,961	\$321	\$27,185	\$430	\$2,500	
8	2003	Quebrada Cambute and Tributaries (Zone A)	from confluence with Rio Canovanillas to 1.3 kilometers upstream	0.8	0.1	0.1	0.1	1	\$1,777	\$48	\$4,039	\$430	\$2,500	
<b>2003 Subtotal</b>				<b>0.0</b>			<b>0.0</b>	<b>18.0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$7,740</b>	<b>\$45,000</b>	<b>\$52,740</b>
9	2004	Rio Grande de Arecibo	from confluence with the Atlantic Ocean to the actual limit of detailed study	10.6	1.7	1.1	11.2	6	\$23,239	\$10,600	\$52,817	\$2,580	\$15,000	
10	2004	Rio Guaynabo (Rio Bayamon FIS)	from confluence with Rio Bayamon to 3.0 kilometers upstream of State Road PR-837	4.8	0.3	0.2	0.9	3	\$10,663	\$858	\$24,233	\$1,290	\$7,500	
11	2004	Rio Sabana (Zone A)	from confluence with the Atlantic Ocean to 4.0 kilometers upstream of State Road PR-3	2.9	0.3	0.2	0.5	1	\$6,288	\$506	\$14,292	\$430	\$2,500	
12	2004	Rio Guayanes (Zone A)	from confluence with the Caribbean Sea to 4 kilometers upstream of State Road PR-182	8.7	5.3	3.3	28.6	4	\$19,138	\$27,216	\$43,496	\$1,720	\$10,000	
13	2004	Rio Limones (tributary of Rio Guayanes)	from confluence with Rio Guayanes to 200 meters upstream of State Road PR-902	3.1	1.9	1.2	3.7	0	\$6,835	\$3,485	\$15,534	\$0	\$0	
14	2004	Rio Loco (Lajas Valley FIS)	from confluence with the Caribbean Sea to the actual limit of detailed study	8.6	1.9	1.2	10.1	2	\$18,865	\$9,617	\$42,875	\$860	\$5,000	
15	2004	Rio Guanajibo	from confluence with the Atlantic Ocean to one (1) kilometer upstream of the detailed study	19.5	0.4	0.2	4.8	7	\$42,924	\$4,607	\$97,555	\$3,010	\$17,500	
16	2004	Quebrada Honda	from confluence with Rio Guanajibo to 1.7 kilometers upstream (Zone A)	1.1	0.5	0.3	0.3	1	\$2,324	\$312	\$5,282	\$430	\$2,500	
17	2004	Rio Humacao	from the confluence with the Atlantic Ocean to the limit of the detailed study	6.6	2.8	1.7	11.5	3	\$14,559	\$10,938	\$33,088	\$1,290	\$7,500	
18	2004	Quebrada Mariana (Rio Humacao FIS)	from the confluence with Rio Humacao to the limit of detailed study	2.3	0.1	0.1	0.1	0	\$4,990	\$134	\$11,340	\$0	\$0	
19	2004	Tributary of Quebrada Mariana	entire reach	1.1	0.1	0.1	0.1	0	\$2,461	\$66	\$5,592	\$0	\$0	
20	2004	Quebrada Mabu (Rio Humacao FIS)	from confluence with Rio Humacao to 0.5 kilometers upstream of the detailed study	2.4	0.7	0.4	1.0	0	\$5,195	\$976	\$11,806	\$0	\$0	
<b>2004 Subtotal</b>				<b>71.6</b>			<b>73.0</b>	<b>27.0</b>	<b>\$157,480</b>	<b>\$69,315</b>	<b>\$357,910</b>	<b>\$11,610</b>	<b>\$67,500</b>	<b>\$663,816</b>
<b>2005 Subtotal</b>				<b>0.0</b>			<b>0.0</b>	<b>0.0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>
<b>2006 Subtotal</b>				<b>0.0</b>			<b>0.0</b>	<b>0.0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>
<b>Riverine Subtotals</b>				<b>71.6</b>			<b>73.0</b>	<b>45.0</b>	<b>\$157,480</b>	<b>\$69,315</b>	<b>\$357,910</b>	<b>\$19,350</b>	<b>\$112,500</b>	<b>\$716,556</b>
<b>Total</b>							<b>189.1</b>	<b>149.0</b>	<b>\$267,776</b>	<b>\$289,907</b>	<b>\$1,703,203</b>	<b>\$64,070</b>	<b>\$372,500</b>	<b>\$2,697,457</b>
FEMA Activities		FEMA Funding to Commonwealth		Commonwealth Contribution										

## **APPENDIX E**

### **LOW FUNDING PROJECT COSTS**

Coastal Restudy Costs														
Priority	Fiscal Year Funding	Reach Name	Reach Description	Coastal Miles	Land Area (Sq Miles)	Bathymetric Area (Sq Kilometers)	Area (Sq Miles)	Panels	Bathymetry (\$950/sq mi)	Topographic Mapping (\$950/sq mi)	Coastal Restudy (\$3,600/mile)	Base Map (\$430/panel)	DFIRM (\$2,500/panel)	TOTAL
1	2004	Atlantic Sea/Caribbean Sea	Entire Shoreline of Puerto Rico	373.7	232.2	300.7	116.1	104	\$110,296	\$220,592	\$1,345,294	\$44,720	\$260,000	\$1,980,901
Riverine Restudy Costs														
Priority	Fiscal Year Funding	Reach Name	Reach Description	Length (Miles)	Approximate Width (km)	Approximate Width (mile)	Area (Sq Miles)	Yearly Panels	Surveying (\$2,200/mile)	Topographic Mapping (\$950/sq mi)	Riverine Restudy (\$5,000/mile)	Base Map (\$430/panel)	DFIRM (\$2,500/panel)	
1	2003	Rio Grande de Loiza	from confluence with the Atlantic Ocean to downstream of Loiza Dam	27.3	4	2.5	67.8	10	\$60,012	\$64,410	\$136,391	\$4,300	\$25,000	
2	2003	Rio Grande de Loiza	from confluence with Gurabo to 3.0 kilometers upstream of PR-183	0.0	0.7	0.4	0.0	1	\$0	\$0	\$0	\$430	\$2,500	
3	2003	Rio Gurabo (Rio Grande de Loiza FIS)	from confluence with Rio Grande de Loiza to 2.0 kilometers upstream of State Road PR-31	16.8	1.4	0.9	14.6	3	\$36,909	\$13,865	\$83,885	\$1,290	\$7,500	
4	2003	Rio Valenciano (Rio Grande de Loiza FIS)	from confluence with Rio Gurabo to 1.0 kilometer upstream of PR-31	2.2	0.4	0.2	0.5	0	\$4,785	\$514	\$10,874	\$0	\$0	
5	2003	Rio Caguaitas (Rio Grande de Loiza FIS)	from confluence with Rio Grande de Loiza to 2.0 kilometers upstream of State Road PR-784	5.5	0.4	0.2	1.4	1	\$12,030	\$1,291	\$27,340	\$430	\$2,500	
6	2003	Rio Turabo (Rio Grande de Loiza FIS)	from confluence with Rio Grande de Loiza to 1.5 kilometers upstream of the detailed study	5.9	0.7	0.4	2.6	1	\$12,987	\$2,439	\$29,515	\$430	\$2,500	
7	2003	Rio Bairoa (Rio Grande de Loiza FIS)	from confluence with Rio Grande de Loiza to the detailed study	5.4	0.1	0.1	0.3	1	\$11,961	\$321	\$27,185	\$430	\$2,500	
8	2003	Quebrada Cambute and Tributaries (Zone A)	from confluence with Rio Canovanillas to 1.3 kilometers upstream	0.8	0.1	0.1	0.1	1	\$1,777	\$48	\$4,039	\$430	\$2,500	
<b>2003 Subtotal</b>				<b>0.0</b>			<b>0.0</b>	<b>18.0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$7,740</b>	<b>\$45,000</b>	<b>\$52,740</b>
<b>2004 Subtotal</b>				<b>71.6</b>			<b>73.0</b>	<b>0.0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>
<b>2005 Subtotal</b>				<b>0.0</b>			<b>0.0</b>	<b>0.0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>
<b>2006 Subtotal</b>				<b>0.0</b>			<b>0.0</b>	<b>0.0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>
<b>Riverine Subtotals</b>				<b>71.6</b>			<b>73.0</b>	<b>18.0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$7,740</b>	<b>\$45,000</b>	<b>\$52,740</b>
<b>Total</b>							<b>189.1</b>	<b>122.0</b>	<b>\$110,296</b>	<b>\$220,592</b>	<b>\$1,345,294</b>	<b>\$52,460</b>	<b>\$305,000</b>	<b>\$2,033,641</b>
FEMA Activities		FEMA Funding to Commonwealth		Commonwealth Contribution										