COMMONWEALTH OF
PUERTO RICO

PUERTO RICO
NATIONAL DISASTER RESILIENCE COMPETITION

PHASE 1 APPLICATION

National Disaster Resilience Competition
ndrc Puerto Rico
Transforming vulnerability into opportunity

TABLE OF CONTENTS

EXHIBIT A: EXECUTIVE SUMMARY A-1

EXHIBIT B: THRESHOLD NARRATIVE B-1

Eligible Applicant B-1

Eligible County & Most Impacted & Distressed Sub-County Target Area B-1

Most Impacted Characteristics B-1

Distressed Characteristics B-1

Unmet Recovery Need B-2

Eligible Activity, Incorporation of Resilience & National Objective: B-3

Overall Benefit Test: B-3

Tie-Back to Disaster: B-3

One Application per Applicant: B-3

Benefit-cost analysis: B-3

EXHIBIT C: CAPACITY C-1

General Management Capacity C-1

Cross-disciplinary Technical Partnership C-2

Community Engagement Capacity C-6

Regional Capacity C-7

EXHIBIT D: NEED AND EXTENT OF PROBLEM D-1

Target Area D-1

Unmet Recovery Need D-2

Most Impacted and Distressed D-3

Responses to Questions D-4

EXHIBIT E: SOUNDNESS OF APPROACH E-1

Consultation E-1

Ideas and Concepts E-3

EXHIBIT F: LEVERAGE AND OUTCOMES F-1
Outcomes F-1
Leverage F-3
Committed Leverage Resources F-5
EXHIBIT G: LONG-TERM COMMITMENT G-1
Puerto Rico's Long-Term Commitment to Resilience and Climate Adaptation G-1
ATTACHMENT E: MAPS, DRAWINGS AND RENDERINGS .....
Map 1: Target Area - Context ATT.E-1
Map 2: PRASA Clients by Type of Service ATT.E-2
Map 3: Target Area Most Impacted Census Tracts ATT.E-3
Map 4: Target Area Risks ATT.E-4
Map 5: Low and Moderate Income (LMI) Population ATT.E-5
Map 6: Population Density ATT.E-6
Figure 1: NDRC Team and Stakeholders Diagram ATT.E-7
Figure 2: Integrated Risk Based Framework ATT.E-8

EXHIBIT A: EXECUTIVE SUMMARY

The San Juan Bay Estuary tells the story of two profoundly disparate urban experiences. On its shorelines lie the drivers of Puerto Rico's institutional and economic life, alongside communities that for decades have endured severe socioeconomic distress, poor housing conditions and exposure to health hazards. The PR NDRC Target Area (TA) identified as most impacted and distressed as a result of 2011's Hurricane Irene is located in the municipality of San Juan, within a wider Impact Area on the shorelines of the San Juan Bay Estuary (SJBE). The only tropical Estuary in EPA's National Estuary Program (NEP), the SJBE contains the systems and assets, which provide the foundations for the economy, food supply chain, and government. Faced with increased exposure to more extreme hazards, the economic and environmental sustainability of both the TA and the wider region depend on addressing long-standing problems with the disruption of the SJBE's natural systems. We propose an Integrated Urban Water-Cycle Management (IUWCM) approach to address the vulnerabilities identified, operationalizing urban water infrastructure, by simulating the natural water cycle.

The Office of the Commissioner of Municipal Affairs (OCMA) will implement the proposed activities in coordination with a multi-sectorial NDRC Team of thirty-one (31) partners, from state and local government, NPOs and the private sector. Together, these partners and the extended network of twenty-four (24) stakeholders have the capacity to assess and analyze scientific information, design and implement large scale planning and capital investment projects, and work collaboratively. The PR NDRC Team has vast experience with community engagement efforts, which are strengthened by ENLACE and the Corporation for the Cantera Peninsula's long-standing experience establishing coalitions of committed stakeholders for communities living on the SJBE's shorelines. The Target Area includes both critical components of the natural water system, which control drainage and act as a buffer against impact from tropical storms and the systems and assets that provide the foundations for Puerto Rico's economy, food supply chain and government.

The wetland areas bordering the SJBE's water bodies are particularly susceptible to impact partly because of high exposure to the hazards threatening insular Caribbean contexts (flooding, tropical cyclones and storm surges, and sea level rise), but also because of development practices in the area. Vulnerable communities in the TA face constant threats to their health, livelihoods and well-being. They are particularly vulnerable because they lack essential infrastructure, such as sewage and wastewater systems, to manage, mitigate or recover from associated shocks and stressors. Chief among these are immediate damage to homes and communities, reduced access to education and to stable jobs, and exposure to health hazards. Low levels of insurance protection has contributed to the TA's resilience needs remaining unmet.

The IUWCM will seek to reduce stresses and shocks on communities through investments to restore the SJBE's natural systems, whilst reducing vulnerabilities, by decreasing exposure to hazards such as flooding, increasing access to safe and affordable housing and strengthening economic sustainability through Place-based Development strategies. The IUWCM approach, recreates the natural water cycle, reducing both the impact from floods and storm water on communities and the impact of urban development on water resources, while improving water access and quality. All three outcomes are fundamental to ensure improved access to safe and affordable housing, increased economic opportunities and livable neighborhoods for our most vulnerable populations in the TA. Our Approach builds upon our partners and stakeholders' engagement experiences and strategies to facilitate a participatory planning processes. Moreover, we have ensured our stakeholders include the broad range of experts and stakeholders needed to support our risk-based science-driven approach. Puerto Rico has faced nine years of economic contraction, which have limited both institutional and individual resources to recover from the impact of hazards. Therefore, reducing exposure by maximizing investments through a data-driven, science-based, participatory planning process is not just desirable, but a necessity. Supporting evidence for Threshold Narrative (link to PRNDRCTeam Folder) and References on: (link to PRNDRCTeam Folder).

EXHIBIT B: THRESHOLD NARRATIVE

Eligible Applicant

The Commonwealth of Puerto Rico is 1 of 67 eligible applicants identified in the NDRC NOFA.

Eligible County & Most Impacted & Distressed Sub-County Target Area

The proposed Target Area (TA) contains 87 geographically contiguous Census Tracts (CTs) in the municipality of San Juan, treated as a county by HUD for the NDRC (See: Attachment E: Map 1). Hurricane Irene (FEMA-4017-DR) impacted the TA in 2011 and it is the most impacted and distressed sub-county area within San Juan.

Most Impacted Characteristics

Housing Damage: Housing in the TA experienced serious damage as a result of flooding and to a lesser degree wind damage caused by Hurricane Irene (FEMA-4017-DR). The FEMA Individual Assistance (IA) data provided in Appendix C of the NDRC NOFA reported 2,280 homes damaged and 181 seriously damaged. This is well in excess of the Most Impacted Threshold of 100 homes damaged and 20 homes seriously damaged (See: Chart 1: Most Impacted Housing Data SJTA).

Distressed Characteristics

Majority LMI: According to the American Community Survey (ACS), Low- and Moderate-Income (LMI) Summary Data from HUD (2011, 5-year estimates), the proposed target area has a population of 222,890 out of which 55.6 % of the population has low- and moderate-incomes and 40.4% of the population has low incomes (Chart 2: Distress Majority LMI SJTA).

Economically Fragile: As evidenced in Chart 3: Economically Fragile Area SJTA, the TA has a civilian labor force of 92,651 with an unemployment rate of 19.8%, compared to the U.S. National Average (6.3%) during the same time period. Thus, the aggregate unemployment rate in the TA is 314% that of the national average, thoroughly exceeding the threshold criteria of 125% of the national average. Nearly 20% of the TA's labor force lives in Census Tracts with unemployment rates 37.7%, or six times the national average.

The labor force participation rate is 52.9%, which is 10% lower than the 62.8% U.S. level that is nearing a 37-year-low.

Environmental Distress: Multiple studies have found that the San Juan Bay Estuary (SJBE) and the TA are contaminated with heavy metals and fecal coliform. As required by the Clean Water Act, the Environmental Quality Board conducts an annual assessment of contaminants in the SJBE - *Puerto Rico 305(b)/303(d) Integrated Report (*Integrated Report 2014*)*. The report, *SJEB Program State of the Bay Report* provides reference points for acceptable levels of the contaminants monitored in both reports. The 2014 *Integrated Report* shows concentrations of mercury, arsenic, lead, fecal coliform and low levels of dissolved oxygen far above the established acceptable levels (SJBE Program State of the Bay - specifically Tables, 25, 26 & 27). A health impact assessment of the CMP communities within the TA (Health Impact Assessment -CMP) found that the contamination in the TA contributed to "higher rates of diseases, such as asthma and diarrhea (…) in the community compared with elsewhere in Puerto Rico." The environmental contamination in the TA hinders the ability of residents to recover from disasters, particularly the most vulnerable populations living in close proximity to water bodies.

Unmet Recovery Need

Housing Surveys: The PR NDRC Team conducted a methodologically sound windshield survey of housing damage within the TA (January 29-31, 2015). The windshield survey focused on 4 zones within the target area with the highest proportions of LMI populations and where FEMA IA data indicated there was significant damage from Hurricane Irene. The windshield survey identified 79 homes that were still damaged. Surveyors interviewed 38 of the households. Residents from 30 of the 38 household surveys confirmed that they had insufficient resources to make repairs to damage caused by (or made worse by) Hurricane Irene. Chart 4: Housing Survey – SJTA provides a summary of windshield and resident surveys. See files Housing Survey Responses and Housing Survey Photos for the documentation from the windshield and household surveys including photographs and written description of damage.

Business Surveys: The PR NDRC Team conducted a methodologically sound windshield survey of business damage within the TA (January 29-31 and March 2-3, 2015). The windshield survey focused on commercial corridors within the TA. The survey identified six businesses that attributed existing damage to Hurricane Irene and completed surveys establishing that they lacked the financial resources to complete the repairs. See Chart 5 Business Survey SJTA for a summary of the responses and files Business Survey Responses and Business Survey Photos or the documentation from the windshield and business-owner surveys.

Eligible Activity, Incorporation of Resilience & National Objective:

Activities to be implemented with the CDBG-NDR funds will be CDBG-NDR eligible activities. The activities undertaken in the most impacted and distressed areas will comply with a CDBG national objective. They will also contribute to improving resilience to current and future threat(s) and hazard(s), including effects of climate change.

Overall Benefit Test:

At least 50 percent of the funds requested will support activities that will provide sufficient benefit to low- and moderate-income persons in the form of services, area benefit, housing, or jobs, to meet the national objective of benefit to low- and moderate-income persons.

Tie-Back to Disaster:

A tie-back to the Qualified Disaster will be identified for each proposed CDBG-NDR-assisted activity.

One Application per Applicant:

The Commonwealth of Puerto Rico prepared only one application.

Benefit-cost analysis:

The state will submit a benefit-cost analysis completed in compliance with Appendix H for each Covered Project in its Phase 2 application.

EXHIBIT C: CAPACITY

General Management Capacity

The Office of the Commissioner of Municipal Affairs (OCMA) will implement the proposed activities in coordination with the PR NDRC Team, a group of 31 partners (Described Attachment E: Figure 1). OCMA will be responsible for overall grant administration and project oversight. As Lead Agency, OCMA will oversee the work of the PR NDRC Team.

OCMA administers State CDBG funds for non-entitlement communities, serves as the Lead Agency for Consolidated Planning for CPD funds, manages multiple Juvenile Justice Programs and has experience administering CDBG-DR awards. OCMA manages an annual award of $26.3 million of CDBG funding, with a staff of 70 employees. OCMA's role as the administrator of the State CDBG funds and the Lead Agency for consolidated planning purposes entails coordination and consultation with contractors, funders, community stakeholders, state agencies, NPOs (non-profit organizations) and municipalities. OCMA manages housing and infrastructure projects, similar to potential NDRC activities, with 51 subrecipients under the CDBG state programs.

Project Management, Administration and Coordination with Partners: Over the past two years, OCMA built its capacity to manage projects and administer federal funds, with the support of HUD and the President's Task Force on Puerto Rico's Status (PTF). OCMA's staff received training on Basically CDBG, Disaster Recovery CDBG, Duplication of Benefits, Uniform Administrative Requirements and Audit Requirements, through technical assistance provided by HUD. In the same timeframe, OCMA implemented new systems to support quality assurance, financial management, procurement processes, and internal controls. In early 2014, OCMA developed and implemented new monitoring protocol for CDBG subrecipients. OCMA executed collaborative agreements with FEMA and SBA to determine Duplication of Benefits for CDBG-DR awards. OCMA successfully launched and managed NSP 1 & 3

programs, which evidence its capacity to quickly implement large new programs similar to NDRC. OCMA implemented NSP 1 & 3 programs in coordination with 11 municipalities and met all NSP program requirements including timely obligation and expenditure of funds.

To centralize expertise and oversight of federal funding, Puerto Rico created an Office of Management and Budget (OMB) Federal Funds Management Office. OMB is part of the PR NDRC Team and will support OCMA around federal compliance and grant administration. Moreover, OCMA plans to hire additional staff and procure a private firm, with long-standing experience in CDBG-DR grant administration, to support the development of new systems and processes necessary to launch the NDRC program and ongoing administration. OCMA will begin the procurement process following submission of the Phase I application. A request for qualifications will be released in late April. OCMA will establish contract terms with one or more firms after Phase 2 announcements but prior to the launch of the NDRC program.

Application Development: OCMA led the development and writing of the application. The Agency organized and managed a team of 31 state agencies, municipalities, NPOs (PR NDRC Team), to draft the application and develop the proposed resilience framework. Enterprise Advisors (a national technical assistance provider for HUD CPD programs) and Estudios Técnicos (a local planning and socio-economic development consulting firm), provided technical advice.

Cross-disciplinary Technical Partnership

The members of the PR NDRC Team fall into four categories: Governmental Entities, Nonprofit Organizations, Private Sector, and Knowledge Institutions. Each category contributes to the PR NDRC Team's capacity to design and implement the proposed Integrated Urban Water Cycle Management (IUWCM) strategy.

Governmental Entities: State Agencies will provide technical expertise and align existing programs and funding to support the implementation of the IUWCM approach. Municipal governments from San Juan,

Cataño and Carolina will support needs analysis, coordinate local land use plans and stormwater projects.

Office of the Commissioner of Municipal Affairs (OCMA) – OCMA will be the Lead Agency for awarded NDRC funding. OCMA's expertise include cross-disciplinary project management and administering federal funds for community development projects, as described in the general management capacity sub-factor.

Puerto Rico Department of Housing (PRDH) – PRDH oversees the operations of two other public corporations: Puerto Rico Public Housing Administration (the second largest PHA in the U.S.) and Puerto Rico Housing Finance Authority (HFA). PRDH brings experience conducting comprehensive planning, implementing complex projects, and addressing civil rights and fair housing issues, to the PR NDRC Team. PRDH is the Lead Agency for the State Housing Plan, a comprehensive policy and planning effort developed with extensive community engagement. PRDH annually provides $654,000,000 in financing and subsidy contributing to the development, maintenance and construction of over 60,000 affordable housing units in the past 10 years. Currently, PRDH is developing two projects within the TA. PRDH serves most vulnerable populations and protected classes which requires a deep understanding of civil right and fair housing issues related to development and housing.

Puerto Rico Planning Board (PRPB) – PRPB is carrying out a comprehensive participatory planning effort for the development of the State Land Use Plan (LUP). PRPB utilizes the best-available information regarding existing and projected infrastructure, affordable housing, and economic revitalization projects along with science-based data on environmental quality and climate change. PRPB brings the multi-disciplinary experience and expertise gained during the development of the LUP, including the consideration of future risks of climate change, to the PR NDRC Team.

Department of Natural and Environmental Resources (DNER) – DNER is the state agency in charge of the protection, conservation and management of natural and environmental resources. DNER possesses extensive experience with the analysis of science-based information on the future risks from climate

change, including programs and projects' assessments on capacity to mitigate anticipated future conditions. DNER leads the efforts on climate change adaptability and coastal zone management, described below.

Puerto Rico Aqueduct and Sewer Authority (PRASA) – PRASA operates a comprehensive capital improvement program (CIP) for the execution of infrastructure projects that include studies, planning, design, bid, construction, start-up and project management. PRASA will provide technical support for all proposed IUWCM infrastructure projects. The CIP's nearly $300 million yearly investment is focused on modernizing water and wastewater systems, protecting public health, safeguarding environmental quality, and fostering economic development.

Office of Management and Budget (OMB) – OMB develops financial, program, administrative and operational analyses of all public agencies, including those that operate with local and/or federal funding.

Corporación ENLACE del Caño Martín Peña (ENLACE) and *Proyecto Península de Cantera* (PPC) – ENLACE and PPC are public governmental corporations, with extensive experience in comprehensive participatory planning processes and engaging vulnerable populations in the Caño Martín Peña and Cantera Peninsula, within the TA. ENLACE led the development of the *Comprehensive Development and Land Use Plan for the Special Planning District of the Caño Martín Peña* (CMP Plan), which received the American Planning Association's Paul Davidoff Award for Social Change and Diversity in 2009. PPC provides local NPOs and other stakeholders support in housing and economic revitalization projects.

Other State Agencies: Emergency Management Agency (PREMA), Governor's Authorized Representative (GAR), Department of Transportation and Public Works (DTPW); Department of Health (PRDOH), Electric Power Authority (PREPA), Trade Company (PRTC), Economic Development Bank (EDB), Department of Economic Development and Commerce (DDEC), Ports Authority (PRPA) and the State Agency for Energy Policy (SAEP). These agencies have vast experience in data analysis, implementation of large scale projects, design and engineering, community engagement and other areas.

Nonprofit Organizations (NPO): San Juan Bay Estuary Program (SJBEP), Entrepreneurial Support for Cantera Peninsula (ESCP) and the Cantera Peninsula Neighborhood Council, G-8 Communities and the Caño Martín Peña Land Trust, will leverage their in-depth knowledge and relationships in the TA to support the implementation of the IUWCM approach.

San Juan Bay Estuary Program (SJBEP) – SJBEP designed the Comprehensive Conservation and Management Plan (CCMP). SJBEP is responsible for implementing and monitoring progress of the CCMP, which includes the development of effective administrative and regulatory frameworks to minimize health risks associated with the San Juan Bay Estuary (SJBE) system's environmental degradation and prevent further degradation. The SJBEP brings extensive scientific and technical expertise on water quality monitoring, *Building by Nature* and community engagement for environmental restoration projects within the TA to the NDRC Team.

Private Sector: Aerostar Holdings administers and manages San Juan International Airport, Puerto Rico's main airport and as such, one of the Island's most important critical infrastructure facilities. Aerostar will coordinate infrastructure projects related to the IUWCM with NDRC activities.

Knowledge Institutions: University of Puerto Rico (UPR) and Puerto Rico Statistics Institute, will supply technical experts to analyze science-based information on existing and future risks from climate change. UPR brings expertise, data and networks from several research institutes to the PR NDRC Team, including: CariCoos and the Water Institute (Mayagüez Campus), Unit for Economic Research (Río Piedras Campus), Environmental and Public Health Departments (Medical Sciences Campus), and the University of Wisconsin- Madison (Space, Science and Engineering Center) will also support the social, scientific and organizational analyses.

Multi-Disciplinary Consortia: Puerto Rico has extensive experience in multi-disciplinary work to develop strategies and projects to foster a more resilient Puerto Rico. Principal among these, the Puerto Rico Coastal Zone Management Program (PRCZMP) is actively involved in the implementation of the SJBEP's

CCMP and serves as Executive Secretary for the Puerto Rico Climate Change Council (PRCCC). The work carried out by both the PRCZMP and the PRCCC will be further described in Regional Capacity below.

Cost Reasonableness & Cost Benefit Analysis: OCMA is experienced in performing cost- reasonableness, price analyses, and benefit cost analsys in compliance with federal regulations. The GAR has the most experience among PR NDRC Team using FEMA's BCA. They are certified to provide BCA training and technical assistance to local governments when accessing FEMA mitigation funds, which enables the completion of many projects using Hazard Mitigation grants. The GAR partners with OCMA and will provide any technical assistance required for the effective implementation of NDRC activities.

Community Engagement Capacity

The PR NDRC Committee includes members for whom community engagement is central to their work. Their experience includes working inside the TA with vulnerable communities in distressed areas impacted by Hurricane Irene. The PR NDRC Team also possesses the capacity to undertake regional community engagement focused on identifying and addressing the effects of climate change.

Community Engagement Capacity within the Target Area: ENLACE, a member of the PR NDRC Team, implemented the CMP Plan (previously described). The CMP addresses environmental, social, economic, housing, and urban concerns through a multi-year participatory community engagement effort. As part of the implementation ENLACE carried out over 800 engagement activities to promote effective participatory planning, decision making, and implementation of projects and policies in eight of the most distressed communities within the TA. These processes focused on issues related to public health, poverty, social and environmental distress. The engagement resulted in the development of public policy that contributed to the development of a land trust and NPO to address the needs of these communities.

The CMPs' planning processes also strengthened residents' understanding of the interrelated issues they faced and how to address them through community organizing. In the words of a resident of *Israel and*

Bitumul, the engagement process' greatest achievement is that communities can now speak the same language. "*We were physically close, and despite having so much in common, did not work together. Now we can provide each other support."* It is our intent to build on the community engagement framework developed by ENLACE to conduct regular outreach with community leaders, meetings, community workshops, and community assemblies to keep stakeholders embedded in the planning and decision-making processes in the design and implementation of NDRC projects and activities.

Regional Community Engagement Capacity: The PRCZMP, within the DNER, is currently engaged in the development of community-based Climate Change Adaptation Plans upon the recommendation of the PRCCC. These plans are actively integrating the diverse stakeholders (private sector, government, community groups, NGO's) in the discussion, analysis and planning processes related to climate change adaptation. Strategies being implemented are based on guidelines provided by the Intergovernmental Panel on Climate Change, and include developing community maps with residents, among other strategies. These participatory processes have resulted in mutual benefits, by aligning conservation and environmental management practices with sustainable economic development for the communities.

Similarly, State Consolidated Planning efforts led by OCMA provides an example of the NDRC Committee's capacity to work with and harmonize the contributions of diverse stakeholders. OCMA developed a series of strategies to engage the community that go beyond the requirements of public participation (public hearing and publication), including web-based surveys, in–depth interviews, and the evaluation of the information derived from these methods by an interagency committee.

Regional Capacity

The Puerto Rico Coastal Zone Management Program (PRCZMP), evidences the PR NDRC Team's experience working on and effectively addressing regional problems, with a particular emphasis on addressing the risks related to climate change. PRCZMP is administered in partnership with the National Oceanic and Atmospheric Administration's (NOAA) Office of Ocean Coastal Resource Management and

a network of state and federal agencies. From 2010-2013, they completed climate change vulnerability assessments for 44 coastal municipalities with municipal governments. The assessments focused on: coastal communities, critical infrastructure, coastal biodiversity and adaptation to changing conditions.

The Puerto Rico Climate Change Council (PRCCC) is a clear example of work across disciplines that incorporates partners at the federal, state, local level as well as knowledge institutions, nonprofits and private sector. PRCCC serves as an advisory body to ensure the coordination of efforts for risk and impact assessments regarding coastal hazards and climate change, and to provide recommendations on adaptation strategies to improve resiliency. The PRCCC uses the best available scientific data to identify the communities and ecosystems at high risk from coastal hazards and climate change. It follow a process of: identification, assessment, prioritization, and development of resiliency strategies and policies; and dissemination of findings and recommendations. As of March 2015, the PRCCC is comprised of over 160 partner organizations, with experts from disciplines such as: planning, architecture, design, engineering, sociology, education, communications, public health, environmental science, public administration and economics, amongst others. Multiple members of the PR NDRC Team participate in the PRCCC ensuring the two efforts will be coordinated in support of the implementation of the IUWCM approach.

Regional Coordination and Engagement: The PR NDRC Team will be the forum through which regional coordination and impact is achieved. Its composition and structure were set with the intent to facilitate regional collaboration. The municipal partners will coordinate NDRC projects and activities across boundaries and support them with consistent local policies and regulations across the SJBE. Several state agencies, as described in this section, work extensively on regional planning and collaboration and will be tapping those existing processes and capacity to support proposed NDRC projects and activities. The airport is private sector actor facing the same threats as the TA and is interested in partnering to address those threats as effectively as possible. NPOs have extensive experience working with communities within the TA and will act as facilitators. Knowledge institutions all work at a state and international level and

have the experience and networks to develop cross-jurisdictional solutions. Together the members of the PR NDRC Team are positioned to address resilience throughout the SJBE.

The Target Area (TA) is located in the San Juan Bay Estuary, a system of nine interconnected water bodies including mangrove wetlands, tidal basins, riparian corridors and lagoons. The severity and frequency of current and future threats– sea level rise, cyclones, flooding and storm surge – are influenced by the state of the natural water system. An approach that acknowledges the interconnected nature of the water bodies in the SJBE is necessary to address current and future threats. In the past, efforts to address threats at a local scale focused on individual water bodies. The results shifted and concentrated problems in other sections of the densely populated SJBE. In particular, past efforts have shifted and concentrated problems in the TA, as evidenced by the higher levels of environmental contamination found there. A regional approach will have the greatest benefit for the TA where vulnerable populations are concentrated, reducing the disparate impact on the TA's most vulnerable populations.

EXHIBIT D: NEED AND EXTENT OF PROBLEM

Target Area

The Target Area (TA), impacted by Hurricane Irene in August 2011, is a low-lying area on the shorelines of the San Juan Bay Estuary (SJBE). The TA includes critical components of the natural water system, which control drainage throughout the SBJE and act as a buffer against impact from tropical storms. The wetlands bordering the SJBE's water bodies are particularly susceptible to impact partly because of high exposure to the hazards threatening insular Caribbean contexts (flooding, tropical cyclones and storm surges, sea level rise, and earthquakes), but also because of development practices in the area. Decades of poor planning led to the development of the wetlands as communities for low-income populations lacking proper sanitation or stormwater infrastructure. The SJBE's natural systems are failing under the pressure of development practices and increased exposure to natural threats. Communities in the TA, with high-concentrations of vulnerable populations, face constant threats to their health, livelihoods and well-being. The historical, political and economic importance of the SJBE to Puerto Rico cannot be overstated. The only tropical Estuary in EPA's National Estuary Program (NEP), the SJBE contains the systems and assets, which provide the foundations for the economy, food supply chain, and government – including the main decision-making bodies from the Executive, Legislative and Judiciary branches. A significant volume of activities sustaining the economy and food supply for the Island are located within our Impact Area. Most critical among these, Puerto Rico's main ports and transportation facilities, through which more than 85% of imports and 80% of food imports enter the Island, are located in the SJBE. Over 9.8 million travelers enter Puerto Rico through the Airport and more than 1 million cruise ship passengers (May 2013-2014) through the San Juan Bay, playing a crucial role driving Puerto Rico's economy. (See Attachment E: Map 1)

Unmet Recovery Need

As described in Exhibit B, 87 homes and 6 businesses with unmet recovery need were identified almost 4 years after they were hit by Hurricane Irene. The unmet resilience recovery need of the thousands of homes and hundreds of businesses that were not elevated and remain vulnerable to future flooding events is not included in these figures. The combined resilience and repair unmet need is best assessed by considering the needs related to underlying systems that contribute to the resilience of all buildings impacted by Hurricane Irene in the TA and that are still vulnerable, not resilient.

Addressing the underlying causes (poor infrastructure and damaged natural systems) of the unmet recovery need for the TA can also help address the resilience need of the TA and the SJBE.

The poor stormwater and sewage infrastructure of the TA "Areas along Caño Martín Peña (a community in the TA) were used for the establishment of substandard housing (See Attachment E: Map 2). This housing lacks basic utilities such as stormwater and sanitary sewer systems (USACE, 2012)." In a high density urban context, the absence or inadequate stormwater management infrastructure leads to urban flooding. However, traditional urban stormwater infrastructure discharges stormwater to the nearest water body, which in the case of our TA is not flowing. "Today, the canal's ability to convey flows has been almost completely blocked as a result of siltation, trash and debris accumulation, and structure encroachments along the eastern segment (USACE, 2012)." The Estuary's natural water systems are impaired and unable to convey runoff as should naturally occur. Now the runoff is retained in the SJBE waterbodies contributing to flooding in communities that neighbor them, including the TA.

In addition to contributing to flooding, the lack of proper stormwater and sewage infrastructure is contributing to the damage of SJBE water systems, indirectly increasing flooding. "The most common and widespread impairments to the SJBE waters are (…)sewage discharges from a variety of sources, especially from overflows in sewage treatment collection systems, combined sewer systems, and illegal

sanitary discharges from residences and commercial establishments connected illegally to the stormwater system or not connected at all." (SJEP, 2013). The stormwater and sewage infrastructure resilience needs and the natural water system resilience needs are part of the unmet recovery need of the TA.

Most Impacted and Distressed

The SJBE area was hit by Hurricane Irene (FEMA-4017-DR), a Category 1 Hurricane, on August 21, 2011 resulting in over $5.2 million damages awarded through FEMA's IA claims within the Municipality of San Juan. As documented in Exhibit B 2,280 homes were damaged by Hurricane Irene in the seven Most Impacted Census Tracts within the Target Area alone. Funds awarded in our Target Area (TA) constitute 87% (94% Flooding) of IA claims awarded in the Municipality of San Juan.

More difficult to estimate is the degree that the damage reported through the FEMA IA data underestimates the number of homes damaged. The Most Impacted Census Tracts are farther from the water than neighboring CTs where less claims were filed (See Attachment E: Map 3). Flooding in the most impacted CTs most certainly would have passed through the lower lying communities closer to the SJBE's water bodies. These communities also have high concentrations of informal housing and owners lacking title claims, consequently residents are far less likely to file claims resulting in the undercount. A more accurate estimate of the damage caused by Hurricane Irene would show the low lying CTs with a greater number of homes damaged, adding significantly to the total damage caused.

Multiple Stresses: The TA is characterized by acute environmental distress, including degraded waterways and mangrove wetlands and exposure to pollutants from sewer overflow. The high level of raw sewage, heavy metals and toxic chemicals stemming from limited and ineffective sewer and stormwater management infrastructure, exacerbate the risk and damage caused by exposure to flood waters for residents and have resulted in increased gastrointestinal, dermatological, respiratory and vector-

transmitted diseases. The studies identified in Exhibit B document the extent of the environmental distress across the SJBE, especially in water bodies such as the Martín Peña Channel (CMP, in Spanish).

The TA also faces acute socioeconomic distress, when considered by most socio-economic indicators. As described in Exhibit B, according to ACS (2013), the majority of the population in the TA is LMI (56%) and 40.1% of the population qualifies as low-income. In fact, 42.8% of households live under the poverty line. The labor force participation rate is 52.9%, which is 12% lower than the 64.8% US level currently nearing a 37-year-low, and is coupled by an unemployment rate of 19.8% (314% the US average).

Comprehensive Risk Approach: The science-based Integrated Risk-Based Framework (IRBF) will be employed by the PR NDRC Team to select projects and activities within the proposed resilience program (Attachment E: Figure 2). The IRBF has five steps that guide communities through the consideration of historical impacts, current risks and future conditions. Step 1 defining development goals, objectives and tipping points. Step 2 identifying the TA's current and future risks, vulnerabilities and trends. Step 3, carry out a Risk Assessment, considering the intersection between hazards, threats and vulnerabilities utilizing science-based methodologies. The Hazus-Multi Hazard model is used to consider multiple hazards, model potential interactions with the built environment, and inform future decisions about interventions. In Step 4 the main stakeholders (PR NDRC Team and regional stakeholders) work to identify Risk Mitigation Activities based on: level of protection, public safety, socioeconomic security, returns on investment and co-benefits. Finally, Step 5 is used to compare and evaluate investment options in Phase 2.

Responses to Questions

Threats, Hazards and Vulnerabilities: The four main hazards and threats, which pose a serious risk to both individuals, throughout the TA and the SJBE are: flooding (as defined as exposure to 100 year events and urban flooding); tropical cyclones; storm surge; and sea level rise (projected at 0.5 meters) (See Attachment E: Map 4; PRCCC, 2013). The main vulnerabilities were identified on the basis of how they

affect communities' exposure, susceptibility and ability to mitigate impacts from hazards. Vulnerabilities relate to levels of poverty (unemployment and LMI population) (See Attachment E: Map 5), the concentration of vulnerable populations (people with disabilities, immigrants, age) and inadequate infrastructure (e.g. sewage and wastewater distribution systems).

Those living in close proximity to SJBE waterbodies are a vulnerable population due to increased exposure to hazards, with 38% of the population within the Impact Area are exposed to a 100-year flooding event. Furthermore, 11% of the population is exposed to storm surge and a projected sea-level rise of 0.5 meters. These communities are particularly susceptible because they lack essential infrastructure and safe housing to manage, mitigate or recover from its consequences to the associated shocks and stressors. The TA is extremely densely populated with the average density for CTs in the TA is 6,148 hab/km^2, or 240% of average CT population density in New Orleans (Attachment E: Map 6), which puts a significant pressure on already fragile infrastructure and service provision systems, and significantly complicates evacuations.

In terms of environmental distress, testing performed on the waters from the CMP found Escherichia coli and Enterococci levels well in excess of allowable levels set by the Environmental Quality Board, according to the SJBE Program. Rates of diarrheal disease reached up to 51% in the 3 months preceding the Health Impact Assessment – CMP field work, and were highest among people who reported that their own street or home had flooded, evidencing a clear association between flood water exposure and increased risk of GI disease. Significantly higher rates of asthma and diarrhea were found among residents within the target area compared to Puerto Rico as a whole. Children and people over 65 years of age were identified in the Health Impact Assessment – CMP as particularly susceptible to these public health threats.

Process Driven by the Best Available Data: Work to understand and restore the SJBE's natural water cycle has been going on for over a decade and the NDRC has taken advantage of the extensive research to use the best available data to inform this application. The main threats, hazards and vulnerabilities were

identified on the basis of historical information related to damage from the main hazards and land development patterns, scientific projections regarding future socioeconomic and environmental trends and consultation with stakeholders from communities, local government and state agencies.

FEMA's Flood Insurance Rate Maps (FIRM's) were used to measure risk of flood hazards for the Target Area. Since current FIRMs do not consider trends or anticipated conditions such as Climate Change and landuse patterns, we utilize two data sources to establish risk from tropical cyclones and sea level rise. The first is study is the *Integrated Hazard Assessment for the Island of Puerto Rico* (URS, 2002), commissioned by FEMA and Puerto Rico's Metropolitan University. The second study is *Storm Surge Modeling in Puerto Rico in Support of Emergency Response, Risk Assessment, Coastal Management and Climate Change Analysis* (Benítez, et al, 2015), developed by DNER and University of Puerto Rico-Mayagüez Campus. Socioeconomic data is from the US Census' American Community Survey (ACS) 2013 5-year estimates. The information evaluated and analyzed is the best information available for Puerto Rico, deriving from Federal, National and Local governments; and studies from recognized higher learning institutions.

Climate Change and Insurance: According to the NCA (2014), unless action is taken, climate change will almost certainly increase the risk, frequency, intensity and variability of hazards and threats identified. The underlying risks represent a serious threat to all the communities along the SJBE and are almost certain to occur given current trends which have shown a steady sea level rise on the Island for 48 years and an increase in extreme rain episodes in the past decade. Already distressed communities will suffer more frequent damage at a larger scales. Moreover, these events have the potential to alter the SJMA and Puerto Rico's economies by impeding travel and trade throughout the SJBE, severely limiting both demand for goods and services through its impact on tourism and supply through its impact on trade. Moreover, an extreme weather event could potentially paralyze the main policy and decision-making bodies in government, all of which are located in the TA, impeding our capacity to recover.

The most pressing "*known unknowns*" are the timing, intensity, location of the future disasters, the impact on complex natural and human systems, how exactly climate change will manifest itself in the near term, or what economic and social tipping points will occur as stressors and shocks combine.

Current Insurance Subscription & Obstacles to Broader Usage: The information on the number of insurance policies that cover losses caused by natural hazards in Puerto Rico is limited. Most policies required by financial institutions cover losses due to earthquake and windstorms. Household policies for natural hazards are based on the property's value, without consideration of either its vulnerability or exposure to hazards.

Puerto Rico participates in the National Flood Insurance Program (NFIP), which requires that property owners purchase flood insurance for buildings located within Special Flood Hazard Areas (SFHA), when Federal financial assistance is used to acquire, repair, improve, or construct a building. Consequently, all mortgaged properties must be covered by the NFIP in compliance with Federal Regulations. However, only 6% (1,498) of estimated 24,712 properties located within the Target Area's SFHA have an active flood insurance policy. Puerto Rico is the only jurisdiction in the United States paying flood insurance policies for property owners that received financial assistance from the Federal Government following a Presidentially-declared disaster, currently 407 policies within the TA.

Participation in the NFIP in areas with high concentrations of low-income households is particularly low. Since properties are not mortgaged residents are under no legal requirement to own insurance. This is compounded by the limited disposable income of residents in these communities and the high proportions of informal housing within the TA, both of which limit the ability to purchase insurance. Finally, individuals' capacity to recover from the effects of natural disasters is limited in high vulnerability communities is limited because the NFIP does not cover the full range of threats they are exposed to.

Impact of Restoring the Natural Water Cycle: At the community and regional levels, restoring the natural water cycle will reduce exposure to threats and impacts from hazards, such as: health-related complications, loss of property, lack of access to water and poor sanitation, disruption of economic and educational activities because of closed roads, airports and ports, and damage to electricity power lines. At the individual level, activities to address unmet needs must include increasing insurance coverage in vulnerable communities. The majority of the direct and co-benefits from the restoration of the natural water cycle will accrue to most vulnerable populations.

Disproportionate Impact on Vulnerable Populations: For the highest risk communities bordering the SJBE's water bodies, both exposure to impacts from hazards and the vulnerability are significantly higher than the wider region. The proposed TA is characterized by high proportions of vulnerable populations living in the multi-risk zone. The TA has higher unemployment (+3.0%), people over 25 without high-school diplomas (+2.4%), total immigrants (+11.9%), non US citizens (+10.0%), renters (+22.6%), population over 65 years (+6.6%), poverty (+6.2%) and child poverty (+14.3%) rates than the SJMA. Exposure to continuous flooding and the island's economic downturn, coupled with shocks from severe flooding events, tropical storms and hurricanes, have further exacerbated most vulnerable populations susceptibility to hazards by altering both the physical and social landscape. The structural integrity of already unsafe housing has worsened and low-income communities are subjected to regular school closures (to provide emergency shelter during frequent flood events). Alongside worsening health conditions due to exposure to sewage backup and other pollutants, the magnitude of impacts increases as individuals' ability to mitigate their impacts decreases. In fact, the stresses related to flood events, generate continuous disruptions on the livelihoods of communities within the target are eroding the limited ability of vulnerable populations to cope with the daily stresses they face. Increased socioeconomic disparities are pushing vulnerable communities to live in high exposure areas with deteriorated housing and

infrastructure, further increasing the pressure caused by repetitive losses from both uninsured damages and stress factors (flood, heat, droughts, and mosquitos).

Improving the water management system would ensure reduce the direct losses suffered by the uninsured, whilst at the same time ensuring those with basic needs have safe access housing and basic services they need. Addressing the risks related to these vulnerabilities is fundamental to improve health, quality of life and social mobility for vulnerable populations for whom the impact from hazards and stressors has reduced their capacity to reduce, recover and overcome the challenges faced from the impact of these hazards and stressors.

One Piece of an On-going Multi-Faceted Approach: The proposal for NDRC will be part of an effort that has been progressing for over a decade. There are currently various initiatives to address the risk from these vulnerabilities, including: flood control works in *Rio Puerto Nuevo* and *Quebrada Margarita* (DNER &USGS), projects in support of the San Juan Bay dredging (PRPA); automatization of storm water pumps systems in *Cataño* (DNER); revision of Municipal Landuse Plans (MSJ); Natural Reserves' Designations (Isla Verde Coral Reefs; *Caño Martín Peña*; *Ciénaga las Cucharillas*) and needs analyses to dredge the CMP, which is currently blocking tidal flow throughout the San Juan Bay Estuary.

Challenges faced to address the risks associated to these vulnerabilities include physical limitations on the implementation of traditional solutions and limited institutional instruments for risk-based planning. For example, the target area is a high density area that limits the ability to raise structures above the base flood elevation and build traditional sewer infrastructure. Limitations to implement risk-based planning exist due to informational gaps between what is currently being collected and maintained by government agencies (such as construction profiles and informal housing inventory) and what is required for a detailed risk assessment (such as integrated water management models)

EXHIBIT E: SOUNDNESS OF APPROACH

Consultation

Expanding our resilience framework will require full engagement of Target Area (TA) communities', as well as that of other stakeholders, including: state agencies, local governments, the private sector and knowledge institutions. The PR NDRC Team designed and implemented a plan for collaboration, outreach and communication based on the public engagement model developed by the *International Association for Public Participation*. This model provides a continuum of strategies which includes from information dissemination to empowerment of stakeholders. Furthermore, collaboration, outreach and communication plans build on our partners' experience (See: Exhibit C-Capacity), including ENLACE and Cantera. ENLACE, was the public corporation in charge of developing the CMP Plan through a participatory process that involved over 700 meetings with stakeholders. ENLACE and Cantera Corporations' ongoing engagement led to the establishment of a cross-sectorial coalition of committed stakeholders focused on strengthening TA communities' resilience.

The specific strategies for consultation and public engagement implemented for our proposal include: mandatory consultation processes (public hearings and publication of draft); the creation of a multi-sectorial, multi-jurisdictional NDRC team for analysis, coordination, engagement and strategic planning; dissemination of information in the TA communities and neighboring jurisdictions to increase their ability to contribute to the framing process, meetings with stakeholders, use of social media and the Internet, and media tours (including TV stations, radio stations and newspapers).

As part of the preparation of the NDRC application PR NDRC Team have discussed with stakeholders the NOFA requirements, the opportunity it represents for Puerto Rico and how the risks, hazards and threats will impact communities throughout the SJBE. Also, the extensive discussions with community stakeholders about the risks, stressors, hazards and threats the SJBE faces that ENLACE had during the development of the CMP Plan, informed the PR NDRC Team's analyses. The development of the CMP

Plan built awareness about coastal management, climate change and sea level rise impacts on TA communities.

Fifty-five (55) stakeholders (including 31 partners), representing: state, units of local government, community based organizations, community leaders, NPOs of regional impact, knowledge institutions and the private sector, were consulted and integrated in the proposal development (See Attachment E: Figure 1). They have participated in the proposal development in several roles, including conducting the housing and business windshield surveys. In order to organize partners' inputs, the PR NDRC Team established two work teams: coordination, logistics and engagement; analysis and strategic planning. These teams, which worked with a broad range of partners and stakeholders, met at least once a week over the past three months.

If selected for Phase 2, OCMA will keep the PR NDRC Team in place and expand it to further its community engagement efforts. The approach developed in Phase 1 has ensured successful integration of stakeholders' input. During Phase 2, OCMA plans to continue this approach and strengthen it with periodic (quarterly or bi-monthly) community meetings, supported by media coverage and grass-tops outreach. Several strategies, illustrated in Appendix I, were used to involve the vulnerable groups and identify their needs, including community meetings with representatives from Cantera Peninsula, the CMP and Dominican Community leaders. ENLACE incorporated the topic in its periodic meetings with community leaders and implemented other strategies to promote the integration of several of the most vulnerable groups into the proposal development. In fact, youth and children's groups from low-income communities provided a significant proportion of written and oral submissions at the public hearing. Cantera organized a meeting between the community and the PR NDRC Team, with the purpose of having an in-depth discussion with the community about the ideas, concepts and approach developed for the proposal.

During the meetings, the public hearing and team work sessions, the indirect risks and vulnerabilities in the TA were discussed. These discussions have included regional impacts and have brought to light potential cumulative effects on TA residents, the SJBE and the Island as a whole, including aspects related to public health and access to education. Structuring the work based on a committee with representation from stakeholders, has ensured a comprehensive proposal, which addresses the different dimensions of resilience. The process also promoted the establishment of collaborative structures and contributed to institutional and individual capacity building, which will undoubtedly facilitate the effective implementation of activities. As a result of these efforts, the PR NDRC Team has engaged the collaboration of 31 partners that represent key state agencies, municipal governments and NPOs. (See: Appendix I and Comments Summary).

Ideas and Concepts

The SJBE tells the story of two profoundly disparate urban experiences. On its shorelines lie the drivers of Puerto Rico's institutional and economic activities, alongside communities that have endured severe socioeconomic distress, poor housing conditions and exposure to health hazards for decades. Faced with increased exposure to extreme hazards (flooding, hurricanes, sea level rise, and storm surge) arising from climate change and a damaged natural water system, the economic and environmental sustainability of both cities depends on addressing long-standing disruptions to the SJBE's natural systems. We propose an Integrated Urban Water-Cycle Management (IUWCM) approach to address the common factor across these threats, by taking water's functions in the built and natural environments into consideration and simulating the natural water cycle. The IUWCM provides a strategic framework to simultaneously reduce the impact from floods and stormwater on communities and the impact of urban development on water resources, while improving water access and quality. Any approach seeking to reduce exposure to the impacts from hazards strengthening the TA's resilience, must achieve all three outcomes.

The proposed IUWCM approach recognizes that water is an integral part of both the natural ecosystems and communities. Consequently, it is focused on: increasing the efficiency and effectiveness of water investments; maximizing the use of alternative water sources; engaging communities; reducing stresses and shocks on existing infrastructure; and, supporting capacity building for individuals, communities and institutions in order to improve water quality, wastewater and stormwater management. Following nine years of economic contraction, which have limited both institutional and individual resources to recover from the impact of hazards, reducing exposure by maximizing investments through a data-driven participatory planning process is not just desirable, but a necessity.

The IUWCM ideas: This approach will address immediate and pressing unmet needs of individuals and communities. At the same time the approach lays the foundation to address underlying structural (ecological, institutional and social) problems that contributed to increased vulnerability and exposure to hazards. Intervention at the regional scale will foster interdependencies between individuals, institutions and communities, to strengthen regional resilience and trigger co-benefits in environmental conditions, public health, quality of life, governance and economic development. Activities will focus on strengthening the built, institutional and social infrastructures in the TA and the SJBE, providing the foundation for three scales of intervention (individual, institutional, regional).

Built Infrastructure: Encompasses projects and activities to improve immediate, mid and long term needs. Immediate needs include; obstructions to tidal water flows; stormwater urban flooding, sub-par sewage infrastructure, combined sewer overflow and access to affordable housing. Mid-term needs relate mainly to aging infrastructure and flood-prone housing units. In turn, long term needs include: flexibility of main assets to cope with stresses and shocks due to climate change and fluctuating demographic trends; and the reduction of GHG emissions at the urban scale.

Built infrastructure activities will include three main areas: secure and affordable housing; green infrastructure; and building by nature. Safe and affordable housing (e.g. separation of sewer and water system infrastructures; eliminating direct discharges into water bodies; resilience retrofitting, and relocate) seeks to address short-term needs. Wherever appropriate and necessary, ENLACE's successful relocation model, including intensive community engagement and collaboration, will be emulated. In turn, green infrastructure (e.g. green roofs; multifunctional infiltration basins) will focus on complementing existing traditional infrastructure with technologies to retain, detain, store, and drain water discharges in urban areas. Building by nature (e.g. riparian corridors, ecological restoration of waterways). Together, these activities will help reduce system loads, enhance flood protection systems, and strengthen the conditions of coastal and marine ecosystems surrounding the TA. Built infrastructure will be better-equipped to respond to water related impacts due to climate change, and thus increase the resiliency of its inhabitants.

Institutional Infrastructure: NDRC funding will be the catalyst for the design and adoption of new deliberative processes and institutional structures that will guide infrastructure investments and policies throughout the SJBE, beyond the implementation of NDRC projects. The IRBF (See: IRBF Description), has been selected by the PR NDRC Team as the framework structuring processes and methodologies to optimize the selection of projects and activities. The IRBF process calls for cross-sectional and multi-jurisdictional engagement and requires a data-driven transparent decision making processes. Outcomes will be measured on the basis of Rockefeller's Resilience Framework. The intent is to establish as the IRBF standard as the default process for all public investment decisions (e.g. infrastructure prioritization and design, community-based adaptation plans; siting decisions) and policy making and planning (e.g. land use plans, building codes, cost-benefit analyses of resiliency projects, green and gray infrastructure guidelines, post-disaster rebuilding guidelines) in the SJBE region.

The tools and best-practices established to support water management investments, will help strengthen resilience through knowledge generation support and collaboration structures. Thus, the established institutional infrastructure will have significant and ongoing impact on the TA and SJBE's resilience and capacity to adapt to climate change, whilst providing a replicable model for the Island and other insular Caribbean or estuarine contexts.

Social Infrastructure: The IUWCM will be undertaken through a Place Based Development (PBD) strategy will aim to maximize capital investments of both IUWCM and related water management projects that alleviate the stresses (public health, poverty, unemployment, unsafe housing, etc.) impacting the target area. State and municipal policies and projects will aim to incentivize all stages of activities, from research and design to execution to locate within the TA. The Water Management Development Corridor (WMDC) in order to foster knowledge-based economic activities and trigger the associated spillovers through productivity gains from innovation and learning-by-doing. These strategies will focus on the localities' assets, including water management challenges and opportunities, to drive social and entrepreneurial innovation. Investments to build and strengthen the social infrastructure, will focus on: establishing the WMDC (e.g. business incubators; water management knowledge hub; tax incentives); developing community-based financial instruments (community-based insurance policies; microcredit; social entrepreneurship funds); and community risk awareness & education programs (community warning systems; community disaster-support network; train the trainer programs; learning communities; resilience ambassadors). The PBD approach will build-upon communities' assets and capacities, further strengthening their resilience to disasters and climate change impacts.

Strengthening Individual, Institutional and Community-wide Resilience: The IUWCM seeks to reduce present and projected vulnerabilities by decreasing exposure to hazards such as flooding, increasing access to safe and affordable housing and strengthening economic sustainability through PBD strategies. In terms

of *environmental quality and public health*, improving stormwater management will reduce pressure on the sewer system triggering co-benefits by improving the quality of water bodies and access to clean water for residents in the TA. Reduced contamination of the SJBE will also minimize exposure to pollutants, toxins and disease transmitting vectors, resulting in improvements to health in communities distressed by increased incidence of vector-transmitted, gastrointestinal, dermatological and respiratory diseases.

In terms of *workforce and economic development*, reduced flooding will improve access to education and jobs, by reducing interruptions in business, educational and transportation operations through stormwater management and safe housing investments. Along with community-based warning systems, these activities will reduce exposure to stressors and shocks, leading to co-benefits by decreasing expenses to mitigate the impact from continued damages for individuals, businesses and communities. Long-run co-benefits result from least resilient residents and small businesses' increased capacity to save and invest in productive economic activities leading to community-wide growth.

The large capital investments in water cycle management and housing infrastructure projects along the communities of the SJBE will create employment opportunities for vulnerable populations and strengthen demand for small local businesses employing these populations in the short term. On the medium to long run it will enable the development of an economic specialization around water management to support sustained long-term growth. There is an opportunity to incentivize the location of businesses that focus on water cycle management policies, products and services both for use within the SJBE and for export. The establishment of this cluster of specialized water management firms and part of the development of social infrastructure to support the IUWCM will be weighed when investment decisions are made with NDRC and other funding streams. Broader community development objectives are achieved through the diversification of economic activities, which enable both the widening the revenue base through the

production of a growing range of outputs and reducing risk of economic shocks and stressors that are concentrated geographically or by sector.

Optimization of Resilience Outcomes through Collaborations: The development of institutional infrastructure will aid in overcoming historical deficiencies in policy and planning processes that have exacerbated communities' exposure to stressors and shocks and strengthening long-term resilience. Applying the IRBF will lead to data-driven risk-based investment and public policy decisions. The IRBF is underpinned by benefit-cost analysis practices that consider not only immediate benefits and costs, but benefits over the assets' useful life, through life-cycle costing, and a long-term outcome-based evaluation process that considers social co-benefits resulting from investments. Both approaches respond to current trends in federal funds management (e.g. EPA, CNCS & HUD). Proposed and new projects and activities, which will be considered and evaluated under optimization methodologies, outlined by the IRBF. These evaluations will consider not only feasibility and effectiveness of proposed activities, but also the means to support recovery and resilience by augmenting existing actions.

Viability of a water management approach for the SJBE's watershed will require ***collaboration and support*** from both the TA's municipal and state entities responsible for stormwater management, flooding control, natural resource regulation and critical infrastructure projects, as well as community and business partners. The IRBF sets the foundation to transform decision-making processes and inter-jurisdictional collaborations and to manage the interdependencies between multiple variables and stakeholders' interests, by establishing systematic processes for all decision-making stages in public policy.

Regional Impact & Interdependencies: IUWCM investments will have a significant impact on the urban water-cycle throughout the SJBE, helping reduce flooding and contamination associated with sewerage backup for residents of the eight municipalities it serves. Alignment and integration are fundamental, because interdependencies between water bodies mean improved stormwater and flooding management

in one point of the system may lead to increased exposure in others. Moreover, stabilizing critical infrastructure systems, service provision and ensuring flow of transport within the Island's main urban center, strengthens trade and commercial activities, and service provision (health, education, etc) for the region, improving resilience of vulnerable populations throughout Puerto Rico.

Strengthening Resilience in Puerto Rico and the Caribbean: Puerto Rico has adopted a multi-faceted approach to strengthen its resilience, informed by the Caribbean context. The IUWCM approach which emphasizes water-related hazards and addresses them through built, institutional and social infrastructure, set the foundation for the successful implementation of a replicable resilience model for Puerto Rico.

National Flood Insurance Program: Puerto Rico participates in the NFIP, and the Puerto Rico Planning Board (PRPB) is the entity in charge of the program. Though it is considered a community under the NFIP, Puerto Rico does not qualify to be part of the Community Rating System (CRS). Puerto Rico's institutional structure and regional divisions limit implementation of the program at the eligible municipal level. Over the past three years, the PRPB has sought to increase the implementation and participation in the program, through a plan that includes the development of a CRS program and outreach to other qualified municipalities, such as San Juan, in order to increase NFIP participation.

Caribbean Learning Communities: Further work is needed to integrate climate change adaptation into existing and future actions, as Puerto Rico works to strengthen its institutional capacity to incorporate the risks associated to projected climatic challenges for the Caribbean region. To this end, Puerto Rico is participating in several regional and international efforts, including the Caribbean Challenge Initiative, regional collaborative agreement to improve coastal management and marine conservation practices along the Caribbean basin. Puerto Rico has already fulfilled the challenge of increasing protected marine and coastal ecosystems by 20%.

Also, Puerto Rico has partnered with several Federal and USVI agencies in the Caribbean Landscape Conservation Cooperative, in order to develop and provide the best available conservation science and strategies for agencies, decision makers, organizations, researchers, and the general public for the restoration, conservation and sustainable development of natural and cultural resources in the Caribbean. Furthermore, Puerto Rico has signed a series of cooperative agreements with several government institutions from Dominican Republic, strengthening the historical ties between the two Caribbean islands. Collaboration agreements, between Puerto Rico's DNER, EMA, and EQB and their counterparts from Dominican Republic, focused on sharing technical and scientific knowledge and capacities in order to tackle climate change impacts and improve disaster risk management practices on the two islands.

Climate Adaptation Planning: Since 2013, Puerto Rico has started taking its first steps toward the development of a climate change adaptation plan, on the basis of the PRCCC's recommendation for more than 15 state agencies providing critical services (e.g. PA, PRDOH, PRASA, PREPA) to carry out vulnerability assessments and develop climate change adaptation plans. The plans will enable the development and execution of action points to address identified vulnerabilities on the short and medium term, and are expected to be completed by the end of 2015. Additionally, a series of community-based adaptation plans are being developed through comprehensive participatory planning processes through the Puerto Rico Coastal Zone Management Program (PRCZMP). The PRCZMP is administered by the DNER in partnership with the National Oceanic and Atmospheric Administration's (NOAA) Office of Ocean and Coastal Resource Management and other federal and commonwealth agencies. From 2010-2013, the PRCZMP completed the Island-wide climate change vulnerability assessments in all 44 coastal municipalities on the Island.

EXHIBIT F: LEVERAGE AND OUTCOMES

Outcomes

Investments in Long-Term Resilience: The Integrated Urban Water-Cycle Management (IUWCM) approach, guided by the Rockefeller Resilience Framework, balances a long-term perspective that focuses on vulnerabilities with immediate unmet recovery needs, particularly, those of the most vulnerable communities. A range of scales of investment are incorporated into the IUWCM. The investments in activities and programs are intended to be incremental, building toward the overall goal of restoring the natural water-cycle, improving environmental conditions, strengthening institutional infrastructure and developing social infrastructure that address the stresses faced by the communities in the Target Area (TA). This incremental approach will allow for flexibility and adaptation to changing social and environmental conditions and enable the IUWCM to be integrated into and leveraged with planned infrastructure, natural system and social welfare investments.

IUWCM Strategy: The water-cycle infrastructure developed will include integrated water management systems that support and restore natural systems and safe affordable housing. Where appropriate, the infrastructure will be decentralized. Integration of green and natural infrastructure should increase the returns on investment by requiring less maintenance and leveraging the capacity of natural systems to sustain and repair themselves. The co-benefits for a tropical island with dense urban areas are significant: improved stormwater management, reduced urban heating and lower energy demands, reduced stress on the large-scale infrastructure including the centralized drinking water supply, and healthy ecosystems.

Up-front investments of the IUWCM will be underpinned by the state agencies, local municipalities, NPOs, and private sector partners that compose the PR NDRC Team. This diverse group of stakeholders engaged each other and committed to the financial sustainability of the IUWCM approach, and expanding the focus of the IUWCM to include institutional and social infrastructure where the PR NDRC Team intends to create and capture major co-benefits.

Building Social Infrastructure by Integrating Community Assets: The IUWCM calls for a Place Based Development (PBD) strategy to trigger economic revitalization. The investments made with NDRC funding will be matched with training and community outreach to capture direct employment opportunities for unemployed and underemployed residents. Investments planned by PRASA and PRDH in the TA will address insufficient infrastructure and substandard housing which have discouraged private investment. Together, the projected large-scale investments along with employment outreach will help to increase demand for local businesses and contribute to the economic growth in the TA.

Measuring Success: The PR NDRC Team will measure impact across each of the three components of the IUWCM strategy: water-cycle, institutional and social infrastructures. Investments into water-cycle infrastructure aim to restore the urban water-cycle and align man-made infrastructure to better support natural systems. The IUWCM strategy's success will be based on its capacity to progressively improve the TA's resilience. It will be measured on the basis of: frequency and severity of flooding; increased vegetative and wetland cover; pollution levels and utility service coverage.

The investment in the institutional infrastructure should yield increased community participation and use of science-driven risk-based planning processes for public policy and investment decisions. Success will be demonstrated on the basis of: adoption of processes by state and local agencies – including the IRBF or similar risk-based tools, cost benefit analyses and participatory planning practices; and the inclusion of climate change adaptation and resilience principals in public policy.

Investment in social infrastructure will target the most vulnerable communities and maximize the co-benefits of the IUWCM. Impact measurements may include: job creation, employment levels; improved public health; decreased days with schools' or roads' closures; availability of safe affordable housing; reduced homelessness and poverty rates; or increased insurance coverage.

Leverage

The NDRC PR Team includes representation from each major stakeholder group: Government (state and municipal), Private Sector, Knowledge Institutions and NPOs. The cross-sectoral and cross jurisdictional approach strengthens the institutional framework necessary for successful implementation of projects and activities, which also allows for a regional effort across the SJBE and supports the long-term implementation of IUWCM.

The Commonwealth's Government is working on a wide range of investments and policy initiatives that lay the groundwork to improving resilience not just in the TA but throughout the SJBE and the Island. The efforts taken on by several of the state agencies participating in the PR NDRC Team extend and expand the reach and funding to support the IUWCM.

Studies of Climate Change and Natural Systems: DNER has completed or is working on multiple studies including; *Regional Coastal Sedimentation and Erosion Assessment* and *Sea Level Rise Vulnerability Assessments*, with its scientific partners which will be the scientific foundation for PR's approach and resilience efforts throughout the SJBE.

Development of New Affordable Housing: Currently, the PRDH is sponsoring the construction of affordable housing units (565) within the TA, including: *Las Gladiolas* (ca. $36 million): 152 housing units and *Puerta de Tierra* (ca. $44 million): 192 housing units. PRDH is committed to funding additional affordable housing projects going forward as part of the IUWCM approach.

Improved Hazard Modelling: PRPB committed to invest $500,000 to validate HAZUS-Multi Hazard-Geographic Information Systems (GIS) software for Puerto Rico and estimate FEMA's Average Annualized Loss for flood event that has a 1% probability of occurring (100-yr flood) and to improve the decision-making capability to identify vulnerabilities, prioritize mitigation actions, and review the

effectiveness of strategies to increase resilience. The PRPB committed to utilizing the model for land use plans and informing investment decisions for the implementation of an NDRC award.

San Juan, *100 Resilient Cities* (*100RC*): The Rockefeller Foundation designated San Juan a member of its *100RC* program in 2014. A Chief Resiliency Officer (CRO) will be funded by Rockefeller but selected by the municipality. The Municipality of San Juan (MSJ) committed that the CRO will support PR NDRC activities

Development of Standard Insurance Risk Assessment: In Puerto Rico, the assessment of vulnerability is limited because it depends on properties' elevation certificates which most uninsured properties lack. The absence of a standard risk-based procedure results in over or underinsured properties throughout the Island. The Office of the Puerto Rico Insurance Commissioner is developing a process to systematically evaluate the expected losses by individuals and communities in order to determine premiums based on risks and vulnerabilities. It should also provide the foundation for increasing accessibility to insurance instruments for LMI households through more accurate pricing.

Public Health Co-Benefits: The implementation of the IUWCM will reduce the cost of provision of health services for the communities within the TA and allow reallocation of resources into other community development goals. Currently, constant flooding events and the absence of a sewer system expose the population to pollutants, which have been proven to increase propensity for skin diseases and vector transmitted viruses such as dengue fever and chikungunya. The provision of aqueduct and sewer infrastructure and safe affordable housing, will reduce exposure resulting in: (1) a reduction of the subsidized healthcare costs for this population; (2) reduction in crisis-centered healthcare, freeing funding for preventive health programs; (3) improved general health and accessibility to transportion will reduce absenteeism from work and school, improving the communities' productivity and their ability to pursue economic sustainability.

Increased Economic Activity Co-benefits: The PBD will promote and incentivize the co-location of enterprises with water-management expertise, establishing an economic cluster to help drive the local economy. Thus, facilitating private capital investments into redevelopment of blighted properties for both new business activities and the development of safe affordable housing. Diversification of the productive base to include innovative high-productivity economic sectors will strengthen the skills of the local labor pool and increase demand for goods and services provided by local businesses.

School Disruption Reduction Co-benefits: Improvements in stormwater management will lead to reduced exposure to hazards, which will in turn reduce emergency management costs related to evacuations and sheltering exposed populations. Moreover, reducing school closures for use as shelters will reduce associated childcare costs and wage losses for parents.

Committed Leverage Resources

Water Infrastructure Investments: PRASA firmly committed to invest $98,928,055, on the provision of sewer systems and existing system growth within the TA over the next 13 years (See: PRASA Leverage Commitment). The scope and timing of these projects will support the IUWCM approach's aims of reducing the impact of human activities on natural systems and improve water quality.

EXHIBIT G: LONG-TERM COMMITMENT

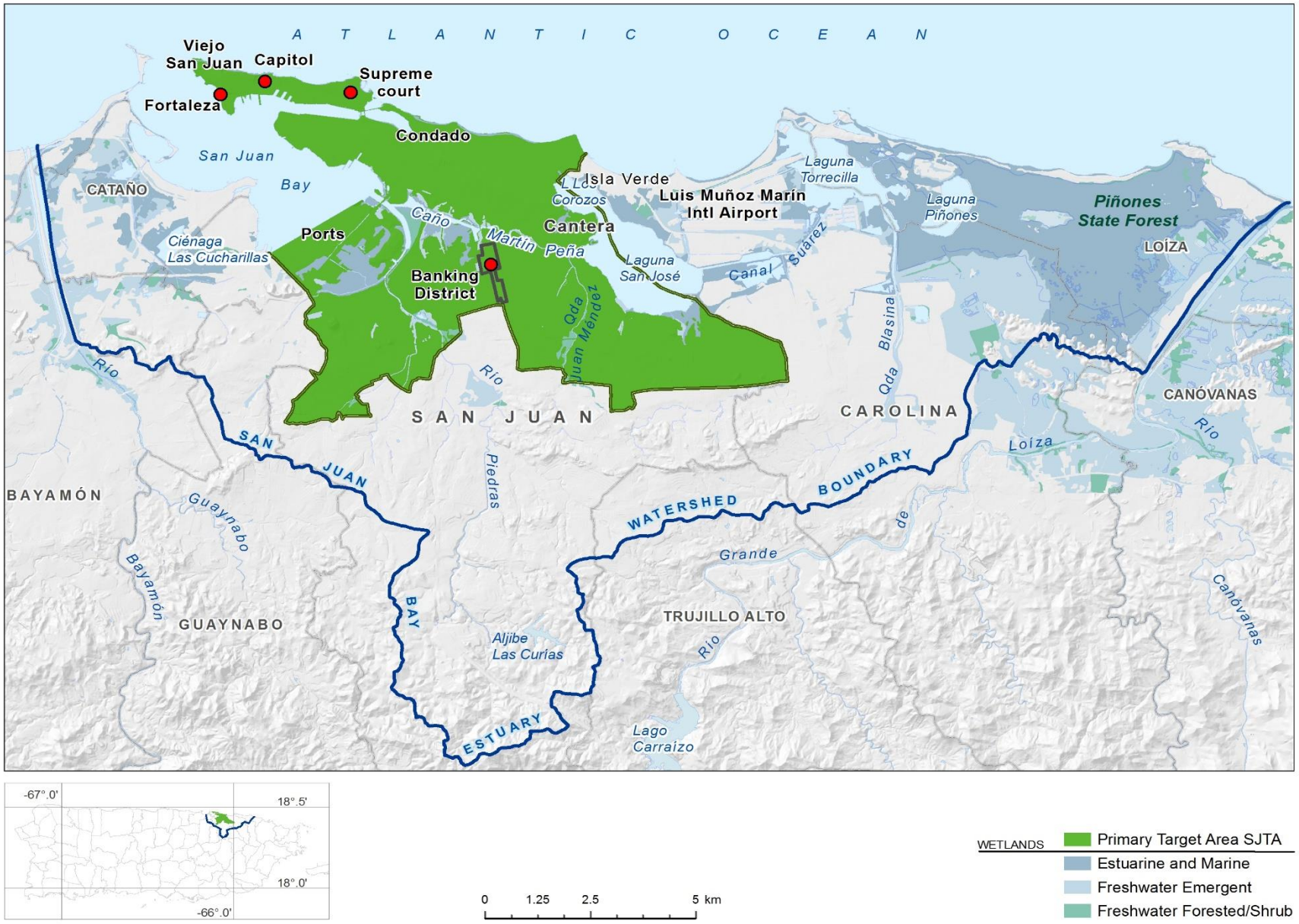
Puerto Rico's Long-Term Commitment to Resilience and Climate Adaptation

The Puerto Rican government is currently committed to a wide range of investments and policy initiatives, that lay the groundwork to improving resilience for areas beyond the Target Area and which will facilitate implementation of the Integrated Urban Water Cycle Management (IUWCM) strategy island-wide. Chief among these initiatives are: Critical Infrastructure and Community Climate Change Adaptation Plans overseen by the Puerto Rico Coastal Zone Management Program and the Climate Change Council; the Puerto Rico Planning Board's integration of Climate Change into Puerto Rico's and Municipal Land Use Plans; PRASA's Capital Investments Program (CIP).

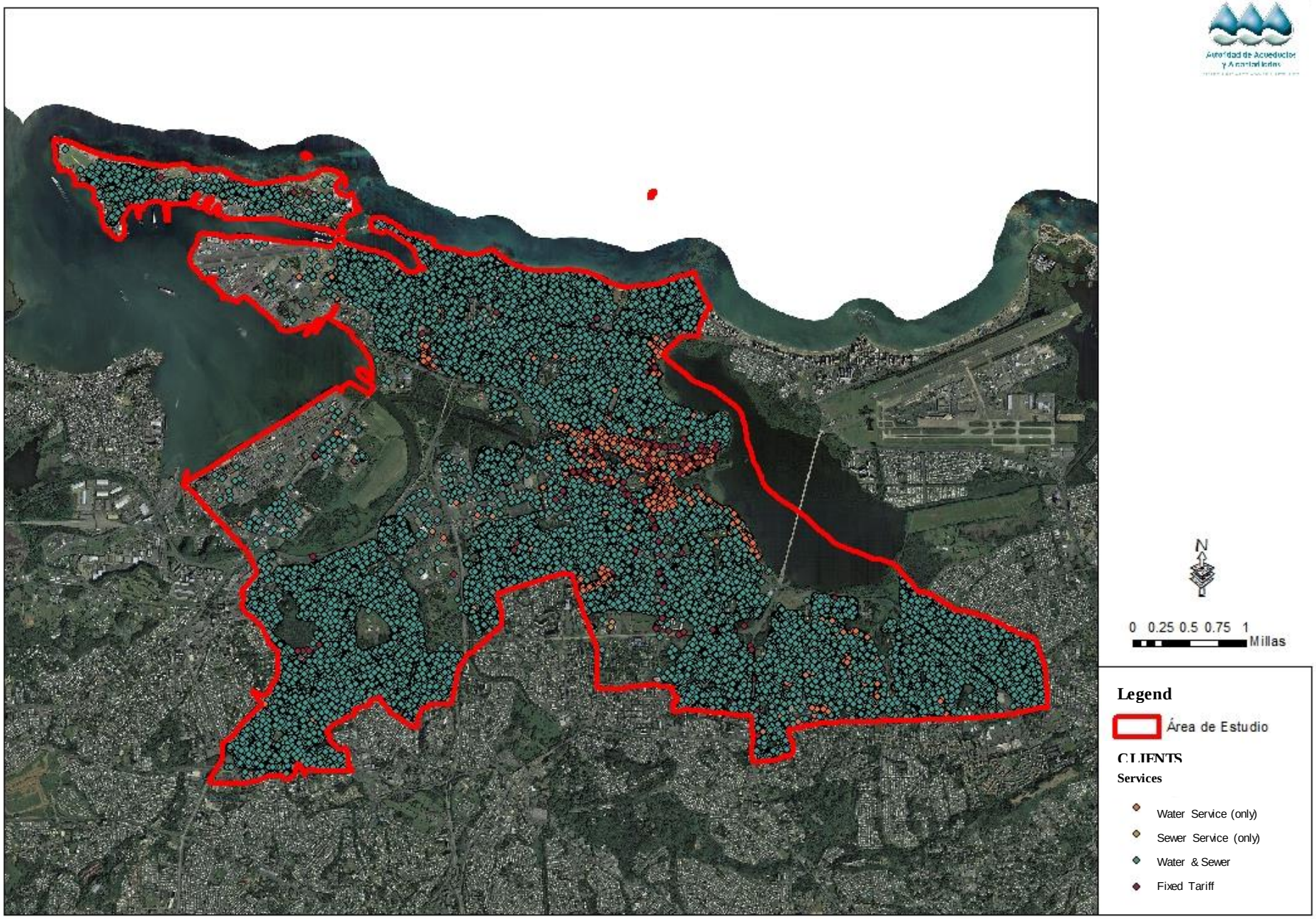
The IUWCM strategy is focused on the development of a scalable and replicable resilience model for Puerto Rico. Both our cross-sectorial implementation structure (19 state agencies, 3 municipal governments, 4 knowledge institutions, 4 NPOs, 1 private) and a broad focus on the SJBE ensure impact in the wider region and Puerto Rico. Moreover, capacity and institution building within governmental entities will embed resilience into policy and decision-making processes, contributing improved resilience island-wide.

As part of the NDRC Phase 1 process the Puerto Rican government drafted an Executive Order that establishes a taskforce, composed of policy-makers working with disaster management, climate change, infrastructure and vulnerable populations experts. The taskforce will: analyze vulnerabilities and risks associated to hazards and climate change; design public policy on resilience, considering technical, environmental, social, legal and economic aspects through comprehensive participatory planning processes; and develop a governance model to strengthen decision-making tools and mechanisms for public institutions increasing their capacity to address the particular vulnerabilities of insular Caribbean contexts. The Executive Order builds upon previous orders related to disaster recovery and climate change. Is currently under review and it is expected to be issued by May, 2015.

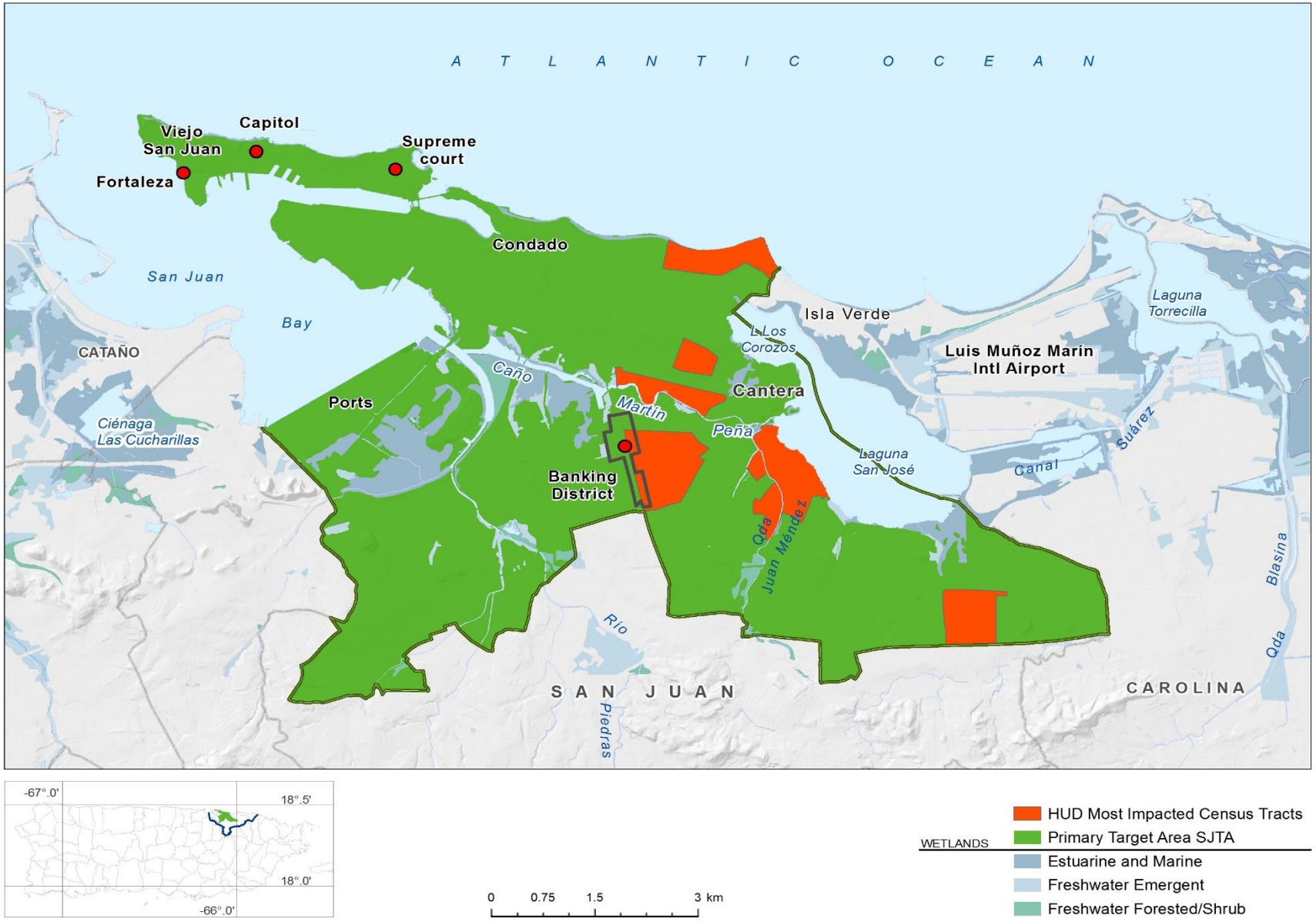
ATTACHMENT E: MAPS, DRAWINGS AND RENDERINGS



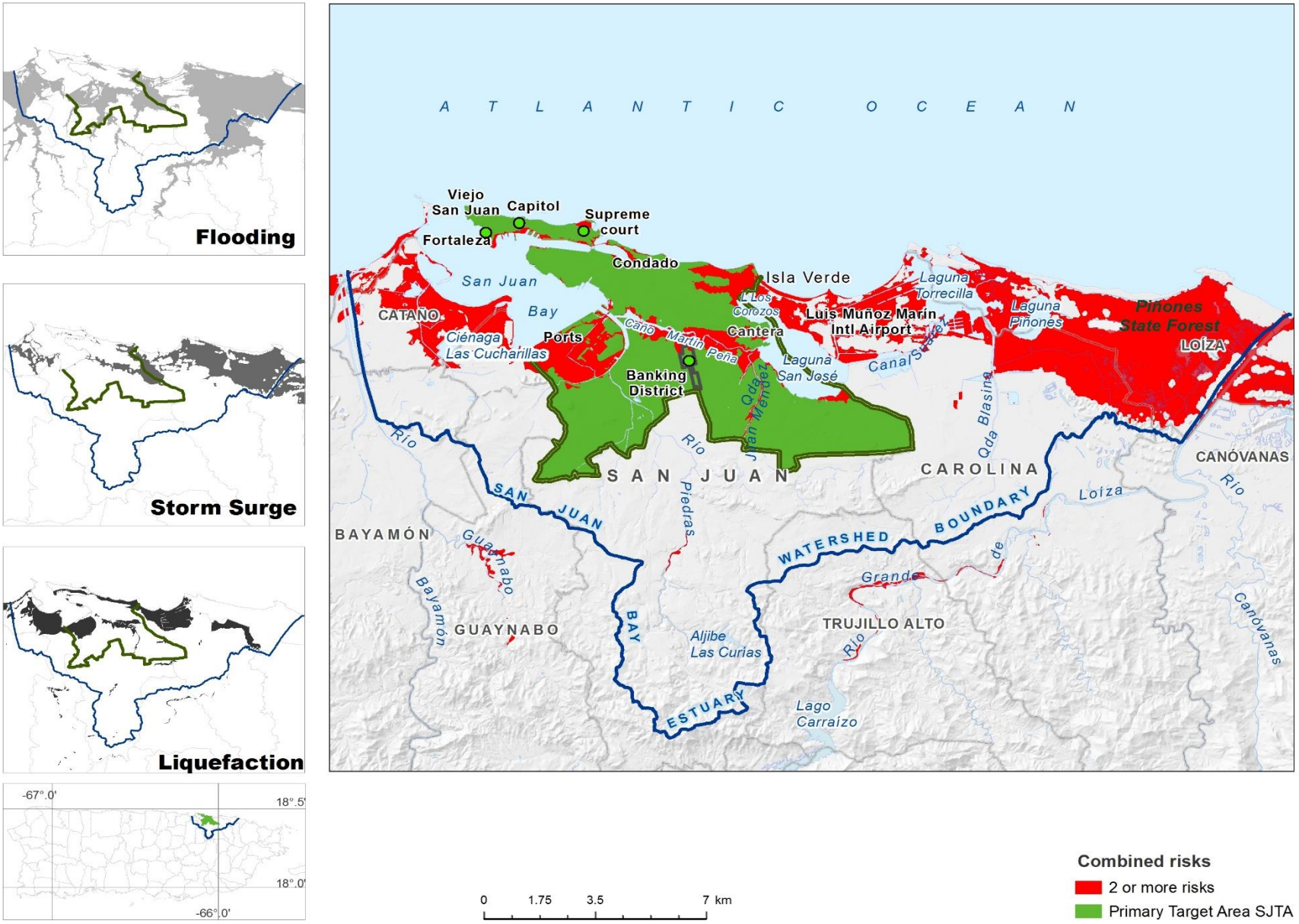
Map 1: Target Area - Context



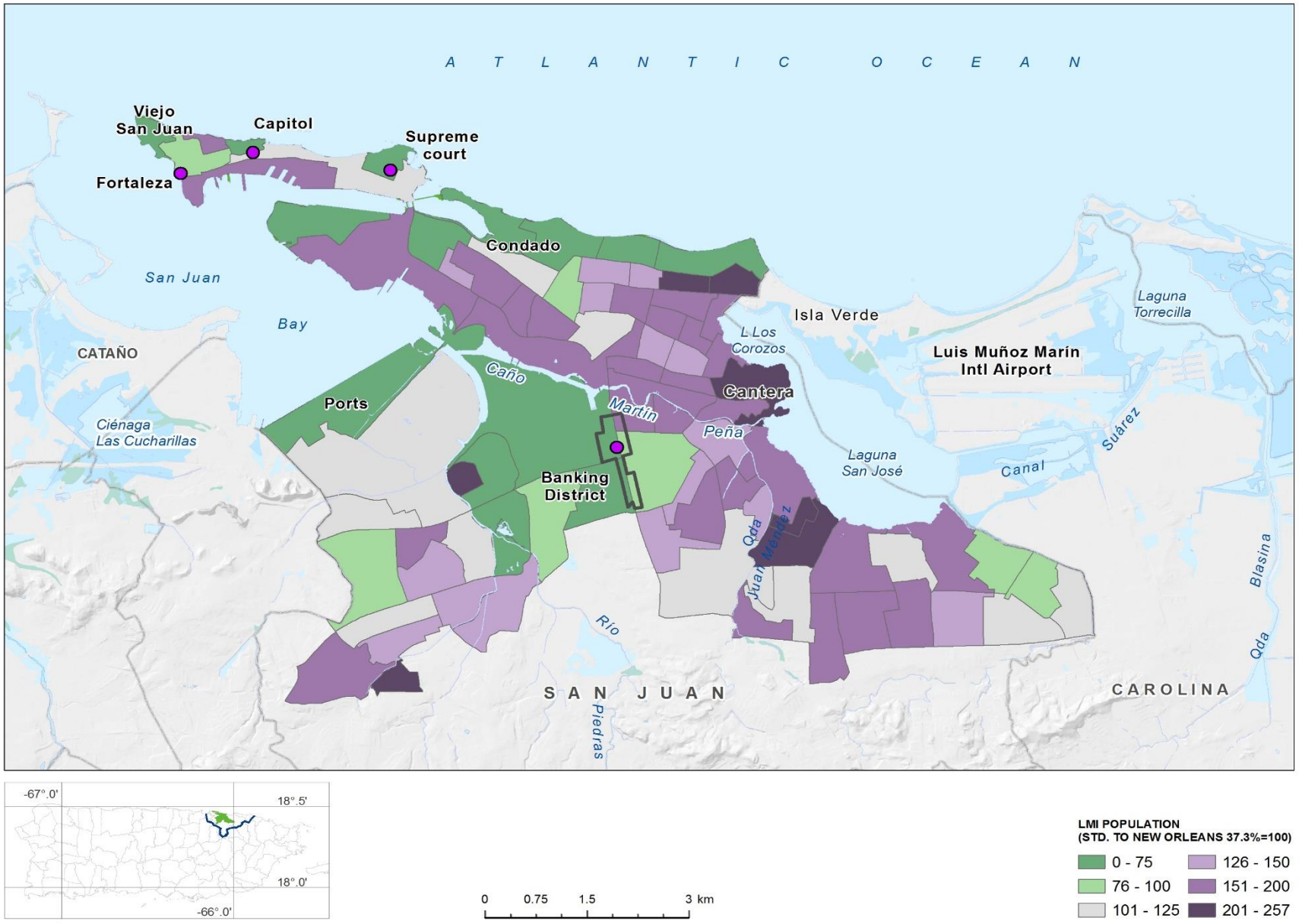
Map 1: PRASA Clients by Type of Service



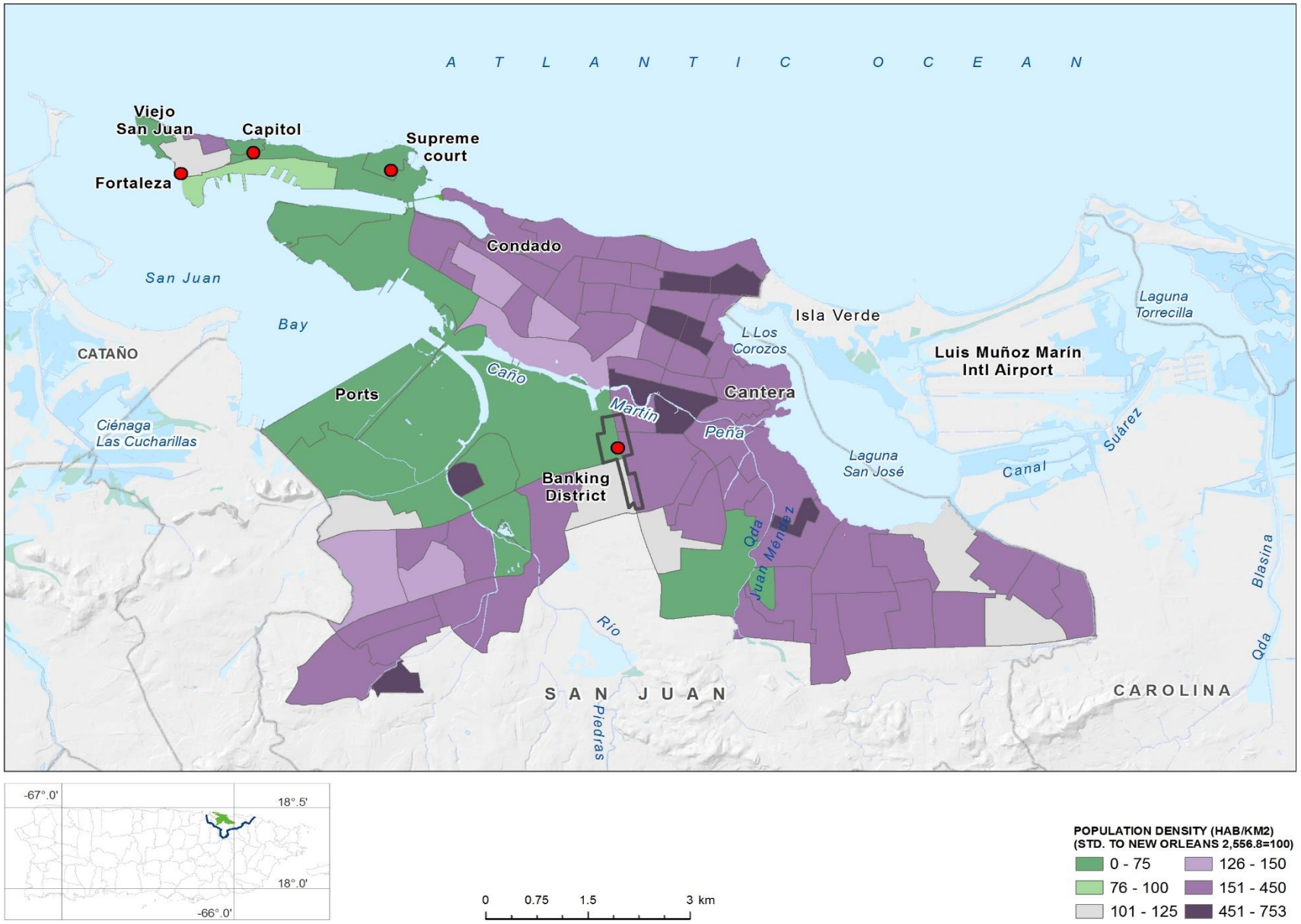
Map 3: Target Area Most Impacted Census Tracts



Map 4: Target Area Risks



Map 5: Low and Moderate Income (LMI) Population



Map 6: Population Density

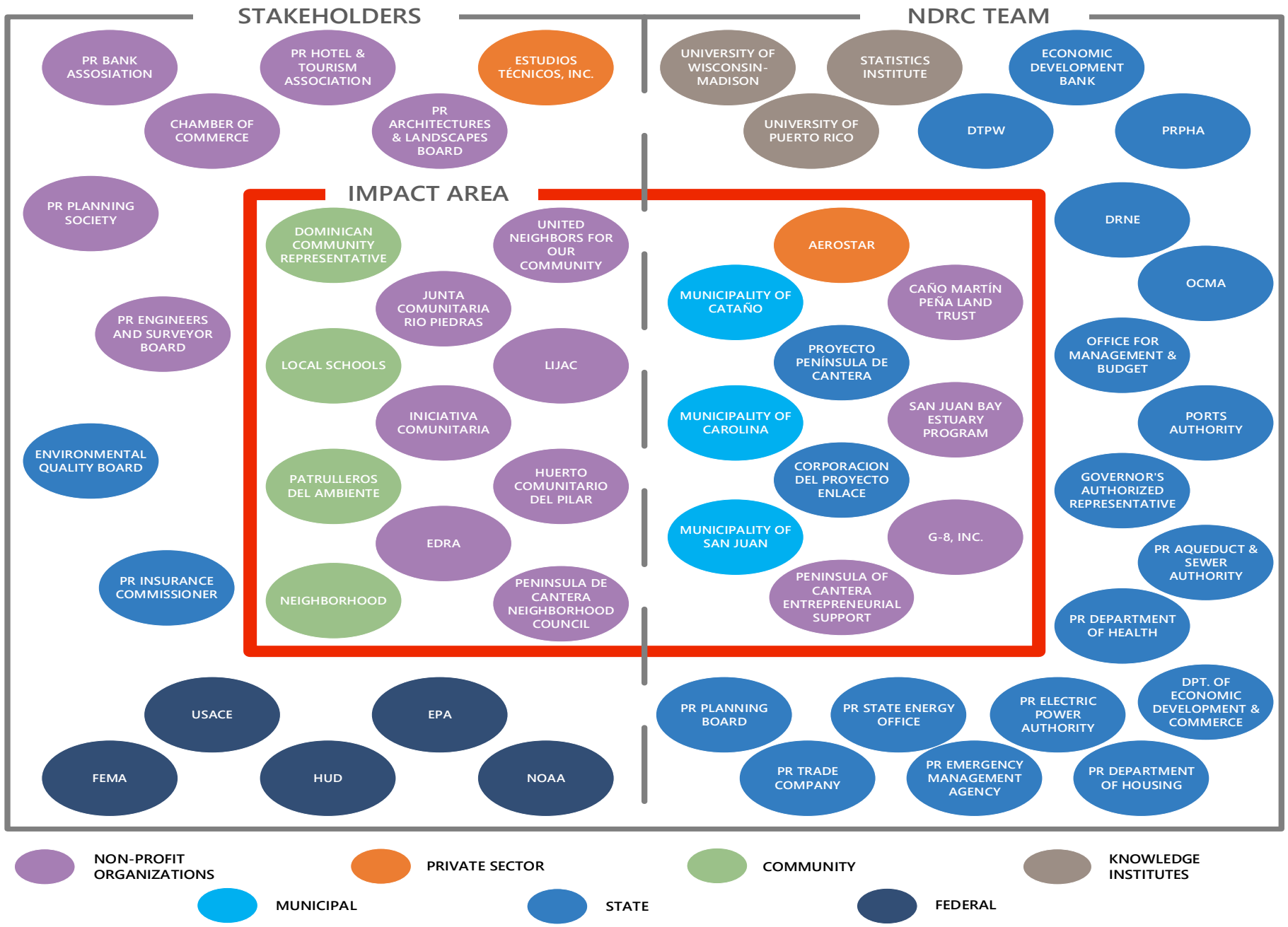


Figure 1: NDRC Team and Stakeholders Diagram

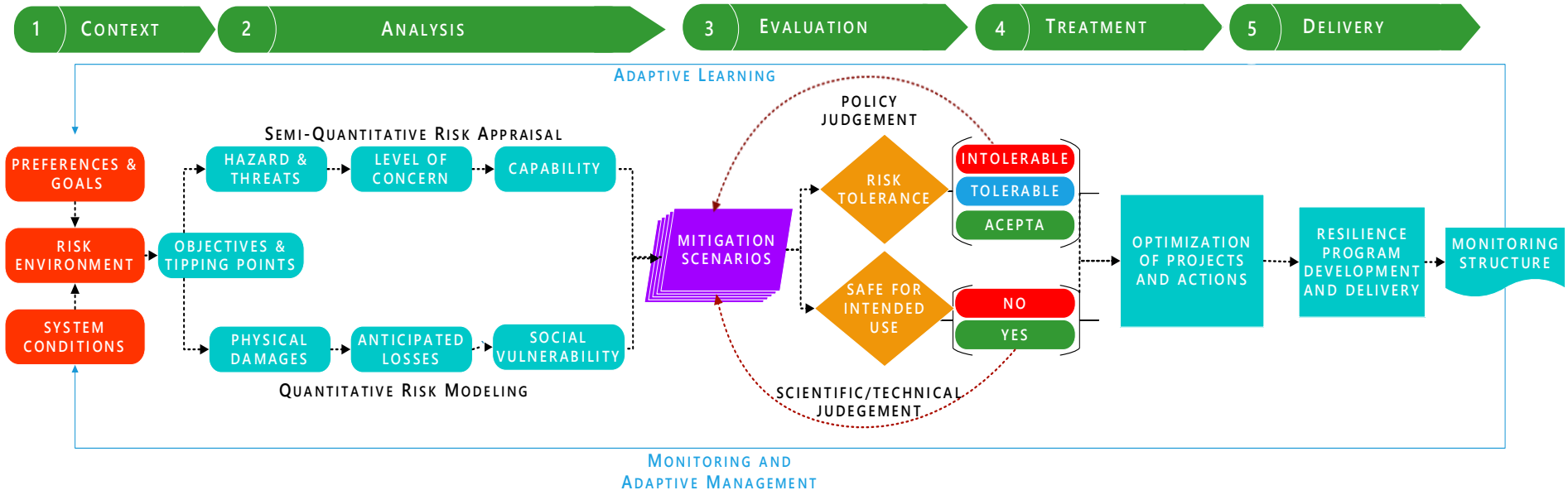


Figure 1: Integrated Risk Based Framework

(Adapted: Disaster Resilience by Design: Extending HAZUS-MH for Risk Based Planning and Decision Support in Canada-www.nrcan.gc.ca)