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Performance Evaluation in LAC Urban DRR Programming: The Neighborhood Approach

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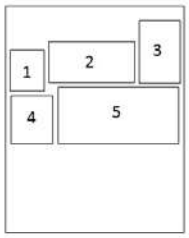
Evaluation Team Leader	Juan Pablo Sarmiento
USAID	Suzanne Polak
FIU Evaluation Team Members	EEI: Vicente Sandoval, Meenakshi Jerath, Gabriela Hoberman HPM: Alejandro Arrieta, Weiwei Chen
A01	Marije van Lidth de Jeude, Oliver Schütte, Erick Mazariegos, Erick Palacios Solano
Independent Consultants	Omar Darío Cardona, Paulo Ruiz Cubillo, Elías Rosales Escalante, Patricia Bittner

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FIU Extreme Events Institute
FLORIDA INTERNATIONAL UNIVERSITY

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Front cover photo composition
1- Mixco, Guatemala. Photo A01
2- Medellín, Colombia, Photo A01
3- Anse-à-Foleur, Haiti, Photo WCDO
4- Lima-Independencia, Peru, Photo PREDES
5- Lima, Peru, Photo V. Sandoval



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Performance Evaluation in LAC Urban DRR Programming: The Neighborhood Approach

Abstract

The goal of this evaluation is to improve the understanding of the Urban Disaster Risk Reduction (DRR) programming carried out in Latin America and The Caribbean, and supported by the United States Agency for International Development's Office of U.S. Foreign Disaster Assistance (USAID/OFDA). The study focused on eight DRR projects awarded by USAID in Colombia, Guatemala, Haiti, Honduras, Jamaica, and Peru, between FY2012 and FY2016. The projects applied the USAID Neighborhood Approach (NA) to find practical and workable solutions for DRR in densely populated informal urban settlements.

Two objectives and specific questions were defined for this evaluation: (1) the effectiveness and (2) the sustainability of the NA. The study comprised an extensive literature review, followed by a mixed research method, including surveys, focus groups, and interviews; disaster risk modeling; georeferencing analysis; and engineering inspections. Finally, an integrative process—triangulation—was used to analyze the data obtained from multiple theoretical positions.

The study confirmed that neighborhoods are a living fabric of social, economic, and physical features that provide the residents of a particular territory with an identity, a sense of security, safety, and familiarity. The USAID-NA expands the consideration of DRR interventions beyond individuals and households to a settlement approach, addressing critical disaster risk drivers and development gaps, and encouraging a long-term vision. The study showed the need to balance physical and social interventions to match individual and collective needs, support community cohesion and self-determination, and meet expectations associated with the common good and community resilience.

Performance Evaluation in LAC Urban DRR Programming: The Neighborhood Approach

Executive Summary

This report presents the results of the evaluation of the Urban Disaster Risk Reduction (DRR) programming in the Latin American and Caribbean (LAC) region supported by the United States Agency for International Development's Office of U.S. Foreign Disaster Assistance (USAID/OFDA). The goal of this performance evaluation is to improve USAID/OFDA's understanding of the performance and outcomes of the urban DRR programs the Agency supports in LAC. Specifically, the evaluation focuses on the effectiveness and sustainability of eight selected USAID/OFDA-funded urban DRR projects that utilized the Neighborhood Approach (NA), which were awarded in six countries (Colombia, Guatemala, Haiti, Honduras, Jamaica, and Peru) between FY2012 and FY2016.

The Neighborhood Approach is an innovative strategy adopted by USAID to find practical and workable solutions for DRR in densely populated informal urban settlements. The concept of the Neighborhood Approach became more utilized after the 2010 Haiti earthquake. Since 2012, it has been introduced into different Latin American and Caribbean countries.

Two objectives were defined for this performance evaluation: (1) the effectiveness and (2) the sustainability of the Neighborhood Approach. The Statement of Work (SOW) defined a specific set of questions for each objective that informed the evaluation design. The evaluation included a third objective on the programming strategy itself, including the Annual Program Statement (APS), programming implementation, alliances, and national counterparts.

To address USAID's evaluation questions for the objectives of effectiveness and sustainability, the research design began with an extensive literature review, followed by a mixed research method, including qualitative and quantitative approaches, such as seismic risk modeling for the eight projects selected; landslide risk modeling for four projects; and tropical cyclone risk modeling for one project. In addition, georeferencing and urban pattern analysis were used in the eight projects selected. Site visits and engineering inspections of key physical and environmental interventions in the eight projects also took place. Surveys, focus groups, and interviews were conducted in eight neighborhoods across the six project countries to gather primary data, following an Institutional Review Board (IRB)-approved research protocol. Finally, using an integrative process—triangulation—was used to analyze the data obtained in this study from multiple theoretical positions.

The findings include tables that present key data extracted from surveys, focus groups, interviews and site visits, allowing readers to draw comparisons across projects and countries. This section also includes key project interventions as well as the result of the indices that were prepared for this evaluation regarding neighborhood status in terms of urban informality, social cohesion, DRR, disaster risk governance, and the contribution of the NA project to the current status. These findings were selected from an extensive compilation of documents generated during the evaluation, the synthesis of which has been included in the annexes. The complete reports are part of a body of documents that supports the study and will serve as the basis for the preparation of thematic peer-reviewed manuscripts whose publication will help built a DRR evidence-based catalog.

Although the eight projects evaluated shared NA characteristics, each project is unique and was designed to respond to community needs and distinct socio-economic and cultural features, thus framing each in specific realities and contexts. Following is a summary of the findings of the questions posed by USAID to guide the evaluation. The first four questions deal with the objective of **effectiveness**. The last three questions are concerned with project **sustainability**.

1. To what extent have projects implemented under a Neighborhood Approach contributed to reducing community disaster hazard risks in targeted urban communities in the selected projects?

Four trajectories or pathways of influence were used to reduce community disaster risk:
1) NA interventions and features associated with secure land occupation. Two key interventions illustrate a successful approach to secure land occupation: a) the land tenure initiative implemented in Portmore, Jamaica, with support from Habitat for Humanity (HfH); and b) relocating at-risk communities in Tegucigalpa, Honduras, with support from the project implementer GOAL.

2) Sufficient and resilient livelihoods. Two main NA initiatives demonstrate effective DRR: a) the small business approach used by Global Communities in Medellín, Colombia; and b) the network of pulperías (grocery stores) implemented by GOAL in Tegucigalpa, Honduras.

3) Robust and resilient ecosystems. Three different NA projects in Lima, Peru implemented afforestation projects, initially designed to reduce the risk of rocks falling from slopes and to recover the fragile ecosystem lost over the past decades. Two other implementers, COOPI and Save the Children, later replicated the project initially designed by PREDES.

4) Adequate disaster risk and emergency management. Physical works such as pathways, access roads, retaining walls and drainage systems are the axes of risk reduction in neighborhood projects. Pathways were common to the six projects in Central and South America, due to the location of settlements on steep slopes. Retaining walls were designed and built in a variety of shapes and sizes to protect against landslides. Infrastructure such as channels to manage the runoff in Port-de-Paix, and gabions in Anse-á-Foleur were built by World Concern in Haiti, and proved to be highly effective during the passage of Hurricane Irma in 2017. Drainage systems were constructed that ranged in magnitude from small works in the projects in Lima, Medellin, Guatemala and Honduras, to more complex systems, such as the one built in the Tegucigalpa project.

2. Which aspects of the urban DRR Neighborhood Approach are most effective? Which aspects of the urban DRR Neighborhood Approach are least effective?

To address this question, we used two different approaches: 1) Life Satisfaction Analysis (LSA) to measure the level of well-being attributed to the NA projects' interventions and 2) Cost-Benefit Analysis (CBA) to calculate and compare benefits and costs of the specific NA interventions selected. The LSA showed that the categories with the highest impact on life satisfaction improvement were physical works and gains in social mobilization. Neighborhoods that received a community empowerment intervention (social mobilization category) increased their life satisfaction by 0.65 points. Considering that on average, the life satisfaction of all neighborhoods in the study was 2.46, the community empowerment intervention produced an increase in life satisfaction of nearly 27%. Other categories with interventions that significantly impacted life satisfaction were livelihoods and financial mechanisms, and institutional arrangements.

The CBA of the DRR interventions revealed that overall, the USAID project interventions had cost-benefit ratios (BCRs) greater than one point, with the access paths being the most cost-beneficial. A BCR of one indicates that the discounted benefit of implementing an intervention equals its cost. The BCR of physical interventions such as access paths ranged from 6.48 in Rímac to 12.16 in Medellin. Using an average value of the statistical cost of life, the BCR for access paths increases to 98.9 and 47.43, respectively, for Medellin and Rímac. The drainage canal in Port-de-Paix, Haiti, yielded a BCR of 13.19, valued for benefits from avoided loss of household assets and increase in productive business days. Sanitation interventions, such as the septic tank in Mixco, obtained a BCR of 1.62. Benefits were projected for certain interventions, such as the land tenure registration effort in Portmore, Jamaica, for which a target has not yet been set.

3. To what extent is the Neighborhood Approach effective as compared to more traditional DRR approaches in LAC?

We identified six DRR categories to conduct a thorough comparative analysis of the NA with other initiatives: 1) area-based; 2*)* market-based; 3) system-based; 4) institutional-based; 5) individual/household-based; and 6) operational. Some of the DRR initiatives fall into more than one category. The NA promoted by USAID can be primarily classified as area-based, but it further incorporates other DRR criteria (market-based, system-based, institutional-based, individual/household-based, and operational-based). In addition, the concept of neighborhood used in the NA goes beyond the pure geographical meaning of the 'area-based' category: the neighborhood is a living fabric of social, economic, and physical features that provides the residents of a particular territory with an identity, a sense of security, safety, and familiarity. Our literature review revealed that institutions such as USAID, OXFAM, UNDP, DFID, and the World Bank used area-based approaches to a certain extent, but without emphasis on precariousness, informality, and risk exposure.

4. What factors influence the effectiveness (or lack thereof) of urban DRR programs using the Neighborhood Approach in each country of focus?

We considered two categories of influencing factors for the effectiveness of urban DRR programs using the NA: 1) reflecting on internal aspects of each project and their immediate environment and 2) referring to the economic, political and social contexts in a broader sense, that is, outside the project's control. For instance, in the three projects in Lima (Carabayllo, Independencia, and Rímac) we identified several emergencies triggered by 'El Niño' in 2017 in northern Peru that created a 'window of opportunity' to introduce innovative DRR practices at different government levels. We also observed that local governments with a greater capacity in urban development avoided silos, fostered cross-sectorial integration, and tended to mainstream DRR practices within urban development. This was particularly effective and a common feature in Carabayllo, Medellin, Mixco, and Tegucigalpa. Other external factors included the volatile political context in Mixco; turnover of municipal personnel in Lima; organized crime and violence in Medellín; and specific land-tenure issues observed in Portmore.

5. To what extent are communities able to integrate DRR practices and take ownership of the Neighborhood Approach? What barriers to utilization of the Neighborhood Approach exist?

We developed a community involvement indicator, using qualitative analysis of focus groups and interviews, to assess four aspects of community involvement: a) active involvement in planning; b) allocation of human and financial resources; c) active involvement in maintenance; and d) social control. In general terms, the communities were able to integrate DRR practices, although only in few cases took ownership of the Neighborhood Approach as a whole. With significant differences among countries, neighbors in Mixco, Medellín, Tegucigalpa, and the three projects in Lima demonstrated appropriation of DRR practices such as better garbage and waste water management for reducing flood impacts and afforestation and gardening to stem the risk of landslides and rockslides. People were more conscious of the risks they face and able to develop mechanisms to cope with and reduce them. In some cases, such as Medellín and Mixco, people achieved a certain level of empowerment as they started to demand more attention and action from local authorities.

6. To what extent are municipal and national authorities incorporating and institutionalizing the urban Neighborhood Approach? What evidence (including, but not limited to, policy or urban planning changes) is there that municipal or national authorities are managing urban risk differently due to USAID/OFDA's urban DRR Neighborhood Approach?

A local government involvement indicator was developed using qualitative analysis of interviews and field observations to assess four aspects of local government involvement: a) active involvement in planning; b)

allocation of human and financial resources; c) active involvement in maintenance; and d) regulatory action. In cases like Carabayllo, Independencia, Mixco, Medellín, and Tegucigalpa, the municipalities incorporated new practices, such as the use of GIS and social media for DRR; participatory design and execution of physical works; inter-sectorial working groups for neighborhood development; and inclusion of DRR measures within municipal budget plans. According to our field observations and interviews, the best institutional ownership was achieved in Tegucigalpa, Mixco, and Medellín, primarily due to three factors: 1) the level of municipal autonomy to intervene in DRR; 2) implementers succeeded in creating inter-institutional and inter-sectorial (including private sector) articulations based on agreements and communication, and then translated these into action; and 3) the willingness and commitment of key actors at the highest level of municipal government, such as mayors or municipal managers. On the other hand, factors that limit the institutionalization of the NA were pointed out by the participants from Rímac, Portmore, and Haiti, including: 1) personnel turnover in municipalities; 2) a lack of willingness and commitment from local authorities; and 3) implementer's lack of capacity/experience in involving local authorities.

7. What enabling factors and factors impeding success contribute to sustainability of the urban DRR Neighborhood Approach? How sustainable could the targeted Urban DRR programs be without external donor support?

Five categories were defined to address the sustainability of the Neighborhood Approach projects: social mobilization, institutional arrangements, physical works, environmental improvements and financial mechanisms. Each of these categories comprised both enabling factors and factors that hinder success. Beyond the enabling and impeding factors mentioned, the study found a circumstance called concatenation. Concatenation refers to the capacity of a project to advance on the achievements of other projects or initiatives. In the same way, the project can also offer the opportunity to other projects and initiatives to build on its own outputs or outcomes. Anse-à-Foleur offers a good example. The NA project provided an excellent quality pipeline from the source of the water to the town. Subsequently the World Bank built ten water tanks, followed by the municipality, which built the distribution network. Another example comes from the NA in Tegucigalpa, where a public university in Honduras took advantage of JICA-sponsored geological studies to advance the studies required by the USAID-sponsored NA project. At the same time, the NA project prepared digital elevation mapping based on LIDAR technology (a detection system that uses light from a laser), which now serves the municipality and other projects supported by the international community.

Beyond the characteristics that define the NA, such as geographic focus, active participation, and sectoral concentration, the NA program strategy has been characterized by closer cooperation among USAID implementers and partners, beneficiary communities, and local and national governments. Additionally, the introduction of techniques such as systematization and the Post-Project Review stressed the importance of processes, and a closer follow-up to project implementation, with special attention to the long-term impacts and the outcomes' sustainability. USAID has fostered the exchange of practices and experiences among implementers, which has resulted in a substantial collective learning process, one that is unique in terms of depth and quality. Most of the NA projects lasted beyond the period initially awarded, whether through extensions or applying for an unsolicited proposal to complete, replicate or expand their scope.

This study detected another clear trend: a significant impact at national and even regional level in the different countries where there is a second or even third wave of initiatives derived from the initial project. Cases that support this assertion: 1) Jamaica: Habitat for Humanity defined a land tenure strategy that will be extended to the whole country, involving other institutions and civil society organizations; 2) Peru: PREDES along with the mayor of Lima, used afforestation as a strategy for land use management and DRR, now recognized internationally by FAO; 3) Honduras: GOAL, along with the municipality of Tegucigalpa, the Inter-American Development Bank, the University of Manchester, and the Nordic Fund promote the NA approach to develop a project to adapt assets to climate change. Additionally, GOAL is now replicating the Honduras NA experience in Haiti; 4) Colombia: the NA project implemented by Global Communities, Corporación Ayuda Humanitaria and Pontificia University in Medellin, expanded

the municipal DRR approach by reaching out to communities, and now it has been integrated into the city's resilience strategy, as part of the 100 Resilient Cities movement. In addition, the NA project inspired a new DRR initiative geared toward small commerce and merchants in precarious areas of the city; 5) Guatemala: Under the leadership of PCI, the NA project convened various local actors, among them the private sector—Cementos Progreso and AMANCO—expanding the NA impact toward many other cities. On a larger scale, PCI contributed to a proposal to change the public housing policies in the country, with support from international organizations and experts such as Build Change and Elemental, as well as establishing alliances with other NA implementers such as GOAL.

The study also included an internal assessment of the NA strategy within USAID. The respondents strongly agreed that the NA supports DRR, the LAC DRR Plan 2015-2019, and the Sendai Framework. The main technical or programmatic challenges to implementing the NA were community participation, followed by a lack of resources in the community; issues with sustainability; and having the right partners with expertise in community development. The main managerial and financial challenges for partners in implementing the NA were identified as government or legal restrictions, followed by the lack of willingness of local governments to institutionalize the policies and activities associated with the program; underestimation by partners of costs during the proposal stage; lack of implementation time, due to the award's stated period of performance; lack of community leaders or other local partners; and lack of financial resources in the community.

In conclusion, the USAID NA expands the consideration of DRR interventions beyond individuals and households to a settlement approach, addressing critical disaster risk drivers and development gaps, and encouraging a long-term vision. The study showed the need to balance physical and social interventions to match individual and collective needs and expectations associated with the common good. Thus, protecting the neighborhood and supporting its cohesion and self-determination, are important strategies to build community resilience. In response to the daily challenges experienced in informal settlements, there is clearly a need to contribute to social mobilization to collectively overcome obstacles such as poverty, marginalization, insecurity and despair. This study shows a broader scope than the one initially foreseen for the NA, identifying different strategies that can stand alone, such as land tenure, rain and storm-water management, housing relocation, and afforestation, among others. The use of state-of-the-art technologies and the exploration and definition of units of measurement were essential to answering the questions proposed by USAID and mark the beginning of a second study phase—the preparation of a series of peer-reviewed publications that will serve to build a catalog of evidence-based DRR practices.

Based on the results obtained in this study and the NA Post-Project Review process conducted in 2016-2017, the following recommendations are proposed regarding the USAID NA urban DRR strategy:

1) Continue fostering the NA strategy with some adjustments to the RFA process such as: a) NA projects must have an ideal duration of three years and never less than two years; b) NA projects should be formulated in two stages, the first one encompassing diagnosis, awareness and social mobilization, followed by a second phase of implementation and transfer. The proposals must contemplate a process of programmatic adjustment between the two stages.

2) The NA could be diversified to allow different types of proposals that foster DRR and resilience-building, using the principles of geographic focus, active participation, and sectoral approach through projects that respond to issues associated with DRR of critical incidence such as land tenure, urban drainage systems, afforestation, precariousness, housing retrofitting, among others.

3) The NA projects should have a plan, from the outset, to deal with the inherent uncertainty and lack of continuity in local public administration policies and practices, as well as to face the incongruities between national and local regulations and processes.

4) Intervention costs centers must be established, with files that conserve technical studies, designs, and technical specifications to maintain a permanent archive. The electronic records must be submitted to USAID at the end of the project.

1. Introduction

This report presents the results of the evaluation of the Urban Disaster Risk Reduction (DRR) programming in Latin American and Caribbean (LAC). The goal of the evaluation was to improve USAID/OFDA's understanding of the performance and outcomes of the urban DRR programs that the Agency supported in the LAC region. Specifically, the evaluation focused on the effectiveness and sustainability of eight selected USAID/OFDA-funded urban DRR projects that utilized the Neighborhood Approach. These projects were awarded in six countries (Colombia, Guatemala, Haiti, Honduras, Jamaica, and Peru) between FY2012 and FY2016. The findings of this evaluation will inform future programming decisions and enable adjustments to ongoing USAID/OFDA urban DRR programming in the LAC region and across the globe. More broadly, the findings of this evaluation will enhance the evidence base related to the Neighborhood Approach as a DRR tool.

Background

The Neighborhood Approach is an innovative strategy adopted by USAID to find practical and workable solutions for disaster risk reduction in densely populated informal urban settlements. The concept of the Neighborhood Approach reached was recognized after its implementation in Haiti following the 2010 earthquake. Since 2012, it has been introduced into other LAC countries.

Florida International University (FIU), through its contractual agreement with USAID/OFDA, has been involved in the Neighborhood Approach since its inception in LAC. FIU led two processes: 1) the systematization of the first four projects from 2011 until 2015, carried out in Haiti, Guatemala, and Peru, and 2) the post-project review of these same initial Neighborhood Approach projects in 2016, which was carried out 12–18 months after completion of the projects. Additionally, at USAID/OFDA's request, FIU participated in the kick-off meetings in which other Neighborhood Approach projects were launched in Haiti, Colombia, and Jamaica. FIU also worked with USAID/OFDA-LAC advisors during field visits to follow-up on project implementation (Honduras, Peru, and Colombia).

Evaluation Objectives

Two objectives were defined for this performance evaluation: understanding the **effectiveness** and the **sustainability** of the Neighborhood Approach. The Statement of Work (SOW) defined a specific set of questions for each objective that informed the design of this evaluation.

Objective 1: Effectiveness

1. To what extent have projects implemented under a Neighborhood Approach contributed to reducing community disaster hazard risks in targeted urban communities in the selected projects?
2. Which aspects of the urban DRR Neighborhood Approach are most effective? Which aspects of the urban DRR Neighborhood Approach are least effective?
3. To what extent is the Neighborhood Approach effective as compared to more traditional DRR approaches in the LAC region?
4. What factors influence the effectiveness (or lack thereof) of urban DRR programs using the Neighborhood Approach in each country of focus?

Objective 2: Sustainability

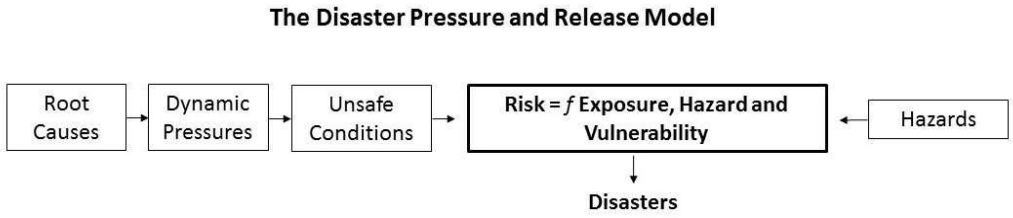
5. To what extent are communities able to integrate DRR practices and take ownership of the Neighborhood Approach? What barriers to utilization of the Neighborhood Approach exist?
6. To what extent are municipal and national authorities incorporating and institutionalizing the urban Neighborhood Approach? What evidence[1] is there that municipal or national authorities are managing urban risk differently due to USAID/OFDA's urban DRR Neighborhood Approach?
7. What enabling factors and factors that impede success contribute to sustainability of the urban DRR Neighborhood Approach? How sustainable could the targeted Urban DRR programs be without external donor support?

The evaluation included a third objective on the programming strategy itself, including the APS, programming implementation, alliances, and national counterparts.

2. Theoretical Framework

Two major themes interact to build the theoretical framework for the current evaluation. The first refers to disaster risk, understood as: "The potential loss of life, injury, or destroyed or damaged assets that could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity" (United Nations, 2016: 14). Beyond a simple formula, disaster risk is the condition resulting from a complex process of accumulation, as explained by Blaikie et al. (1994) through the pressure and release model.

Figure 1. Disaster Pressure and Release Model



Adapted from the Disaster Pressure and Release Model proposed by Blaikie et al. (1994)

Figure 1 attributes risk conditions to a progression that originates in root causes: ideological processes of an economic, demographic, and political nature that influence power relationships and the allocation and distribution of resources in a society. These manifest in dynamic pressures of population growth, migration, accelerated urbanization, etc., which in turn, result in and are seen as unsafe conditions, such as the segmentation of society; unstable livelihoods; occupation of insecure land with an exposure to hazards; and inadequate emergency management. More recently, these processes, described by Blaikie et al., are called underlying disaster risk drivers or "processes or conditions, often development-related, that influence the level

[1] Including, but not limited to, policy or urban planning changes.

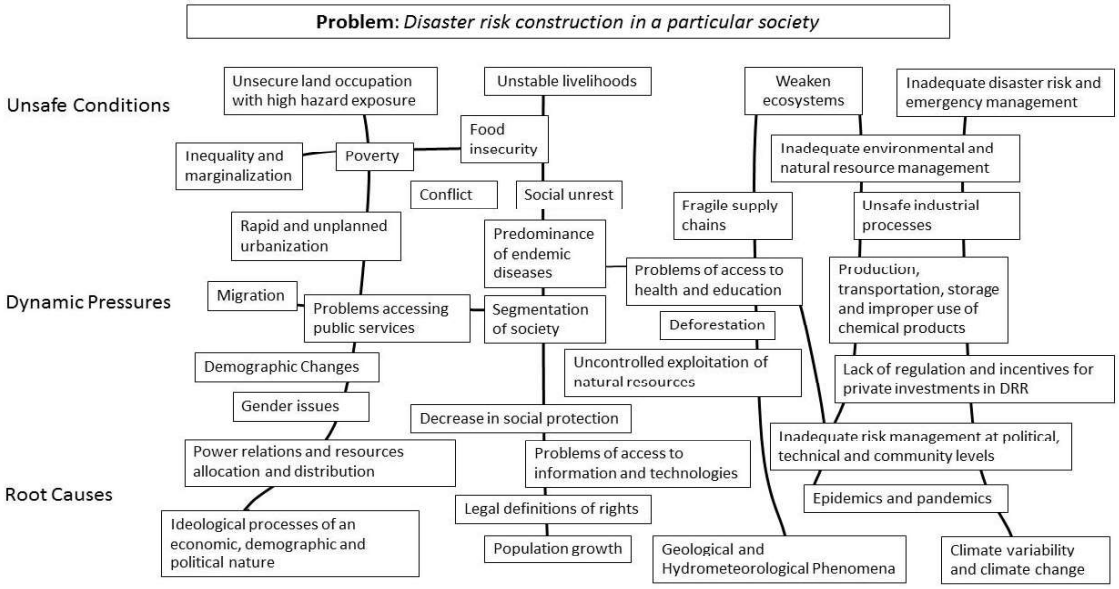
of disaster risk by increasing levels of exposure and vulnerability or reducing capacity" (United Nations, 2016: 24).

The second theme is represented by the high growth of urban informality and precariousness in recent decades, leading to the generation of slums or informal settlements. According to Habitat III (2015: 1), informal settlements are "residential areas in which 1) inhabitants have no security of tenure vis-à-vis the land or dwellings they inhabit, with modalities ranging from squatting to informal rental housing; 2) the neighborhoods usually lack, or are cut off from, basic services and city infrastructure; and 3) the housing may not comply with current planning and building regulations, and is often situated in geographically and environmentally hazardous areas." According to Sandoval and Sarmiento (2018), approximately 924 million people lived in informal settlements or slums around the world in 2001, representing 31.6% of the world's urban population (UN-Habitat, 2003). The 2014 UN-Habitat report (2016) indicates that 104.8 million now live in informal settlements in LAC (21.1%).

An important segment of the world's population exists in conditions of chronic poverty in urban areas, exposed to stress situations and shocks associated with events of natural or anthropic origin, in a continuous process of disaster risk construction and with very low levels of resilience. In this context, resilience is understood as: "the ability of people, households, communities, countries, and systems to mitigate, adapt to, and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitates inclusive growth"(USAID, 2012: 5).

Sarmiento (2017: 36) defines the problem as: "The construction of disaster risk in a particular society (including population, territory, infrastructure, goods, and services) that define and determine the potential magnitude of the effects in the presence of a specific hazard(s)." He designs the problem tree using the Blaikie et al. (1994) model, identifying the underlying risk factors or root causes, and then, the main and secondary causes, resulting in a process of concatenation and hierarchy that reaches the visible manifestations of the analyzed problem.

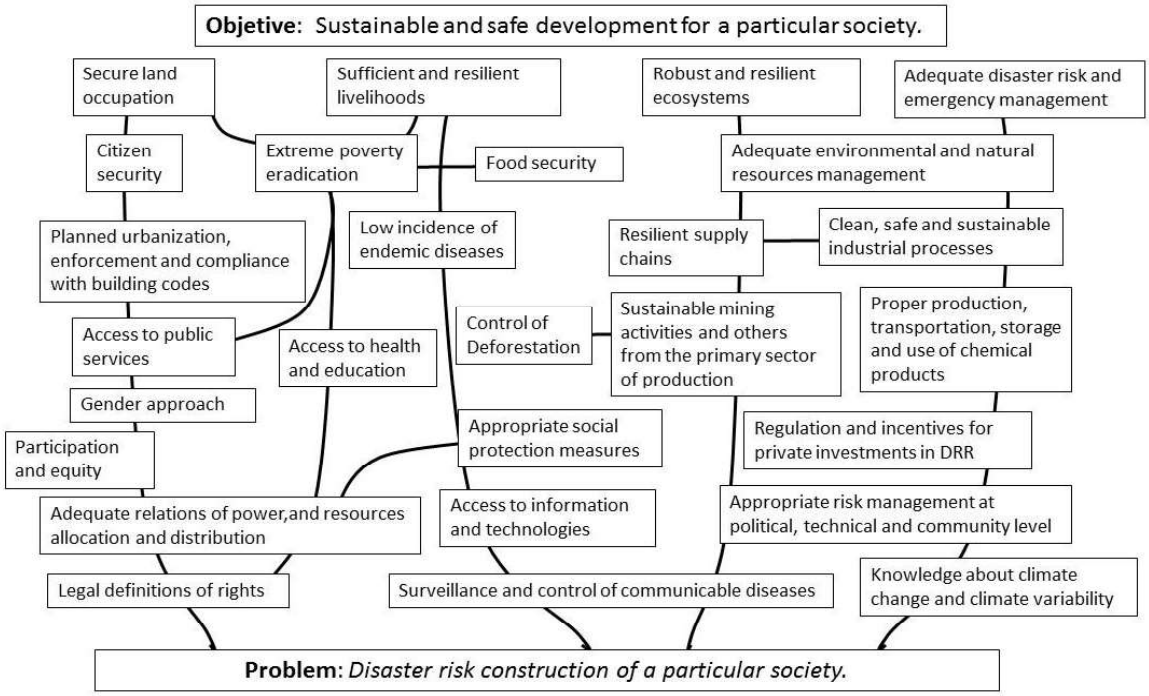
Figure 2. Disaster Risk Construction in a Society



Translated and adapted from Sarmiento (2018)

Using the Theory of Change, Sarmiento (2017) advances in the identification of domains of change or key points of influence (intervention domains), the main areas in which change must occur in order to reach the desired objective's impact: 'sustainable and secure development for a particular society.'

Figure 3. Sustainable and Safe Development in a Society



Translated and adapted from Sarmiento (2017)

Under the category of unsafe conditions, four domains are identified: 1) insecure land occupation with high hazard exposure; 2) unstable livelihoods; 3) weakened ecosystems; and 4) inadequate disaster risk and emergency management. Additionally, poverty, accompanied by inequality, marginalization, and food insecurity aggravate the conditions.

The resulting trajectories are, at the same time, pathways of influence through which action must be taken to influence disaster risk determinants. The actions are taken through specific interventions: 1) secure land occupation; 2) sufficient and resilient livelihoods; 3) robust and resilient ecosystems; and 4) adequate disaster risk and emergency management. It is important to also address the issue of extreme poverty, which influences two of the four identified domains.

This framework allows one to identify the intersection of the pathways of influence as a crosscutting topic in the NA's priority sectors: Shelter and Settlements (S&S); Economic Recovery and Market Systems (ERMS); Water, Sanitation, and Hygiene (WASH); and Natural and Technological Risks (NTR).

In addition to these sectors, the evaluation expanded its focus to measure actions geared toward reinforcing community resilience: strengthening social cohesion processes and governance mechanisms, and the well-being attributed to the project's interventions (USAID, 2012).

3. Research Methods

To address USAID's evaluation questions for the objectives of effectiveness and sustainability, the research design began with an extensive literature review, followed by a mixed research method, including qualitative and quantitative approaches:

- Literature review on DRR approaches and interventions implemented in the LAC region.
- Seismic risk modeling for the eight projects selected, landslide risk modeling for four projects, and tropical cyclone risk modeling for one project.
- Georeferencing and urban pattern analysis for the eight projects selected.
- Site visits and engineering inspections for key physical and environmental interventions in the eight projects selected.

In order to gather primary data from the selected projects, surveys, focus groups, and interviews were conducted following an IRB-approved research protocol. These techniques were conducted in the eight neighborhoods across the six different countries where the DRR projects were implemented. The study involved both males and females and the subjects of the surveys, interviews, and focus groups were adults (aged 18 and over with no upper age limitation).

Surveys

The targeted subject for each survey was the head of a household or spouse in the selected neighborhood. We targeted approximately 40 surveys per project and 320 surveys in total for all eight selected projects. However, the survey process was completed with an average of 44 surveys per project, and a total of 349 surveys. The estimated size of the sample was carried out using the sample size calculator, Raosoft Inc. (Bird, D. and Dominey Howes, D., 2008), with a margin of error of 3.94% and a 95% confidence level, resulting in n=349. Subsequently, the sample was distributed in proportion with the estimated population in the selected neighborhoods. We estimated an average of 100 households per project that benefitted directly from the NA projects. The survey consisted of a total of 39 questions grouped into four sub-topics: social cohesion, DRR, urban informality, and Life Satisfaction Analysis (LSA). A preceding section on demographics and housing conditions collected information on household identification, demographic and socioeconomic aspects of household respondents, and housing structural details. The heads of households shared their experience of the NA project and its impacts on their life and community. Through the survey questions, we were able to gauge the contribution of the project to improving social cohesion, disaster risk reduction, and disaster risk governance in the neighborhood, and the impact of the project on the degree of urban informality/precariousness. The section on LSA measured the value of non-market impacts of interventions, and the subjective well-being reported due to the interventions of the projects.

Focus Group Studies

We conducted one focus group study for each of the eight NA projects. Focus groups for each neighborhood included approximately 8–12 subjects: community leaders, women, people with disabilities, and elders who lived in the selected neighborhood. These studies gathered the opinions of the representatives of these neighborhoods on the effectiveness and sustainability of the project interventions.

Interviews

The research team conducted approximately 8–10 semi-structured interviews per DRR project with local and national government officers, civil society actors, academics, and private sector partners. A total 105 informants participated in the interviews. Interviewees were approached using a snowball stratified sampling technique, as described by Atkinson and Flint (2004). If more than one intervention was carried out in a location, interviews for those interventions were conducted during the same session with national authorities. Where municipal associations or sub-national mechanisms were involved in the project implementation or replication, officers in charge of those mechanisms were interviewed. In addition, an interview for each project implementation manager or designee was conducted.

Together with USAID M&E, interviews were carried out with USAID officers in OFDA (Washington, D.C. and LAC regional office) to review the USAID/OFDA program strategy.

We developed an integrative strategy, also called triangulation, wherein we purposefully analyzed the data obtained in this study from multiple theoretical positions. This helped increase the validity of the evaluation and research findings to answer and satisfactorily address USAID's questions.

4. Evaluation Limitations

The design of the evaluation and the selected methodologies allowed the different actors involved—community members, implementers and partners, local and national authorities—to register perceptions, attitudes, knowledge and advances in risk management and disaster management associated with the implementation of the projects. However, because community members are highly mobile, during the evaluation of some projects, not all the actors who had been involved could be located. Another important limitation was the collection of information related to designs, technical specifications, and budgets of the project interventions that had concluded between one and three years earlier. Likewise, the high turnover of public employees was evident—with the consequent ignorance of the NA project—the reason why we resorted to former employees or employees who had changed their position within the same organization for interviews and information gathering. Despite these limitations, returning to the participating public institutions during the evaluation allowed the concerned actors to revisit the issue and their attention to informal settlements exposed to disaster risk. For the communities, the presence of the evaluators was seen as a sign of commitment and trust toward the donor, and for the implementers, an act of accountability. Given the conditions of insecurity in the neighborhoods where the evaluation was carried out— common crime, drug trafficking, gangs, and other illicit activities—it was necessary to implement a careful safety plan for the whole team, limiting the working hours, ensuring appropriate clothing, and in some cases avoiding the use of electronic systems such as tablets for data capture and georeferencing of surveys.

This report contains the most relevant findings of the evaluation. However, given the volume of information and data collected, a second phase of the study will be necessary to prepare a series of peer reviewed manuscripts that will serve to build a catalog of evidence-based DRR practices.

5. Main Findings

This section contains the main evaluation's findings by project. The next four pages display seven tables containing project information and the indices prepared for this study in order to provide an order of magnitude, necessary for comparisons across projects and countries: 1) NA Projects Assessed; 2) NA General Features; 3) Urban Informality / Precariousness Index; 4) DRR Index; 5) Disaster Risk Governance Index; 6) Social Cohesion Index; and 7) Social Resilience Index. These indices used relevant data coming out of the surveys, transect walks and risk modeling. The following pages of this section address the findings related to each NA project and they are organized as follows:

Main Interventions - A table is built on the project transfer matrix. The first column refers to the intervention's category, the second identifies the project's outcome studied and a third column synthesizing the main findings coming from the transect walks (engineering and environmental inspections), interviews, and focus groups.

Urban Informality - Also referred here as precariousness. This study adopts the UN-Habitat definition of informal settlements: "…any specific place, whether a whole city or a neighborhood, as a slum area if half or more of all households lack [i] improved water, [ii] improved sanitation, [iii] sufficient living area, [iv] durable housing, [v] secure tenure, or combinations thereof. An area or neighborhood deprived of improved sanitation alone may experience a lesser degree of deprivation than an area that lacks any adequate services at all, but both are considered slums in this definition." (Castro et al. 2015: 110) Based on this definition we prepared an index composed of three sub-indexes: Legal, Physical, and Social (details in Annex 2) and applied it to each of the neighborhoods selected using the survey. Quintiles are used to create cut-off points, a statistical value of a data set that represents 20% of a given population. The first quintile represents the lowest fifth of the data, 1–20% in Green; the second quintile, 21%– 40% in Yellow; the third quintile, 41%– 60% in Orange; the fourth quintile, 61%– 80% in Ochre; and the fifth quintile represents the highest fifth, 81%– 100% in Red. Higher numbers mean higher informality/precariousness.

Disaster Risk Reduction - Based on the most recent United Nations terminology, this study adopts the DRR definition: "DRR is aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development." (United Nations, 2016: 16). This study developed a DRR Index (details in Annex 2) to measure the perceived DRR status at the neighborhood level, and also measure the contribution of the NA project to the level of DRR found. Higher numbers mean higher DRR implementation.

Social Cohesion - The study adopted the Stanley (2003: 5) definition of social cohesion: "the willingness of members of a society to cooperate with each other to survive and prosper." Cohesion is a necessary driver of resilience. We developed a Social Cohesion Index (details in Annex 2), to measure the perceived social cohesion at the neighborhood level, and also measure the contribution of the NA projects to the level of social cohesion found. Higher numbers mean higher social cohesion.

Disaster Risk Governance - The study adopted the Disaster Risk Governance concept from United Nations (2016: 15), "The system of institutions, mechanisms, policy and legal frameworks and other arrangements to guide, coordinate and oversee disaster risk reduction and related areas of policy…Good governance needs to be transparent, inclusive, collective and efficient to reduce existing disaster risks and avoid creating new ones." This study built a Disaster Risk Governance Index (details in Annex 2) to assess the community associativity reported in the surveys, and the institutional involvement both at local and national level registered in the interviews and focus groups. Higher numbers mean higher disaster risk governance.

Table 1. Neighborhood Approach Projects Assessed During the Period Dec. 2, 2017 - Mar. 12, 2018

Country	Peru	Peru	Peru	Colombia	Guatemala	Haiti	Jamaica	Honduras
City	Lima - Carabayllo	Lima - Independencia	Lima - Rimac	Medellin	Mixco	Port-de-Paix	Portmore	Tegucigalpa
Project Title	Resilient Urban Neighborhoods and Districts in Lima Norte	Risk Reduction in Vulnerable Areas of Independencia District, Lima Province	Reinforcing Innovative Mechanisms for Arising Capacities in Disaster Risk Reduction in Rimac	Programa de Conocimiento y Reducción del Riesgo de Desastres	Barrio Mio	Community Initiatives in Disaster Risk Reduction (CIDRR)	Building Resilience and Capacities for Emerging Disasters (BRACED)	Operationalizing a Neighborhood Approach to Reduce Urban Disaster Risk in Latin America and the Caribbean
Award No.	AID-OFDA-A-14-00024	AID-OFDA-A-14-00025	AID-OFDA-A-14 00023	AID-OFDA-A-14-00026	AID-OFDA-A-12-00013	AID-OFDA-A-12-00012	AID-OFDA-A-14-	AID-OFDA- A-13-00023
IP	Save the Children/US	PREDES	COOPI	Global Communities	Project Concern International	World Concern Development Organization	Habitat for Humanity	GOAL
Dates	October 1, 2014--September 30, 2017	October 1, 2014—March 31, 2017	September 15, 2014—September 14, 2017	October 1, 2014—January31, 2017	Sept 28, 2012—Sept 30, 2016	September 6, 2012—March 31, 2014	September 2014 – April 2018	September 23, 2013—December 23, 2016
Goal	Urban neighborhoods and districts in Northern Lima increase their resilience to disasters through the adoption of risk-sensitive policies and practices.	Strengthened capacity of the community, local, and national stakeholders to disaster risk management in vulnerable peripheral urban settlements.	Reduced risk of disasters in the vulnerable neighborhoods of Rimac prone to multiple hazards.	Reduce the social and economic impact of disasters of highly vulnerable urban populations in Medellín, Colombia	High-risk urban neighborhoods are transformed into resilient, safe and productive communities.	Vulnerable populations enabled to identify risks associated with, and reduce the impact of, anticipated disasters on their communities.	Increasing the neighborhood's resilience through work at both the settlement and shelter level; contributing to the neighborhood's ability to formalize itself, connect to the municipality's redevelopment plan, and bring future investments.	Disaster risk reduced in three high-risk neighborhoods in Tegucigalpa with emphasis on the protection of vulnerable groups.
Sectors	Economic Recovery and Market Systems, Shelter and Settlements, Natural and Technological Risks, Risk Management Policy and Practice	Natural and Technological Risks, Risk Management Policy and Practice, Water, Sanitation and Hygiene, Shelter and Settlements	Water, Sanitation and Hygiene, Natural and Technological Risks, Risk Management Policy and Practice	Policy and Practice, Shelter and Settlements, and Economic Recovery and Market Systems.	Water, Sanitation and Hygiene, Economic Recovery and Market Systems, Shelter and Settlements	Water, Sanitation and Hygiene, Shelter and Settlements, Natural and Technological Risks	BRACED 1: Water, Sanitation and Hygiene, Shelter and Settlements, and Risk Management Policy and Practice. BRACED 2: Land tenure and neighborhood redevelopment plan	Water, Sanitation and Hygiene, Economic Recovery and Market Systems, Shelter and Settlements, Natural and Technological Risks, Risk Management Policy and Practice
Budget	$1,894,843	$1,303,302	$1,012,662	$1,708,726	$3,082,151	$1,608,992	$1,688,000	$1,377,444

Total $13,676,120. This amount includes all projects described in the table.

Table 2. Neighborhood Approach Projects - General Features

NA General Features	Peru	Peru	Peru	Colombia	Guatemala	Haiti	Jamaica	Honduras
City	Carabayllo	Independencia	Rimac	Medellin	Mixco	Port-de-Paix	Portmore	Tegucigalpa
NA Area - Hectares	53.4	11.2	48.5	95.7	8.1	46.4	110.4	59.3
NA Built area - Hectares	42.6	8.1	44.8	131.0	4.8	14.1	104.3	53.4
House's surface area sqm	127.5	119.3	106.3	67.8	122.9	337.14	75.3	100.8
Total Households	3,338.3	678.1	4,214.3	19,333.1	389.5	419.4	13,854.6	5,299.8
Household members - Average	5	5	5	6	6	7	5	5
Total individuals	15,623.4	3,295.6	20,987.1	115,998.8	2,298.1	2,780.9	62,068.6	27,717.7
Population density - People/Hectare	293	295	433	1,211	285	60	562	467
sqm per person	27.24	24.54	21.34	11.29	20.84	50.85	16.80	19.28

Table 3. Neighborhood Approach Projects - Urban Informality / Precariousness Index

Urban Informality / Precariousness Index	Peru	Peru	Peru	Colombia	Guatemala	Haiti	Jamaica	Honduras
City	Carabayllo	Independencia	Rimac	Medellin	Mixco	Port-de-Paix	Portmore	Tegucigalpa
Legal (0-30)	18.44	11.11	13.29	8.12	6.02	22.32	19.53	10.95
a. Issues with land use and land tenure (0-10)	5.40	1.27	1.60	2.12	3.27	6.43	7.07	3.26
b. Unplanned settlements/Lack of compliance with urban planning & Zoning (0-10)	4.44	3.33	4.44	2.22	2.22	8.89	5.56	1.11
c. Issues with building regulations/Lack of compliance with building regulations (0-10)	8.61	6.51	7.25	3.78	0.53	7.00	6.91	6.59
Physical (0-40)	15.72	12.58	14.32	13.55	13.35	21.98	14.75	14.21
a. Issues with access to water, sewage, energy (0-10)	1.21	0.23	0.53	0.15	0.40	7.79	2.12	0.15
b. Deficient or poor housing conditions (0-10)	1.29	0.53	0.61	3.18	2.06	0.78	0.08	0.08
c. Overcrowding, environmental degradation (0-10)	4.85	4.09	5.45	3.64	5.08	4.81	4.11	5.61
d. Exposure to natural and human induced hazards (0-10)	8.38	7.73	7.73	6.58	5.81	8.61	8.44	8.38
Social (0-30)	4.91	5.38	6.27	5.43	4.30	8.12	5.31	6.27
a. Issues with access to social infrastructure: health, education, cultural, commercial (0-10)	3.27	2.78	2.64	2.34	3.27	4.68	2.07	3.85
b. Marginalization (0-10)	0.11	0.91	0.68	0.68	0.48	1.17	0.45	0.45
c. Violence and illegal activities (0-10)	1.53	1.68	2.95	2.41	0.55	2.26	2.78	1.97
Informality/precariousness Index (0-100)	39.08	29.07	33.88	27.09	23.67	52.41	39.59	31.43

Table 4. Neighborhood Approach Projects – DRR Index

DRR Index	Peru	Peru	Peru	Colombia	Guatemala	Haiti	Jamaica	Honduras
City	Carabayllo	Independencia	Rimac	Medellin	Mixco	Port-de-Paix	Portmore	Tegucigalpa
1. Community has members trained in DRR	90.5	68.3	53.7	51.5	48.7	52.4	44.4	71.8
Project contributed to it (Agree and strongly agree)	*77.3*	*52.3*	*34.1*	*40.9*	*42.9*	*51.2*	*36.4*	*59.1*
2. Community has motivated members who support DRR	90.5	85.7	59.5	73.8	76.9	62.8	72.2	94.9
Project contributed to it (Agree and strongly agree)	*81.8*	*61.4*	*50.0*	*61.4*	*64.3*	*62.8*	*56.8*	*79.5*
3. Community has a functional EWS including drills	65.1	68.2	32.6	23.1	37.8	58.1	19.5	64.9
Project contributed to it (Agree and strongly agree)	*61.4*	*59.1*	*27.3*	*18.2*	*31.0*	*51.2*	*18.2*	*50.0*
4. Community involved in the emergency plan implementation	87.2	75.6	34.2	36.1	54.8	57.1	51.4	62.2
Project contributed to it (Agree and strongly agree)	*70.5*	*52.3*	*20.5*	*25.0*	*38.1*	*55.8*	*40.9*	*45.5*
5. Community involved in maintenance of projects' physical works	82.9	83.3	52.3	90.9	76.3	93.0	85.0	81.4
Project contributed to it (Agree and strongly agree)	*70.5*	*70.5*	*43.2*	*86.4*	*64.3*	*90.7*	*68.2*	*70.5*
6. Social Inclusion V+W	85.6	82.6	47.7	82.1	64.1	80.8	66.1	79.2
Project contributed to it (Agree and strongly agree)	*76.1*	*71.6*	*39.8*	*65.9*	*54.8*	*75.6*	*52.3*	*68.2*
DRR Index (0-100)	**83.6**	**77.3**	**46.6**	**59.6**	**59.8**	**67.4**	**56.4**	**75.7**
Contribution of the NA projects to the DRR Index (0-100)	***72.9***	***61.2***	***35.8***	***49.6***	***49.2***	***64.5***	***45.5***	***62.1***
Ratio	**1.15**	**1.26**	**1.30**	**1.20**	**1.22**	**1.04**	**1.24**	**1.22**

Table 5. Neighborhood Approach Projects – Disaster Risk Governance Index

Disaster Risk Governance Index	Peru	Peru	Peru	Colombia	Guatemala	Haiti	Jamaica	Honduras
City	Carabayllo	Independencia	Rimac	Medellin	Mixco	Port-de-Paix	Portmore	Tegucigalpa
1- Community Associativity	29.6	25.0	38.6	20.5	17.1	26.2	22.7	11.4
2- Community Involvement	55.0	57.5	52.5	64.5	67.5	40.0	42.5	70.0
3- Local Government Involvement	62.5	42.5	42.5	69.5	67.0	25.5	39.5	68.5
Disaster Risk Governance Index (0-100)	**49.02**	**41.67**	**44.55**	**51.48**	**50.52**	**30.56**	**34.91**	**49.95**

Table 6. Neighborhood Approach Projects – Social Cohesion Index

Social Cohesion Index	Peru	Peru	Peru	Colombia	Guatemala	Haiti	Jamaica	Honduras
City	Carabayllo	Independencia	Rimac	Medellin	Mixco	Port-de-Paix	Portmore	Tegucigalpa
1. Strong sense of belonging to this neighborhood	93.2	86.4	90.9	90.9	82.9	54.8	88.1	100.0
Project contributed to it (Agree and strongly agree)	*77.3*	*56.8*	*70.5*	*75.0*	*73.8*	*51.2*	*77.3*	*90.9*
2. Living here gives you a sense of community?	86.4	86.4	77.3	84.1	90.2	62.8	88.4	97.7
Project contributed to it (Agree and strongly agree)	*68.2*	*56.8*	*59.1*	*68.2*	*78.6*	*58.1*	*79.5*	*86.4*
3. Willingness to work together to improve your neighborhood	78.6	93.0	93.2	95.4	95.1	78.6	100.0	100.0
Project contributed to it (Agree and strongly agree)	*86.4*	*65.9*	*75.0*	*79.5*	*83.3*	*74.4*	*90.9*	*88.6*
4. Neighbors would help each other during an emergency	86.4	92.9	72.7	92.9	86.8	71.4	90.0	95.5
Project contributed to it (Agree and strongly agree)	*72.7*	*65.9*	*54.5*	*84.1*	*71.4*	*65.1*	*70.5*	*88.6*
Social Cohesion Index (0-100)	**90.9**	**89.7**	**83.5**	**90.8**	**88.8**	**66.9**	**91.6**	**98.3**
Contribution of the NA projects to the Social Cohesion Index (0-100)	***76.1***	***61.4***	***64.8***	***76.7***	***76.8***	***62.2***	***79.5***	***88.6***
Ratio	**1.19**	**1.46**	**1.29**	**1.18**	**1.16**	**1.08**	**1.15**	**1.11**

Using the previous three indices, we proceed to prepare a single Community Resilience Index which shows the current resilience capabilities in the different neighborhoods where the NA were implemented.

Table 7. Neighborhood Approach Projects – Social Resilience Index

Community Resilience Index	Peru	Peru	Peru	Colombia	Guatemala	Haiti	Jamaica	Honduras
City	Carabayllo	Independencia	Rimac	Medellin	Mixco	Port-de-Paix	Portmore	Tegucigalpa
DRR	83.6	77.3	46.6	59.6	59.8	67.4	56.4	75.7
Social Cohesion	90.9	89.7	83.5	90.8	88.8	66.9	91.6	98.3
Disaster Risk Governance	49.0	41.7	44.5	51.5	50.5	30.6	34.9	50.0
Community Resilience Index (0-100)	**74.5**	**69.5**	**58.2**	**67.3**	**66.4**	**54.9**	**61.0**	**74.7**

The following tables contain a selection of the most relevant findings from the analysis of each project. In the column 'Findings', common abbreviations are used to indicate the source of the information:

- FGD: Focus group conducted in the particular neighborhood
- Interviews: Interviews conducted with public officers, partners and project implementers
- Technical: Transect walk, physical inspections carried out by engineers and architects
- ER: Environmental resilience inspection where projects involve environmental interventions

A more comprehensive analysis of the survey findings, an exhaustive collection of research outputs and results in available in Annex 3.

Project Title: Resilient Urban Neighborhoods and Districts in Lima Norte

Implementing Partner (IP): Save the Children/US
Location: Lima-Carabayllo, Perú

Table 8. Main Interventions in the Lima-Carabayllo NA Project

	Output	Findings
Physical Works & Maintenance	• 12 community centers with seismic design and 5 small markets • 6 'tambos' or depots, also called 'advanced warehouses' **Transferred to :** Carabayllo Municipality; community leaders; and INDECI	• Works built by professionals and community members [Technical]. • Good earthquake resistance, followed construction standards and applied a correct selection and use of materials [Technical]. • The structures do not require short-term maintenance [Technical]. • There are some issues: still vulnerable to strong shocks, long-term maintenance (2 years) not arranged, some columns are not attached to the bases/foundation [Technical]. • Physical interventions have worked as 'catalyzer' for social mobilization and cohesion [Interviews]. • Community boards signed an agreement to maintain the physical works. During trainings they were taught how to do this [FGD].
Social Mobilization Gains	[Not declared by implementer] **Transferred to :** Community	• Authorities assert that communities were empowered and mobilized [interviews]: Evidence shows that higher individual than collective mobilization [FGD]. • Forming community platforms [FGD]. • Participation of community members in construction of the physical works has strengthened their knowledge, experience, appropriation and replication [FGD]. • Ownership is strengthened by physical works that facilitate daily live activities (e.g. stairs and railings) [FDG].
Environmental Improvements	• Forestation (2 implemented projects) • Forestation ("Iniciative" project) + Irrigation system • Green area or park in "tambos" **Transferred to :** Community leaders and neighbors	• After project closed out, one forestation has noautomatic irrigation system. The other forestation site has also lost trees. Both areas are marginally functional (50% effectiveness for DRR) [Technical]. • 'Slightly effective' as barrier to prevent landslides [Technical]. • Effective type of vegetation, marginal use of water [Technical].

	Output	Findings
Institutional Arrangements	[Not declared by implementer] **Transferred to :** Municipality	• High involvement of the municipality, especially related to the creation of the Civil Defense sub-department [Interviews]. • Participatory budgeting (previously installed) brought opportunities to better position DRR within the municipal agenda [Interviews]. • DRR investments reflected in the annual municipal budget may be seen as evidence of institutional ownership and sustainability [Interviews].
Livelihoods and Financial Mechanisms	Livelihood assessment and opinion poll **Transferred to :** Stakeholders: business, municipality and universities	Not a strong emphasis on improving/impacting livelihoods [Interviews]
DRR Interventions	• Methodologies and instruments (plans) for DRR • 12 Emergency signs were designed for all neighborhoods **Transferred to :** Carabayllo Municipality; Communities	• Municipal personnel were trained in DRR, this accelerated some technical and managerial processes [Interviews] • Project mentioned that several risk studies were undertaken, however there is not evidence of how these impacted methodologies and plans for DRR [Interviews] • 12 emergency signs were designed for all neighborhoods; these were transferred to community organizations [Interviews]. Some are for 'wear and tear' [ER]. • People make a household emergency plan and package [FGD]

Urban Informality/Precariousness Index

Based on the UN-Habitat definition of informal settlements, the informality/precariousness index was designed, composed of three sub-indexes: Legal, Physical and Social (details in Table 3) and used it for the Carabayllo's neighborhoods. The higher the numbers, the greater is the level of higher informality/precariousness.

Carabayllo has an Informality/Precariousness Index of 37.97, the third highest among the eight projects in this study. The legal realm represents the highest score, particularly in the areas of compliance with building regulations and land tenure. In the physical realm, the scores are driven by the high exposure to natural and human-induced hazards. The social realm shows some issues with access to social infrastructure and low levels of violence and illegal activities. Even though the NA project was intended to positively impact some of the variables here, the NA incidence in the final index is marginal (less than 1 unit). Other methodologies used in this study allow the capture of other project impacts.

Disaster Risk Reduction

Based on the recently adopted United Nations terminology, this study developed a particular DRR Index (details in Table 4) to measure the perceived DRR status in the neighborhood as well as the contribution of the NA project to this level.

Carabayllo obtained the highest score on the DRR Index among the eight projects analyzed, and the highest (by far) in terms of the contribution of the NA project to this level. Nevertheless, it is interesting to note that the EWS score is proportionally lower than the other five variables measured, a common trend among all the projects.

Social Cohesion

This study developed a Social Cohesion Index (details in Table 6) to measure the perceived social cohesion at the neighborhood level as well as the contribution of the NA project to this level. Carabayllo obtained the third highest Social Cohesion Index score among the eight projects analyzed and the fifth highest in terms of the contribution of the NA project to the level of social cohesion.

Disaster Risk Governance

Based on the UNISDR terminology, this study developed a Disaster Risk Governance Index (details in Table 5) to measure the Disaster Risk Governance associated to the particular NA project

Carabayllo obtained the fourth highest Risk Governance Index score among the eight projects analyzed. It registered second highest in Community Associativity, which means more than a quarter of the individuals interviewed belong to a community organization. Community involvement in the project was the fourth highest. Local Government was highly involved, even though it is the fourth highest among the eight projects.

Project Title: Risk Reduction in Vulnerable Areas of Independencia District, Lima Province

Implementing Partner (IP): PREDES
Location: Lima-Independencia, Perú

Table 9. Main Interventions in the Lima-Independencia NA Project

	Output	Findings
Physical Works & Maintenance	• Water tanks and irrigation system for forestation areas • Public areas: green spaces, handrails • Retaining walls • Access Roads • Drainage (rain water runoff) • House retrofitting **Transferred to :** Municipality of Independencia; Neighborhood organizations; Households	• Water tanks in good structural conditions, comply with technical specifications for construction process [Technical]. • Public areas are in good conditions and structural development. Designed were well executed by professionals in engineering and architecting [Technical]. • These structures are effective in reducing vulnerability and risks to disasters [Technical]. • Physical interventions have worked as 'catalyzer' for social mobilization and cohesion [Interviews].
Social Mobilization Gains	[Not declared by implementer]	• Thanks to the process of constructing physical works people engaged with project aims and DRR: physical works as catalyzer of social gains [FGD; Interviews]. • Identification of a positive feedback, a 'snowball effect', when good practices improve people's conditions the replicability is assured [Interviews].
Environmental Improvements	Forestation areas **Transferred to :** Municipality; Mancomunidad de Lima Norte (North-Metropolitan area administration)	• Forestation areas are in good structural conditions; they comply with technical specifications for construction process [Technical]. • Risks (landslides, rock falling, etc.) will be reduced if there is adequate growth of the trees [Technical].

	Output	Findings
Institutional Arrangements	[Not declared by implementer] **Transferred to :** National and local authorities	• El Niño Costero affected the way in which authorities and communities view risks: a window of opportunity for DRR [Interviews]. • Implementers play a key role, opening a space for authorities to enter into communities that historically have been reluctant to cooperate [Interviews]. • Communities depend largely from the Municipality to sustain some interventions, such as the water tanks [FGD]. • Participatory budgeting became as a governance mechanism: but it requires a base to encourage DRR [Interviews].
DRR Interventions	• DRM plans, municipal and community levels • Forestation for reducing risks **Transferred to :** Municipality; Mancomunidad de Lima Norte	• Communities are more aware about risks and vulnerabilities [FGD]. • See Forestation in 'What' section above.

Urban Informality/Precariousness

Independencia has an Informality/Precariousness Index of 30.18 (Table 3), the third lowest among the eight projects included in this study. The legal realm represents the highest scores, particularly in the areas of compliance with building regulations and urban planning, while land tenure is not a major issue. In the physical realm, scores are driven by the high exposure to natural and human-induced hazards and environmental degradation. The social realm shows some issues with access to social infrastructure and low levels of violence and illegal activities. Even though the NA project was intended to positively impact some of the variables here, the NA incidence in the final index is marginal (less than 1 unit). Other methodologies used in this study allow the capture of other project impacts.

Disaster Risk Reduction

Independencia obtained the second highest DRR Index score (details in Table 4) among the eight projects analyzed, and the fourth highest in terms of the contribution of the NA project to the level of DRR found. It is interesting to note that the community involved in the emergency plan implementation and the EWS are proportionally lower than the other four variables measured; those are common trends among all the projects.

Social Cohesion

Independencia obtained the fifth highest Social Cohesion Index score (details in Table 6) among the eight projects analyzed, and the lowest in terms of the contribution of the NA project to the level of social cohesion found.

Disaster Risk Governance

Independencia obtained the third lowest Disaster Risk Governance Index score (details in Table 5) among the eight projects analyzed. It registered the fourth highest Community Associativity, which means a quarter of the individuals interviewed belong to a community organization. The community was positively involved with NA project (the fourth highest) and continue working on this.

Project Title: Reinforcing Innovative Mechanisms for Arising Capacities in Disaster Risk Reduction in Rimac

Implementing Partner (IP): COOPI
Location: Lima-Rimac, Perú

Table 10. Main Interventions in the Lima-Rimac NA Project

	Output	Findings
Physical Works & Maintenance	Irrigation system with residual water **Transferred to** : Municipality; Neighborhood organizations	• In general, physical interventions were 'Moderately Effective' and are 'Slightly Maintained' [PW; ER]. • Irrigation system: Wetland was not complicated to build and it does not require a high maintenance. The pump used inside the storage tank is automatic and does not require a person to manipulate it [PW; ER].
	Access roads (evacuation) **Transferred to** : Municipality; Neighborhood organizations	• Stairs and handrails are in higher places or in places that are difficult to access, where people are in the highest risk condition. People use these points to meet or rest as they walk around. Some people or families benefited directly with the works, because their house entrances are in a better condition [Technical].
	Murals, tribune, bus stop, and park improvements **Transferred to** : Municipality; Neighborhood organizations	• These works increase the quality of life of the users [Technical]. In Letícia, the recovery of residual areas in the community is moderately effective on reducing vulnerability, by protecting recreational areas that can be used at the same time as safe areas [ER].
	Shoring and ladder **Transferred to** : Municipality; Neighborhood organizations	• The location of the columns (part of intervention) is not the most appropriate and is not in symmetry with the existing structural elements. Some of the wooden plates placed in the joints of the elements are damaged, including by the placement of the nails. Columns placed directly on the ground can start to have problems due to humidity and deterioration [Technical].
Social Mobilization Gains	• Several training courses • Empowerment of the recycling group **Transferred to** : Community	• Communities are more aware of risks and vulnerability than before. People thank that they were trained in 'public project management': i.e. elaboration of proposals for municipal funds. These two element contribute to the sustainability of training interventions [FGD]. • There is a 'replicating factor' or 'snowball' among people on the knowledge acquired during trainings [FGD; Interviews]. • Participation in the construction of physical works benefited community ownership for such interventions: physical works as catalyzers [FGD; Interviews].
Environmental Improvements	Forestation areas **Transferred to** : Municipality; Neighborhood organizations	• The implemented system has a good functionality and sustainability because there are people who contribute sewage water, the principal resource for the wetland and thus for the irrigation system [Technical]. • Trees, desert shrubs and other superficial vegetation can retain small rocks. They also reduce soil erosion. However, the area does not constitute a high-risk area, since its slope is moderate [ER]. Due to the early stages of the forestation (22/2017) the protection factor is moderately effective.

Urban Informality/Precariousness

Rimac has an Informality/Precariousness Index of 33.88 (Table 3), the fifth highest among the eight projects included in this study. The legal realm represents the highest score, particularly in the areas of compliance with building regulations and urban planning, while land tenure is not a major issue. In the physical realm the scores are driven by the high exposure to natural and human induced hazards, and the environmental degradation; housing is in good condition. The social realm shows some levels of violence and illegal activities and some issues

with access to social infrastructure. Even though the NA project was intended to positively impact some of the variables here, the NA incidence in the final index is marginal (less than 1 unit). Other methodologies used in this study allow to capture other project impacts.

Disaster Risk Reduction

Rímac obtained the lowest DRR Index score (details in Table 4) among the eight projects analyzed and the lowest in terms of the contribution of the NA project to the level of DRR found. In addition, the community involved in the implementation of the emergency plan and the EWS is proportionally lower than the other four variables measured; these are common trends among all the projects.

Social Cohesion

Rímac obtained the third lowest Social Cohesion Index score (details in Table 6) among the eight projects analyzed, and the third lowest in terms of the contribution of the NA project to the level of social cohesion found.

Disaster Risk Governance

Rímac ranks fifth in the Disaster Risk Governance Index score (details in Table 5) among the eight projects analyzed. Nevertheless, it registered highest in Community Associativity, which means more than a third of the individuals interviewed belong to a community organization. Rímac is sixth in community involvement and sixth in local government involvement among the eight projects.

Project Title: Knowledge and Risk Reduction Program (CRRP)

Implementing Partner (IP): Global Communities
Location: Medellín, Colombia

Table 11. Main Interventions in the Medellin NA Project

	Outputs	Findings
Physical Works & Maintenance	• Housing improvements: roofing • Retaining walls **Transferred to** : Community and benefited families	• Houses are safer due to training, manuals and physical works [FGD]. • Houses for improvements were carefully selected in a participatory way, which resulted in community members accepting the selection [FGD].
	• Drainage (rain water runoff) • Access/ Evacuation roads **Transferred to :** Municipality	• Sidewalks, stairs and railings have reduced the risk of falling. Previously people died or were seriously injured. They now can get to their destination safer and more easily [FGD].
	Street lighting (Solar off-grid) **Transferred to** : Fundación Litro de Luz and Community	• Solar lighting was not installed in all the areas where it was needed, due to lack of time and money. During inspection, these lights were not working [FGD].
Social Mobilization Gains	[Not declared by implementer]	• Community members learned their obligation (pay taxes) and rights (access to public works (PW) and property titles), and to demand support from municipality [FGD]. • Community associations were strengthened and are recognized by the municipality [Interviews; FGD]. • Participatory design has facilitate community ownership [Interviews]. • Implementer has highlighted the social value of physical works, this has propitiated community ownership [Interviews].

	Outputs	Findings
Environmental Improvements	• Environmental gardens • Garbage disposal management **Transferred to** : Community and Fundación Salvaterra	• Environmental group cleans up, provides maintenance and monitors the state of physical works and natural areas in alliance with institutions through a signed agreement [FGD].
Institutional Arrangements	[Not declared by implementer]	• Private-public alliances may benefit/speed-up transition of local economic activities from informal to formal [Interviews]. • Private partners have seen the potential of informal settlements' small economies and helped to develop innovative ideas: concatenation of projects [Interviews]. • Municipality is investing strongly in these communities [FGD; Interviews]. • Support from many different institutions augments possibility of continuing projects with some of them: Municipality, UPB, DAGRED, Salvaterra, FENALCO, Police [FGD; Interviews].
Livelihoods and Financial Mechanisms	Public-private partnership for financial credit of small businesses **Transferred to** : Public and private organizations, and merchants	• Many micro business owners learned to assess risks, how to reduce them, how to stay safe and understood that risk management is their responsibility [FGD]. • Vegetable gardens provide an income and food security, which makes people maintain them [FGD].
DRR Interventions	• Emergency management protocol design for community EWS • Housing improvements: roofing • Retaining walls (see section Physical Works in this table) **Transferred to** : Community and benefited families	• Families have prepared their emergency plans [FGD]. • Families benefited from house improvements and retaining walls are safer than before. However, these specific and particular actions are not significant for a overall reduction of risks in the neighborhoods [FGD; Interviews].

Urban Informality/Precariousness

Medellin has an Informality/Precariousness Index of 29.32 (Table 3), the second lowest among the eight projects included in this study. The legal realm represents the highest score, particularly in the areas of compliance with urban planning and building regulations there are still issues in land tenure. In the physical realm, the scores are driven by the high exposure to natural and human-induced hazards, and environmental degradation; the housing is in good condition and access to basic utilities is not a major problem. The social realm shows some levels of violence and illegal activities and some issues with access to social infrastructure. Even though the NA project was intended to positively impact some of the variables here, the NA incidence in the final index is marginal (less than 1 unit). Other methodologies used in this study allow the capture of other project impacts.

Disaster Risk Reduction

Medellín obtained the third lowest DRR Index score (details in Table 4) among the eight projects analyzed, and the fifth highest in terms of the contribution of the NA project to the level of DRR found. In addition, community involved in the emergency plan implementation and the EWS are proportionally lower than the other four variables measured; these are common trends among all the projects.

Social Cohesion

Medellín obtained the fourth highest Social Cohesion Index score (details in Table 6) among the eight projects analyzed, and the fourth highest in terms of the contribution of the NA project to the level of social cohesion found.

Disaster Risk Governance

Medellin obtained the highest Disaster Risk Governance Index score (details in Table 5) among the eight projects analyzed. It registered the third lowest Community Associativity, which means a fifth of the individuals interviewed belong to a community organization. The community involvement is the third highest and local government had the highest involvement in the NA project among the eight projects analyzed, and continues working on this initiative in six additional neighborhoods.

Project Title: Barrio Mio

Implementing Partner (IP): Project Concern International
Location: Mixco, Guatemala

Table 12. Main Interventions in the Mixco NA Project

	Outputs	Findings
Physical Works & Maintenance	Tailored retaining walls **Transferred to**: Technology transferred to municipal teams	Appropriate maintenance by community members [Implementers]. The municipality will not receive the works until land titles are defined. [Interviews].
	• Drainage system • Permeable pavements **Transferred to**: Municipality of Mixco, through written agreement	Working properly. It is considered that the reduction of environmental vulnerability is well achieved by installing sewage and gray water systems that mitigate the disposal of pollutants to natural areas, as well as in the streets and other public and collective areas of the communities [ER].
	Rainwater collection system **Transferred to**: Municipality of Mixco and Neighborhood organization	• Structures are in good shape, but not enough maintenance: the community is not well organized to maintain clean the structures [Implementers]. • The rainwater collection system is an effective measure to address issues related to drinking water availability, reducing vulnerability and so reducing risks. [ER].
	Septic tanks: Residual water treatment plan (PTAR) **Transferred to** : Municipality of Mixco and Neighborhood organization	• Working well but some neighbors still unconnected to the plan because of miscommunication with local authorities [Implementers]. • The treatment plants are effective in mitigating pollution both in natural areas (in the ravines) and public spaces, as well as in reducing disease caused by the presence of surface pollutants in the communities. However, in Cipresales some families have not made their gray water connection and in some cases, the water stagnates, thus generating the appearance of mosquitoes and related health problems [ER]. • The assessment found that there are no lab tests to check the Tank's performance and there are no operational manuals. The implementer is working on this issue.
	House retrofitting **Transferred to** : Benefited families	The reinforcement made for structural elements comply with seismic-resistant standards. Blocks and reinforced concrete were used. In construction plans, it was possible to observe the design and dimensioning of the elements. The upper floor is made with horizontal joists and blocks on which the concrete slab is placed. A good finish of the elements and a correct construction technique are observed. The walls have a plaster finish. The work done increases the safety against collapse of the built structures, as long as the weight is not increased or subjected to loads greater than those it was designed for.

	Outputs	Findings
	Community center in Cipresales **Transferred to** : Community organization	A one-story building used by the different communal groups. The structural section was built using PVC pipes as columns and beam. The structure is very light and does not transmit significant loads to the ground, and therefore, to the walls. We cannot determine whether the structure will be stable in seismic conditions. A little flexion was observed in the horizontal elements.
	Access roads **Transferred to** : Municipality of Mixco and Community organization	Sidewalks, stairs and accesses built with reinforced concrete. They were mostly placed on slopes. Also, in some points, small walls were built for the safety and integrity of the work. They are rigid structures, safe and of good dimension.
Social Mobilization Gains	• Facilitating neighborhood committee (COCODE) • Empowered Women program • **Transferred to** : Community organizations	See Livelihoods and Financial Mechanisms.
Environmental Improvements	[Not declared by implementer]	Forestation areas generated during the project are in good condition, they protect the area from erosion. However, there are also areas of clandestine garbage and construction rubble dumping and burning near areas sensitive to erosion [ER].
Institutional Arrangements	[Not declared by implementer]	• NA approach for private sector may be interesting, but it needs to be aligned with market opportunities [Interviews]. • Implementers not only enable municipality to enter to communities, but also the private actor (market) [Interviews]. • Physical works as catalysts for the relationship between the municipality and the community: corruption acts in an opposite way [Interviews]. • Neighborhood organizations can establish direct agreements with private companies [Interviews]. • There is lack of presence of the government in the neighborhoods: implementers and NA approach has helped to bridge that gap [Interviews]. • Implementers/donors (when they are trusted organizations by governments) may help state organization to create trusted relations with other state or non-state institutions [Interviews].
Livelihoods and Financial Mechanisms	Women network for entrepreneurship **Transferred to** : Community	• Role of women in implementing interventions: they were always present and willing to contribute [Interviews]. • Importance of women as part of the workforce to improve family economies [Interviews].

Urban Informality/Precariousness

Mixco has an Informality/Precariousness Index score of 25.90 (Table 3), the lowest among the eight projects included in this study. The legal realm shows issues in the areas of compliance with urban planning and land tenure, and less problems related to building regulations. In the physical realm, scores are driven by the high exposure to natural and human-induced hazards, and environmental degradation, while the housing conditions are less problematic and access to basic utilities is not a problem. The social realm shows issues with access to social infrastructure. Even though the NA project was intended to positively impact some of the variables here, the NA incidence in the final index is marginal (less than 1 unit). Other methodologies used in this study allow the capture of other project impacts.

Disaster Risk Reduction

Mixco obtained the fifth highest DRR Index score (details in Table 4) among the eight projects analyzed, and the third lowest in terms of the contribution of the NA project to the level of DRR found. In addition, the

community involved in the implementation of the emergency plan and the EWS is proportionally lower than the other four variables measured; these are common trends among all the projects.

Social Cohesion

Mixco obtained the second lowest Social Cohesion Index score (details in Table 6) among the eight projects analyzed, and the third highest in terms of the contribution of the NA project to the level of social cohesion found.

Disaster Risk Governance

Mixco obtained the second highest Disaster Risk Governance Index score (details in Table 5) among the eight projects analyzed. It registered the second lowest Community Associativity, which means less than a fifth of the individuals interviewed belong to a community organization. To the contrary, community involvement registered the second highest score among the eight projects. The local government involvement had ups and downs, but recently was highly involved, and the relationship with the association of municipalities (mancomunity) that adopted the NA was reinforced.

Project Title: Community Initiatives in Disaster Risk Reduction (CIDRR)

Implementing Partner (IP): World Concern Development Organization
Location: Port-de-Paix and Anse-à-Foleur, Haiti

Table 13. Main Interventions in the Port-de-Paix and Anse-à-Foleur NA Project

	Outputs	Findings
Physical Works & Maintenance	Shelter improvements (WASH, roofing) **Transferred to** : Churches, schools, and CDGRD-NO, through written agreements	Shelters were extremely effective interventions in Port-de-Paix and Anse-à-Foleur: they were extensively used during Hurricane Irma (2017) and no electricity shortage was reported [FGD].
	• Drainage canals • Gabions **Transferred to** : MTPTC and Neighborhood committees through verbal agreement	• Canals were critical during Hurricane Irma. Decline of flood events since their construction. Nevertheless, most of them are filled with garbage and mud, so better waste management may improve their performance substantially. • Some people have fallen down, as the canals lack of handrails. [FGD].
	Water supply (pipe that runs) **Transferred to** : MTP DINEPA through written agreement	The project provided an excellent quality pipeline from the source of the water to the town. The World Bank built 10 water tanks and the municipality built the distribution network. An excellent effect of concatenation of projects [Interviews].
Social Mobilization Gains	Youth volunteers trained for EWS/DRR: including a siren crank by community **Transferred to** : CPC and CDGRD-NO	• Not all communities developed ownership with regards to their physical works (FGD). • Hiring locals enhances community participation, awareness, and neighbors' appreciation on the interventions [Interviews].
Environmental Improvements	Canal and coastal clean-out, and garbage disposal **Transferred to** : MTPTC, Municipality, and Neighborhood committees through verbal agreement	Garbage disposal was not an effective intervention. Cans were removed and/or vandalized, and garbage were not collected by the municipality [FGD].

	Outputs	Findings
Institutional Arrangements	[Not declared by implementer]	• Institutional ownership is lacking. Municipality is not picking up the trash deposited in the trash cans or in other areas. When it rains the trash floods into the canal; also people throw trash in the canal. There is however some civil society organizations that support the sustainability of the works (e.g. Bon vive maintaining the canals with young male community members) [FGD]. • Communities appreciate the role of implementers, over even the municipality and other public organizations [Interviews]. • NA approach enabled a 'concatenation' of interventions built from previous works: canals [Interviews].
DRR Interventions	Shelter (and other) improvements (WASH, roofing) **Transferred to** : Churches, schools, and CDGRD-NO, through written agreements	• Shelters operated efficiently during Hurricane Irma (2017). • Protection Civil provided good logistical support during Hurricane Irma (2017). [FGD]. • People feel that they have learned how to react during emergencies: siren crank manager recognizes importance of being ready in case of emergencies (as he did during Hurricane Irma) [FGD]. • Institutions recognize that canals, gabions and shelters worked well during Hurricane Irma [Interviews].

Urban Informality/Precariousness

Port-de-Paix and Anse-à-Foleur have a combined Informality/Precariousness Index score of 52.41 (Table 3), the highest (by far) among the eight projects included in this study. The legal realm shows serious issues in the areas of compliance with urban planning and land tenure and building regulations, and also important deficiencies with land tenure. In the physical realm, the scores are driven by the high exposure to natural and human-induced hazards, lack of access to basic utilities and environmental degradation, while the housing conditions are much less problematic. The social realm shows issues with access to social infrastructure, violence and illegal activities, and some level of marginalization issues. Even though the NA project was intended to positively impact some of the variables here, the NA incidence in the final index is marginal (less than 1 unit). Other methodologies used in this study allow the capture of other project impacts.

Disaster Risk Reduction

Port-de-Paix and Anse-à-Foleur obtained the fourth highest DRR Index score (details in Table 4) among the eight projects analyzed, and the second highest in terms of the contribution of the NA project to the level of DRR found. Compared to the other NA projects, the scores in the DRR Index related to the Haitian community's involvement in the implementation of the emergency plan and the EWS are similar to the other four variables measured. It is interesting to note the importance that the community attributes to the project's physical works built and their involvement in their maintenance.

Social Cohesion

Port-de-Paix and Anse-à-Foleur obtained the lowest Social Cohesion Index score (details in Table 6) among the eight projects analyzed, and the second lowest in terms of the contribution of the NA project to the level of social cohesion found.

Disaster Risk Governance

Port-de-Paix and Anse-à-Foleur obtained by far the lowest Disaster Risk Governance Index score (details in Table 5) among the eight projects analyzed. Nevertheless, it registered the third highest in Community Associativity, which means more than a quarter of the individuals interviewed belong to a community

organization. The community involvement in the NA was mediated by the cash-for-work formula and the local government involvement in the NA was by far the lower in the eight projects.

Project Title: Building Resilience and Capacities for Emerging Disasters (BRACED)

Implementing Partner (IP): Habitat for Humanity
Location: Portmore, Jamaica

Table 14. Main Interventions in the Portmore NA Project

	Outputs	Findings
Physical Works & Maintenance	Housing improvements: retrofitting and roofing **Transferred to** : Community members, families Ventilated Improved Dry Pits (VIDPs) **Transferred to** : Community households and Sanitation committees	Interventions have helped to reduce problems with heavy storms in 2017 [FGD]. • Reduction of environmental vulnerability is moderately achieved by installing the sanitation modules inside the communities. This mitigates the disposal of pollutants (fecal matter) in case of potential flooding in streets and collective areas of the communities. It also reduces potential contamination to water source [ER]. • VIDPs demonstrated that they are effective in reduction of health risks. During the visit, it was observed that the modules have been adopted by the members of the community, which translates into a lower risk of diseases caused by fecal matter that were previously superficial and close to all homes [ER]. • It was observed that the VIDPs are well maintained. And at the level of management and sustainability of the interventions, it is considered that since a limited number of families have access to each bathroom (between 4 and 5 families), it is expected that their maintenance will be easier to coordinate among family members. The use of a double dry tank system for the VIDP's helps to facilitate long-term maintenance [ER].
Social Mobilization Gains	CERT trainings **Transferred to** : Social development commission - PMC	• Construction skills training for youth (mostly men) with certification gave them (temporary) jobs [FGD].
Environmental Improvements	Garbage receptacles **Transferred to** : Neighborhood Committees: NSWMA	• Receptacles in Naggos Head and Gregory Park have helped to reduce health risks and prevent contamination in natural areas [ER]. In addition, garbage in open areas interrupt the raining runoff, increasing the risk of flooding during the rainy season. • The receptacles for waste management are effective in reducing informal or clandestine dumps in open areas. Because of the height of these infrastructures, it is less possible that dogs or goats try to look for food waste. Some neighbors report that the garbage collection is irregular and that also affects its functionality in relation to preventing garbage from being exposed [ER]. • The receptacles are robust infrastructure that requires very little maintenance [ER]. • Construction of receptacles helped to reduce the risk of inundations as garbage used to block drainages. And in case of inundations there is less garbage floating into the houses [FGD].

	Outputs	Findings
Institutional Arrangements	Land tenure mapping and regularization **Transferred to** : National Land Agency, LAMP, NSWMA and Naggos Head Citizen's Association	• Local government incorporated new methods for land management as experience from the project: this may result in future replication [Interviews]. • Land tenureship augmented willingness to make improvements and helps to attain wealth: and pay taxes and demand public services [FGD]. • Implementer has helped in rendering more visible the informal settlements to local authorities and national government [Interviews]. • Implementer has demonstrated how to speed up processes of land-tenure by supporting people with knowledge, data and financial resources [Interviews]. • Community awareness and mobilization have facilitated land-tenure surveying [Interviews].
	Maps of Naggos Head **Transferred to** : Portmore Municipal Council - Planning Division	• Neighbors learned about map reading and evacuation routes [FGD]. • Doing a survey / mapping to define levels of risk helps to get everybody to agree on location of physical works [FGD].

Urban Informality/Precariousness

Portmore has a combined Informality/Precariousness Index score of 38.48 (Table 3), the second highest among the eight projects included in this study. The legal realm shows serious issues with land tenure and compliance with building regulations and urban planning. In the physical realm, the scores are driven by the high exposure to natural and human-induced hazards, environmental degradation, and access to basic utilities. The social realm shows issues with violence and illegal activities, and access to social infrastructure. Marginalization is not a major issue. In the case of Portmore, some of the interventions are still in an implementation phase. Those related to land tenure will be completed in 10-12 months, and they would have a moderate positive incidence in the final index, 2-3 units. Other methodologies used in this study allow the capture of additional project impacts.

Disaster Risk Reduction

Portmore obtained the second lowest DRR Index score (details in Table 4) among the eight projects analyzed and the second lowest in terms of the contribution of the NA project to the level of DRR found. It is interesting to note that the EWS is proportionally lower than the other five variables measured, a common trend among all the projects; it is also the lowest EWS score among the eight projects.

Social Cohesion

Portmore obtained the second highest (by far) Social Cohesion Index score (details in Table 6) among the eight projects analyzed, and the second highest (by far) in terms of the contribution of the NA project to the level of social cohesion found.

Disaster Risk Governance

Portmore is the second lowest in Disaster Risk Governance Index score (details in Table 5) among the eight projects analyzed. It registered in the fifth position with regard to the Community Associativity, which means less than a four of the individuals interviewed belong to a community organization. Community involvement is the second lowest and local government involvement in the NA project is very low, second lowest among the eight projects.

Project Title: Operationalizing a Neighborhood Approach to Reduce Urban Disaster Risk in Latin America and the Caribbean

Implementing Partner (IP): GOAL
Location: Tegucigalpa, Honduras

Table 15 Main Interventions in the Tegucigalpa NA Project

	Outputs	Findings
Physical Works & Maintenance	Drainage systems **Transferred to** : Committees of Water Management, Neighborhood organizations (Patronatos), and CODEL	• Gray and rainwater drainage with ditches is effective to reduce potential flooding in the communities. Moreover, it mitigates soil erosion produced by superficial runoff water to natural areas. This helps to protect the streams, mainly by conducting the discharges to lower areas and by using trenches to reduce water flow speed [ER]. • The ditches for rainwater runoff and domestic gray water management are in good condition [ER]. • It is important to mention that the risk areas in the communities are well monitored, both by the community (with measuring instruments for rain, fissures in walls, inclination of sensitive areas) as well as by a new project with the World Bank, who gave financing to locate 16 drill points with an early alteration system [ER]. • Committees pay a plumber to conduct maintenance and repairs of the system [Implementer]. • The system works well, although some maintenance issues were raised: collection trucks cannot access some areas [Implementer].
	Housing improvements and new houses (relocation) **Transferred to** : Households/families	• Three years after improvements, 36 of 47 show to be in good condition. 39 of 47 households have conduced maintenance regularly. 14 of 47 have made new improvements. Seven additional households, non-related to the project, have initiated improvements to their houses, based in the project [Implementers].
	Gabions **Transferred to** : Community organization	• Gabions were built in the relocation area. Even though there are some technical issues, with acceptable specifications and an estimated life of 20 years. There are some observations regarding the size of the stones, as well as the quality of the wire that tightens-up the metal mesh.
	WASH drinking water systems **Transferred to** : Director of Educational Centers, CODEL, and Parents organizations	• The implementation of sanitation modules is very effective. It mitigates superficial contamination in the communities by providing an effective solution to the lack of municipal sewage collectors in most parts of Duarte and Ulloa communities. Also, it controls ground pollution, thus improving people's health. Some modules had an improvised harvesting rainwater system, which gives an alternative solution for water consumption for domestic use (as no potable water is needed) [ER]. • Families maintain regularly their sanitation systems [ER; Implementers].
Social Mobilization Gains	[Not declared by implementer]	• Social control (auditoria social) mechanisms are an opportunity to people to have voice in decision making and for empowerment [Interviews].
Institutional Arrangements	• Household relocation • GIS outputs **Transferred to** : Households/families and diverse public institutions	• NA for EWS is being replicated by national institutions (COPECO) [Interviews]. • 8 of 9 constructed houses are being well maintained by families [Implementers]. • Technical studies of hazards have been delivered to different local and national institutions, some of them are informing decisions regarding to mitigation measures and future relocations [Implementers].
Livelihoods and Financial Mechanisms	Grocery stores (pulperías) network and the savings strategy **Transferred to** : Merchants network organized in a cooperative saving and credit entity	• Many grocery stores have incremented their stock and have done improvements to their infrastructure [Implementers]. • 17 of 21 members have maintained their businesses after a year [Implementers]. • A system of basic baskets is being working within the stores.

	Outputs	Findings
DRR Interventions	Early warning systems (SAT) **Transferred to** : CODEM and CODEL	• Two of three CODELs maintain an operative EWS. Main limitations are: reliable communication and a massive broadcasting system for warnings [Implementers].

Note: There are two interventions that were not reported within the Project Transfer Matrix submitted by the implementers: the Resilience Analysis for Social Systems (R4S); and the Analysis of the Resilience of Communities to Disasters (ARC-D) Toolkit. More information about these interventions can be found in Annexes.

Urban Informality/Precariousness

Tegucigalpa has a combined Informality/Precariousness Index score of 35.88 (Table 3), the fourth highest among the eight projects included in this study. The legal realm shows serious issues with compliance with building regulations and urban planning, and also problems with land tenure. In the physical realm, the scores are driven by the high exposure to natural and human-induced hazards and environmental degradation. The social realm shows issues with access to social infrastructure and violence and illegal activities. Marginalization is not a major issue. In the case of Tegucigalpa, an intervention related to community relocation due to existing disaster risk is still in an implementation phase. This intervention is related to land tenure, urban planning and building regulations and will be completed in the next four months; it will have a moderate positive incidence in the final index, 3-4 units. Other methodologies used in this study allow to capture additional project impacts.

Disaster Risk Reduction

Tegucigalpa obtained the third highest DRR Index score (details in Table 4) among the eight projects analyzed, and the third highest in terms of the contribution of the NA project to the level of DRR found. In comparison with other NA projects, community involvement in Tegucigalpa in the implementation of the emergency plan and the EWS has closer scores to the other four variables measured.

Social Cohesion

Tegucigalpa obtained the highest Social Cohesion Index score (details in Table 6) among the eight projects analyzed, and the highest in terms of the contribution of the NA project to the level of social cohesion found.

Disaster Risk Governance

Tegucigalpa obtained the third highest Disaster Risk Governance Index score (details in Table 5) among the eight projects analyzed. It is interesting that this NA project registered the lowest in Community Associativity, which means only a tenth of the individuals interviewed belong to a community organization. Community involvement registered the highest score and local government involvement had the second highest score among the eight projects.

6. Response to the USAID Questions

The following premises are essential to answering the questions posed by USAID: 1) The eight projects evaluated share NA characteristics such as a geographical approach and a participatory action process; they address specific sectors, and aim to reduce risk and build resilience of the target communities; 2) However, each project is unique, responding to the communities' needs, their distinct socio-economic and cultural features, and is framed in specific realities and contexts; and 3) the answers to the USAID questions will refer, in some cases, to common NA characteristics, and in other cases, to strategies, methods and techniques used by some of the implementers, which enriched, complemented and even came to guide the NA.

6.1 Objective 1: Effectiveness

1. To what extent have projects implemented under a Neighborhood Approach contributed to reducing community disaster hazard risks in targeted urban communities in the selected projects?

To answer this question one must return to the proposed conceptual framework, specify the areas where the construction of risk (the social construction of exposure and vulnerability) must be tackled, and identify the NA interventions in each area that have proven to be appropriate and sufficiently implemented.

The four trajectories or pathways of influence to reduce community disaster risk are: a) secure land occupation; b) sufficient and resilient livelihoods; c) robust and resilient ecosystems; and d) adequate disaster risk and emergency management. As indicated earlier, in communities suffering from significant levels of precariousness, it is critical to first address the basic and survival needs that influence all the other domains.

a) NA interventions and features associated with secure land occupation

Two main interventions illustrate a successful approach to secure land occupation: 1) Land tenure initiative implemented in Portmore, Jamaica, with support from Habitat for Humanity (HfH), and 2) Relocating of at-risk communities in Tegucigalpa, Honduras, with support from GOAL. The former is being implemented in the community of Naggo-Head in Portmore as a pilot activity by the HfH and Jamaica's Land Administration and Management Program. This initiative helps communities exposed to disaster risk acquire a registered title. Empirically, there is a positive link between land registration and access to credit, housing improvement, and risk reduction. Nevertheless, there is not enough evidence that obtaining property titles alone will address the issue of access to credit, and even more, reduce risk (Domeher & Abdulai, 2011). What is clear and can be stated with confidence is that land tenure issues and exposure to natural hazards may result in an exclusion of aid distribution and post-disaster reconstruction programs, making these communities more vulnerable to future disasters. Secure land tenure is critical to assure restoration of shelter and livelihoods and to reduce the risks of precariousness in communities (Caron et al., 2015), as observed in the 2010 earthquake in Haiti (Desir & Jackson, 2012; Jahn et al. 2017), the 2004 tsunami in Sri Lanka (Boano, 2009), and the 2013 Typhoon Haiyan in Philippines (Oxfam, 2014).

The relocation of at-risk communities in Tegucigalpa's Berlin neighborhood by GOAL is currently in the implementation phase after several months of delay due to the extensive paperwork required to fulfill environmental standards and secure land tenure for the beneficiaries in the new location. The complex process involved multiple actors such as the Municipality, the national housing authority, the water authority, universities, and a private engineering and geologist consultancy firm, among others. The initiative included a detailed hazard assessment in both the original location and receiving territory, a socio-economic and resilience study, and a carefully designed participatory process. The local government and GOAL joined efforts to ensure an effective and efficient process, keeping the relocating community together in the selected destination, and ensuring that the at-risk lots remain unoccupied through reforestation and community surveillance/control.

b) Sufficient and resilient livelihoods

Two main NA initiatives can illustrate effective DRR: 1) the small business approach used by Global Communities in Medellín, Colombia; and 2) the pulperias networks implemented by GOAL in Tegucigalpa, Honduras.

c) Robust and resilient ecosystems

In Lima, Perú, three different NA projects implemented an afforestation project, initially designed to reduce the risk of rocks falling from the slopes and to recover the fragile ecosystem lost over the past decades. The project, initially designed by PREDES, was later replicated by the other two implementers, COOPI and Save the Children. However, the endeavor grew in magnitude, in both geographical size and scope, achieving the status of a timely and a much-relevant intervention for the neighborhood, given its geographical and environmental context.

The afforestation project then became an effort, by the city of Lima, to limit the expansion of informal settlements in its surrounding hills with high slopes, which are susceptible to landslides and earthquakes.

The initiative integrates different components that demand locally available technical capabilities: 1) a subsystem of gray water collection and treatment; 2) a pumping, storage and irrigation subsystem; 3) the selection and sowing of native trees; 4) the use of synthetic materials (hydrogel) that retain moisture in the soil for prolonged periods; and 5) most importantly, involvement of the surrounding communities to develop and maintain this initiative.

This strategy obeys the theoretical model proposed by the implementers and supported by local forestry technicians, but lacks evidence as to its effectiveness and the long-term impacts of some of the materials used (hydrogel), including the extensive use of gray water (e.g., physical-chemical or bacteriological controls of the water used in irrigation have not been carried out).

d) Adequate disaster risk and emergency management

Physical works such as pathways, access roads, retaining walls and drainage systems are the axes of risk reduction in neighborhood projects. Since these settlements usually lack most of the urban amenities, the NA projects contributed to ease some essential basic infrastructure, which is directly associated with reducing vulnerability and disaster risk.

The pathways were common to the six projects implemented in Central and South America due to the location of settlements on steep slopes. This infrastructure offers appropriate conditions for carrying out a safe evacuation in case of an emergency, reducing time, accidents, and allowing a rapid and safe evacuation of people with disabilities. Additionally, this is one of the interventions with the greatest impact on the quality of life of the members of the community, an externality that can benefit the community on a day-to-day basis.

Another physical work of great importance is the retaining wall, designed and built in a variety of shapes and sizes to protect against landslides. The smaller-sized walls accompany and protect the pathways and access roads, while the larger walls protect individual homes or even a set of dwellings, sewage treatment tanks, and other vital structures.

Infrastructure such as channels to manage the runoff in Port-de-Paix, as well as gabions in Anse-à-Foleur, were built by World Concern in Haiti, and proved to be highly effective during the passage of Hurricane

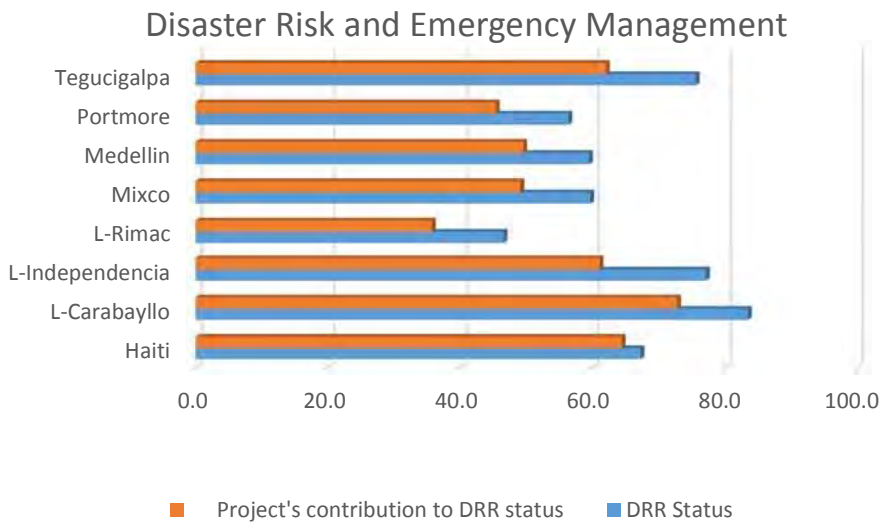
Irma in 2017. The works reduced the intensity of the 2017 impact and the duration of the emergency, especially in comparison to previous events such as Tropical Storm Joanne in September 2004. In addition, the community was provided with a hand crank alarm siren, and community training and improvements were made to the shelters provided by Civil Protection. These measures allowed for an early and safe evacuation to the shelters and a restoration of activities in less than 72 hours after the passage of Hurricane Irma.

Drainage systems are recorded in different magnitudes, from small works associated with the pathways and retaining walls—the most common in the projects in Lima, Medellin, Guatemala and Honduras—to more complex systems such as the one seen in the Tegucigalpa project, whose design demanded digital elevation mapping, generated with LIDAR (a detection system that works on the principle of radar, but uses light from a laser), a runoff, modeling and the generation of multiple scenarios to ensure a lifespan of 20-30 years. The issue of drainage is considered an essential DRR intervention, associated with the problem of managing rain and storm water, landslides and slope instability, particularly in urban settings.

The officials from institutions responsible for emergency management, private organizations and the private sector acknowledged a significant contribution of the NA to DRR in the eight projects when interviewed. However, with no system in place to measure DRR progress in general, they could not quantify the DRR advances contributed by the NA projects.

In the surveys directed to the community present in the selected neighborhoods, the study measured the progress and attribution of the NA to DRR.

Figure 4. Project's contribution to community Disaster Risk and Emergency Management



We built an attribution index relating to the community's perception of their current neighborhood's DRR status and of the NA project's contribution toward it. An index of 1 means that the surveyed population attributes the DRR advances 100% to the NA project. This is an inverse relationship; numbers greater than 1 mean that the attribution to the project is lower.

Table 16. Ratio project's contribution to DRR status

Haiti	Carabayllo	Independencia	Rimac	Mixco	Medellin	Portmore	Tegucigalpa
1.04	**1.15**	**1.26**	**1.30**	**1.22**	**1.20**	**1.24**	**1.22**

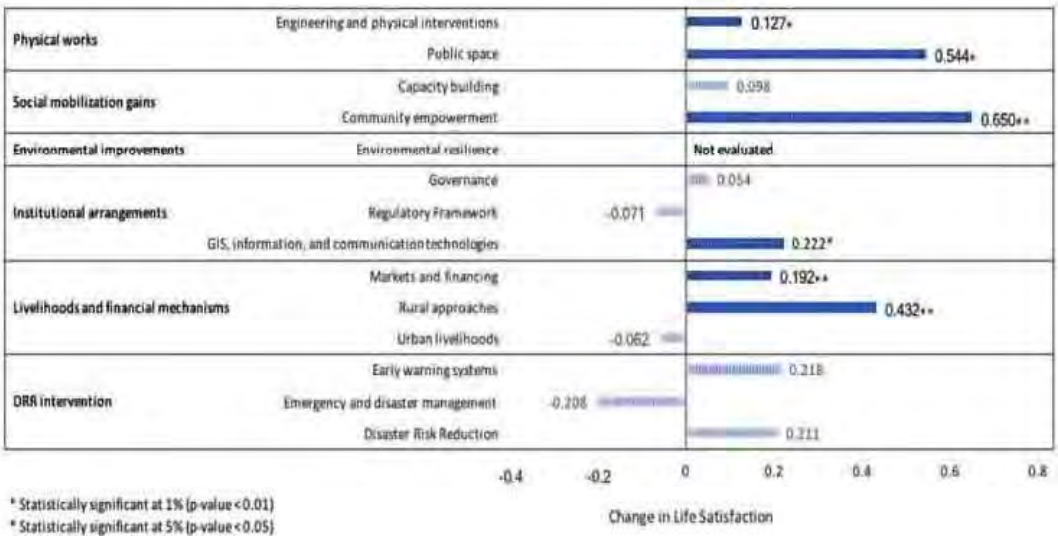
As can be seen, the community attribution of DRR advances in the NA Project is very high in Haiti, followed by the communities of Carabayllo in Lima, Medellín, Tegucigalpa and Mixco. The lowest values correspond to the community of Rímac, Lima.

2. Which aspects of the urban DRR Neighborhood Approach are most effective? Which aspects of the urban DRR Neighborhood Approach are least effective?

To address this question, we used two different approaches: 1) Life Satisfaction Analysis (LSA), and 2) Cost-Benefit Analysis (CBA). Using these two approaches allowed us to measure different NA project dimensions, the former measuring the level of well-being attributed to the NA projects' interventions and the latter focusing on calculating and comparing benefits and costs of the specific NA interventions selected.

For the LSA, we used a multivariate regression analysis to evaluate the association between each of the 14 neighborhood DRR interventions and changes in life satisfaction (more details in Annex 4-8). Figure 5 presents the results of our estimation for all interventions grouped by categories. The categories with the highest impact on life satisfaction improvement are physical works and social mobilization gains. Neighborhoods that received a community empowerment intervention (social mobilization category) increased their life satisfaction by 0.65 points. Considering that on average, the life satisfaction of all neighborhoods in the study was 2.46, the community empowerment intervention produced an increase in life satisfaction of nearly 27%.

Figure 5. Impact of Interventions on Life Satisfaction



Other categories with interventions that had a significant impact on life satisfaction are livelihoods and financial mechanisms (rural approaches intervention and markets and financing), and institutional arrangements (GIS, information and communication technologies intervention). While in most cases the interventions were implemented in several neighborhoods, the rural approach case with the positive impact corresponds only to the Medellin neighborhood so, a generalization of this case should be taken with caution.

Other interventions such as capacity building, governance, regulatory framework, urban livelihoods, early warning systems, emergency/disaster management and disaster risk reduction were not statistically associated to changes in life satisfaction.

The CBA of the DRR interventions revealed that overall, the USAID project interventions have benefit-cost ratios (BCRs) of more than one, with the access paths being the most cost-beneficial. A BCR of one indicates that the discounted benefit of implementing an intervention equals its cost. The BCR of physical interventions such as access paths ranged from 6.48 in Rímac to 8.5 in Medellin. On using an average value of statistical life ($107,000 for lower income countries, Viscusi & Masterman, 2017), the BCR for access paths increases to 138 and 122, for Medellin and Rímac, respectively. The drainage canal in Port-de-Paix, Haiti, yielded a BCR of 13.19, valued for benefits from avoided loss of household assets and increase in productive business days. Sanitation interventions like the septic tank in Mixco obtained a BCR of 1.62. The analyses were performed using conservative estimates and a discount rate of 10%. The life span for most cases was taken as 10 years considering the nature of the interventions and that the project implementers did not factor in maintenance costs in their estimates. For interventions in which benefits could not be monetized, we enumerated the benefits in terms of value gained to residents, potential monetary gains, and qualitative improvements for the neighborhoods to underscore the importance of the interventions. Benefits were projected for certain interventions like the land tenure registration effort in Portmore, Jamaica, which has not attained its target as yet.

Our results match the evidence from the statistical analysis of BCRs of various categories of a heterogeneous group of risk management interventions by Wethli (2014), for the World Bank Development Report 2014), which also reveals a wide range of results. The table below compares the results of the CBA of some of our interventions with the estimates of the World Bank study.

Table 17. Comparative Benefit-Cost data from World Bank and USAID DRR Evaluations

Intervention Category	World Bank Report	USAID Evaluation
	Median BCR (Min–Max)	BCR
Flood mitigation	5.1 (0.01– 60.1)	13.19
Improved Water and Sanitation	3.7 (1.27– 61.5)	1.62
Earthquake mitigation	2.5 (0.01–6.5)	
Tropical Storm mitigation	3.4 (1.50–18.6)	
Early warning systems:	5.0 (0.93–57)	
Evacuation paths		6.48–138

Similarly, the CBA of 5,500 FEMA mitigation grants for earthquake, flood and winds hazards yielded an overall benefit-cost ratio of 4:1 (although the range varies between 1.5 for earthquakes to 5.1 for flood mitigation) (Rose et al. 2007).

The most significant limitation of the analysis has been the lack of detailed and organized cost data files in a technical format from the project implementers. Hastily collected cost data after project close out does not support good analyses. Ideally, project personnel should be trained in the basics of economic impact analysis from project inception onward and should be able to account for comprehensive costs associated with the interventions, articulate project benefits, and support a robust analytical process.

3. To what extent is the Neighborhood Approach effective as compared to more traditional DRR initiatives in the LAC region?

To address Question # 3, we conducted an extensive literature review for the years 2000–2018 that resulted in a total of 210 documents. Most were institutional documents (gray literature), from which we selected works prioritizing disaster risk reduction approaches in urban risk with a focus on precariousness, informality, and risk exposure in the Latin American and Caribbean region. The results were narrowed down to twenty six (26) disaster risk reduction approaches with a focus on urban risk in the LAC region. The five implementing agencies or funding sponsors that were most frequently mentioned in the DRR approaches with a focus on urban risk were: UNDP (4), USAID (4), World Bank (3), OXFAM (3), and IADB (2). We identified six DRR categories to conduct a thorough comparative analysis of the neighborhood approach with other DRR initiatives: 1) area-based, 2*)* market-based, 3) system-based, 4) institutional-based, 5) individual/household-based, and 6) operational. It is worth noting that some DRR initiatives fall within more than one category.

Table 18. DRR Categories

DRR Approach	Characteristics	Number of Documents
Area-Based	▪ Identified geographical area ▪ Participatory ▪ Multi-sectoral ▪ Neighborhood as the 'unit' of the intervention	13
Market-Based	▪ Existing or new markets ▪ Cash or voucher program ▪ Supporting recovery and improving supply chain	2
System-Based	▪ Rehabilitation of critical infrastructure (water, sanitation, roads, communications)	8
Institutional-Based	▪ Individuals based on affiliation with a specific institution – school, health clinic or workplace (USAID 2008; DFID 2014) ▪ Supporting local authorities to recover	12
Individual/Household-Based	▪ Beneficiaries from violence, conflict and IDPs. ▪ Gender, education, health, disabilities, etc.	2
Operational	▪ Capacity building associated with emergency preparedness, response and recovery ▪ May include minor equipment devices such as radios, flashlights, helmets, etc.	3

Adapted from Parker, E., & Maynard, V. (2015). *Humanitarian response to urban crises: A review of area-based approaches* (Rep.). International Institute for Environment and Development. Retrieved from http://www.jstor.org/stable/resrep01316

The neighborhood approach promoted by USAID/OFDA, primarily identified in the area-based category, incorporates most of the criteria utilized by other approaches (market-based, system-based, institutional-based, individual/household-based, and operational-based). Nevertheless, there is a significant difference between the pure geographical meaning of the term 'area-based' versus the richness of the neighborhood concept used by USAID: a living fabric of social, economic, and physical features that provides the residents of a particular territory with an identity, a sense of security, safety, and familiarity.

The results showed a limited number of initiatives/projects in urban settings, with an emphasis on areas with precariousness, informality, and risk exposure. However, some area-based approaches in institutions such as USAID, OXFAM, UNDP, DFID, and the World Bank have been identified. It is worth mentioning that several articles reviewed focused on policy recommendations but failed to identify specific

interventions/approaches that can be measurable in terms of community-based disaster risk reduction. Regarding methodological approaches, most of the literature review utilized qualitative methods. Only a few used mixed-methods. More traditional DRR strategies (such as system-based and/or operational-based) are less prevalent than neighborhood approaches (or area-based) or institutional-based, with a primary focus on local/national/INGOs efforts in disaster risk reduction. An increasing consensus on the determinant role of the community/neighborhood, both for purposes of effectiveness and sustainability, indicates the benefits of including a more participatory and multi-sectoral approach in a limited geographical area. Many of the DRR initiatives identified as participatory in nature include multiple stakeholders with a focus on community input, which can later work toward the creation of appropriation mechanisms in favor of making these efforts sustainable.

Another positive consideration of the area-based in comparison to other categories is their geographically-based nature, which has been utilized by different organizations in the response to the Haitian earthquake in 2010 (UN-HABITAT), suggesting the need to maintain, if possible, the same location for rebuilding if safety is guaranteed, or in the case of USAID/OFDA's neighborhood approach, that focused on communities with high socioeconomic vulnerability and exposure to natural hazards. As Sanderson (2017) notes, the area-based initiatives involve sectoral interaction of multiple stakeholders and focus on community engagement, which helps in identifying vulnerable populations. Other examples, such as the system-based Homeowner-Driven Housing Reconstruction and Retrofitting in Haiti (Build Change, 2014) has demonstrated effectiveness in empowering homeowners in Haiti by improving awareness on reconstruction after a disaster. This approach, along with mitigating disaster risk, has resulted in about 1,330 buildings retrofitted or built new and enabled 8,150 people to live in safer homes.

Worth noting in the literature review is the comparison between the Latin American and Caribbean regions and other regions such as Asia or Africa. The number of disaster risk reduction approaches such as the neighborhood approach or other area-based is significantly lower in the LAC region in comparison to other regions (e.g., Asia, Africa). Regarding the time span of the DRR approaches identified, the following timeframe applied: area-based (2004–2017); system-based (2009–2017); institutional-based (2007–2015); household/individual-based (2007–2011); operational-based (2007–2016); and market-based (2009–2015). These results suggest that while most of the DRR initiatives have been in place over a significant period of time (area-based, system-based, and institutional-based), others such as the household/individual-based approach have been less utilized or reported.

On a less positive note, the multiplicity of actors—local and national levels, implementers, and international organizations—can help to promote or hinder the integration of DRR practices and appropriation of the neighborhood approach by local actors.

As a methodological note, most of the studies fall under a descriptive level of analysis and do not reach the theoretical, indicative, or causal analysis. Some of the themes addressed in these approaches are: water management, public investment in urban developments, resettlement and resilience, early warning system, vulnerability reduction of landslides, eco-system based adaptation DRR strategies, homeowner-driven reconstruction and retrofitting.

4. What factors influence the effectiveness (or lack thereof) of urban DRR programs using the Neighborhood Approach in each country of focus?

We consider two categories of influencing factors for the effectiveness of urban DRR programs using the NA: 1) reflecting on internal aspects of each project and their immediate environment and 2) referring to the economic, political and social contexts in a broader sense, that is beyond the project's control. For instance, in the three projects in Lima (Carabayllo, Independencia, and Rímac), several emergencies triggered by 'El Niño' in 2017 in northern Peru created a sort of 'window of opportunity' to introduce innovative DRR practices at different government levels. The three project implementers found these 'disasters' as influencing factors that facilitated the process of building disaster risk awareness among authorities, which allowed them to get endorsement of authorities for the NA projects. Subsequently, we corroborated these causality relations across several interviews with national and local government authorities.

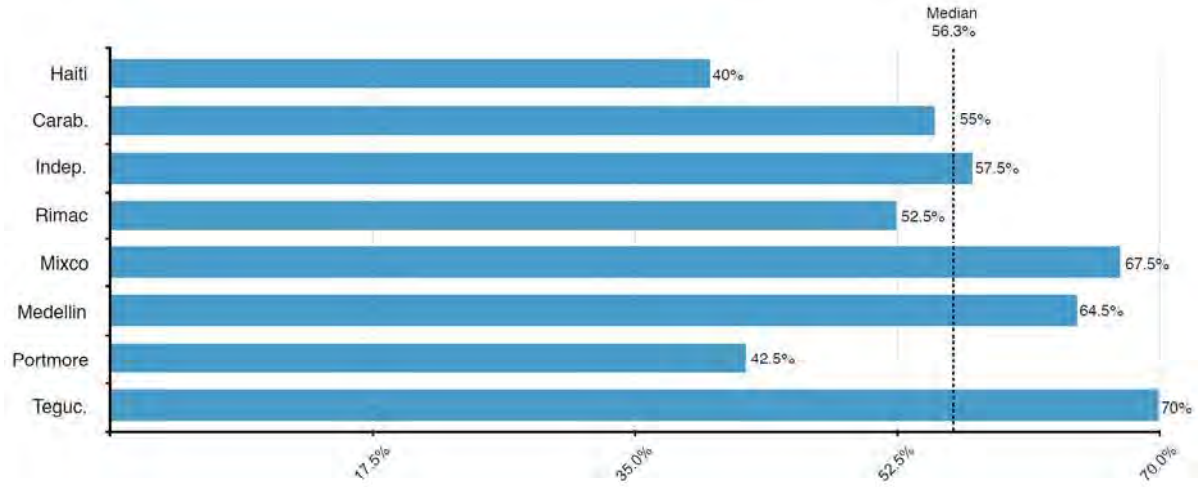
These factors affect the effectiveness of DRR programs and limit collaboration and engagement among communities, local and national authorities in a particular territory. Other positive influencing factors can be the capacity to lead and the ability of some implementers to bring together a very diverse group of actors with different agendas, interests and expectations under a common goal and principles, and especially the ability to preserve and enhance the significance of social processes such as building awareness, capacity development, and empowerment. This was particularly effective for the NA projects in Mixco, Medellín, and Tegucigalpa. We also observed that local governments with more comprehensive urban development capabilities avoided silos, fostered cross-sectorial integration and tended to mainstream DRR practices within urban development. Through interviews with several municipal and national directors in all projects, we concluded that this factor was particularly effective and a common feature in Carabayllo, Medellin, Mixco, and Tegucigalpa. Other external factors, in this case negative, may be related to bad past experiences between NGOs and donors which created mistrust among communities; the volatile political contexts in Mixco; municipal personnel turnover in Lima; organized crime and violence in Medellín; and specific land-tenure issues observed in Portmore.

6.2 Objective 2: Sustainability

5. To what extent are communities able to integrate DRR practices and take ownership of the Neighborhood Approach? What barriers to utilization of the Neighborhood Approach exist?

The answer to this question stems from focus group discussions conducted in the eight projects, in conjunction with inputs from interviews and field observations. We estimate that, in general terms, the communities were able to integrate DRR practices, although only in few cases took ownership of the Neighborhood Approach as a whole. With significant differences among countries, neighbors in Mixco, Medellín, Tegucigalpa, and the three projects in Lima demonstrated appropriation of DRR practices such as better garbage and waste water management for reducing flood impacts and afforestation and gardening for the risk of landslides and stone falls. This can be explained by the projects' strong emphasis on training and awareness development within communities; through techniques such as participation in the design and construction of physical works (e.g., murals, drainage construction, etc.); development of manuals and courses; among others. People were able to generate more consciousness about the risks they face and develop mechanisms to cope with and reduce them. In some cases, such as Medellín and Mixco, people achieved a certain level of empowerment as they began to demand more attention and action from local authorities. The Community Involvement indicator (see Figure 6) was developed using qualitative analysis of focus groups and interviews, assessing four aspects of community involvement: a) active involvement in planning; b) allocation of human and financial resources; c) active involvement in maintenance; and d) social control ('auditoria social'). The figure also seeks to inform the dimension of governance within each project and reflects participation and appropriation by communities.

Figure 6. Community Involvement per Country, in Percentages



Each of the four aspects was weighted equally from 0 to 25.

On the other hand, communities less able to integrate DRR practices were in Haiti (Port-de-Paix and Anse-à-Foleur) and Jamaica (Portmore), where appropriation of the project interventions was very limited. Community members in Haiti and Portmore explained that they expected more involvement and participation from implementers, municipalities, or 'others' in solving local problems. Other factors pointed out were that participation by fewer men (in proportion to women) and land-tenure insecurity may have limited the level of participation and subsequent ownership.

Although most of the barriers to utilization of the NA refer to contextual circumstances of each country, there are some general difficulties present in different degrees in all cases. The lack of participation tended to generate lack of appropriation when interventions were carried out, and this affected the potential of utilizing NA by the communities in the future. Likewise, precariousness and unemployment seem to have an important effect on how people interact and create community spaces for sharing and cohesion; the latter was especially observed in Portmore and Haiti.

6. To what extent are municipal and national authorities incorporating and institutionalizing the urban Neighborhood Approach? What evidence (including, but not limited to, policy or urban planning changes) is there that municipal or national authorities are managing urban risk differently due to USAID/OFDA's urban DRR Neighborhood Approach?

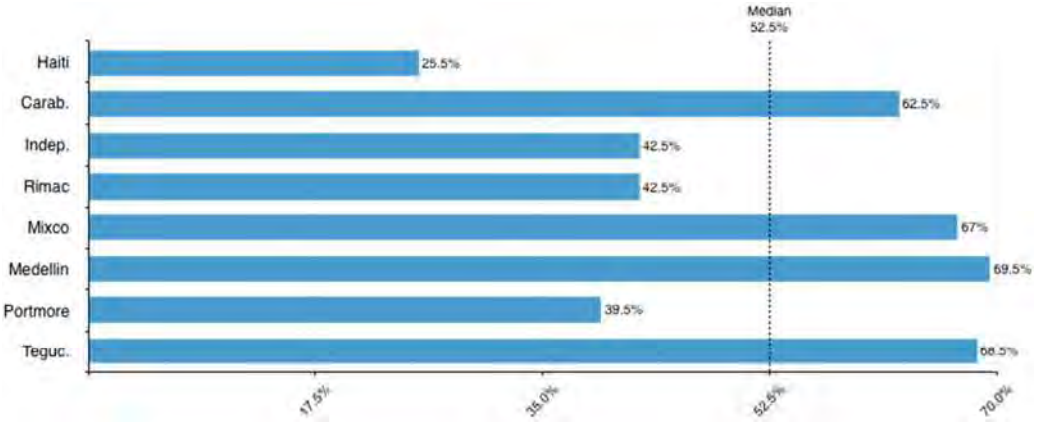
Considering an overall analysis of eight NA projects, we were able to estimate that municipal and national authorities are 'moderately' incorporating and institutionalizing the urban Neighborhood Approach. Nevertheless, there are specific cases where the institutionalization has been intense due to a particular context. Local and national governments show a reasonable, but not a strong or intense, incorporation of DRR approaches into urban planning practices that change the paradigm from just response to emergencies and disaster situations. Hence, there is a moderate acknowledgment of the complex interconnected reality of disaster risk in an urban environment.

Based on the interviews with 105 key informants from national to local levels of government in the eight projects, the evidence shows that most of the impact (in terms of institutionalization) was achieved at the municipal level. In cases like Carabayllo, Independencia, Mixco, Medellín, and Tegucigalpa, the

municipalities moderately incorporated new practices such as the use of GIS and social media for DRR; participatory design and execution of physical works; inter-sectorial working groups for neighborhood development (including DRR components); and inclusion of DRR measures within municipal budget plans, among others. According to our field observations and in conversation with the above-mentioned key informants, the best institutional ownership was accomplished in Tegucigalpa, Mixco, and Medellín, mainly due to three factors: 1) level of municipalization or municipal autonomy to intervene regarding DRR; 2) implementers succeeded in creating inter-institutional and inter-sectorial (including private sector) articulations based on agreements and communication, and then translated them into actions; and 3) willingness and commitment of key actors at the highest level of municipal government, such as mayors or municipal managers.

The municipalization or municipal autonomy, however, poses a sort of 'distance' between local governments and the national players and practices, becoming an important limitation to incorporating and institutionalizing the NA and its practices into upper government levels. The majority of municipal authorities pointed to a 'gap' between municipalities and national authorities. The Local Government Involvement Indicator (see Figure 7) was developed using qualitative analysis of interviews and field observations, assessing four aspects of local government involvement: a) active involvement in planning; b) allocation of human and financial resources; c) active involvement in maintenance; and d) regulatory action. The figure also seeks to inform the dimension of governance within each project and reflects participation and appropriation by local and national governments.

Figure 7. Local Government Involvement per Country, in Percentages



Each of the four aspects was weighted equally from 0 to 25.

On the other hand, factors that limit the institutionalization of the NA were pointed out by the participants from Rímac, Portmore, and Haiti: 1) personnel turnover in municipalities, particularly after popular elections, leads to difficulties in maintaining institutional memory and integrating knowledge and experiences from project implementation within these institutions, resulting in very fragile long-term approaches; 2) lack of willingness and commitment from local authorities; and 3) implementer's lack of capacity/experience in involving local authorities and thereby fostering DRR awareness and motivation.

7. What enabling factors and factors impeding success contribute to sustainability of the urban DRR Neighborhood Approach? How sustainable could the targeted Urban DRR programs be without external donor support?

Building on USAID's Post-Project Review's five categories to address project sustainability of the Neighborhood Approach projects: social mobilization, institutional arrangements, physical works, environmental improvements and financial mechanisms, we complemented the analysis with the outputs of the different methodologies utilized throughout the study. Each of these categories comprises both enabling factors and factors that hinder success.

Social Mobilization

Enabling Factors	Impeding Success
• Community awareness aimed at active and inclusive participation. • Shared interests among neighborhoods and strengthen links between neighborhoods and local actors. • Participation of vulnerable groups (women, youth) and collaboration with civil society organizations. • Rapid response toward conflict resolution. • Physical evidence of the project and design of identifying elements. • Transparency as a key factor when sharing project's results. • Shared responsibility by stimulating a sense of belonging.	• Lack of presence of state actors aggravated by limited interaction with the municipality. • Combination of poor levels of education, lack of empowerment, and socioeconomic barriers in the community. • Time limitations of community members that hamper participation in the project. • Entrenched political interests and authoritarian leadership. • Frustrated experiences with previous organizations that negatively impacted on the levels of confidence of beneficiaries. • Isolated and sporadic collaboration that can impede the projects' sustainability.

Institutional Arrangements

Enabling Factors	Impeding Success
• Political will to participate in the project that translated into committed leadership, adequate involvement of local authorities and shared credit. • Appropriate legal frameworks that support the sustainability of these kind of projects, such as Peru's SINAGERD (National Disaster Risk Management Policy). • Established relationships among stakeholders that generate trust in the community. • Comprehensive knowledge of the territory, including its main local actors as well as the intervening sector. • Flexible structures that contribute to planning and implementation in pursuit of project's sustainability.	• Rotation of staff and nepotism that hinders the sustainability of the project. • Lack of transparency and accountability and deep-rooted corruption. • Disconnection between national and local frameworks and lack of enforcement. • Political interests and competing priorities that impedes community participation. • Other efforts are considered to be more visible than DRR, affecting the sustainability of the project. • Rigid structures that fail to contemplate the neighborhood approach demand for high level of flexibility in planning and administration.

Environmental Improvements

Enabling Factors	Impeding Success
• Recognition of previous outcomes in the environmental dimension that ensured sustainability of the project and identification of community advocates. • Education and awareness for environmental protection with a focus on youth and their parents. • Use of environmentally-friendly technological options that comply with environmental norms. • Selection of experts that can demonstrate knowledge on the topic while identifying potential negative consequences.	• Lack of compliance and regulation of environmental standards and urban zoning regulations. • Deficient land use planning, lack of legal frameworks and environmental standards. • Lack of government funding for public works and infrastructure and poor interaction of all stakeholders. • Limited community awareness on how certain habits (e.g., waste disposal) can contribute to environmental degradation. • Solutions implemented contribute to environmental problems.

Physical Works

Enabling Factors	Impeding Success
• Identification of physical works that can help mitigate the neighborhood's risks. • Active participation in decisions on work projects can promote transparency and credibility. • Shared funding between local/national government and NGOs. • Neighborhood contribution to physical works in a variety of forms (workforce, monetary contributions, in-kind activities). • Improved social inclusion through the participation of marginalized members of the community/neighborhood. • Replication of physical community housing projects as a result of knowledge/techniques learned during the project.	• Lack of community participation and deficient socialization of the physical work to be conducted. • Uncertain legal ownership of the location to be utilized and deficient municipality leadership over public spaces. • Lack of awareness on best techniques to perform maintenance and quality control of the physical work implemented. • Deficient knowledge of potential/alternative solutions and how to enforce safe construction standards. • Maintenance of public works is managed by few leaders. • Theft of construction materials.

Financial Mechanisms

Enabling Factors	Impeding Success
• Promotion of self-saving groups with the support from financial/banking institutions that help empower community members (e.g., women). • Legal restrictions to preserve the allocation of DRR funds. • Public supply of approved vouchers to improve accountability. • Competitive process to evaluate suppliers. • Economic methodologies and metrics along with financial models from other sectors.	• Deficient coordination between local actors and the municipality. • NGOs working in double capacity which hinders repayment rate. • Uncertain land tenure and limited understanding of credit. • Volatile market prices that prevent project's sustainability. • Lack of awareness of DRR funds' allocation as well as limited financial information.

Beyond the enabling and impeding factors mentioned above, it is worth mentioning a common finding to the different NA projects, a circumstance referred to as concatenation, and that has been recorded in interviews, engineering inspections and transect walks. The concatenation consists of the capacity of a project to advance on the achievements of other projects or initiatives. In the same way, the project can at the same time offer the opportunity to other projects and initiatives to build on its own outputs or outcomes. The case of Anse-à-Foleur is a good example, where the NA project provided an excellent quality pipeline from the source of the water to the town, and then the World Bank built 10 water tanks followed by the municipality who built the distribution network. Although this mechanism could be confused with 'alliances' or 'partnerships', in the case of concatenation it is not necessary to reach an agreement between those who lead the undertakings. This can be illustrated with the opportunity that the Bank of Ireland and the microfinance company Alfasic saw to commercialize at low-cost a rainwater harvesting program through microfinance on the NA project in Tegucigalpa, and then in different neighborhoods. A final example, also from NA in Tegucigalpa, where a public university in Honduras took advantage of the geological studies sponsored by JICA to advance the studies required by the NA project supported by USAID. At the same time, the NA project prepared a digital elevation mapping based on Lidar technology, which is now serving the municipality and other projects supported by the international community.

6.3 Objective 3: NA Programming Strategy

The evolution of the NA strategy has been evident in other programmatic lines within USAID/OFDA since the first APS launch in 2012. Beyond the characteristics that define the NA, such as geographic focus, active participation, and sectoral concentration, the NA has been characterized by a closer cooperation among USAID implementers and partners, beneficiary communities, and local and national governments. Additionally, systematization has helped to reestablish the balance between project processes and outputs/outcomes, a closer follow-up to project implementation, and attention to the long-term impacts and their sustainability. By sharing techniques and results with the other awardees following the post-project evaluation of the first NA projects, greater awareness of project transfer and close-out was achieved.

Through its regional advisers, USAID has promoted a space for the exchange of practices and experiences among implementers. This has resulted in an important collective learning process, one that is unique in terms of depth and quality in the short amount of time that the NA strategy has been implemented. Over the five year strategy—with the exception of the NA project in Haiti—the implementation period of the projects has exceeded the period initially awarded, whether through a no-cost extension, a cost-extension, or as an unsolicited proposal to complete, replicate or expand the scope. Beyond the replicability and scalability of the NA strategy as a package in itself, this study has detected another clear trend with an enormous impact at national and even regional level in the different countries, where we are witnessing a second or even third wave of initiatives derived from the initial project. Cases that support this assertion:

1) Jamaica: Habitat for Humanity defined a land tenure strategy, together with the land authority in Jamaica (LAMP) and the University of Technology, that will be extended to the entire country, involving several other institutions and civil society organizations.

2) Peru: PREDES, along with the mayor of Lima, has led afforestation as a strategy for land use management and disaster risk reduction, now recognized internationally by FAO as "Forests and Sustainable Cities— Inspiring Stories from Around the World." Additionally, the agreement reached among the three NA implementers in Lima—PREDES, COOPI, and Save the Children—and one common partner, Practical Solutions, resulted in a coalition that shares practices and learning on different topics, including the aforementioned forestry project, replicated in all NA projects.

3) Honduras: GOAL, along with the municipality of Tegucigalpa, the Inter-American Development Bank, the University of Manchester, and the Nordic Fund are promoting the NA approach to develop a project to adapt assets to climate change. Additionally, GOAL is now replicating the Honduras NA experience in Haiti.

4) Colombia: the NA project implemented by Global Communities, Corporación Ayuda Humanitaria and Pontificia University in Medellin, expanded the municipal DRR approach to communities; it has now been integrated into the City's resilience strategy. Medellin is recognized as part of the 100 Resilient Cities movement. In addition, the NA project inspired a new DRR initiative geared toward small commerce and merchants in precarious areas of the city. The project led by FENALCO—a merchants association—is undergoing an internal transformation to include DRR and business continuity in all its businesses and promote this strategy among its affiliates. Moreover, they are strengthening disaster resilience in communities where they work.

5) Guatemala: Under the leadership of PCI, the NA project convened various local actors, among them the private sector—Cementos Progreso and AMANCO—expanding the impact of the NA to many other cities. On a larger scale, PCI contributed to a proposal to change public housing policies

in the country, introducing participatory solutions, technological approaches, and financial strategies with the support of international organizations and experts such as Build Change and Elemental. It is also establishing alliances with other NA implementers such as GLOBAL.

To gauge how the NA strategy is viewed within the USAID, a voluntary and anonymous questionnaire was shared internally at OFDA (Washington, D.C. and LAC). The respondents strongly agreed that the NA supports disaster risk reduction, the LAC DRR Plan 2015-2019, and the Sendai Framework. In the same vein, the respondents agreed it would be opportune to expand the NA within the LAC region and to other areas of the world where OFDA supports DRR activities.

The following were cited as the main technical or programmatic challenges for implementing the NA: community participation; followed by lack of resources in the community; issues with sustainability; and having the right partners with expertise in community development. Partners pointed to the main managerial and financial challenges for implementing the NA primarily as: government or legal restrictions; followed by the lack of willingness of local governments to institutionalize the policies and activities associated with the program; underestimation of costs during proposal stage; lack of time due to the performance period of the award; a lack of community leaders or other local partners; and a lack of financial resources in the community. In the event that the NA continues, one respondent suggested that, in the future, the APS should request that each partner clearly demonstrate examples of successful implementation and institutionalization of urban DRR through the NA.

7. Conclusions

1. As described in the NA Post-Project Review report, the USAID-NA responds to the growing urban population that lives in informal settlements, made up of diverse and unique neighborhoods that extend beyond geographical jurisdictions. Neighborhoods are a living fabric of social, economic, and physical features that provide the residents of a particular territory with an identity, a sense of security, safety, and familiarity.
2. The NA contributes to marginalized communities' sustainable and safe development while protecting the neighborhood and supporting its cohesion and self-determination.
3. The USAID-NA expands the attention of DRR interventions beyond individuals and households to a settlement approach, addressing critical disaster risk drivers and development gaps, and encouraging a long-term vision.
4. The study showed the need to balance physical and social interventions to match individual and collective needs and expectations associated with the common good. Thus, protecting the neighborhood and supporting its cohesion and self-determination, are important strategies to build community resilience.
5. In response to the daily challenges experienced by informal settlements, there is clearly a need to facilitate social mobilization to collectively overcome obstacles such as poverty, marginalization, insecurity and despair.
6. The NA shifts from the stereotypical humanitarian response to empower in communities, helping them become active members of the neighborhood planning processes and local governance mechanisms to build a resilient community, strengthen livelihoods, and improve the quality of life.

7. This study has expanded the scope initially foreseen for the NA, identifying different strategies that can stand alone, such as: land tenure, rain and storm-water management, housing relocation, and afforestation, among others.
8. The use of state-of-the-art technologies such as geographic information systems and remote sensing; methods for modeling hazards and risks based on global platforms complemented by local studies; methods of economic evaluation and econometrics in public health coupled with the use of traditional techniques based on surveys, focus groups, interviews, engineering inspections and transect walks—all of these allowed for the development of a comprehensive assessment of the NA strategy proposed by USAID.
9. The exploration and definition of units of measurement was essential to answering the questions proposed by USAID and marks the beginning of a second phase of the study—the preparation of a series of peer reviewed manuscripts that will serve to build a catalog of evidence-based DRR practices.

8. Recommendations

Based on the results obtained in this study and the NA Post-Project Review process conducted in 2016-2017, the following recommendations are proposed regarding the USAID NA urban DRR strategy:

- Continue fostering the NA strategy with some adjustments to the RFA process such as: 1) NA projects must have an ideal duration of three years; never less than two years; 2) NA projects should be formulated in two stages, the first one of diagnosis, awareness and social mobilization, followed by a second phase of implementation and transfer. The proposals must contemplate a process of programmatic adjustment between the two stages based on changes in assumptions and a better understanding of the territory and its social, cultural, economic, institutional, political, and environmental conditions.
- The NA could be diversified to allow different types of proposals that foster DRR and resilience-building, using the principles of geographic focus, active participation, and sectoral approach through projects that respond to issues associated with DRR of critical incidence such as land tenure, urban drainage systems, afforestation, precariousness, housing retrofitting, among others.
- Promote the use of tools to support decision-making, such as those used in the present study, including GIS and remote sensing applications, hazard and risk modeling, cost analysis, cost-benefit analysis, life satisfaction analysis, use of specific indicators, among others. Ideally, the proposals themselves should be prepared based on the principles of the above-mentioned techniques.
- All NA projects must have a communications plan, in a permanent form, to reach out to beneficiaries, and internal and external partners.
- The NA projects should have a plan, from the outset, to deal with the inherent uncertainty and lack of continuity in local public administration policies and practices, along with the rapid turnover of public employees. Likewise, strategies must be designed to deal with the incongruities between national and local regulations and processes.
- Intervention cost centers must be established, with files that conserve technical studies, designs, and technical specifications to maintain a permanent archive, which must be submitted to USAID at the end of the project.
- NA projects must strengthen its M & E system; beyond a contractual requirement its purpose is to assess the project's performance, improve practices, inform decisions, and increase accountability.

Consistent with the evidence-based practice approach used in this evaluation, a second phase of the study is recommended in the upcoming 12 months, in which a series of peer reviewed publications should be prepared based on the knowledge, data, and information generated in the first phase. The publications: papers, book chapters, technical and institutional documents, would be prepared by the evaluation team based in FIU in collaboration with USAID, other evaluation team members from the LAC region, national academic and institutional counterparts. The documents produced will serve as foundation to build a catalog of evidence-based DRR practices in informal settlements.

The topics initially identified are:

- Evidence-based evaluation of Urban DRR practices: the Neighborhood Approach
- Systematic Review on Urban DRR initiatives
- DRR metrics and Informal settlements
- Governance and informal settlements
- Risk Assessments and Modeling
- Economic Impact Analysis and NA
- Life Satisfaction Analysis
- Land Tenure and Disaster Resilience
- Exploring Urban Patterns in Informal Settlements
- Urban Integration and Multi-Functionality

These subjects could be addressed independently or jointly, depending on the editors' interests, publications scope, and opportunities identified.

Acronyms and Abbreviations

APS	Annual Program Statement
CDGRD	Departmental committees on risk and disaster management. In instances of CDGRD-NO, this refers Haiti's North-west Department (NO).
CENEPRED	Centro Nacional de Estimación, Prevención y Reducción del Riesgo de Desastres
CLPC	Comité Local de Protection Civile (Local Civil Protection Committee – Haiti)
COCODE	Community Development Committees
CODEDE	Departmental Development Councils COLRED Local Disaster Reduction Committee
CONRED	National System for the Coordination of Disaster Reduction (Guatemala)
COOPI	Cooperazione Internazionale Fondaziones
COPECO	Comisión Permanente de Contingencias de Honduras
DAGRD	Departamento Administrativo de Gestión del Riesgo de Desastres (Medellin, Colombia)
DINEPA	Direction Nationale de l'Eau Potable et de l'Assannissement (National Directorate for Drinking Water and Sanitation – Haiti)
DPC	Directorate of Civil Protection
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
FENALCO	Federación Nacional de Comerciantes (Colombia)
FIU	Florida International University
FY	Fiscal Year
GC	Global Communities (formerly CHF International)
GOAL	GOAL Global is an Irish Aid Charity
HfH	Habitat for Humanity
INDECI	Instituto Nacional de Defensa Civil de Perú
LUM	Land Use Management
LAMP	Land Administration and Management Programme (Jamaica)
MICOOPE	Federación Nacional de Cooperativos Asociados (National Federation of Associated Cooperatives – Guatemala)
NA	Neighborhood Approach
ODPEM	Office of Disaster Preparedness and Emergency Management
PCI	Project Concern International
PPR	Post-Project Review
PREDES	Centro de Estudios y Prevención de Desastres
SC	Save the Children
SINAGERD	Secretaria de Gestion del Riesgo de Desastres (Secretariat for Disaster Risk Management – Peru)
UNGRD	Unidad Nacional para la Gestión del Riesgo de Desastre (Colombia)
USAID/OFDA	United States Agency for International Development, Office of Foreign Disaster Assistance
UTECH	University of Technology (Jamaica)
WCDO	World Concern Development Organization WE Women's Empowerment

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Performance Evaluation:
LAC Urban DRR Programming
The Neighborhood Approach

ANNEXES

April 2018





ANNEX 1
Performance Evaluation: LAC Urban DRR Programming
Office of U.S. Foreign Disaster Assistance
U.S Agency for International Development
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- IRB Exempt Review Process
- Neighborhood Approach - Project Interventions
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- Indices Mapping

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- Lima - Independencia, Peru
- Lima - Rimac, Peru
- Medellin, Colombia
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ANNEX 4-2
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- Lima - Independencia, Peru
- Lima - Rimac, Peru
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ANNEX 4-3
Supporting Documents
Focus Groups
- Lima – Carabayllo, Peru
- Lima - Independencia, Peru
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ANNEX 4-4
Supporting Documents
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- Lima - Independencia, Peru
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ANNEX 1

Performance Evaluation:
LAC Urban DRR Programming
Office of U.S. Foreign Disaster Assistance
U.S Agency for International Development
Scope of Work





Performance Evaluation: LAC Urban DRR Programming
Office of U.S. Foreign Disaster Assistance
U.S Agency for International Development

SECTION C – STATEMENT OF WORK

C.1 PURPOSE

U.S Agency for International Development's Office of U.S. Foreign Disaster Assistance (USAID/OFDA) seeks to award a firm fixed price contract to evaluate the effectiveness and sustainability of the Urban Disaster Risk Reduction (DRR) programming in the Latin America and Caribbean (LAC) region.[1] The goal of this performance evaluation is to improve USAID/OFDA's understanding of the performance and outcomes of the urban DRR programs supported by USAID/OFDA in the LAC region. Specifically, the evaluation will focus on the effectiveness and sustainability of selected USAID/OFDA-funded urban DRR programs that utilize the Neighborhood Approach in Colombia, Guatemala, Haiti, Honduras, Jamaica, and Peru (the precise countries will be determined after the award of contract). The findings of this evaluation will inform future programming decisions and adjustments to ongoing USAID/OFDA urban DRR programming in the LAC region and globally. More broadly, the findings of the evaluation will add to the evidence base of the Neighborhood Approach as a DRR tool.

C.2 BACKGROUND

C.2.1 USAID/OFDA LAC Programming

USAID/OFDA is the lead U.S. Government office responsible for providing humanitarian assistance in response to international disasters. USAID/OFDA's mandate is to save lives, alleviate human suffering, and mitigate the social and economic impacts of disasters. To fulfill its mandate, USAID/OFDA funds a range of life-saving programs and DRR projects across its worldwide portfolio. In the LAC region, USAID/OFDA funds both response and DRR programs.

After four years of supporting urban DRR programming in a variety of regions, USAID/OFDA seeks a deeper understanding of the results, successes, and areas for improvement in the Neighborhood Approach. The introduction of the Neighborhood Approach into a variety of LAC countries after its use in Haiti after the 2010 earthquake has led USAID/OFDA to seek more information about the factors for success and the potential for sustainability.

C.2.2 Goal and Objectives of Urban DRR

The goal of USAID/OFDA LAC's DRR programming is to support governments, communities, and civil society in reducing the risk of and preparing for natural disasters by safeguarding lives, livelihoods, services, and facilities, thereby increasing resilience to adverse transitory events.

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[1] The LAC region includes the countries of Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Bermuda, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, Uruguay, and Venezuela. Political issues have inhibited USAID/OFDA operations in Cuba, Venezuela, and Bolivia.

USAID/OFDA developed a LAC DRR plan that has the following guiding principles and approaches:

- Building capacity
- Supporting community-based urban and rural DRR
- Supporting inclusive programming that accounts for high-risk populations
- Using evidence-based learning and capturing good practices
- Innovation

The plan prioritizes the following locations and portions of the population: locations with at-risk populations; areas recently affected by disasters; historically vulnerable areas; areas either undergoing rapid urbanization and unplanned growth or slated for expansion; and areas undergoing post-disaster transition. The USAID/OFDA LAC DRR Plan (see Section J.2.) seeks to reduce chronic vulnerability in areas of recurrent crisis while strengthening local capacities and systems to mitigate the impact of, adapt to, and recover from emergencies and is consistent with USAID's resilience policy (see Section J.2.). The plan also underscores USAID/OFDA's position that universities in the LAC region play a key role in promoting DRR policies and influencing decision-making.

In FY2015, USAID/OFDA provided over $18,700,000 for DRR projects throughout LAC. These projects took place at a regional or country level (Chile, Colombia, Costa Rica, Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay and Peru) and were delivered by international organizations and international non-governmental organizations (INGOS).

USAID/OFDA urban DRR programs are focused at both the institutional and community levels to increase the sustainability of results. At the institutional level, projects have supported municipal governments in the development of tools, procedures, and regulatory instruments that advance DRR in their jurisdictions. USAID/OFDA believes that success in promoting DRR depends in large measure on municipal authorities being able to engage and mobilize a range of stakeholders. For instance, public sector actors, such as line ministries and public utilities, are important partners. In addition, the private sector and universities, have been identified and integrated into project processes and activities.

At the community level, USAID/OFDA has required implementing partners in a Neighborhood Approach project to carry out a number of steps to ensure the project includes a significant amount of community participation and consultation. First, project partners must conduct a participatory risk assessment and planning process. Second, partners must formulate and adopt implementation plans that are informed by their community assessment processes. Third, partners must select and implement the neighborhood interventions. Finally, partners must complete continued systematization[2] exercises and must disseminate the results to USAID/OFDA and other donors and partners.

C.2.3 The Neighborhood Approach to Urban DRR

Defining the Neighborhood Approach

In LAC, USAID/OFDA has focused a significant portion of its DRR funding since 2010 on urban areas with a particular focus on the Neighborhood Approach. USAID/OFDA defines the Neighborhood Approach as an integrated, multi-sectoral analytical framework that centers on the geographic confines of neighborhoods in order to address risks in the urban environment. USAID/OFDA considers

[2] Systemization encompasses the identification, documentation, and transfer of experiences and key lessons extracted from a project or an initiative, or group of projects or initiatives for the purpose of advocacy, learning and replication/scaling up. The method originated in Latin America as early as the 1960s.

"neighborhoods" to be geographic areas of cities typically defined by social, economic, and physical features, which often serve as the basis for administrative recognition within larger jurisdictions.

Neighborhood Approach programs share four common characteristics:

1. Promotes greater compliance with local laws and regulations as well as internationally recognized guidelines such as the Sphere Project that help strengthen and/or develop existing laws and regulations;
2. Fosters the reduction of the economic and social impacts of present and future disasters;
3. Reflects the needs of the main stakeholders through participatory processes, especially those deemed the most vulnerable;
4. Relies on the use of Geographic Information Systems (GIS) to collect, analyze, store, and disseminate information.

USAID/OFDA has funded programs that aim to reduce risk in informal[3] and marginalized neighborhoods by supporting sustainable participatory planning methodologies and the implementation of risk mitigation measures. The types of objectives included as a part of the Neighborhood Approach include:

1. Improving unsafe living environments;
2. Clarifying ambiguous land tenure and rights to build or occupy shelter;
3. Improving access to neighborhood health, markets, water, and sanitation services;
4. Addressing limitations of space and high population density;
5. Addressing economic vulnerabilities; and
6. Reducing vulnerability to floods, landslides, high winds, and seismic activity.

Sectoral focus

In order to reach the objectives outlined above, USAID/OFDA funded projects within four priority sectors: Shelter and Settlements (S&S); Economic Recovery and Market Systems (ERMS); Water, Sanitation, and Hygiene (WASH); and Natural and Technological Risks (NTR). All proposed activities were to be coordinated with appropriate national and state level government authorities, utility owners or managers, and/or government emergency management bodies. Specific activities included as a part of the Neighborhood Approach within each of these sectors are listed below:

S&S: All S&S sector activities fell within the Shelter Hazard Mitigation sub-sector. Examples include:

- Neighborhood reconfiguration to:
  - Improve accessibility to basic services, markets and evacuation routes;
  - Open up space for future infrastructure improvements and population growth (densification); and
  - Voluntarily relocate especially vulnerable households to safer locations.
- Construction, repair and upgrading of critical infrastructure such as drainage canals.
- Improvements to housing resilience through retrofitting, repairs and upgrading.

ERMS: All ERMS sector activities funded as part of the Neighborhood Approach collection of programs fell within the following sub-sectors: Economic Asset Development, Economic Asset Restoration, Market Infrastructure Rehabilitation, Microcredit, and Microfinance Institutions. Examples include:

- Baseline market-system assessments of critical goods and services in neighborhoods and cities as a part of the first phase of community-based assessment.[4]

[3] Neighborhoods constructed on land that the occupants have no legal claim to occupy.

[4] Critical goods and services are defined as those that play a key role in the survival or livelihoods of vulnerable

- Interventions to improve the resilience of critical market systems to likely future disasters, including:
    - Capacity-building or awareness-raising among small business owners;
    - Facilitating disaster contingency planning throughout the market system;
    - Improving disaster resilience of key market infrastructure (e.g. businesses, storage, transportation) with contributions from relevant market actors; and
    - Protecting livelihood assets, incomes, or access to finance at the household level to avoid negative coping strategies in the event of a disaster.
- Identifying and supporting micro/small enterprise or employment opportunities directly linked to disaster risk reduction in shelter or water, sanitation and hygiene including:
    - Waste management, composting, WASH-related services;
    - Manufacture or sale of disaster-preparedness items.

WASH: All WASH sector activities funded as part of the Neighborhood Approach collection of programs fell within the following sub-sectors: Environmental Health, Hygiene Promotion, Sanitation and Water Supply. Examples include:

- Documenting existing waste management practices, including solid waste management, medical waste management, and human excreta management.
    - Identifying risks and recommending mitigation actions.
- Recording baseline information of existing practices and infrastructure to help guide emergency response activities in case of a disaster.
- Assessing existing drainage within targeted communities and recommending mitigation activities:
    - Defining of problem areas, problematic practices, scope, and severity of problems;
    - Educational or communication strategies to change risky behaviors; and
    - Design and construction of new or improvements to existing drainage infrastructure to reduce vulnerabilities to flooding.
- Assessing existing hygiene practices within targeted communities:
    - Hygiene education; and
    - Education and communication with national, state, and local authorities to improve hygiene messaging.
- Assisting local and national government to locate and document all existing water sources in targeted communities:
    - Technical assistance for the creation of a database or the improvement of existing databases;
    - Identification of which water sources are utilized by which populations and for what purposes;
    - Identification of the most important sources of drinking water, conducting risk assessments and implementing mitigation activities; and
    - Identifying and mapping water distribution systems and wastewater collection systems.
- Conducting sanitary surveys and risk assessments of utilities.

NTR: All NTR sector activities funded as part of the Neighborhood Approach collection of programs fell within the following sub-sectors: Disaster preparedness, Mitigation, and Management, Geological Hazards and Hydro-meteorological Hazards. Examples include:

- Community-based watershed and natural resource management interventions to reduce the impact of hydro-meteorological hazards.
- Development and implementation of regional, local, or community-based hazard reduction policies

people, either currently or in the event of a disaster.

and plans, or incorporating hazard reduction policies and plans into existing plans.

- Community-based mitigation and preparedness activities for:
  - Geological events such as earthquakes, volcanic eruptions, and landslides; and
  - Hydro-meteorological events such as floods, droughts, tsunamis, tropical storms, avalanches and other weather extremes.

C.3 ILLUSTRATIVE LIST: LAC URBAN DRR PROGRAMS TO BE EVALUATED

C.3.1 Summary of Projects to Be Evaluated: General

This performance evaluation will cover a selection of USAID/OFDA-funded urban DRR projects that were awarded between FY2012 and FY2016. This evaluation will examine the effectiveness[5] and sustainability[6] of selected urban DRR projects that utilized the Neighborhood Approach. It is anticipated that the Contractor will conduct the evaluation in at least four countries. For an illustrative list of projects that may be evaluated, see Section J.3. The exact projects to be included in this evaluation will be determined after award and could change from those included in Section J.3.

C.3.2 Existing Performance Data

The Contractor will have access to USAID/OFDA implementing partner award agreements, regular quarterly reporting, supporting documentation, and any internal evaluations or reviews. The quarterly reporting should include data on outputs accomplished by the implementing partners in line with the standard indicators referenced in OFDA's Guidelines for Proposals (October 2012) (see Section J.2). Some USAID/OFDA partners have additional reported data such as beneficiary surveys and baseline data. Further, the Post-Project Review (PPR) workshop report and documents related to the Neighborhood Approach systematization described in Section J.4 will be made available to the team.

C.3.3 Evaluation Audience

The primary audiences of this evaluation will be USAID/OFDA's LAC regional team and the USAID missions in Colombia, Guatemala, Haiti, Honduras, Jamaica, and Peru. More broadly, this evaluation will be shared with USAID/OFDA and USAID/DCHA staff in Washington, DC, USAID/OFDA regional field offices, and USAID/OFDA implementing partners. This evaluation will also be shared with other donors and development partners interested in utilizing the Neighborhood Approach and will add to the evidence base on urban DRR programming in the LAC region and globally. The evaluation report will be made publically available on USAID's Development Experience Clearinghouse (DEC).

C.4 THE EVALUATION

C.4.1 Evaluation Questions

This performance evaluation has two objectives: understanding effectiveness and sustainability of the Neighborhood Approach. Each objective has several lines of inquiry that will inform the evaluation design. Primary data must be collected for all evaluation questions in the countries of the selected projects in LAC.

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[5] Effectiveness: successfully engaging governments, organizations, communities and/or individuals to develop strategies to reduce the risk of disasters, tailored to the needs of at-risk populations in targeted neighborhoods.

[6] Sustainability: extent to which governments, organizations, communities and/or individuals have taken ownership of the Neighborhood Approach.

Section C.4.5 contains more information on the Geographic Scope of this evaluation.

While exact wording of the questions could be modified through USAID/OFDA dialogue with the Contractor, the objectives of the evaluation as well as the intent will not change.The questions will be considered final in the approved version of the Evaluation Design deliverable of this contract.

Objective 1: Effectiveness

1. To what extent have projects implemented under a Neighborhood Approach contributed to reducing community disaster hazard risks in targeted urban communities in the selected projects?
2. Which aspects of the urban DRR Neighborhood Approach are most effective? Which aspects of the urban DRR Neighborhood Approach are least effective?
3. To what extent is the Neighborhood Approach effective as compared to more traditional DRR approaches in the LAC region?
4. What factors influence the effectiveness (or lack thereof) of urban DRR programs using the Neighborhood Approach in each country of focus?

Objective 2: Sustainability

5. To what extent are communities able to integrate DRR practices and take ownership of the Neighborhood Approach? What barriers to utilization of the Neighborhood Approach exist?
6. To what extent are municipal and national authorities incorporating and institutionalizing the urban Neighborhood Approach? What evidence[7] is there that municipal or national authorities are managing urban risk differently due to USAID/OFDA's urban DRR Neighborhood Approach?
7. What enabling factors and factors impeding success contribute to sustainability of the urban DRR Neighborhood Approach? How sustainable could the targeted Urban DRR programs be without external donor support?

C.4.2 Evaluation Approach

This evaluation must take a utilization-focused evaluation approach, meaning the evaluation will be designed through extensive consultation with USAID/OFDA and its implementing partners. USAID/OFDA seeks to gain feedback directly from relevant communities, national and local governments, international and regional organizations, non-governmental organizations (NGOs), and implementing partners throughout the evaluation period. The evaluation must be designed to ensure that findings and recommendations can directly inform future programming decisions related to urban DRR programming in the LAC region. The Contractor may need to tailor the evaluation approaches to the specific country context and analyze findings by country. The evaluation must be designed to allow readers to draw comparisons across country locations and provide analysis of the findings for the different contexts.

C.4.3 Evaluation Design and Methodology

Guidance on methods

The suggested design that will be used to answer the evaluation questions for both objectives will be a mixed methods approach that focuses on, but is not limited to, the following: desk study, key informant interviews, focus group discussions, site visits, and consultations with relevant stakeholders. Other

[7] Including, but not limited to, policy or urban planning changes.

applicable qualitative and quantitative methods are also welcome as appropriate, including surveys. Additionally, because the Neighborhood Approach is a relatively new intervention within DRR, innovative participatory evaluation methods and context adaptable approaches are encouraged. Primary data must form the majority of the data collected for this evaluation; secondary data review alone will not suffice to inform the deliverables for this evaluation. The evaluation must use primary data collected in the countries where the selected projects were implemented within LAC. Section C.4.5 has more information on the geographic scope of this evaluation.

In the selection of methods, the Contractor must include ethical considerations, do no harm precautions, and informed consent.

The exact methods to be used in this evaluation will be determined through the submission and acceptance of the Evaluation Design deliverable. Suggested methods to each question are listed below; however, the Contractor is encouraged to propose other methods as appropriate.

Objective 1: Effectiveness

1. *To what extent have projects implemented under a Neighborhood Approach contributed to reducing community disaster hazard risks in targeted urban communities in the selected projects?*

The Contractor must use a creative evaluation design and a collection of mixed methods to respond to this question in a comprehensive manner. Qualitative data collected through structured interviews, focus groups, case studies and community self-assessment exercises are all relevant methods for this line of inquiry. Quantitative methods such as a survey may also be considered. Other approaches to measure the contribution that the Neighborhood Approach made to hazard risk reduction are welcomed.

2. *Which aspects of the urban DRR Neighborhood Approach are most effective? Which aspects of the urban DRR Neighborhood Approach are least effective?*
3. *To what extent is the Neighborhood Approach effective as compared to more traditional DRR approaches in the LAC region?*
4. *What factors influence the effectiveness (or lack thereof) of urban DRR programs using the Neighborhood Approach in each country of focus?*

The lines of inquiry above relate to the effectiveness of the Neighborhood Approach design and implementation. The Contractor must strive to measure actual changes in effectiveness, not perceptions of effectiveness. To address these questions, the Contractor must examine the individual designs and implementation methodologies of the projects selected to be included in this evaluation. This examination should include a combination of document review, individual interviews, direct observation of active programs, and direct observation of locations covered by closed programs. Quantitative methods such as a survey may also be considered. These questions also require comparison between approaches to design and implementing methods among the different projects. USAID/OFDA is particularly interested in the effectiveness of its selection criteria for neighborhoods targeted. Finally, these questions must include comparisons between country contexts that will allow USAID/OFDA to understand country-level factors that influence effectiveness.

Objective 2: Sustainability

5. *To what extent are communities able to integrate DRR practices and take ownership of the Neighborhood Approach? What barriers to utilization of the Neighborhood Approach exist?*

6. *To what extent are municipal and national authorities incorporating and institutionalizing the urban Neighborhood Approach? What evidence is there that municipal or national authorities are managing urban risk differently due to USAID/OFDA's urban DRR Neighborhood Approach?*
7. *What enabling factors and factors impeding success contribute to sustainability of the urban DRR Neighborhood Approach? How sustainable could the targeted Urban DRR programs be without external donor support?*

Methods to respond to these types of questions lend themselves to qualitative inquiry, so it is anticipated that individual interviews, focus groups, case studies, and document review will formulate the majority of the data collected for these questions. Quantitative methods such as a survey may also be used to answer the lines of inquiry above. The Contractor will also be expected to take into consideration the findings of the PPRs in developing the methodological approach.

Data Sources

It is critical that the Contractor interview the most relevant stakeholders for each of the evaluation questions. While each line of inquiry will have a different set of respondents deemed to be most relevant, it is anticipated that the Contractor will collect data from the following groups (contingent upon the receipt of informed consent):

1. Communities where the Neighborhood Approach was implemented
2. Communities where the Neighborhood Approach was not implemented (as applicable)
3. Municipal or local representatives
4. Government officials (National and Regional)
5. National staff from INGOs and Public International Organizations (PIOs) involved in the Neighborhood Approach projects
6. International staff from INGOs and PIOs involved in the Neighborhood Approach projects
7. USG staff involved in designing and overseeing Neighborhood Approach programs

This list of data sources is not exhaustive. The Contractor must include a complete list of data sources in the Evaluation Design.

C.4.4 Limitations

In certain instances there may be limitations on availability of previously gathered data from communities and implementing partners. Baseline data, performance monitoring data, and evaluation data may be incomplete or missing for some of the USAID/OFDA awards. Additionally, the data collection phase of this evaluation will take place after some international staff, as well as beneficiaries involved in the implementation of the Neighborhood Approach, have moved on. In both instances, the Contracting Officer's Representative (COR) will provide clarification on available project data and beneficiaries upon contract award.

C.4.5 Geographic Scope

Anticipated countries for field work

The countries where fieldwork is required will be determined upon contract award (Section F.3.2) of this evaluation. USAID/OFDA anticipates that fieldwork will be required in at least four of the following countries: Colombia, Guatemala, Haiti, Honduras, Jamaica, and Peru, and also include approximately eight

projects, ideally a mix of completed and ongoing interventions. Final selection of projects will be determined in consultation with USAID/OFDA. Primary data collection for this evaluation – and thus travel for relevant members of the Contractor – must occur in the countries where the final selected project(s) took (or are taking) place.

The evaluators may also interview respondents via the telephone or internet-enabled communication in countries outside of the geographic scope of this evaluation if identified respondents no longer reside in the aforementioned countries.

Other allowable travel

Travel to the United States and Costa Rica (OFDA/LAC Regional Office) is also allowable under this contract. If the Contractor determines travel to another country for the purposes of this evaluation is needed, the Contractor must submit a justification to the COR that states how the additional travel is directly related to achieving the objectives of this contract. Only after the COR approves the request may the Contractor submit a formal travel request for the trip.

Access responsibility

It is the responsibility of the Contractor to access all locations selected for this evaluation.

C.4.6 Past Programming Period to be Covered by Evaluation

This performance evaluation will cover selected USAID/OFDA urban DRR programs implemented using the Neighborhood Approach funded between FY 2012 & FY 2016 (to be disclosed after contract award).

C.5 LOGISTICS

The Contractor will receive guidance from USAID/OFDA in prioritizing organizations and places to visit during the evaluation. The Contractor must schedule interviews or other modes of data collection with all key stakeholders. The Contractor is also responsible for making its own meeting and logistical arrangements. These will include all travel arrangements, visa requirements, appointment scheduling, secretarial services, report preparations services, printing, duplicating and other similar logistical items. The Contractor's evaluation team must have the necessary language skills for countries of focus, or engage local language interpreters to support interviews and reviews of local language documents and records, where necessary. See the language requirements under Section F.7.

End of Section C

Performance Evaluation:
LAC Urban DRR Programming
The Neighborhood Approach

ANNEX 2

Research methodology
(complementary information)





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Research methodology
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- IRB Exempt Review Process
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- Indices Used in the Urban DRR Evaluation
- Indices Mapping

BIOS Team Members

Juan Pablo Sarmiento M.D. M.P.H.

Dr. Juan Pablo Sarmiento is a Research Professor and Associate Director for Research at the Florida International University (FIU) Extreme Events Institute. He is also the Director of the Disaster Resilience in the Americas Program, funded by the U. S. Agency for International Development's Office of Foreign Disaster Assistance (USAID/OFDA), Dr. Sarmiento is a Medical Doctor and Surgeon (Universidad del Rosario, Colombia) with a M.Sc. in Public Health, Specialty in Health Promotion and Social Development (Université de Bordeaux, France & Universidad Pública de Navarra, Spain); a M.A. in Project Management (UCI, Costa Rica). He has a Specialization Degree in Medical Education (Universidad de la Sabana, Colombia). Dr. Sarmiento has also post-graduate studies in Disaster Management (Oxford, Great Britain); High Level Public Administration (Colombian Superior School of Public Administration), and a residence in Nutrition (Tufts University, U.S.A.).

Suzanne Polak, Ph.D. M.P.H.

Suzanne Polak is the Acting Lead Sector Advisor for Monitoring and Evaluation at USAID/OFDA. She holds an M.P.H. in International Health from the Uniformed Services University of the Health Sciences and a Ph.D. in Political History from Indiana University.

Meenakshi Jerath, M.Sc.

Meenakshi Jerath is Coordinator of Research Programs at the Extreme Events Institute at Florida International University. Meenakshi obtained her Master of Science in Environmental Studies (2012) from Florida International University (FIU) with specialization in Environmental Economics, Environmental Policy, Resource Management, and Geographic Information Systems. She has a M.Sc. and B.Sc. in Zoology, and a Bachelor's in Science Education from the University of Delhi, India.

Vicente Sandoval, Ph.D.

Dr. Sandoval was recently appointed as Visiting Postdoctoral Research Scholar at the Florida International University's Extreme Events Institute (FIU-EEI). Dr Sandoval obtained his Ph.D. in Development Planning at the University College London, a M.Sc. in Urban Management at the Technische Universität Berlin, and a B.A. in Design at the Universidad Católica de Temuco, Chile.

Alejandro Arrieta Ph.D.

Dr. Alejandro Arrieta is a health economist and faculty in the Department of Health Policy and Management at Florida International University (FIU). He holds a Ph.D. in Economics from Rutgers University, an M.A. in Finance from Universidad del Pacifico, and a B.A. in Economics from Universidad Catolica in Peru.

Marije van Lidth de Jeude M.Sc.

M.Sc. Marije van Lidth de Jeude is cofounding director of A-01 (A Company / A Foundation), a transdisciplinary office for innovative sustainable development. M.Sc. van Lidth de Jeude has a bachelor degree in commercial economy and a master degree in cultural anthropology, with a specialization in gender and development studies, from Utrecht University in the Netherlands.

Oliver Schütte Dip.Ing.

Oliver Schütte is co-founding director of A-01. He got his master's architecture degree from the University of Aachen, Germany.

Erick Mazariegos M.Sc.

Erick Mazariegos is associate consultant of A-01. He has a B.A. degree in Architecture from the University Istmo in Guatemala and a M.A. in design and sustainable development of the city, with a specialization in urban landscaping from the Technological Institute of Higher Studies in Monterrey, México.

Erick Palacios Solano CE, CRCE

Erick Palacios is associate consultant of A-01. He is a Civil Engineer from the University of Costa Rica.

Paulo Ruiz Cubillo Ph.D.

Paulo Ruiz is a faculty member of the University of Costa Rica's Geology Department and he works also at the Management and Evaluation Unit of the National Road Network. He has a Ph.D. in Volcanology from Rutgers University; and a B.Sc. of Geology from the University of Costa Rica.

Elías Rosales Escalante, Eng. MSc

Civil Engineer from the Technological Institute and Higher Education of Monterrey (ITESM), Mexico, with M.Sc. in Sanitary Engineering from the International Institute of Hydraulic Engineering and Environmental, (IHE) of Delft, (Holland) The Netherlands.

Omar Darío Cardona Ph.D.

Dr. Cardona is a Civil Engineer of the National University of Colombia, Manizales, with a Ph.D. on Earthquake Engineering and Structural Dynamics from the Technical University of Catalonia. He has graduate studies on Earthquake Engineering, Disaster Prevention and Risk Mitigation in the Institute of Earthquake Engineering and Engineering Seismology IZIIS, Macedonia 1985, Oxford Polytechnic 1991, and Colorado State University, in 1991, respectively.

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Office of Research Integrity
Research Compliance, MARC 414

MEMORANDUM

To:	Dr. Juan-Pablo Sarmiento, Principal Investigator
CC:	File
From:	Eliza Gomez, M.Ed., Coordinator, Research Integrity EG
Date:	November 29, 2017
Protocol Title:	**"USAID/OFDA Performance Evaluation: LAC Urban DRR Programming"**

The Florida International University Office of Research Integrity has reviewed your research study for the use of human subjects and deemed it Exempt via the **Exempt Review** process.

IRB Protocol Exemption #: IRB-17-0384 **IRB Exemption Date:** 11/29/17
TOPAZ Reference #: 106303

As a requirement of IRB Exemption you are required to:

1) Submit an Event Form and provide immediate notification of:
   - Any additions or changes in the procedures involving human subjects.
   - Every serious or unusual or unanticipated adverse event as well as problems with the rights or welfare of the human subjects.
2) Submit a Project Completion Report Form when the study is finished or discontinued.

Special Conditions: N/A

For further information, you may visit the IRB website at http://research.fiu.edu/irb.

Neighborhood Approach - Project Interventions

Category	Intervention Type
A. Physical works	**1. Engineering and physical interventions** Water & Sanitation, drainage systems, retaining walls, retrofitting
	2. Public space Access, connectivity, functionality, social interaction, entertainment, safety
B. Social mobilization gains	**3. Capacity building** Build and enhance knowledge and skills, technical and non-training support
	4. Community empowerment Facilitating community-led development and social progress
C. Environmental improvements	**5. Environmental resilience** Forestation, re-forestation, watershed and coastline management, water resources
D. Institutional arrangements	**6. Governance** Redefining government, civil society, and community roles.
	7. Regulatory Framework Policies, laws, decrees. Land tenure, land use and zoning regulations, building and construction codes
	8. GIS, information, and communication technologies Remote sensing, GIS, big data, mobile technologies
E. Livelihoods and Financial Mechanisms	**9. Markets and financing** Market Mapping & Analysis, Household Economy Analysis, Financing
	10. Rural approaches Food security, mitigation, agriculture, livestock, fishery, climate adaptation
	11. Urban livelihoods Food security, construction and domestic workers, home-based producers, street vendors, transport workers and waste pickers.
F. DRR Intervention	**12. Early warning systems** Hazard monitoring, alert systems, communications
	13. Emergency and disaster management Preparedness, response, local and community disaster committees
	14. Disaster Risk Reduction Prospective, corrective and compensatory risk reduction plans or programs ***(no regulations)***

A. Physical works - Design, construction, and maintenance of urban infrastructure at the neighborhood level.

1. **Engineering and physical Infrastructure** - Interventions geared to provide critical urban infrastructure and to reduce physical vulnerability. It involves settlement and housing approaches.

- ***WASH*** - Environmental Health, Hygiene Promotion, Sanitation, and Water Supply measures implemented in hazard prone and vulnerable urban areas.
- ***Retaining Wall*** - A structure that retains (holds back) any material (usually earth) and prevents it from sliding or eroding away.
- ***Drainage System*** - A system of watercourses or drains for carrying off excess water.
- ***Retrofitting*** - Modifications to the elements of a building to reduce or eliminate the risk of future damage. Structural retrofits are designed to protect elements such as foundations, load-bearing walls, beams, columns, building envelopes, windows, structural floors, roofs, and the connections between these elements. Non-structural retrofitting involves the modification of a building or facility's non-structural elements and may include bracing building contents to prevent earthquake damage or elevation of heating and ventilation systems to minimize or prevent flood damage.

2. **Public space** - Area or place that is open and accessible to all peoples, which facilitates their coexistence and represent their collectivity and common interest.
   - ***Access*** – Efficient and safe transportation, roads, trails, ramps, stairs to the neighborhood
   - ***Connectivity*** – It describes the extent to which urban forms permit (or restrict) movement of people or vehicles in different directions.
   - **Functionality** - Public places play a vital role in the social and economic life, cultural expressions, and recreation according to community needs.
   - ***Social interaction*** - Public spaces allow people to have a meaningful contact with one another within the context of the whole community.
   - ***Entertainment*** - Place used or intended to be used for conducting public entertainment or public meetings
   - ***Safety*** - Designated areas where people should gather after evacuating, avoiding expose evacuating personnel to additional hazards

B. Social Mobilization – It allows people to think and understand their situation and to organize and initiate action to address their priorities with their own initiative and creativity UN-Habitat).

3. **Capacity building** - Build and enhance knowledge and skills, technical and non-training support
4. **Community empowerment** - Facilitating community-led development and social progress

C. Environmental Improvements – Seek for conservation of natural resources, protection of habitats and control of hazards.

5. **Environmental resilience** - Strengthen the capacity of an ecosystem to respond to a perturbation or disturbance by resisting damage and recovering quickly.
   - ***Forestation***- The act of planting trees and other plants covering a large area.

- ***Re-forestation*** - Natural or intentional restocking of existing forests and woodlands that have been depleted, usually through deforestation.
- ***Watershed management*** - Practices to protect and improve the quality of the water and other natural resources within a watershed (DEEP).
- ***Coastline management*** - Practices geared toward nature conservation, recreational activity, habitat and species restoration, coastal defense particularly for protection from coastal erosion and flooding (ICZM).
- ***Water resources management*** - A process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems (GWP).

D. Institutional arrangements - Policies, systems, and processes that organizations use to legislate, plan and manage their activities efficiently and to effectively coordinate with others in order to fulfill their mandate (UNDP).

6. **Governance** - The system of institutions, mechanisms, policy and other arrangements to guide, coordinate and oversee disaster risk reduction and related areas of policy (UN-ISDR).
7. **Regulatory Framework** – Critical Governance's component related to legal and procedural frameworks
8. **GIS, information, and communication technologies** - Information systems that manage, manipulate and analyze spatial data using services and infrastructures which link computer and digital media equipment over telecommunications links.

E. Livelihoods and Financial Mechanisms - Capabilities, assets (including both material and social resources) and activities required for a means of living. Livelihoods are formed within social, economic and political contexts (UNDP – UN-ISDR).

9. **Markets and financing, Household Economy Analysis, and Market Mapping & Analysis** - Set of tools and guidance notes, designed to improve the efficiency and effectiveness of measures taken to ensure people's survival, protect their food-security and their livelihoods. In post-disaster situations, to encourage and assist relief and recovery actors to better understand and make use of market-systems.
10. **Rural approaches** - Food security, mitigation, agriculture, livestock, fishery, climate adaptation
11. **Urban livelihoods** - Food security, construction and domestic workers, home-based producers, street vendors, transport workers and waste pickers.

F. DRR Intervention - Action taken to identify, assess and reduce disaster risks by dealing with environmental, socio-natural and technological hazards, as well as reducing hazard exposure and socio-economic vulnerabilities.

12. **Early warning systems** - An integrated system of hazard monitoring, forecasting and prediction, disaster risk assessment, communication and preparedness activities systems and processes that enables individuals, communities, governments, businesses

and others to take timely action to reduce disaster risks in advance of hazardous events (UNISDR). Involves Hazard monitoring, alert systems, communications.

13. **Emergency and disaster management** - Create and implement preparedness and other plans to decrease the impact of disasters and "build back better" (UNISDR). In includes: preparedness, response, local and community disaster committees
14. **Disaster Risk Reduction** - Measures aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development (UNISDR). It includes Prospective, corrective and compensatory risk reduction plans or programs (no regulations)

Indices Used in the Urban DRR Evaluation

Infomalidad Urbana y Precariedad **- Urban Informality and Precariousness**

Mide el nivel de informalidad y precariedad de una comunidad en su escala legal, física y social en conformidad con la definición de asentamientos informales de UN-Habitat.

It measures the level of informality and precariousness of a community in its legal, physical and social scale in accordance with the definition of informal settlements of UN-Habitat.

Resiliencia Comunitaria **- Community Resilience**

Usamos la definición de resiliencia de USAID como la capacidad de las personas, los hogares y las comunidades para mitigar, adaptarse y recuperarse de los impactos y tensiones de una manera que reduce la vulnerabilidad crónica y facilita el crecimiento inclusivo. Su medición se logra al integrar tres índices: reducción del riesgo, cohesión social y gobernanza del riesgo a nivel comunitario.

We apply the USAID definition of resilience as the ability of people, households, and communities to mitigate, adapt to, and recover from shocks and stresses in a way that reduces chronic vulnerability and facilitates inclusive growth. Its measurement is achieved by integrating three indices: Risk Reduction, Social Cohesion and Risk Governance at the community level.

> ***Reducción del Riesgo de Desastres /*** **Disaster Risk Reduction**
>
> *Mide la percepción de la comunidad en relación a sus capacidades en gestión de riesgos y manejo de emergencias.*
>
> It measures the perception of the community in relation to its capacities in risk management and emergency management.
>
> ***Cohesión social /*** **Social Cohesion**
>
> *Mide la percepción de la comunidad en relación con la cohesión social (niveles de apoyo afectivo e instrumental), así como el sentido de pertenencia (el lugar emocional y político que ocupan dentro de la comunidad). La cohesión social y el sentido de pertenencia contribuyen a la resiliencia de la comunidad y son objetivos instrumentales para lograr el bienestar entre la comunidad.*
>
> It measures the perception of the community in relation to social cohesion (levels of affective and instrumental support) as well as the sense of belonging (the emotional and political locus they occupy within the community). Social cohesion and sense of belonging contribute to community resilience and are instrumental goals to achieve well-being among community.
>
> ***Gobernanza del riesgo de desastres*** **/ Disaster Risk Governance**
>
> *Se refiere a las relaciones y los mecanismos de coordinación entre los actores gubernamentales y no gubernamentales, la sociedad civil y la comunidad para implementar efectivamente la gestión de riesgos y la gestión de emergencias. De manera práctica, en cierto territorio, es posible medirlo a través de la asociatividad, la participación de la comunidad y el involucramiento del gobierno local en un Proyecto de DRR en particular.*

It refers to the relations and mechanisms of coordination between governmental and non-governmental actors, civil society and community to effectively implement risk management and emergency management. In a practical way, in a certain territory, it is possible to measure it through association, community participation and the involvement of the local government in a DRR Project in particular.

Asociatividad / Associativity

Llamada también membresía asociativa se refiere a la capacidad de generar vínculos duraderos, generación de redes o asociaciones, para actuar bajo objetivos o intereses comunes, principios de reciprocidad y confianza.

Called also associative membership refers to the capacity to generate lasting bonds, generation of networks or associations, to act under common objectives or interests, principles of reciprocity and trust.

Involucramiento comunitario / Community involvement

Es el nivel de participación de los miembros de una comunidad en la planificación de una determinada actividad o iniciativa, asociado a la apropiación de recursos, el compromiso con el mantenimiento de logros y ganancias alcanzados y la capacidad de ejercer un nivel de control o auditoría sobre sus propios emprendimientos.

It is the level of participation of the members of a community in the planning of a certain activity or initiative, associated with the allocation of resources, the commitment to maintain achievements and gains, and the ability to exercise a level of control or audit of their own ventures.

Involucramiento del gobierno local / Local Government involvement

Es el nivel de participación del gobierno local en la planificación de actividades o iniciativas dirigidas a una comunidad, asociado a la apropiación de recursos, el compromiso con el mantenimiento de logros alcanzados y la capacidad para establecer reglas, comunicarlas y hacerlas cumplir.

It is the level of participation of the local government in the planning of activities or initiatives geared toward a community, associated with the allocation of resources, the commitment with the maintenance of achievements and gains, and the ability to establish rules, communicate and enforce them.

***Cumplimiento con la planificación y la zonificación urbana* - Compliance with urban planning & Zoning**

En asentamientos informales, hace referencia a la funcionalidad en la ocupación del territorio, la interacción con el medio natural y construido, la aplicación de de las pautas o normas básicas de urbanismo así como su cumplimiento por la comunidad.

In informal settlements, it refers to the functionality in the occupation of the territory, interaction with the natural and built environment, the application of the guidelines or basic rules of urbanism as well as its compliance by the community.

a- *Acceso y formas urbanas (físicamente evidentes)* - Access and urban shapes (physically evidents)

Patrones nucleados, donde las construcciones/viviendas se agrupan, generalmente alrededor de una intersección de caminos, el cruce de un río o arroyo, o entre áreas urbanas existentes; o lineal, cuando las construcciones tienen una forma lineal, generalmente a lo largo de carreteras, ferrocarriles, canales, diques, valles, piedemonte, pendientes y otros lugares con poco espacio para crecer de otra manera. En cualquier caso, las construcciones/viviendas están conectadas directamente con los espacios públicos y las vías de acceso/caminos del asentamiento.

Nucleated patterns, where the constructions/dwellings are grouped, usually around an intersection of roads, the crossing of a river or stream, or between existing urban developed areas; or linear, when the constructions have a linear shape usually along roads, railways, canals, dikes, valleys, piedmonts, slopes, and other places with little space to grow in another way. In any case, constructions/dwellings are connected directly to the settlement's public spaces and access paths/roads.

b-*Respeto por la zonificación básica (zonificación verde, áreas propensas a peligros, uso de la tierra)* - Respect for basic zoning (green zoning, hazard prone areas, land use)

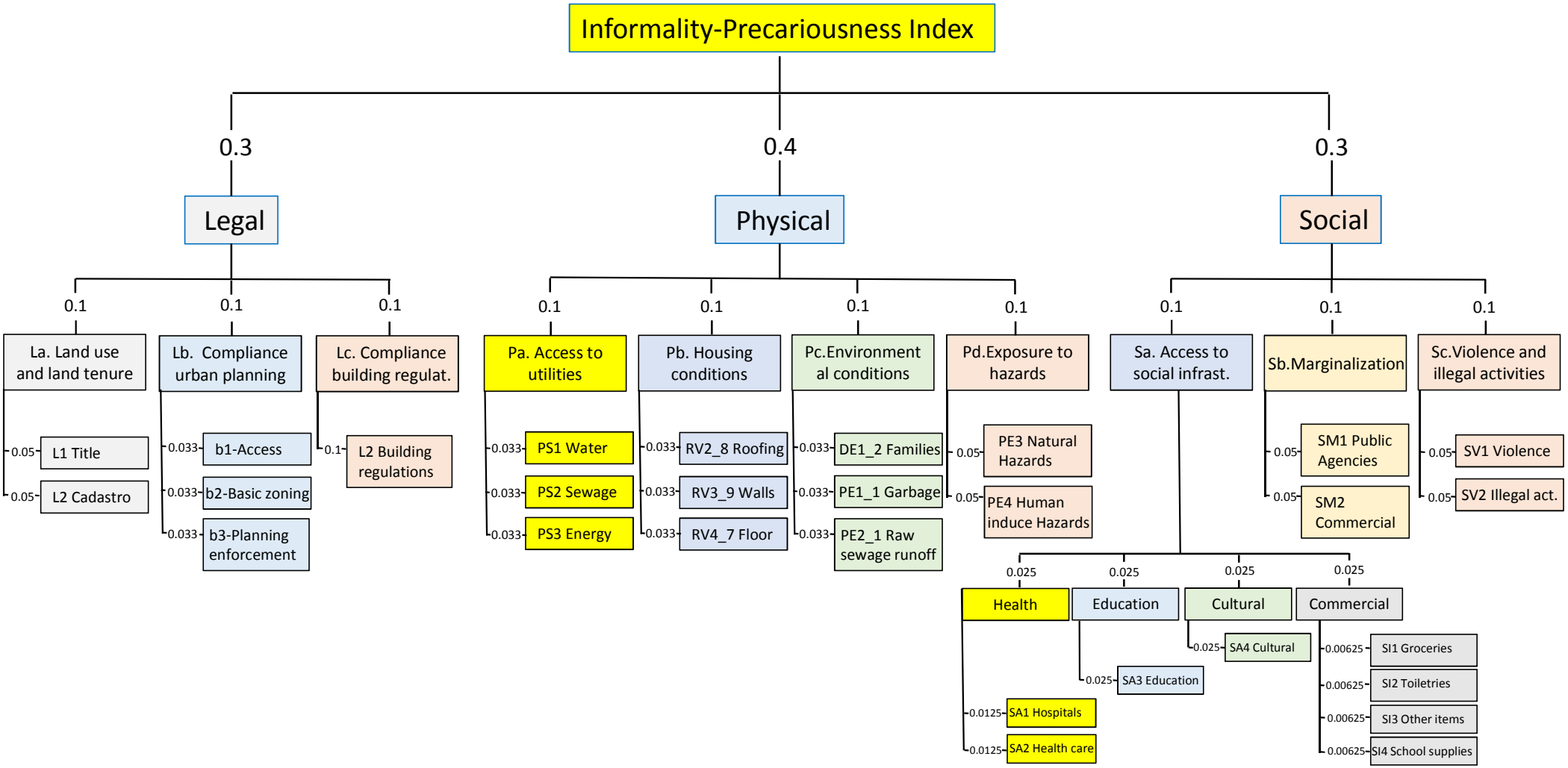
Cumplimiento de la comunidad sobre las restricciones de uso de la tierra asociadas con áreas verdes y propensas a amenazas dentro del territorio.

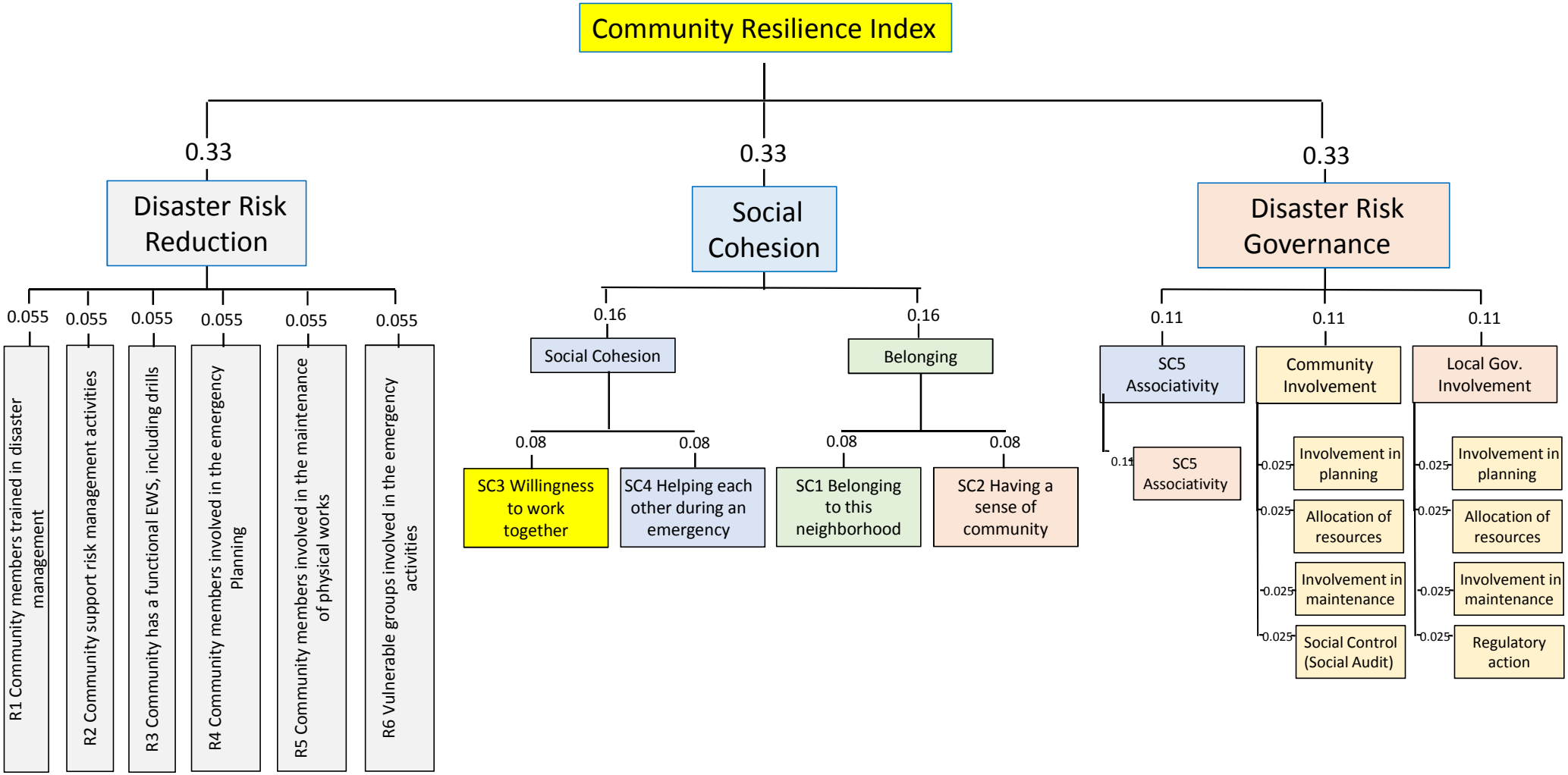
Community compliance on land use restrictions associated with green and hazard prone areas within the territory.

c-*Aplicación de la planificación urbana* - Urban planning enforcement

Existencia de un conjunto de normas, reglas, acuerdos, prácticas o acciones de la autoridad local para ejercer control sobre el uso de la tierra en el territorio.

Existence of a set of norms, rules, agreements, practices, or actions of the local authority aimed at exercising control over land use in the territory


Informality-Precariousness Index
0.3
0.4
0.3
Legal
Physical
Social
0.1
0.1
0.1
0.1
0.1
0.1
0.1
0.1
0.1
La. Land use and land tenure
Lb. Compliance urban planning
Lc. Compliance building regulat.
Pa. Access to utilities
Pb. Housing conditions
Pc.Environmental conditions
Pd.Exposure to hazards
Sa. Access to social infrast.
Sb.Marginalization
Sc.Violence and illegal activities
0.05
L1 Title
0.05
L2 Cadastro
0.033
b1-Access
0.033
b2-Basic zoning
0.033
b3-Planning enforcement
0.1
L2 Building regulations
0.033
PS1 Water
0.033
PS2 Sewage
0.033
PS3 Energy
0.033
RV2_8 Roofing
0.033
RV3_9 Walls
0.033
RV4_7 Floor
0.033
DE1_2 Families
0.033
PE1_1 Garbage
0.033
PE2_1 Raw sewage runoff
0.05
PE3 Natural Hazards
0.05
PE4 Human induce Hazards
0.025
0.025
0.025
0.025
Health
Education
Cultural
Commercial
0.025
SA4 Cultural
0.025
SA3 Education
0.0125
SA1 Hospitals
0.0125
SA2 Health care
0.00625
SI1 Groceries
0.00625
SI2 Toiletries
0.00625
SI3 Other items
0.00625
SI4 School supplies
0.05
SM1 Public Agencies
0.05
SM2 Commercial
0.05
SV1 Violence
0.05
SV2 Illegal act.


Community Resilience Index
0.33
Disaster Risk Reduction
0.055
R1 Community members trained in disaster management
0.055
R2 Community support risk management activities
0.055
R3 Community has a functional EWS, including drills
0.055
R4 Community members involved in the emergency Planning
0.055
R5 Community members involved in the maintenance of physical works
0.055
R6 Vulnerable groups involved in the emergency activities
0.33
Social Cohesion
0.16
Social Cohesion
0.08
SC3 Willingness to work together
0.08
SC4 Helping each other during an emergency
0.16
Belonging
0.08
SC1 Belonging to this neighborhood
0.08
SC2 Having a sense of community
0.33
Disaster Risk Governance
0.11
SC5 Associativity
0.11
SC5 Associativity
0.11
Community Involvement
0.025
Involvement in planning
0.025
Allocation of resources
0.025
Involvement in maintenance
0.025
Social Control (Social Audit)
0.11
Local Gov. Involvement
0.025
Involvement in planning
0.025
Allocation of resources
0.025
Involvement in maintenance
0.025
Regulatory action

Performance Evaluation:
LAC Urban DRR Programming
The Neighborhood Approach

ANNEX 3

Main Findings and Survey Results

USAID
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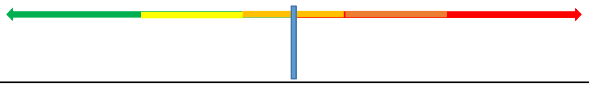
FIU | Extreme Events Institute
FLORIDA INTERNATIONAL UNIVERSITY

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Main Findings and Survey Results
- Formality-Informality Relationship in Urban Settings
- Social Cohesion
- DRR
- Disaster Risk Governance

Formality-Informality Relationship in Urban Settings

Formality 0 — 10 Informality



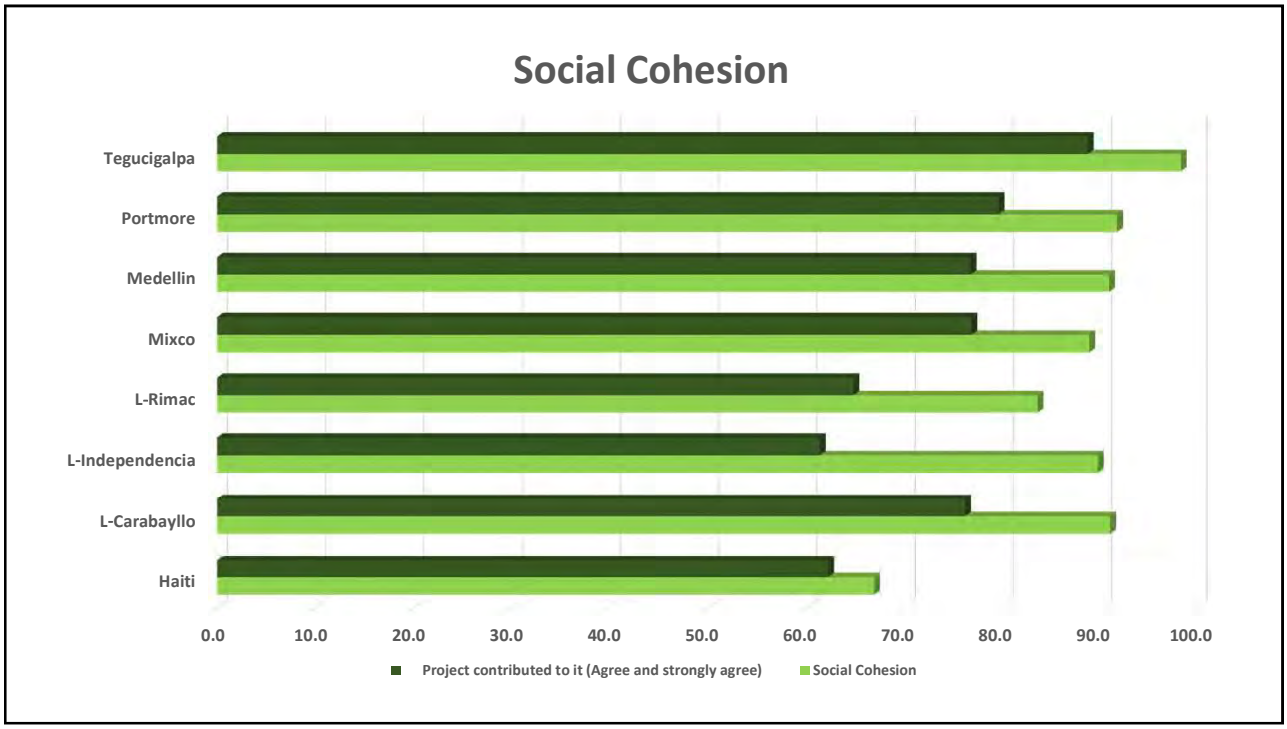
Legal		
Proper land titles Proper cadastral registration	**a. Land use and land tenure**	Land which occupants live in illegality, no cadastral records
Compliance with planning & zoning	**a. Compliance with urban planning & Zoning**	Unplanned settlements
Compliance with building regulations	**a. Compliance with building regulations**	Houses are not in compliance with building regulations
Physical		
Complete Access to utilities	**a. Access to basic sanitary services (water, sewage, energy)**	Lack of access to basic sanitary conditions water & sanitation
Sound houses, fulfilment of Int. housing standards	**a. Structural housing conditions**	Poor housing conditions
Fulfilment of Int. environmental standards	**a. Environmental conditions**	Overcrowding, environmental degradation
Low exposure to natural and human induce risks	**a. Exposure to natural and human induced hazards**	High exposure to natural and human induced hazards
Social		
Access to social infrastructure	**a. Access to social infrastructure: health, education, cultural, commercial**	No access to social infrastructure
Social inclusion	**a. Marginalization**	Social, economic, educational, and cultural marginalization
Safe environment, law enforcement	**a. Violence and illegal activities**	Intra-family violence, gangs, drugs, crime, no law enforcement



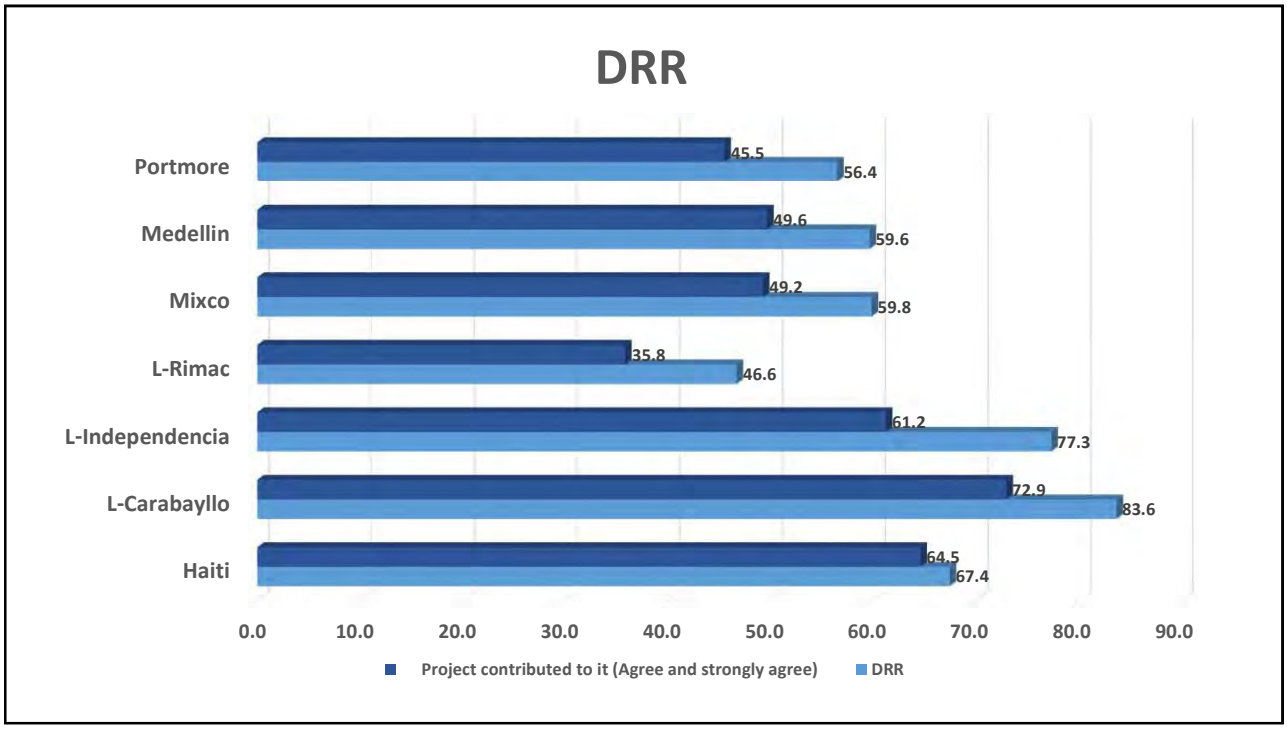
Legal	Haiti	L-Carabayllo	L-Independ.	L-Rimac	Mixco	Medellin	Portmore	Tegucigalpa
a. Land use and land tenure	0.643	0.540	0.127	0.160	0.327	0.212	0.707	3.26
b. Compliance with urban planning & Zoning	0.889	0.444	0.333	0.444	0.222	0.222	0.556	0.111
c. Compliance with building regulations	0.700	0.861	0.651	0.725	0.053	0.378	0.691	6.59
Physical								
a. Access to water, sewage, energy	0.779	0.121	0.023	0.053	0.040	0.015	0.212	0.15
b. Structural housing conditions	0.078	0.129	0.053	0.061	0.206	0.318	0.008	0.08
c. Overcrowding, environmental degradation	0.481	0.485	0.409	0.545	0.508	0.364	0.411	5.61
d. Exposure to natural and human induced hazards	0.861	0.838	0.773	0.773	0.581	0.658	0.844	8.38
Social								
a. Access to social infrast.: health, education, cultural, commercial	0.468	0.327	0.278	0.264	0.327	0.23.4	0.207	3.85
b. Marginalization	0.117	0.011	0.091	0.068	0.048	0.068	0.045	0.45
c. Violence and illegal activities	0.226	0.153	0.168	0.295	0.055	0.241	0.278	1.97

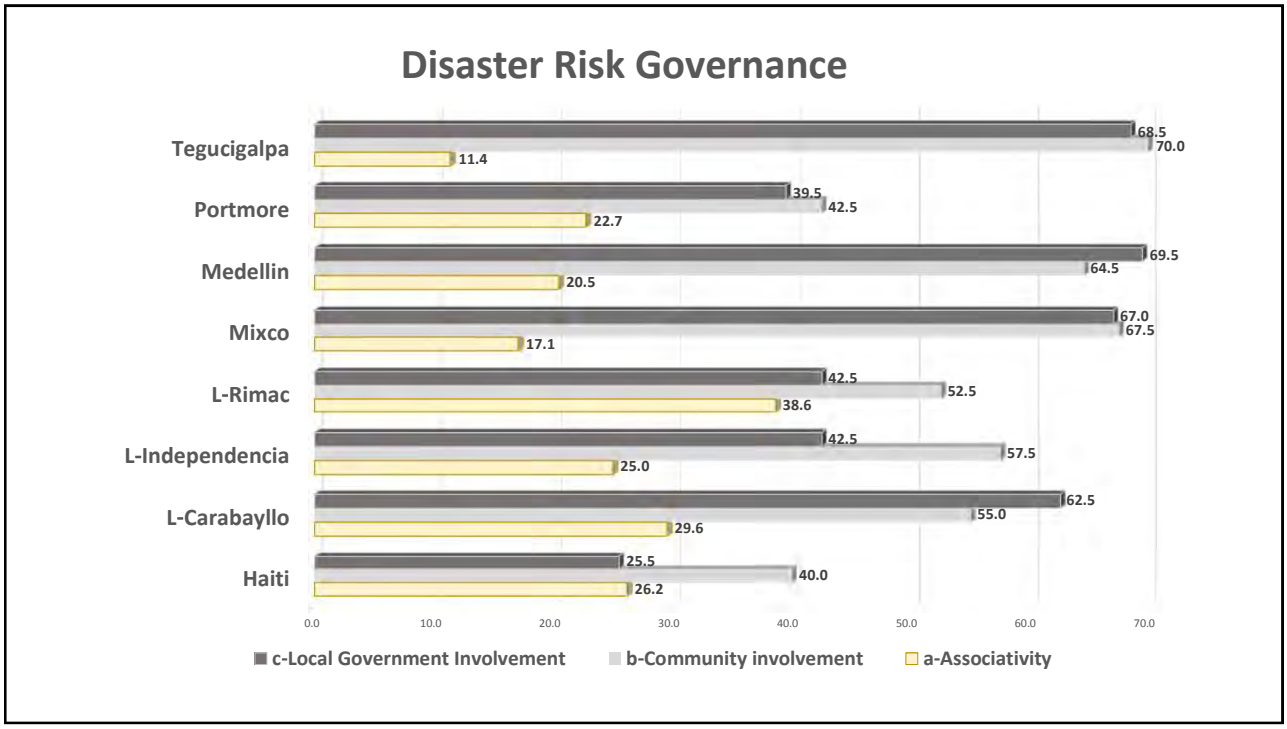
	Haiti	L-Carabayllo	L-Independ.	L-Rimac	Mixco	Medellin	Portmore	Tegucigalpa
Legal (0-30)	22.32	18.44	11.11	13.29	6.02	8.12	19.53	10.95
Physical (0-40)	21.98	15.72	12.58	14.32	13.35	13.55	14.75	14.21
Social (0-30)	8.12	4.91	5.38	6.27	4.30	5.43	5.31	6.27
Formality-Informality Index (0-100)	52.41	39.08	29.07	33.88	23.67	27.09	39.59	31.43

Social Cohesion	Haiti	L-Carabayllo	L-Independ.	L-Rimac	Mixco	Medellin	Portmore	Tegucigalpa
1- Strong sense of belonging to this neighborhood	54.8	93.2	86.4	90.9	82.9	90.9	88.1	100.0
Project contributed to it (Agree and strongly agree)	51.2	77.3	56.8	70.5	73.8	75.0	77.3	*90.9*
2- Living here give you a sense of community?	84.1	86.4	77.3	90.2	84.1	84.1	88.4	97.7
Project contributed to it (Agree and strongly agree)	58.1	68.2	56.8	59.1	78.6	68.2	79.5	*86.4*
3- Willingness to work together to improve your neighborhood	78.6	78.6	100.0	93.0	93.2	95.1	100.0	100.0
Project contributed to it (Agree and strongly agree)	74.4	86.4	65.9	75.0	83.3	79.5	90.9	*88.6*
4- Neighbors would help each other during an emergency	71.4	86.4	92.9	72.7	86.8	92.9	90.0	95.5
Project contributed to it (Agree and strongly agree)	65.1	72.7	65.9	54.5	71.4	84.1	70.5	*88.6*



DRR	Haiti	L-Carabayllo	L-Independ.	L-Rimac	Mixco	Medellin	Portmore	Tegucigalpa
1- Community has members trained in DRR	52.4	90.5	68.3	53.7	48.7	51.5	44.4	71.8
Project contributed to it (Agree and strongly agree)	51.2	77.3	52.3	34.1	42.9	40.9	36.4	59.1
2- Community has motivated members who support DRR	62.8	90.5	85.7	59.5	76.9	31	72.2	94.9
Project contributed to it (Agree and strongly agree)	62.8	81.8	61.4	50	64.3	61.4	56.8	79.5
3- Community have a functional EWS including drills	58.1	65.1	68.2	32.6	37.8	23.1	19.5	64.9
Project contributed to it (Agree and strongly agree)	51.2	61.4	59.1	27.3	31	18.2	18.2	50.0
4- Community involved in the emergency plan implementation	57.1	87.2	75.6	34.2	54.8	13	51.4	62.2
Project contributed to it (Agree and strongly agree)	55.8	70.5	52.3	20.5	38.1	25	40.9	45.5
5- Community involved in maintenance of projects' physical works	93	82.9	83.3	52.3	76.3	40	85	81.4
Project contributed to it (Agree and strongly agree)	90.7	70.5	70.5	43.2	64.3	86.4	68.2	70.5
6- Social Inclusion V+W	80.8	85.6	82.6	47.7	64.1	82.1	66.1	79.2
Project contributed to it (Agree and strongly agree)	75.6	76.1	71.6	39.8	54.8	65.9	52.3	68.2


DRR
Portmore
Medellin
Mixco
L-Rimac
L-Independencia
L-Carabayllo
Haiti
45.5
56.4
49.6
59.6
49.2
59.8
35.8
46.6
61.2
77.3
72.9
83.6
64.5
67.4
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
Project contributed to it (Agree and strongly agree)
DRR


Disaster Risk Governance
Tegucigalpa
Portmore
Medellin
Mixco
L-Rimac
L-Independencia
L-Carabayllo
Haiti
68.5
70.0
11.4
39.5
42.5
22.7
69.5
64.5
20.5
67.0
67.5
17.1
42.5
52.5
38.6
42.5
57.5
25.0
62.5
55.0
29.6
25.5
40.0
26.2
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
c-Local Government Involvement
b-Community involvement
a-Associativity

Performance Evaluation:
LAC Urban DRR Programming
The Neighborhood Approach

ANNEX 4.1

Support Documents
Physical Works





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Physical Works
- Lima – Carabayllo, Peru
- Lima - Independencia, Peru
- Lima - Rimac, Peru
- Medellin, Colombia
- Mixco, Guatemala
- Port-de-Paix and Anse-à-Foleur, Haiti
- Portmore, Jamaica
- Tegucigalpa, Honduras

FACT SHEET: LIMA – CARABAYLLO

Communities:	3 de Octubre, Libertadores, Bellavista, Comité 38-B, Rafael Álvarez y Sol Naciente
Main Intervention:	**Advanced warehouse and community house:** The advanced warehouse is a safe place and designed for the storage of equipment, tools and other materials necessary in cases of a disaster and works as a refuge / shelter for people. The communal space is a place where community groups have meetings and can also be used for social events.
General construction description:	**Advanced warehouse**: building with masonry walls, columns and beams made with bamboo, wooden structure and galvanized sheets for the roof, reinforced concrete foundation, reinforced concrete slab, foundation shoes and foundation beams. **Community house**: building with columns and beams made with bamboo, wooden structure and stringers wooden or bamboo for the roof, galvanized sheets, concrete foundation, reinforced concrete slab and lateral closures with cane. The interventions cost is between USD14.600 and USD22.500.
Key question: in how far is the (physical) vulnerability reduced (e.g. actual reduction of the community disaster hazard risks)	The physical works were designed and built by professionals in engineering and architecture. The structures are seismic resistant and follow the construction codes and norms. They are used by the community for organizational and social meetings, and can serve as a shelter in case of a disaster. The structures reduce the risk condition if the disasters are of medium or small scale. However, when stronger events occur, it is possible that the structures are affected by a global condition of the area; for example: "huaicos", landslides, falling rocks or heavy rains. In this condition, the structures start to be insecure. Also, they are vulnerable to other external situations like the collapse of a nearby building or wall.
Techniques used **Score:** Quite effective (4)	**Advantages:** _Professional staff used for construction: Save the Children, Municipality of Carabayllo, National University of Engineering – CISMID, local Builders Architects and Engineers. _Community participation. _The selected materials are of good quality and had a good handling during the construction process. _All the structures have good finishes and appropriate dimension. _In some cases, additional works were built, such as retaining walls (*pircas*), steps, railings, bathrooms, gardens and concrete ramps to complement the main works for comfort and structural security. _The structures have a secure electrical system (PVC pipes). _In some cases, some materials were used from the previous structures for example for the lateral closures, which contributes to the efficiency of the works. _The structures do not require short-term maintenance.
	Disadvantages: _The structures, in spite of being built with correct and stable construction procedures, may be vulnerable to strong shocks, for example, earthquakes, landslides and falling rocks. Also, other nearby structures can put at risk the interventions. _ Around every two years the bamboo requires maintenance. _*Comité 38 – B*: The advanced warehouse is located at a lower level from the community house, like a basement, which can be a dangerous condition because of the limited space where people can get trapped or get hurt.

_*Rafael Álvarez and Sol Naciente:* some of the bamboo elements for columns are not attached to the base of the concrete blocks, which can be dangerous because the structure can collapse in the event of a disaster.

_*Libertadores:* an erosion problem near one of the property boundaries induced by runoff water, this may put at risk the same structure as well as a retaining wall on the neighboring property.

Not at all Effective	Slightly Effective	Moderately Effective	Quite Effective	Extremely Effective
			X	
The interventions are described as “Quite Effective” because of their earthquake resistancy, having followed construction standards and having applied a correct selection and use of materials. The community appropriate the works, which led the development of secondary works such as: bathrooms, bamboo rails, concrete steps and a children's playground. However, there are two critical conditions that must be corrected immediately, in the case of Sol Naciente and Libertadores where the works can be put at risk as described in the report. In the sites of Alto Perú and Nuevo Milenio, the interventions consisted in the improvement of the *pircas* so that the community could rebuild their community house, but this has not happened (yet).				

Photographic compilation:

3 de Octubre



Libertadores



Bellavista



Comité 38-B



Rafael Álvarez



Sol Naciente



FACT SHEET: LIMA – INDEPENDENCIA

Communities: Volante II y III & Villa El Angel

Main Interventions:

Forestation and water tanks for the irrigation system (including concrete houses): The intervention consists on a forestation with trees in a strategic point of the hill with the objective that once the trees have grown, the environmental condition of the community is improved but also protect against rock falling, landslides or detritus. For this to work it was necessary to install an irrigation system with the implementation of water tanks and a net of hoses required to carry the water helped by hydraulic pumps placed inside of concrete houses one in the lower part of the hill and another one in the top.

Public areas: The intervention consists on the construction of a square including a green area, sidewalks, concrete stairs, pedestrian passages and railings. The structures were built to create public and secure spaces for the community. The principal objective with these interventions was to create escape routes and meeting points during risk situations.

General construction description:

Concrete houses: consists of two structures built with bricks (with steel reinforcement) and mortar, a continuous beam around it and columns in the corners and in the center of the walls. It has an area of approximately 32m2. On the right side, there is a retaining wall that starts about 2.2m in depth (under the ground). A foundation beam anchored to the wall and the slab was built around the site. These descriptions are observed in the construction plans. The ceiling structure was built with rectangular steel tubs and steel sheets. There are installed ventilation grills on the left side of the structure. A retaining wall was built on the left side of the property.

Water tanks and irrigation system: consist of an implementation of pumping equipment joined to the water tanks that push the water through by-pass valves and pumps. The water is pumped through a net of hoses inside the ground that keep the soil wet around the shrubs, trees and desert plants. There is another pipeline that leads the water and fill other tanks placed on the concrete house on top of the hill and the irrigation is repeated to other forestation parts. In general terms, the intervention is 90% complete.

Public areas: Consist of a circular area built with stone paving blocks and a green area around it. Near the square, a concrete ramp was built to communicate with a sports field. A steel railing was installed over the ramp. Adjacent to the square begins a pedestrian passage to communicate another larger area built with paving blocks too. This new area has vertical steel tubes to prevent the entry of cars and protect people. Concrete sidewalks were built around this area. Entering the community steel railings were placed over some concrete walls built by the Municipality of Independencia. Another part of this intervention is the reconstruction of a concrete stairs that communicate with another section of the community.

Techniques used: **Score:** Quite effective (4)

Advantages:

Forestation and water tanks for the irrigation system:

- A Forest Engineer was contracted to guide the process of forestation.
- Seismic resistant structures.
- Professional staff: PREDES Center for Studies and Prevention of Disasters, Municipality of the District Independencia, National University of Engineering – CISMID, SENCICO National Training Service for the Construction Industry, Local Builders, Architects and Engineers.
- Community participation.
- The selected materials are of good quality and had a good handling during the construction process.
- All the structures have good finishes and appropriate dimensions.
- Inside the concrete houses an efficient electrical system has been installed to operate the pumping system.
- It is also important to mention that the pumping system is safe inside the concrete houses, any damage in the system can put plants / trees at risk.

- The retaining wall built for the lower house protects the structure from falling rocks or landslides.
- The water pipes (PVC) collocated between concrete houses are in ditches about 0.30x0.30cm and will be filled with sand to protect it. It is important to say that if the ditches are not filled, the pipe system can be exposed to damage and the entire irrigation process will be stopped. The valves along the pipes system will be protected with small concrete boxes, principally for maintenance. This protection was being installed while we made the field visit.

Public areas:

- Places with good dimensions and good construction techniques.
- Physical works were developed by people who know the construction processes.
- No vehicles can enter in this area due to the placement of bollards. Therefore, the square is always free of big obstructions and adequate to serve as a safe meeting point in case of a disaster.
- These spaces are not only secure points for people in risk condition but also impulse people to develop recreational activities.

Disadvantages:

Forestation and water tanks for the irrigation system:

- The location of the houses is difficult, for example to carry equipment and materials there but also the route to take towards the house up the hill is a bit dangerous for people because of the slope of the hill and the road is sandy and rocky.
- The pumping system requires constant maintenance for a good functioning of the system and should have a group of people assigned with a good training to operate the equipment, this must be associated with a budget for the operation.
- The house at the top may be exposed to vandalism due to distance to other houses. It is rather excluded.
- The climate and the humidity condition could be a factor of deterioration for the intervention, especially for the concrete houses and the pumping system inside, as well as for the electrical system.

Public areas:

- The green area around the square will need constant maintenance and this will have a cost. When we were there a municipal officer was providing this maintenance.
- Due to dogs that live in the community there are many excrements on the square, pedestrian walks, sidewalks and concrete stairs. it can be provoking an accelerate wear of the interventions.
- Some people talked about the dimensions of the railings because they are safe for adults but not for children, as they could fall through due to the wide opening between them.
- The concrete staircase in the community has been repaired almost 3 or 4 times, but not because of a bad construction process, but because many people walk on them and sometimes pull construction materials over the stairs, equipment or others. It is an indicator of a lack of appropriation and maintenance.

Key question: in how far is the (physical) vulnerability reduced (e.g. actual reduction of the community disaster hazard risks)

Not at all Effective	Slightly Effective	Moderately Effective	Quite Effective	Extremely Effective
			X	

Forestation and water tanks for the irrigation system: The physical works were observed in good structural conditions and comply the technical specifications for the construction process. The risk in which people live due to landslides, detritus or falling rocks will be reduced if there is adequate growth of the trees. This depends on how people take care of the physical works, their function and maintenance for the installed irrigation system.
Public areas: The physical works were observed in good conditions and with a good structural development. The construction was made by contractors with good techniques. The dimensions were indicated in the design plans and the construction was supervised by professionals in engineering and architecting. The criteria for the selected physical interventions were safe places within the community where people could go to in case of a disaster.

Physical Works

FACT SHEET: LIMA – RIMAC

Communities: Flor de Amancaes, Las Brisas, Francisco Pizarro Ave. and Quinta Jirón Chiclayo 363

Main Intervention:

It consists of 5 interventions located in the indicated communities

1) *Forestation:* in terms of physical works this intervention corresponds to a concrete tank where people pour their sewage day by day which is treated through a natural cleaning process by the "carrizo" plant. The water goes to a plastic tank and a hydraulic pump carries the clean water to a hose (irrigation system) and finally to the trees. Then, once the trees have grown, their objective is to protect the community against landslides or rock falling.
2) *Tribune:* this physical work is at the top of the community of Las Brisas. It is a wooden structure in front of a soccer square where people can sit and watch the game, rest or get together.
3) *Bus stop:* consists of a wooden structure for people waiting for a bus or other public transport.
4) *Evacuation routes:* consists of the construction of concrete sidewalks, wooden and steel railings, concrete stairs and two retaining walls. All these structures integrated have the purpose of facilitating the escape of the people during a disaster.
5) *Shoring and ladder:* consists of the placement of wooden props for the reinforcement of an intervened building and a wooden ladder for the second floor. The shoring was carried out on an external balcony within the internal courtyard. The property already had some accessories before the intervention was made, as is observed in the detailed plans for the internal area (Patio 1) and at the entrance just below the balcony.

General construction description:

1) *Forestation:* In terms of physical works, the intervention consists of a biochemical wastewater treatment system where 15 neighboring families deposit laundry, kitchen and shower water. The water is deposited in a reinforced concrete tank and directed to a plastic storage tank and a submersible pump directs the water to a polyethylene drip irrigation hose. Cleaning the waters within the wetland will take approximately 1.5 days of treatment.
2) *Tribune:* a wooden structure with columns for ceiling support and a space to sit. Plastic sheets were used for the roof. The structure is placed in ready-mix concrete blocks that are emptied into oil trays that work as a foundation.
3) *Bus stop:* simply placed on the sidewalk next to the street with a small platform used as a step to access the structure. Some drawers were built at the ends of the structure to be used as garbage dumps and others as flower boxes.
4) *Evacuation routes:* Las Brisas y Flor de Amancaes: new stairs were built in concrete and the railings were placed in wood and rope on both sides of the sidewalks. Additionally, a reinforced concrete wall was built. Leticia: steel railings were built (~100 m) at existing passage ways and concrete stairs were improved. Also, a concrete wall with steel rods was anchorage to the ground. The stairs and railings were placed only in some routes but located in the places of greater risk.
5) *Shoring and ladder:* The struts are made with sanded and wood treated with preservative, sealer and varnish. They are supported on lower and upper beams and a diagonal wood element is used to rigidize the different sections of the shoring. Rectangular wooden plates were used and nailed to the connection points of the elements. Wooden wedges were used to adjust the struts to the lower and upper beams. The new wooden stairs is in excellent condition and has good dimensions.

Techniques used. Score: 3.4 = between moderately and quite effective

Advantages:

Forestation:

- The implemented system has a good functionality and sustainability because there are people who contribute sewage water, the principal resource for the wetland and thus for the irrigation system.
- The wetland was not complicated to build and can be replicated in other points of the community; the knowledge can be easily transmitted to other people. Also, it does not require a high maintenance.

- The pump used inside the storage tank is automatic and does not require a person to manipulate it.

Evacuation routes:
- They are in higher places or in places that are difficult to access, where people are in the highest risk condition.
- People use these points to meet or rest as they walk around.
- Some people or families benefited with the works, because their house entrances are in a better condition.

Tribune and bus stop: These works improve the quality of life of the users.

Disadvantages:

Forestation:
- One disadvantage could be that while the trees continue to grow, people will be at risk in case of a disaster.
- If people stop bringing the wastewater for some reason, the irrigation process will stop and put into danger the sustainability of the whole forestation area.

Tribune and bus stop:
- These structures do not reduce the vulnerability in case of disaster.
- They are not considered to be structures with a long useful life.

Evacuation routes:
- Some works in Las Brisas were observed with erosion problem which can affect their stability.
- The steel railings located in Leticia were observed with problems at ground level due to garbage and dog excrements, which is causing deterioration.
- Some passages in Leticia that were repaired with concrete were made on irregular points and the relief of the site is not the most appropriate; these places are still a little dangerous for people due to the existing slope.

Shoring:
- The building where the intervention was carried out is quite old and subsequently has structural deficiencies.
- It is considered that the work done may have stability problems during an earthquake. The location of the columns is not the most appropriate and is not in symmetry with the existing structural elements.
- It is observed that some of the wooden plates placed in the joints of the elements are damaged, including by the placement of the nails.
- Vertical elements (columns) placed directly on the ground can start to have problems due to humidity and deterioration.

Key question: in how far is the (physical) vulnerability reduced (e.g. actual reduction of the community disaster hazard risks)				
Not at all Effective	**Slightly Effective**	**Moderately Effective**	**Quite Effective**	**Extremely Effective**
		X		
The interventions are described as “Moderately Effective” because: In case of the **forestation**, there will be a reduction of the vulnerability if there is a controlled and adequate growth of the trees preventing them from dying. However, this depends on the use and maintenance given to the built physical works. In general, the growth of trees can help to consolidate the soil surface and protect the community from falling rocks or detritus during a disaster. The **evacuation routes** reduce the risk as people have an escape route to a safe area when a disaster occurs. In the case of **shoring**, the risk will be reduced only in case of events of low or moderate intensity. If a strong event, like an earthquake, occurs, the building will collapse before people can get out. The role of the **bus stop and tribune** in reducing risk is not exactly identified				

FACT SHEET: MEDELLIN - COLOMBIA

Communities: Comuna 8 (Llanaditas – El Pinal) y Comuna 1 (Santo Domingo Savio (SDS) - El Compromiso)

General construction description:

1) *Steps / stairs, railings and sidewalks:*

The steps were built with concrete at the entrances and some other points of the communities. In Llanaditas and Pinal they have concrete ditches and manholes for runoff water. In general, the concrete used for the steps is 210 kg / cm2 of resistance.

SDS: steps are 3.5m wide and 10.5m in length, masonry walls were built on both sides. One wall is 8m long and 1.7m high and built with concrete frames (beam / column) and the cells of the blocks are filled with concrete. The other one is 60cm tall.

In Llanaditas, one wooden stair was built, going down into the vegetable garden. It has an excellent presentation and a good construction process. it also has a wooden railing for the safety of the people.

The sidewalks built with reinforced concrete are 10 cm thick, before building the ground is leveled and prepared. To one side the sidewalk is covered with "Wedelia and Vetiver" plants for erosion control.

The railings are made with steel and are painted, always located on the side of the steps or sidewalks. The measures are the same ones that the Municipality uses, and they are united with plates and steel screws to the concrete. They are 1.3m high. Each railing section has 12cm between bars.

2) *Vegetable gardens:* Green areas used for planting vegetables.
Commune 8 (Llanaditas): 40m x 40m approx.
Commune 1 (SDS): 65m x 70m approx.

The areas have ~50 degrees of inclination and they are in places where landslides occurred. The places were sites used as garbage dumps. There are improvised greenhouses made with wood, bamboo and plastic or saran meshes. Plastic tanks are used for planting.
In a more rural area of El Pinal households have small vegetable gardens in their plots, which consist in an enclosure with steel mesh and wooden posts. Here people grow other types of vegetables.

3) *Solar lamps:* Consist of LED lighting systems, which work with batteries adapted to solar panels. Installed about 15 - 20m away from each other approximately.

4) *Retaining walls and surface coating:* Consists of masonry walls with concrete frames (columns and beams). SDS has two walls on the sides of both concrete steps. In Llanaditas there is a wall built for a house.
Some points have concrete covers on little slopes, no more than ~2m high. This coating protects the soil surface against erosion; normally applied on stable slopes without slide condition. For this work a steel hexagonal mesh (typically used for poultry fences) was anchored to the surface of the ground, after which concrete is poured all over the soil surface

5) *Retrofitting:* consists of the construction of a beam around the houses made of reinforced concrete. A gable wall of bricks was built above the beam and fiber-cement roofs were placed on a group of houses in the community of El Pinal.

Techniques used. Score: = 4 (quite effective)

Advantages:

1) *Steps, railings and sidewalks:* They are resistant structures and comply with design standards, they are safe and located where there is a higher presence of people walking, they do not require early maintenance because there is no damage, the rails are a little scratched, but it is for use. They are located at risk-vulnerable points such as the edge of slopes, houses at lower levels or even some points that the structure (sidewalk) is almost cantilevered. On one of the sidewalks of El Pinal, the slope of the land was reduced, it is about 1.5m wide and built in little blocks to prevent cracking.

2) *Vegetable gardens:* The existing contour lines are used to develop the planting in both community gardens. It is the recommended technique because it does not generate major modification of the topography. Sheet piles are used for the conformation and containment of the land where plants are sown. It is a recommended method, easy to do and inexpensive. They are 1.3m or 0.8m high. Vetiver plants are also used for soil stabilization, a technique commonly used, low cost and with good results. It allows the reuse and recycling of other materials such as plastic containers and wood. It generates employment and there are families that benefit from the consumption of plants.
For the individual gardens in El Pinal the mesh delimits the properties and people have more appropriation of their lands and crops.

3) *Solar lamps:* They are in places where there is no interference with the capture of sunlight. They are practical and manipulable systems (low complexity). The luminosity has a range of 12m. The LED light is protected by a plastic bottle, a good initiative in recycling. It is an "inexhaustible source" system.

4) *Retaining walls and surface coating:* These structures are resistant to earthquakes. They are well constructed. SDS: the walls give security to the steps. You can see the cells of blocks filled with concrete, very important for their rigidity. In Llanaditas, the wall benefits two households, in one case it protects the entrance of the house and the other, the wall retains the land for the stability of the house.

5) *Retrofitting:* The fiber-cement materials used can withstand high temperatures and the spread of fire. It is a relatively cheap material compared to other materials used in construction.

Disadvantages:

1) *Steps, railings and sidewalks:* No disadvantage of the works done is found or observed, other than the necessity of building more.

2) *Vegetable gardens:* Vetiver is not growing much because there is still garbage and debris in the ground which may be preventing the plant from growing. There is no drainage system for the control of runoff water. This generates gullies and damages the crops. It is not possible to install an irrigation system, for example during the dry season, because it can generate a saturation of the ground and activate some failure plane or landslide; it is not allowed by the Municipality. Maintenance must be daily and there must always be people committed to the cause.

3) *Solar lamps:* During the visit it was indicated that some of the lamps do not work. It seems that the batteries can be the inconvenience, either because they have low load capacity or short life. Now it depends on the company or people who installed them for review. This is an indicator that the equipment requires constant maintenance.

4) *Retaining walls and surface coating:* Llanaditas, over the wall the owner built a second part of the house, which could be a critical condition because the wall can fail in case of seism due to load capacity. Coating: this technique has not been applied in the best way; the mesh is very thin and sometimes the concrete has not a good adherence to the mesh and starts to break. There are no pipes placed in the coating to allow a good drainage of the water, that seeps inside the soil. A damage in the covering could put in risk other interventions like sidewalks or railings because both are close.

5) *Retrofitting:* Even though the mooring beam was built around the house, it depends a lot on the construction process in general. If the structure has deficiencies by itself, the mooring beam will not have much functionality.

Key question: in how far is the (physical) vulnerability reduced (e.g. actual reduction of the community disaster hazard risks)

Not at all Effective	Slightly Effective	Moderately Effective	Quite Effective	Extremely Effective
			X	

Not at all Sustainable	Slightly Sustainable	Moderately Sustainable	Quite Sustainable	Extremely Sustainable
		X		

The steps, sidewalks and rails are in places of greater risk for people and are points that are widely used by the population. In some cases, these routes communicate important sites for the community, such as the police station, medical center and neighborhood parks. The dimension of the rails prevents children from falling through them. It was also observed that some interventions generate an improvement in several accesses of houses. At another point the conformation of small concrete ramps was observed on the steps where people enter with their motorcycles, however there may be a risk because it also becomes a vehicle passage. The works done are observed to work well and do not require immediate maintenance or apparent damage. They are undoubtedly effective works in any disaster situation that arises and requires an evacuation of the population.

The vegetable gardens allow the appropriation of lands that are not suitable for housing development. The process of sowing and using the land does not generate an impact on the instability of the soil. The use of the systems of retention (sheet piles) and sowing plants like the vetiver, favor the topography of the site. They are a source of food for several families and a source of income as part of the vegetables from one of the gardens are sold to a neighbor of the community that has a restaurant. However, the sites remain vulnerable to landslides since there is still rubbish and debris in the slopes, and they also lack a run-off water catchment system. Moreover, the functioning of both gardens depends on a small group of people who are committed to the cause. If they stop participating, the gardens will be lost. It should also be mentioned that during the visit a small plague of butterflies was observed eating the plants in both communal gardens.

Solar lamps are a renewable source system and do not require any other input to operate. It can be replicable in another site. However, the fact that many were not in operation leaves in doubt if the system placed meets the requirements necessary for proper operation. The maintenance in this case is linked to a single entity (the company that performed the installation) and not as such to the community. It is unknown if the municipality has the capacity to perform such maintenance.

The retaining wall that was built for a house in Llanaditas was used as a base for the extension of the house. As it was not built for that purpose, now the structure is part of a higher risk condition.

The covering with concrete of several slopes, has not been built with the appropriate mesh.

Fiber cement (used for the roof) is a rather fragile material (in comparison to metal sheets), which wears with time and rain. It is also heavier and requires more manipulation. It is less resistant to impacts.

FACT SHEET: MIXCO - GUATEMALA

Communities: Vistas de la Comunidad y Cipresales.

Main Intervention:

It consists of 8 interventions located in the communities:

1) *Community House Vistas:* a one level building used by the different communal groups. The structural section was built using PVC pipes as columns and beam. The cover around the building was made of steel and wood sheets and the roof of steel sheets. On the left side there are two retaining walls built by strips of tires. Between the walls there is a flat concrete area.

2) *Retaining wall (Cyclopean):* consists of a gravity wall that works by its own weight and is built with stones, mortar and plaster in the front. The structures are usually located in the back of the properties. PVC pipes are used to drain water from the back.

   Retaining wall (Masonry): consists of a masonry wall with concrete frames (columns and beams) and foundation slab. The structures are in the back of the property and near a soccer square. At this point there is a large wall at the edge of the square. Another wall is on the left side of the square on an upper terrace. This wall was built to create a play area for kids. PVC pipes are used to drain water from the back.

   Retaining wall (Tires): This structure works as a structural fill with strips of front tires to protect the fill. The strips have been placed in ties and joined together to form a monolithic structure, which was then filled with granular material to stiffen the front part of the wall. There are two retaining structures separated by a flat terrace.

3) *Surface coating:* consists of a concrete coating on the slopes in some points of the community, for example, near the sports field and on some slopes near the wastewater treatment plant. This coating protects the soil surface against erosion. Normally applied on stable slopes without slide condition. A steel mesh is placed before the coat protection is applied.

4) *Model House:* Masonry houses built with reinforced frames (columns and beams). There is a continuous roof beam where the roof structure is anchored, which is made with steel sheets. During the visit 6 houses were inspected. It was observed that most have a different architectural distribution, according to the different measurements of the plot. The houses usually have 2 rooms, a common area and a sanitary service.

5) *Retrofitting:* consists of the construction or structural improvement of columns, beams, walls and upper floor. These are built in reinforced concrete and reinforced masonry. The works are mostly carried out in the internal parts of the houses. Also, some windows were built and in one of the houses a toilet.

6) *Treatment Plant:* consists of a system to capture and treat wastewater for 90 families in Vistas de la Comunidad and 60 families in Cipresales. It has a PVC pipe system, a digester tank, a solid waste collection tank and a second tank for liquids.

7) *Access Routes:* consists of a series of improvements in the community with the construction of sidewalks, stairs, railings and accesses that can be used as an escape route in case of an emergency. These access routes are on the same road where the drainages that go to the treatment plant are located. At some points, rainwater channels were also placed.

8) *Pluvial and Sanitary System:*

   Vistas de la Comunidad: Network of pipes that collect rainwater and wastewater from the upper part of the community for an adequate treatment of the water. These pipes lead to where the treatment plant is located.

Cipresales: A line of pipes and circular register boxes were built in front of the houses that are located on the entrance road of the community. The pipes and boxes are planned to be connected to the municipal sewer system in the future. In other sections of the community, concrete ditches were built next to the sidewalks and stairs for the runoff water.

General construction description:

1) *Community House:* The columns and beams are PVC pipes that form a structure through PVC connection that join them. Wooden pieces were used to nail a cover around it and like stringers to nail the roof sheets. In the outside the wooden columns hold the roof wing. The whole building is painted and located on a concrete slab. Part of the slab is used as a sidewalk and there are some concrete steps that go to the second terrace located between the walls, where there is a wooden floor. The structure is observed in good condition despite the fact that the structural system was built with PVC pipes.

2) *Retaining wall (Cyclopean): consists of a wall of gravity that works by its own weight and is built with stones, mortar and plaster in the front. The walls have the following characteristics:*

   Length = 6.0 m, corresponds to the width of the property.
   Height = 2.8 m
   Inclination = 6 degrees.

   The upper part measures about 50 cm. The PVC pipes to drain the water are approximately 2 inches in diameter.

   Retaining wall (Masonry): Consists of a masonry wall and concrete frames (columns and beams). Concrete frames are made every 5 or 6 rows of blocks. The concrete blocks have a size of 40x20x20cm. The columns of the wall are built with concrete blocks, steel reinforcement and concrete inside. All walls have a foundation slab. The walls built in the private properties have the following characteristics:

   Vistas de la Comunidad:
   Length = 6.0 m (whole width of the property).
   Height = 2.6 m
   Inclination = 0 degrees.

   Cipresales: The walls were designed so that people can raise their height a little more.

   Retaining wall (Tires): placing the strips is a good technique to use the tires in this type of retaining system, since it simulates other similar techniques with synthetic elements on the front. Both walls have been built with an inclination to stabilize the structure against overturning.

3) *Surface coating:* For this work a steel hexagonal mesh (called *malla de gallinero* as it is typically used for poultry fences) was anchored to the surface of the ground, after which concrete is poured all over the soil surface. The assumption is that the mesh will function as a reinforcement for the poured concrete. However, this mesh is very thin and not the right material to use for erosion control.

4) *Model House:* All the houses are observed in good conditions and safe. The masonry is well aligned and plumbed. The columns and the beams have a good dimension. The structures are placed on a foundation slab. The roof structure is made with steel elements placed transversely for the placement of the sheets. The roof has a single drop of water and is high enough so that the inner part of the house is wider and fresher. The houses have a piped electrical system and a load distribution box. The houses are painted on the outside and inside, and have glass windows.

5) *Retrofitting:* The reinforcement made for structural elements comply with seismic resistant standards. Blocks and reinforced concrete were used. In constructive plans, it was possible to observe the design

and dimensioning of the elements. The upper floor is made with horizontal joists and blocks on which the concrete slab is placed. A good finish of the elements and a correct construction technique are observed. The walls have a plaster finish.

6) *Treatment Plant:* The wastewater is channeled through a line of pipes that pass through a biological decomposition system inside a PVC container. During the process, the solid material is deposited in an outdoor pool or tank that must then be cleaned manually. The remaining liquids are treated and taken to a second tank and then evacuated by another line of pipes.

7) *Access Routes:* Sidewalks, stairs and accesses built in reinforced concrete. They were mostly placed on slopes. Also, in some points, small walls were built for the safety and integrity of the work.

   Vistas de la Comunidad: At some points the access coincides with the installed line of pipes.

   Cipresales: a sidewalk with permeable concrete was built and a drainage system was placed under the sidewalk. The drainage captures the runoff water.

8) *Pluvial and Sanitary System:*

   Vistas de la Comunidad: It is a hydraulic system of pipes joined to concrete wells to control and dissipate water energy. The wells are located within the routes or in green areas within the properties.

   Cipresales: Prefabricated structures for the drainage of rainwater made of concrete. Pipes 6-8 inches in diameter were used.

Techniques used. Score: 4 (quite effective)

Advantages:

1) *Community House:* The structure is very light and does not transmit significant loads to the ground, therefore, neither to the walls. At the back of the roof there is a rain channel to collect the rainwater and take it outside. This is very important to avoid saturating the fill where the house and part of the tires wall is placed. The structure is observed in good condition at this time. The pipes used to hold the roof are sealed to prevent the entry of water. A good columns distribution around the building is observed.

2) *Retaining wall (Cyclopean):* the structures do not retain a filling whose weight and compaction process is unknown, which is a favorable condition. The structures do not show faults or other irregular conditions that affect their stability. During the visit, it was mentioned that the walls were placed on good quality soil and it could be observed that at other points around the area, there is a cohesive soil of good consistency. None of the structures was observed with problems of instability or cracks.

   Retaining wall (Masonry): The walls are more rigid because the concrete frames are confining masonry in about 3-5 lines of blocks (vertical) and in other cases a long beam to each 3-5 block lines connects the first with the last column of the wall. None of the structures was observed with problems of instability or cracks.

   Retaining wall (Tires): Good design. The pneumatic strips will bring a long life to the retaining. It was observed that plants are growing over the tires and the whole surface; this is a good sign and technique used to reinforce the front part of the structure. The plants help to control the runoff water. In general terms, the inclination and the structures separated by the terrace increase the overall stability of the filling. None of the structures was observed with problems of instability or cracks.

3) *Surface coating:* is an easy and economical solution to protect a slope surface.

4) *Model House:* Are structures with a seismic design, good handling of materials and construction techniques. The houses have a standard dimension suitable for a medium family.

5) *Retrofitting:* The work done increases the safety against collapse of the built structures, as long as the weight is not increased or subjected to loads greater than those it was designed for.
6) *Treatment Plant:* The system controls the water and contributes significantly not only to the protection of the environment but also to the health and quality of life of the people of the community.
7) *Access Routes:* They are rigid structures, safe and of good dimension.
8) *Pluvial and Sanitary System:* The installed drainage system is integral and necessary for reducing the risk of inundations and landslides. Moreover, it contributes to the development of the community from an urbanistic and environmental point of view. The location of the pipes is easy to access in case of maintenance.

Disadvantages:

1) *Community House:* Although the roof is a light structure and the PVC pipes are flexible, it cannot be determined whether the structure will be stable in a seismic condition. A little flexion was observed in the horizontal elements.
2) *Retaining walls (Cyclopean and Masonry):* In one of the structures, it was not possible to observe the drainage pipes in the front, this could be a dangerous situation if there is a saturated soil condition because the water can cause pressure on the wall, for example, in the rainy season.

   In some of the houses where a wall was built, the construction of a second floor of the house was observed and was supported by concrete columns resting on the wall. This can be a very unfavorable condition because if the wall was not designed to support the weight of the building, its stability could be compromised. It is mentioned that the second floor was built by the owner of the house who is a builder. In another case, another masonry wall was built over the first wall.

   Retaining wall (Tires): In the lower level of the wall exists a concrete layer covering the surface. The runoff water flows into a concrete trench that is observed with damage and with a soil erosion process under it. This condition can be injurious for the wall due to its closeness to the trench.
3) *Slope coating:* This technique is not the best solution for erosion control because the mesh is very thin and sometimes the concrete has not a good adherence to the mesh and starts to break. There are no pipes placed in the coating to allow a good drainage of the water that seeps inside the soil. The covering made over the slopes around the residual water treatment plant has some important cracks in some points, despite the fact that drainage pipes were placed in the surface. It looks like a bad adherence of the concrete to the mesh.
4) *Model House:* One of the houses was built on a higher ground and located between existing houses. It has the disadvantage that the sanitary service (toilet and shower) is not in use since the drain pipes have no way out; access is a bit limited.
5) *Retrofitting*: It can be dangerous for people if, due to a need for more space, they try to expand their houses and put in a critical condition the carrying capacity of the built elements. Possibly this can happen without the advice of a professional.
6) *Treatment Plant:* During the visit, the operation of the two plants could not be observed, so their effectiveness could not be evaluated.
7) *Access Routes:* having the line of pipes near to the access, implies that the drainage system must always be maintained in good condition, since if a risk condition occurs due to natural hazards such as heavy rains or an unforeseen event such as a collapse of a pipeline, this could interfere with the steps, sidewalks, etc. This is a scenario that can put families, houses or others at risk.
8) *Pluvial and Sanitary System:* In case of breakage, it can affect the accesses used by people.

Physical Works

Key question: in how far is the (physical) vulnerability reduced (e.g. actual reduction of the community disaster hazard risks)				
Not at all Effective	**Slightly Effective**	**Moderately Effective**	**Quite Effective**	**Extremely Effective**
			X	
Not at all Sustainable	**Slightly Sustainable**	**Moderately Sustainable**	**Quite Sustainable**	**Extremely Sustainable**
			X	

The interventions are described as “Quite Effective” and “Quite Sustainable” because:

In general, it is considered that the interventions have been carried out with professional criteria, respecting the construction standards during the execution process of each of the works. An imminent risk condition is not observed, but several points or situations must be corrected as mentioned above.

The people who live in the houses where the cyclopean walls were built, use the area of generated land facing the wall (the terrace), as patio, green area for planting, for keeping their pets or domestic fowl, or as a storage for things. An unfavorable condition is that, in some cases, people place a wooden ladder to get down from the house to the area of generated land and they can fall (the construction of concrete steps to access the lower area was also observed). A galvanized mesh was placed on the wall next to the square to protect people from falling.

According to the responsible professional, the biodigestor tank underwent an adaptation for the functionality of the treatment plant The intervention must be monitored continuously to verify its proper functioning, in addition to the maintenance associated with the system. It must be ensured that the environment of the treatment plant is always without the presence of any risk condition. There are additional physical works, for example, the covered slopes, that must be repaired and always be protected.

The surface coating was not adequately executed (use of wrong mesh).

Eng.
ELIAS ROSALES-ESCALANTE

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PHYSICAL WORKS BUILT IN PORT DU PAIX - HAITI, CONSIDERING THE HYDRAULIC PERSPECTIVE

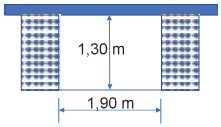
Existing sections (canal dimensions) supported the procedure to determine the prevailing hydraulic capacity

A) Démélus

For this neighborhood is possible to define three main sections. The upper part, the middle one and another one, the section downstream, around the city.

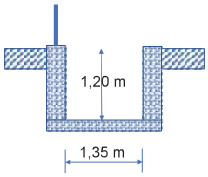


- The dimensions measured are: width = 1,90 m; depth = 1,30 m; taken or calculations: y = 1,25 m
- The estimated slope is: S = 2 %
- The Manning Roughness coefficient taken is: n= 0,030



$Q = (1/n)\ A\ R^{2/3}\ S^{1/2}$
$= (1/0{,}03)\ 2{,}375\ (0{,}54)^{2/3}\ (0{,}02)^{1/2}$
$= 7{,}409\ m^3/s$





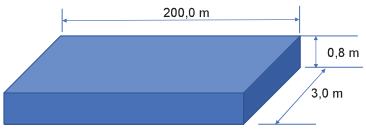
$Q = (1/n)\ A\ R^{2/3}\ S^{1/2}$
$= (1/0{,}013)\ 1{,}35\ (0{,}403)^{2/3}\ (0{,}078)^{1/2}$
$= 15{,}776\ m^3/s$

The channel section downstream, located among the city streets layout, has a very reduce slope, almost flat.

There is a very clear evidence on the reduce action or lack of maintenance. The cleanness of the canal does not follow a routine. Specially, the risky situation is more relevant in this lower section because it is flat, the slope drives to low velocities and provokes sedimentation. Due to these conditions, the volume of soil sediments and garbage is significant in the canal.

Making an assumption of a span L = 200,0 m, it is possible to have another figure, now related to the total volume of material to remove.

This is,
$V = 3{,}0 \times 200{,}0 \times 0{,}8 = 480\ m^3$



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PHYSICAL WORKS BUILT IN PORT DU PAIX - HAITI, CONSIDERING THE HYDRAULIC PERSPECTIVE

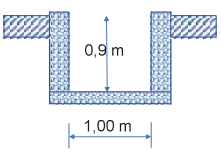
Existing sections (canal dimensions) supported the procedure to determine the prevailing hydraulic capacity

B). The Jerilon community

The canal built for this neighborhood is in a good constructed shape. But, also having the same constraint, lack of a permanent maintenance program to clean it from the garbage and sediments.

This situation is a real problem to fulfill the objective or main purpose of the project. A canal to easy release the big volume of rainwater caught during a heavy rain from the streets and houses around.





$Q = (1/n)\ A\ R^{2/3}\ S^{1/2}$
$= (1/0{,}013)\ 0{,}8\ (0{,}3077)^{2/3}\ (0{,}02)^{1/2}$
$= 3{,}951\ m^3/s$

Remarks

- The numbers obtained are related to the hydraulic behavior of the canals, as elements of infrastructure. These results should be compared with other values from the hydrological information, related to the amount of rainwater to expect.
- All the matter not frequently remove from the canals is a huge risk for the expected hydraulic performance at the moment of a heavy rain.
- The canals downstream are in a flat area, they have many obstacles for an appropriate hydraulic performance such as lower velocities, houses and other structures built on top, the proximity to the sea side and the effect of high tides during the storm season.
- The removal of sediments coming down because erosion from the hill, and from the human's work on those lands, should be prevented with tramps. This is to build in the upstream part, lower ections in the canal bottom, and to remove the sediments before they flow to the lower part of the canal.

FIU Extreme Events Institute — Florida International University

Eng.
ELIAS ROSALES-ESCALANTE

DEC. 2017

PHYSICAL WORKS BUILT IN ANSE A FOLEUR - HAITI, CONSIDERING THE HYDRAULIC PERSPECTIVE

Estimated existing sections supported the procedure to determine the prevailing hydraulic capacity

THE GABIONS

These are structures built to protect the town of Anse a Foleur from river water high levels, strong currents and flood effects.

They are wire mesh boxes, normally 1,0 x 1,0 m x 1,0 m, fill of rocks.

The gabions help to protect the river banks built as stronger walls, guide the river and control floods.







FIU Extreme Events Institute — Florida International University

Eng.
ELIAS ROSALES-ESCALANTE

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PHYSICAL WORKS BUILT IN ANSE A FOLEUR - HAITI, CONSIDERING THE HYDRAULIC PERSPECTIVE

Estimated existing sections supported the procedure to determine the prevailing hydraulic capacity

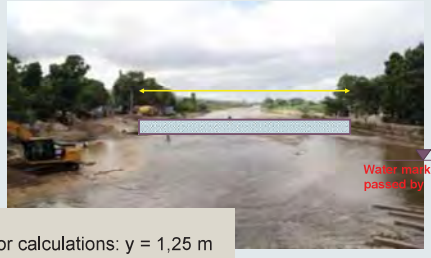
THE GABIONS

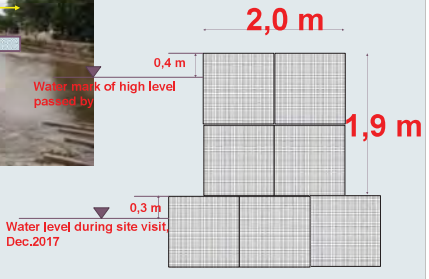
Built aspects found:

a) The whole structure shows a good condition.
b) There are some small pieces damaged due to pedestrians' transit, mainly on the top; and water currents at the base of the structure that is eroding its foundation. There is a significant settlement at the upstream end.
c) The structure shows it had a good performance and was able to support the forces caused by the Irma hurricane's high-water level.
d) Hydraulic estimated capacity of the river and the gabions vertical wall.









Estimated dimensions
- width = 55,0 m; depth = 1,80 m; taken for calculations: y = 1,25 m
- Slope: S = 1 %
- The Manning Roughness coefficient taken: n= 0,040 (major streams; top width at flood stage > 100 ft)

$$Q = (1/n)\, A\, R^{2/3}\, S^{1/2} =$$

$$(1/0{,}04)\ 99\ (1{,}6894)^{2/3}\ (0{,}01)^{1/2} = 351{,}687\ m^3/s$$

FIU Extreme Events Institute
FLORIDA INTERNATIONAL UNIVERSITY

Eng.
ELIAS ROSALES-ESCALANTE

DEC. 2017

PHYSICAL WORKS BUILT IN PORT DU PAIX & ANSE A FOLEUR - HAITI, CONSIDERING THE SANITARY AND HYGIENE PERSPECTIVE

THE SHELTERS

The specific observation to make related to the shelters, from the sanitary point of view is because the bathrooms. During the site work, there were three shelters visited. There are aspects to take into consideration and improve the objective of prevention, not transmit illness or not have conflicts with people's behavior.

a) The toilets space, at one of the schools visited, was been utilized by everybody; even when it is supposed to have separated spaces. This means that boys, girls and teachers were in the same.
b) The "height" of toilets or urinals is greater than the children's. This has an effect, which leads children (boys and girls) to urine in the shower sink.
c) Natural light and natural ventilation in the whole bathroom are not appropriate in two of the visited shelters.
d) There are not enough sinks for the correct handwashing around the toilets facilities. Neither soap to do so.





Remarks

- The number of toilets in each site needs to be review, specially because the quantity of people during an emergency. There are numbers with specific quantities from the WHO and other international organizations that should better guide this aspect. Such as one toilet for 50 people in case of shelters, or one for every 30 girls or one for every 60 boys in the case of schools.
- The reduce number of toilets in a shelter induce everybody in every bathroom, opening abusive actions against children or women.
- There is a need for a better maintenance program on the septic tanks. The sanitary removal of fecal sludge must follow a periodical action; taking into consideration that these toilet facilities are permanent used by "big" groups (students) in periods different from emergencies.

FACT SHEET: PORTMORE – JAMAICA

Communities: Newland, Naggo Head and Gregory Park

General construction description:

1) *Retrofitting:* Community Resource Center (CRC) Naggo Head: Designated area for the construction of a computer center, bathrooms, storage and a kitchen area. The area will also have a space for people to meet or organize an activity. Another retrofitting collective work was done in Primary School Gregory Park, where two classroom walls were reinforced with steel beams. However, most retrofitting works were done in individual houses with four different levels of investment:

Tier / Cost	Selected structures + Type of Interventions
A) $ 75	Given as a voucher for rudimentary structures requiring reinforcement and strengthening; too unstable for major upgrades or repairs. • Reinforcement of wall studs with simple cross-bracing elements, reinforcement of wall cover elements in precarious structures • Reinforcement of roof-supporting structures with metal straps or simple galvanized wire to make them better resistant to wind solicitation • Roof repairs, reinforcement/reinstallation of roofing sheets using proper fasteners • Simple plastering of base of adobe/mud brick/cinder block walls to prevent erosion • Repair of cement floors or provision of simple cement floor in one room to prevent erosion and improve health • Simple repair or provision of simple wood frame door and windows that work as shutters during storms
1) $ 250	Minor Repairs / Upgrades of acceptable supporting structures; possibility of recycling most of existing materials. Affectation of less than 25% of building components. • Roof restructuring, strapping, nail reinforcement of existing CGI sheets • Cross bracing of roof structures • Reinforcement of roof-wall joints • Simple pavement of floors
2) $ 500	Moderate Repairs / Upgrades of structures with an affectation to 25-50% of building components: • Roofing and wall system repairs • Wall reinforcement, minor structural retrofit
3) $ 1,000	Full retrofit for structures with an affectation of more than 50% of building components: • Foundation work, re-composition of foundation soil • Full wall system retrofit, incorporation of vertical and horizontal structural elements (bond beam) • Roof reconfiguration and structure

2) *VIDPs (Ventilated Improved Double Pit toilets):* Consist in the construction of toilets that operate without water (thus also called dry toilets); using soil to mix with the feces and generate a natural degradation. The toilets are inside a wooden structure located in the lots where between 3-5 households (10-12 people) live. The toilets are placed over a concrete tank that store the waste. Each toilet has two tanks, each of which have 4 or 5 years of capacity to store. When a tank is full the toilet will move to the other tank. The tanks have a PVC pipe for ventilation.

3) *Garbage Receptacle:* These are open concrete structures where people can put their garbage bags and then a truck from a municipal contractor picks it up. This concrete receptacle is 2m wide, 2.5m long and around 1.8m high.

4) *Model House:* These are houses with frames and wooden enclosures designed according to the regulations to withstand conditions of strong winds or even hurricanes. They are built on a reinforced concrete slab 10cm thick. The wooden frames are linked by bolts and nuts to a row of concrete blocks. The roof structure is also made of wood and zinc sheets which are nailed.

Techniques used. Score: 4 (quite effective)

Advantages:

1) *Retrofitting:* the CRC will be a seismic resistant structure with a safe hard ceiling to withstand hurricanes. It has good ventilation for the computer equipment and good electrical outlets and distribution box to safely connect the equipment. For the kitchen area a concrete slab was built as roof, which is a safe condition in case of a hurricane. Bathrooms are built in reinforced masonry. Regarding the retrofitting of individual houses:

A - It improves the quality of life of people and offers a more dignified place to live. It reinforces the most critical and vulnerable points of their homes.

1 - 2 The works carried out are a little more significant and are carried out in the structural elements vital for the house.

3 - The works were carried out in houses that were very vulnerable to disasters due to structural affectation greater than 50%. It is interpreted that they were houses at risk of collapse. The works are properly made in the body of the structure.

2) *VIDPs:* The structure follows the construction norms to build against hurricane risks (as indicated in drawings). For example: the wooden structure is connected to the concrete by studs, the ceiling to the wall framing by steel straps and there are wooden horizontal and vertical elements to rigidize the structure. The toilet is built higher than the ground level to prevent flooding from mixing with the fecal matter. The PVC pipe for ventilation works well because of all the toilets visited, none of them had bad odors. The concrete tank for the storage of the waste was built with reinforced masonry. The upper part of the pipe is protected with a mesh to prevent the entry or exit of insects such as flies. This prevents any contamination or any disease control.

3) *Garbage receptacle:* This is a seismic resistant structure, built with reinforced masonry and a concrete slab. An environmental advantage is that the trash will not flow out when a minor flood occurs. Moreover, it reduces the amount of trash in the streets and gutters, because people now have a designated place to leave their trash. The receptacles are in easily accessible sites.

4) *Model House:* Bolts were used to join the wooden frames to the floor slab as required by the regulations. An adequate separation of the vertical elements that make up the armor of the house was observed. It was also observed that the placement of rafters for the roof have an adequate dimension and separation, this generates that the roof structure is safer. The fact that the eaves are not so long, reduces the possibility that the roof can be lifted by strong winds.

In some model houses and retrofitting, "hurricane straps" (steel twist pieces) have been placed to strengthen the connections between the roof and the wooden frame. Straps offer a good way to add strength to the roof as protection against strong winds. This structural element has a minimal cost in comparison with other elements needed for the construction.

Disadvantages:

1) *Retrofitting:* The CRC is only 10cm high from the soil, which could be dangerous in case of flooding. Inside there is a steel grill in the window for security but this could dangerous in case of an emergency because people can be caught up. Regarding the individual homes retrofitting:

A - The works do not necessarily reduce the structural risk of the houses. The structures visited were observed to still be in a rather insecure condition that requires more intervention to achieve a disaster risk reduction.

1-2-3 no disadvantages were found in the work done. The reinforcements improve the structural quality of the buildings.

2) *VIDPs:* Normally people do not have a container with dirt to throw into the toilet, they have to go for a walk and pick up and it can happen that people do not follow the process. The drawings indicate the use of a hat on the upper part of the ventilation tube to prevent the entry of water during the rainy season, but they were not observed. The bending of the nails that join the galvanized roof sheet is pending. This is done for safety and there is no detachment during high winds. If this does not do it reduces the security of the structure.

3) *Garbage Receptacle:* The receptacles have some holes in the back to drain the leachate. This is a residual substance that is highly polluting to the environment and very harmful to health.

4) *Model House:* The houses are placed just above the ground, but not too much, thus could be exposed to flooding. The placement of braces was not observed in the wall structures and ceilings, as indicated in the design manual. This makes the structure vulnerable to a hurricane. One of the houses had the cables of the electrical installation exposed, which is a very dangerous condition because a short circuit can occur and cause a fire. The house belongs to a man in a wheelchair.

Regarding the use of hurricane straps, it must be ensured that the element complies with the technical specifications necessary for it to be certified, for example that they are made of stainless galvanized steel. If this is not done, the element will be of poor quality and put the integrity of the structure at risk.

Key question: in how far is the (physical) vulnerability reduced (e.g. actual reduction of the community disaster hazard risks)

Not at all Effective	Slightly Effective	Moderately Effective	Quite Effective	Extremely Effective
			X	

Not at all Sustainable	Slightly Sustainable	Moderately Sustainable	Quite Sustainable	Extremely Sustainable
		X		

The interventions are described as “Quite Effective” and “Moderately Sustainable” because:

CRC: this place was an abandoned building after construction, now the place will be a center to promote the community development. It could moreover be used as a shelter in case of an emergency; the building includes a kitchen and bathrooms and is built in concrete for more security. It will be a fresh area thanks to the windows that were built and this is very important for the computer system because it needs to be in this kind of environment to not suffer any damage by overheating.

Also, the Gregory School, where steel beams were placed to retrofit two walls, can be used like a shelter in case of an emergency.

Regarding the retrofitting of the houses, it can be said that there is a greater risk reduction for interventions tier 1, 2 and 3 compared to tier A. The amount invested for tier A is very low compared to the need for retrofitting that the houses require as these are "rudimentary structures requiring reinforcement and strengthening; too unstable for major upgrades or repairs". Therefore, it is considered to have no major affectation in risk reduction because they are structures that in one way or another already have compromised their structural stability. It is considered that the amount associated with type A, reflects more a community aid for improving the quality of life, than an investment for risk reduction.

VIDPs: people are very committed to the cause and are cleaning the toilets regularly. In one toilet someone even put an audio system into the wooden structure because of the cleanliness and security of the place. Also, he seeded plants around it to make it a nice place.

In relation to the garbage receptacles, people commented that the communities are now cleaner places. During the visit it was observed that the municipal trucks do collect garbage, but people complained it was not done regularly and we indeed observed receptacles with big amounts of garbage around them. In the case of the effluent of the leachate coming from the garbage, the best thing could have been to find a solution to treat or store these substances.

It is considered that the houses have been built to be safe sites and follow with the majorities of the construction normative, but still require structural improvements, for example the placement of straps in the roof structures or braces in walls, roofs and connection points. It is necessary to fold the nails to make stronger the ceiling structure but this must be done carefully to not damage the nail or the structure. The house made for a man who uses a wheelchair had a concrete ramp for proper mobilization, which allows also for a quicker evacuation in case of an emergency. It is the largest of the built houses, but has a serious problem with the electrical installation.

FACT SHEET: TEGUCIGALPA, HONDURAS

Communities: **José Angel Ulloa, José Arturo Duarte and Nueva Providencia.**

General construction description:

1) *Drainage system:* It consists of the construction of hydraulic works for control and evacuation of runoff water. Executed works: concrete ditches, masonry ditches, Ribloc pipes, concrete pipes and manholes. At some points the ditches were built on both sides of the street. In the sections where the gradient is high energy dispersers were constructed. The manholes also function as energy dispersers. Ulloa: the Ribloc pipe evacuates the water towards the brook.

2) *Retaining walls: Tires wall:* consists of a structure by gravity made with tires attached to maintain pressure on the ground. The tires are placed in an intercalated way for a better performance of the structure. They were built in several points, for example: for a community park (also used as a children's playground), for a bridge and conformation of fillings for houses. In Sector 2, José Arturo Duarte, a tire stabilization was carried out for an access to a property. The tires were placed in the form of bleachers and filled with concrete for leveling, later the owner made the construction of his house.

3) *Water capturing system (includes toilet reparation and wash basin):* consists of a reservoir of water installed in the Carlos Roberto Reina School for the supply and operation of 6 built toilets and a wash basin located next to it. Rainwater is collected by a gutter located in one of the sections of the roof that carries the water to the collection tank.

4) *Berlin Settlement:* Corresponds to the construction of 22 houses for people who are or will be relocated from other sites that are at high risk. The project consists of two blocks of housing (11 each block), which are located on two terraces of different elevation. Between the two terraces, a wall of gabions containing the natural floor and filling of the upper terrace was built. The project consists of access to a public street on three of its sides with drainage system type ditches for the control of runoff water. The water is captured in a larger channel and directed to a ravine that is active only in rainy season. The project is in its initial construction phase, the gabion wall is already built and the foundations and slabs of the houses in the lower block are being built at the moment. The terrace of the upper block is already leveled to start building houses and the water channeling system (ditches) has also been built already.

5) *Model House:* Corresponds to a construction of a masonry house with two bedrooms, kitchen, bathroom and a living room. Each house has a sewage treatment system consisting of a septic tank and an absorption well.

6) *Sanitation modules and tank for harvesting:* Consists of the construction of toilets type latrine with a septic tank, that work without the use of a pumping system for evacuation and spaces for showers, built for households that have their own house. In addition, a concrete basin has been built for water storage and for washing clothes. They are masonry and steel structures with galvanized sheets for the roof. The upper part of the structure is open and does not require any ventilation.

7) *Access routes:* Construction of concrete stairs and steel handrails.

8) *Retrofitting & Image change:* In Sector 2, José Arturo Duarte, in one of the streets of the community, repairs were made to the facades of several houses to improve their aspects, among which colorful paint that gives a nice appearance to the community. Sidewalks were built in front of their houses and small masonry walls. On the same site, facade work was also carried out in a grocery shop (*pulpería*), which is a minimarket. For one of the houses in Nueva Providencia, a plaster was made on its facade, where a bottle veneer mural was placed. In Sector 2, José Arturo Duarte, a reparation has been carried out in four cases for a church that presents damages due to the sliding condition.

Techniques used. Score: = 4 (quite effective)

Advantages:

1) *Drainage system:* The ditches and other drainage works have a hydraulic design to estimate the volume of flow and includes cross sections to have more controlled flooding in communities. These are works designed in reinforced concrete and masonry that comply with standards and construction processes. These drainage systems prevent a greater saturation of soils and possible landslides in the points of greatest risk. They also prevent runoff water from causing damage to other works such as streets, sidewalks, stairs, houses, etc. Thanks to the construction of these works, many people were able to improve the entrance to their house.
2) *Tires walls:* first and very important the tires are reused and not thrown away. The system of union between the elements (tires), even though it does not have numerical methods for the calculation of its stability, has been well conceptualized achieving an optimal performance. A mixture of soil with cement and gravel is used to fill the tires, forming a block of greater weight and consistency, using steel cable or nylon rope to tie and join each of the elements forming a single block of major rigidity. The structure is placed on a floor with a permissible load capacity and on a block of rocks. The sections of walls indicated in the plans are observed with an optimal sizing and with an inclination in the front side that improves the stability of the structure. In addition, the fact that the front of the walls is covered by vegetation improves its stability because the roots form a natural network and consolidate even more the union of the tires and controls the front erosion of the structure. In the internal part of the structures, drainage pipes were placed to control the filtration of water and avoid pressure due to saturation of the soil.
3) *Water capturing system:* The installed system is observed to be effective. The gutter, the plastic tank, the wash basin and the toilets are in the same line so there was no greater impact than necessary on the space and the acquisition of pipes for water conduction. The tank has a capacity of 5000 Lt that perfectly supplies the toilets. It is also connected to the potable water system to work in the dry season. The tank is placed on a concrete structure and raised above the ground which allows it to work by gravity, thus it does not require a pumping system, which makes it more effective and efficient. The gutter was placed in one of the sections of the roof that has a larger area and thus a greater load capacity for tank recharging. A wash basin was built next to the tank so that children can wash their hands after the use of the toilets; this prevents the spread of diseases. The 6 toilets were restored for proper operation. Reinforced masonry steps were built to access the patio where the toilets are located, and a steel railing was placed for the safety of the children. In general, the intervention is observed with good functionality.
4) *Berlin Settlement:* Site material for leveling and shaping the ground for the foundation of the house is used, which represents an economic advantage in the cost of the project. During the visit the construction process for the concrete floor of the house was observed; an additive was used to accelerate the concrete curing process and sawdust was applied to protect and keep the floor surface moist. It represents an effective method to ensure that the concrete (floor) acquires resistance and meets the quality standard. The use of reinforcement steel previously placed and embedded in the foundation floor of the masonry system was observed. This makes it a seismic resistant structure. The work is being executed by a construction company, which provides confidence that it is being done professionally. The gabion has a base floor with stones and concrete to level the ground and increase the supporting capacity.
5) *Model House:* The proposed house complies with design regulations for a seismic resistant structure. The house is well conceptualized and has professional design plans. Most of the houses are located on a foundation of rock and improved soil, with a concrete slab built on top. Masonry walls are joined by tie beams at the top and bottom to give greater rigidity to the structure. On the

upper beam a gable wall is placed to support the roof that is made of a steel structure and galvanized sheets. The houses have a channeled in electrical system. In general, it is considered that the houses are safe structures and have the basic conditions for a household of about 4 to 5 members.

6) *Sanitation modules and tank for harvesting:* These are structures that improve people's living conditions and are highly effective. The structure complies with design regulations and therefore is a seismic resistant structure. The building is well modulated and allows adapting to relatively small spaces next to the houses. The concrete basin stores water for the daily use of the household given the condition of lack of public service. The toilet and shower area are adapted to a septic tank and this to an absorption well for the treatment of wastewater; an effective system for the condition of the community and a reduction in the negative impact on the environment.

7) *Access routes:* The works are well constructed and do not present any apparent damage. The railing is fastened to the concrete and secured with shores to the ground. Under the stairs in Nueva Providencia, a drain was placed that directs the runoff water to a concrete gutter located next to it.

8) *Retrofittting:* The restructuring done on the facades of houses, walls and sidewalks improves the social condition of the community.

Disadvantages:

1) *Drainage system:* Because the communities are in an area of potential risk due to a movement of lands caused by a geological fault, there are sections of the ditches that are fractured. In the worst case, there could be some pipe sections under the ground that are damaged and cause leakage and subsequent soil erosion. People are dumping their gray water into the ditches and this can generate environmental pollution. At several points in the communities, where the streets are a bit narrow, concrete covers were placed to protect the ditches and prevent garbage or vehicles from falling inside, but several broken covers could be observed due to the passing of the vehicles. With this condition there is a risk for vehicles, people walking along the route and possible deterioration of the ditches.

2) *Tires walls:* There are no reliable design procedures and their useful life is unknown. Its real behavior in seismic conditions is unknown. They are structures susceptible to fire.

3) *Water capturing system:* The intervention is not considered to present disadvantages, rather it is considered an effective and efficient solution. The only condition is that it requires constant maintenance to avoid sedimentation at the bottom of the tank due to the dragging of particles from the roof and gutter. Moreover, the water must not be stored for too long to prevent mosquitos nesting in it or any other condition that might be a health risk.

4) *Berlin Settlement:* One of the main disadvantages of the Berlin Settlement is that there is no sewage and no potable water system either. There is a company that sells water and enters twice a day to sell to people. About the wall of gabions, a deficiency was observed in the construction process, especially in the tie between the boxes; this situation makes that the wall does not function as a homogeneous structure. There was also a lot of space between the stones, reducing the weight of the structure and therefore its effectiveness.

5) *Model House:* It was observed at some houses that the access from the street is not very safe, because they had to place wooden boards on a dirt ditch to access the property.

6) *Sanitation modules and tank for harvesting:* In some cases, it is observed that the septic tank is only a few meters away from the house, whereas they should be placed at a longer distance (according to the construction plans at least 12 meters) to avoid bad odors near the people's living

spaces, especially when they begin to fill up. However, the size of the plots does not allow for such distances.

7) *Access routes:* No disadvantage is observed.

8) *Retrofitting:* The works carried out are physical improvements that will always be affected by the sliding condition of the slope.

Key question: in how far is the (physical) vulnerability reduced (e.g. actual reduction of the community disaster hazard risks)

Not at all Effective	Slightly Effective	Moderately Effective	Quite Effective	Extremely Effective
			X	
Not at all Sustainable	**Slightly Sustainable**	**Moderately Sustainable**	**Quite Sustainable**	**Extremely Sustainable**
		X		

The interventions are described as “Quite Effective” and “Moderately Sustainable” because:

The drainage system improves the flood risk condition in which the communities live and the structures have professional backing in terms of design and construction. In addition, community leaders mentioned that there are cleaning brigades to collect garbage and try to avoid obstructions in the drains. During the visit, we did indeed observe areas which were kept really clean, but we also observed areas with quite some garbage in the ditches. In one of the intervened sectors, GOAL personnel indicated that the ditches were over-designed by 20% because people will connect their rain and gray water systems to the drainage system (In the worst case, it can happen that people attach their wastewater pipes to the drainage systems). However, the risk of landslide on the mountainside is causing the works to suffer significant damage and require recurrent maintenance. No maintenance had been provided yet for the damages that were observed.

In case of the walls, the use of tires reduces environmental pollution and creates awareness in people for the protection of the environment. Important to mention is, that the tires were also used for the creation of stairs. It was observed there were replicas of the solution, however, the procedure used for the construction of the structure is unknown and they may not be stable structures. It was observed, they were not done well; they did not have a good configuration, tires were not intercalated, the slope did not look stable. This may cause the structures to suffer damages or even collapse during an earthquake.

The water collection system is quite effective since it does not require a pumping system to function, is adapted to store rain and potable water depending on the availability. If required, the school can function as a shelter in case of an emergency and supply the necessary water for a certain period.

For the construction of each of the houses in the Berlin Settlement the future owner is involved by contributing work during the construction process and therefore there is a sense of belonging and commitment created from the beginning. People have made extensions although a bit rudimentary but effective. For example, in one house they installed a channeling of rainwater by placing a PVC pipe open and along the roof, which is attached to a plastic bottle and this to the PVC pipe, directing water through a hose to a concrete basin in the house. In other cases, next to the house they have built wooden structures that they use as storages, additional rooms or to place a firewood stove for cooking. The placement of wooden boards to delimit the property was also observed. And finally, the making of gardens around the house.

For the sanitation modules, it was observed in most cases that people adapted through a PVC pipe, a rainwater collection system from the roof of their houses to supply the concrete basin. In maintenance

issues the beneficiaries must have the commitment to ensure that these are done at the right time (e.g. emptying the basin) so that the treatment system works smoothly and effectively.

In the case of access routes, they have undoubtedly improved the quality of life of the people in the community. Before the interventions, the sites were quite risky, and people suffered constant falls. Now they are suitable places for the transit of people and as escape routes in emergency situations. It is important to mention that during the construction process the people helped with the excavation and shaping of the soil and the hauling of materials. The same happened for the construction of the ditches. This stimulates community ownership and subsequent taking care of, correct use and maintenance of the work.

In general, there are things to evaluate in terms of sustainability. INFOP (*Instituto Nacional de Formación Profesional*) trained people for the execution of works, like modules in masonry, construction of foundations, beams, columns and masonry, which foments replication of what was learned, with people teaching other people the learned techniques. It also motivated some people to create cleaning brigades for the maintenance of the interventions. But all these tasks as well as the physical works that were carried out, are threatened by the sliding condition of the slope. This condition of sliding and the visible damages in houses, streets, walls, ditches, churches, etc. puts into question if the risk in which people live is really reduced. It is important to mention that instruments used to measure changes and displacements of soils, evolution of fissures, cracks, expansion of joints, etcetera were placed at various points in the communities.

The retrofitting works will always be affected by the sliding condition of the slope.

Performance Evaluation:
LAC Urban DRR Programming
The Neighborhood Approach

ANNEX 4.2

Support Documents
Environmental Resilience





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Environmental Resilience
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Environmental Resilience

FACT SHEET: LIMA – CARABAYLLO

Communities:	**GRUPO 1** (3 de Octubre y Santa Rosa, Alto Perú, Nuevo Porvenir and Nuevo Milenio). **GRUPO 4** (Comité 38B, Rafaél Álvarez)
Main Intervention:	**Forestation:** Strategy to reduce the vulnerability of communities towards disasters, reduce the occupation in risk areas and preserve the hills' ecosystem.

Main uses:

Forestation reduces potential invasion or community expansion to high risk areas. The present scale and location of the forestation does not help to recover the ecological area of the hills. However, it allows to conserve natural areas within communities, generating areas that could be used for recreation. Moreover, it provides an aesthetic improvement to the community landscape (foresting the desert) and helps to improve soil retention.

Only in Group 4 an irrigation system and water tanks were installed for the forestation project, which is an advantage for the maintenance of the trees and plants. The community in Group 1 still waters manually, carrying buckets of water for each plant.

Key question: In how far is the (environmental) vulnerability reduced (e.g. actual reduction of the community disaster hazard risks)?

It is considered that the reduction of environmental vulnerability is limited. Because of the slopes, it is difficult to avoid mayor landslides, but the forestation can reduce the risk of displacement of small rocks and soil erosion. The intervention allows trained people to continue the forestation in other areas. Also, the intervention raises awareness about of the importance to preserve natural areas on the hills.

General Info:

	Existing green areas in the community (m2)	Existing natural areas (m2)
	0.00	~10,832.95
Estimated Population:	NI	
	environmental intervention total area (m2)	# of people with direct benefits (#)
	~4,441.00	NI

Type of intervention:	Estimated m2	Who is benefiting	Community
Forestation Pilot Project	~4,441.00	Community and Municipality	All
Tank for water storage and irrigation system	N/A	Community and Municipality	Group 4



GIS map of the Transect Walk Group 1



GIS map of the Transect Walk Group 4

Environmental Resilience

ER - Effectiveness:		ER - Sustainability:	
On natural areas	**Moderately effective (3)**	Maintenance	**Moderately maintained (3)**
On risk reduction	**Slightly effective (2)**	Monitoring risk areas	**Limitedly monitored (2)**

The forestation is effective in limiting the expansion to areas of high risk, makes the community aware of the importance of conserving natural areas, helps to reduce soil erosion and (with an adequate maintenance) can improve the perception of environmental quality (this will depend on the maintenance by the community).

It is slightly effective as barrier to prevent landslides. Reduces risk only in a very limited way, because the slopes are very steep and the existence of loose material is predominant.

Because the type of vegetation, it is possible to use marginal or treated water for irrigation. This solution is even more effective if a pressure irrigation system is implemented, because it has a lower water loss compared to other systems.

Forestation areas in Group 1 are limitedly maintained, mainly because only one member of the community is in charge of the irrigation manually, carrying buckets of water for each plant. Also, since there is no irrigation system, it requires more time and availability of domestic water for maintenance.

In Group 4, the intervention is well maintained, currently there are 5 members of the community who are responsible. Also, the fact that an irrigation system was installed makes it easier to provide maintenance. It does however add another element (irrigation system) to be maintained.

In general, risk areas are limitedly monitored, mainly, because there is only a small group providing maintenance of the trees and plants. Moreover, because of the steep slopes and the lack of safe paths / stairs, it is less probable that people wish to be involved in the maintenance of the forestation.

Images of the interventions



Left: irrigation system of forestation areas; middle up: desert shrubs or xerophiles to reduce erosion; middle down: water tank and pump for irrigation; right: planted tree.

Environmental Resilience

FACT SHEET: LIMA – INDEPENDENCIA

Communities:	**El Volante II, III and Villa del Ángel**
Main Intervention:	**Forestation, water tanks for the irrigation system, public green areas:** Strategy to reduce the vulnerability by limiting the occupation in risk areas and preserve the hills' ecosystem. Recovery of small-scale green areas as safe zones in case of emergency.

Main Uses:

Forestation reduces potential expansion to higher areas. It moreover helps to conserve the ecological area of the hills and reduce the risk of falling rocks towards the community. Planting shrub vegetation (xerophiles), desert plants and native dry forest helps to keep demand for irrigation water low because of its good tolerance to dry conditions. The trees help to protect the soil from erosion. Potential forest park areas were identified for Villa del Ángel and Volante III. Finally, accessible green areas and public space were recovered as part of the safe areas in the community and for recreational purposes.

Key question: In how far is the (environmental) vulnerability reduced (e.g. actual reduction of the community disaster hazard risks)?

It is considered that the reduction of environmental vulnerability is quite achieved by limiting the area of growth of the community. It moreover retains the displacement of small rocks and slightly reduces soil erosion. The recovery of small-scale green areas helps to gain safe zones for neighbors to meet in case of emergency or for social purposes too. Both interventions raise awareness about of the importance to preserve natural areas at the hills or/and in the community.

General Info:

	Existing green areas in the community (m2)	Existing natural areas (m2)
	1,103 m2	33,982.00
Estimated Population:	~1,516	
	environmental intervention total area (m2)	# of people with direct benefits (#)
	2,000.00	150

Type of intervention:	**Estimated m2**	**Who is benefiting**	**Community**
Forestation Pilot Project	2,000.00	Community and Municipality	All
Trace of pedestrian paths on slopes	N/A	Community	Volante II & III
Registration of "Boca de Sapo" district forest parks	143,832.88 m2	Municipality	Volante II & III
Tanks for water storage and irrigation system	N/A	Community and Municipality	Volante II & III
Recovered green areas	1,103.00	Community and Municipality	Villa del Ángel





Environmental Resilience

GIS map of the Transect Walk Volante II & III

GIS map of the Transect Walk Villa del Ángel

ER - Effectiveness:		**ER - Sustainability:**	
On natural areas	**Quite effective (4)**	Maintenance	**Moderately maintained (3)**
On risk reduction	**Slightly effective (2)**	Monitoring risk areas	**Partially monitored (3)**

The forestation project in Volante II & III is quite effective for protecting exiting natural areas and to limit the growth or expansion of informal settlements to areas of high risk. The reduction of vulnerability towards the hill sides is slightly effective. Trees can function as a "trench" for small displacements of surface rocks. However, given the current small size and subsequent fragility of the trees, it is not possible to retain large landslides.

The use of recycled water from municipal treatment plants for irrigation is very effective in saving potable water in the community. Even more by supplying the water through a punctual irrigation system.

Communal green areas are quite effective in reducing vulnerability, as they are considered as recreational areas and, at the same time, safe areas in case of an emergency.

The forestation project in Volante II & III is well maintained by the community, with support from the municipality of Independencia that provides water for irrigation. On the contrary, in Villa del Ángel there are no irrigation systems, which suggests that their forestation area will be poorly maintained.

The recycling or use of water from municipal treatment plants is presented as a comprehensive strategy of resource management, as it helps to reduce the pressure of the availability of potable water for consumption. At the same time it guarantees the supply of water for irrigation and greater capacities of maintaining the forestation area.

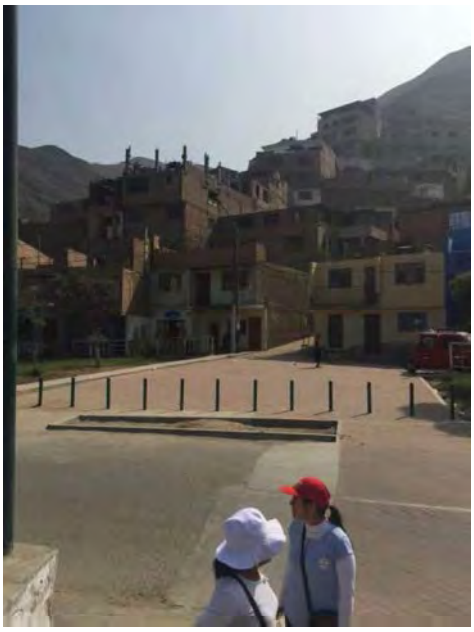
In Volante II & III, through the management of PREDES with the Municipality of Independencia, the Boca de Sapo Forest Park was formalized in SENAC as a protected park. This gives a local and institutional responsibility for its protection, consequently, it supports the monitoring of risk areas.

Images of the interventions









Left: planted trees and irrigation system; middle up: Main pump for water distribution to irrigation tanks; middle down: irrigation system pipeline; right: green areas and public space as safe zones.

Environmental Resilience

FACT SHEET: LIMA – RIMAC

Communities:	**22 Noviembre, Brisas, Santa Rosa & Letícia**
Main Intervention:	**Forestation, artificial wetland for irrigation system, eco-parks:** Strategy to reduce the vulnerability by reducing the occupation in risk areas and preserve the hills' ecosystem. Recovery of small-scale eco-parks for neighbors to meet in case of emergency and for recreation.

Main Uses:

Forestation reduces the expansion to high risk areas and helps to protect the ecological area of the hills. Also, it helps to reduce the risk of falling rocks towards the community caused by new settlements. Artificial wetland is a tool to generate awareness in the members of the community regarding the potential use of gray water for irrigation of trees and ornamental plants. The recovery and integration of a pocket eco-park is part of the strategy of locating safe areas in the community. Also, to recycle materials (like tires or wooden pallets). There is an improvement of the pedestrian boulevard, where trees were planted again to recover the presence of vegetation within the community.

Key question: *In how far is the (environmental) vulnerability reduced (e.g. actual reduction of the community disaster hazard risks)?*

It is considered that the reduction of environmental vulnerability is moderately achieved by limiting the area of growth of the community. It also retains the displacement of small rocks. The recovery of residual areas helps to reduce social vulnerability. Both interventions raise awareness about preserving natural areas on the hills and open spaces in the community.

General Info:

	Existing green areas in the community (m2)	Existing natural areas (m2)
	1,516 m2	13,225.52
Estimated Population:	~6,615	
	environmental intervention total area (m2)	# of people with direct benefits (#)
	3,066.62	~600

Type of intervention:	**Estimated m2**	**Who is benefiting**	**Community**
Forestation Pilot Project	3,000.00	Community and Municipality	22 Nov, Brisas & Sta. Rosa
Artificial wetland for gray water treatment	~3.00	Community	22 Nov, Brisas & Sta. Rosa
Tank for treated water storage and irrigation system	N/A	Community and Municipality	22 Nov, Brisas & Sta. Rosa
Recovered green areas (permeable) / eco-parks	66.62	Community and Municipality	Letícia



GIS map of the Transect Walk 22 Nov, Brisas & Sta. Rosa



GIS map of the Transect Walk Letícia

Environmental Resilience

ER - Effectiveness:		ER - Sustainability:	
On natural areas	**Moderately effective (3)**	Maintenance	**Slightly maintained (2)**
On risk reduction	**Slightly effective (2)**	Monitoring risk areas	**Limitedly monitored (2)**

The forestation in 22 de Noviembre is moderately effective for protecting natural areas from future expansion. Trees, desert shrubs and other superficial vegetation can retain small rocks. They also reduce soil erosion. However, the area does not constitute a high-risk area, since its slope is moderate.

The use of treated water from community's artificial wetland is quite effective as it provides a solution for the limited access to potable water by recycling domestic gray water. It also provides an irrigation alternative for other green areas in the community.

In Letícia, the recovery of residual areas in the community is moderately effective on reducing vulnerability, by protecting recreational areas that can be used at the same time as safe areas. On the other hand, Leticia's eco-park, also reduces social vulnerability by recovering a disused area.

Forestation project and the artificial wetland in 22 de Noviembre is slighty maintained by only the members who agreed to be part of the irrigation pilot project. Each of them must provide gray water to the artificial wetland to ensure that the storage tank has enough water for irrigation. Similarly, only one community leader is responsible for supplying electric power from his home to the water pump of the irrigation system.

In Letícia, the eco-park interventions are slightly maintained. They are not abandoned, but it was not possible to determine the existence of members of the community that give maintenance to the works. In 22 de Noviembre risk areas (erosion or landslides) are limitedly monitored, mainly, because there is only a small group that gives maintenance to the forestation intervention.

Images of the interventions



Left: artificial wetland for grey water treatment; middle up: eco-park as tool for social vulnerability reduction; middle down: green areas as safe zones; right: planted tree and irrigation system.

FACT SHEET: COLOMBIA – MEDELLÍN

Communities:	**Comuna 8 (Llanaditas and El Pinal) & Comuna 1 (Sto. Domingo and El Compromiso)**
Main Intervention:	**Communal Vegetable Gardens (VG) and Greenhouses (GH), Recovered non-accessible green areas:** VG is a strategy to reduce collective risk to landslides produced by soil erosion and loss of plant substrate. It reduces environmental pollution and health vulnerability, mitigates the use of clandestine dumps and supports food security in the community. GH is a strategy for sustainable seed production of vegetables and the use of organic soil through the composting of waste and treatment of leachate as fertilizer. The recovery of green areas is a strategy to reduce the risk potential of landslides in sensitive areas (erosion made by human intervention).

Main Uses:

VG is a pilot project to demonstrate the recovery of green areas on slopes that have lost their topsoil. Transforming them into a community open space for food security by collective collaboration. This project has two main areas. The first is the greenhouse or area of seed reproduction and preparation of organic fertilizer. The second is the occupation of areas with greater slope for the placement of plastic containers that allow to retain the soil and at the same time allow the cultivation of vegetables. The recovery of eroded areas through stabilization with vegetation are complementary works to the interventions of stairs and paths / sidewalks. These are areas that are not accessible by their inclinations, but are part of the landscape of the communities.

Key question: *In how far is the (environmental) vulnerability reduced (e.g. actual reduction of the community disaster hazard risks)?*

It is considered that the reduction of environmental vulnerability is well achieved by the implementation of VG in areas that were used as clandestine dumps. This helps to reduce health risks and contamination in natural areas within the communities. Also, it provides a temporary solution to the fragility of eroded soil and raises awareness about waste management in the communities. The recovery or stabilization of sensitive green areas reduce small-scale potential landslides, preventing soil erosion. The intervention signifies an improvement to the landscape of the community, using low maintenance vegetation.

General Info:	Existing green areas in the community (m2)	Existing natural areas (m2)
	NA	NA
Estimated Population:	~112,608	
	environmental intervention total area (m2)	# of people with direct benefits (#)
	~1,188.00	~10,154

Type of intervention:	**Estimated m2**	**Who is benefiting**	**Community**
Communal vegetable gardens	~832	Community and Municipality	Comuna 1 + 8 (Santo Domingo + Llanaditas)
Communal greenhouses	~112	Community and Municipality	Comuna 1 + 8 (Santo Domingo + Llanaditas)
Green areas for stabilization (non-accessible areas)	N/A	Community and Municipality	All



GIS map of the Transect Walk in Comuna 8 (Llanaditas - Pinal)



GIS map of the Transect Walk in Comuna 1 (Sto. Domigo – El Compromiso

ER - Effectiveness:		**ER - Sustainability:**	
On natural areas	**Quite effective (4)**	Maintenance	**Well maintained (4)**
On risk reduction	**Moderately effective (3)**	Monitoring risk areas	**Well monitored (4)**

The implementation of the vegetable gardens in areas sensitive to landslides is quite effective (in both communities) to mitigate the deterioration of natural areas in slopes or ravines that, due to their location and erosion, represent a threat. Taking into consideration that these areas were used as clandestine or informal waste dumps in the community, it is important to mention that given the amount of waste that was in place, the strategy of the gardens does not ensure the total stability of the area.

The use of terraces and membranes to seal the soil that is polluted with garbage, as well as the installation of small plastic containers to facilitate the containment of fertile land for cultivation is also quite effective. It should be mentioned that the garden project allows the generation of compost based on organic waste and fertilizer through leachate. This is a comprehensive tool for the reduction and management of waste. At the same time, it allows generating a circular economy (of small scale) by taking advantage of organic waste to produce fertilizers. It allows a closed cycle of matter without contamination, which can be replicated in other spaces of the community. The food security strategy is also effective in reducing the economic vulnerability of families who collectively cultivate the vegetable gardens. The production allows them to create sources of income both from sale within the community, as with the chain of business units, where urban farmers can sell their products.

On the other hand, these spaces are catalysts for social change, since the area was transformed from a socially insecure place (especially in Santo Domingo, Comuna 1), where a group of young gang members meet, to what it is now. The interventions allow the community to take over their territories again and with it, have more control over the area, as they are more frequented by the community (although the FGD also showed other experiences).

The renovation or recovery of devegetated slopes is very effective to reduce the risk of small landslides caused by soil erosion. These interventions help protect the circulation areas (stairs, paths or sidewalks), so they are not affected in case of an emergency. On the other hand, they also improve the aesthetics of the collective spaces of the community.

In the sit visit, it was observed that the Vegetable Gardens in both Comunas are well maintained. However, it is important to compare the level of ownership by members of the community. In the case of Llanaditas (Comuna 8), there is just one single family in charge of the production of vegetables and all the care needed (irrigation, cleaning and harvesting of vegetables ready to consume). On the contrary, in the garden of Sto. Domingo, the maintenance and production of vegetables is made up of a team of 6 people, although initially there were 18 active members.

It was also observed that some of the plantings in both VG have problems of pests (butterfly worms), which they still can't eradicate. This could compromise the sustainability of the project in case a solution approved by the municipality is not achieved (since the use of non-organic pesticides in urban areas is not allowed).

In general, it can be indicated that the revegetated slopes are in good condition (well maintained). During the visit it was not possible to identify the degree of maintenance that the community gives, however the community leaders indicate that there is an organization that is in charge of the care and protection of the recovered areas. It was observed that some of the slopes that were landscaped have recyclable garbage (bottles) and waste construction materials, which generates the deterioration of the gardens and the loss of the vegetal layer that protects the slope. It was also observed that in other areas, the plants that were planted are no longer found, possibly due to vandalism or because some members of the community have extracted them.

The leaders of the communities express that there is a continues monitoring and early warning by some members of the community, which facilitated the process of identifying possible risks or prepare for an extreme climate event (e.g. strong rains that could impact sensitive landslides zones).

Images of the interventions



Left: Llanaditas communal vegetable garden; middle up: Composting process; middle down: construction waste in green area in Sto. Domingo community; right: pedestrian path and revegetated slopes in comuna 8.

FACT SHEET: GUATEMALA – MIXCO

Communities:	**Los Cipresales and Vistas de La Comunidad**
Main Intervention:	**Treatment plant, rainwater drainage and sewage system, small green areas, urban agriculture and community gardens, forestation, soccer field:** Strategy for the management of surface contamination and sanitation in communities. The reduction of environmental vulnerability in nearby natural areas to protect the ravines' ecosystem. Implementation of small-scale gardens (as demonstrative project) to protect public areas inside the community near to main exit routes. Forestation nearby treatment plant to prevent soil erosion.

Main Uses:

The sanitation project reduces environmental vulnerability (surface contaminants) in the community. Also, the treatment plant mitigates pollutant discharges into the ravine, which helps to protect the ecosystem. The ditches allow a better management of rainwater within the community. Forestation limits the expansion to lower risk areas and helps to protect sensitive areas near to the treatment plant. Moreover, it reduces the risk of potential landslides, mainly by soil erosion control. The recycling of materials (like tires) helps to create awareness in the members of the community regarding the potential to reuse materials and in general to not pollute but rather protect natural areas. The recovery and integration of small-scale gardens and urban agriculture (as a pilot project of food security in the community) are part of the strategy to preserve clear accesses and evacuation routes, and at the same time protect green areas sensitive to erosion. Also, there is an improvement of open areas, like the soccer field that can be used as a meeting area in case of an emergency.

Key question: ***In how far is the (environmental) vulnerability reduced (e.g. actual reduction of the community disaster hazard risks)?***

It is considered that the reduction of environmental vulnerability is well achieved by installing sewage and gray water systems that mitigate the disposal of pollutants to natural areas, as well as in the streets and other public and collective areas of the communities. The recovery and transformation of residual areas helps to reduce physical vulnerability and potential expansion of the community to lower, high risk, areas in the ravines. Reforestation and the improvement of green areas raises awareness about preserving natural areas in the ravines and open spaces in the community.

General Info:	Existing green areas in the community (m2)		Existing natural areas (m2)
	0.00 m2		~34,439.00
Estimated Population:		~950	
	environmental intervention total area (m2)		# of people with direct benefits (#)
	~6,500.00		517

Type of intervention:	**Estimated m2**	**Who is benefiting**	**Community**
Sanitation project (sewage)	N/A	Community and Municipality	All
Treatment plants	N/A	Community and Municipality	All
Reforestation	N/A	Community and Municipality	Vistas de La Comunidad
Recovered urban gardens / open green areas (permeable)	----	Community	All



GIS map of the Transect Walk in Vistas de La Comunidad



GIS map of the Transect Walk in Cipresales

Environmental Resilience

ER - Effectiveness:		ER - Sustainability:	
On natural areas	**Quite effective (4)**	Maintenance	**Slightly maintained (2)**
On risk reduction	**Moderately effective (3)**	Monitoring risk areas	**Limitedly monitored (2)**

The sanitary and rainwater collection system is quite effective. In both communities, it was possible to observe that the system is in operation. However, not all members in Cipresales have made their connection to the treatment plant.

The treatment plants are effective in mitigating pollution both in natural areas (in the ravines) and public spaces, as well as in reducing diseases caused by the presence of surface pollutants in the communities. However, in Cipresales some families have not made their gray water connection and in some cases, the water stagnates, thus generating the appearance of mosquitoes and related health problems.

The green areas are only slightly effective. Some individual gardens are there but not all are maintained. Moreover, there is no evidence of use for collective gardens, nor for agriculture. On the other hand, the forestation areas are in good condition, they protect the area from erosion. However, there are also areas of clandestine garbage dumping and burning near areas sensitive to erosion.

The sanitation works carried out in the communities are slightly maintained. Little trash was observed in the ditches, as some neighbors continue to organize for cleaning. It was observed that treatment plants receive sewage from household connections. However, it was not observed that both plants are in maintenance. Specifically, Cipresales seems to be only partially operative. But even the plant in Vistas de La Comunidad presents a small leak. In neither was mud observed as a result of the treatment.

The green areas do not present maintenance at all. The communal gardens and urban agriculture no longer exist and the vegetation planted at the end of the intervention is lost. There is no organization on the part of the community to maintain or care for these areas. The zones of reforestation do not present major maintenance, but the condition of the soil and the climate, makes it easier for the trees to continue their growth without further intervention. However, there is no indication that they are monitored, therefore, it is not possible to identify if there are new zones vulnerable to landslide.

Images of the interventions



Left: Treatment plant in Vistas de la Comunidad; middle up: open areas for gardens without maintenance; middle down: forestation area near treatment plant; right: drainage for rainfall in Cipresales and individual garden initiative (with recycled tires, method from project).

FACT SHEET: JAMAICA – PORTMORE

Communities:	**Naggo Head, New Land and Gregory Park**
Main Intervention:	**Sanitation modules of Ventilated Improved Double Pit toilets (V.I.D.P.) and receptacle for waste management:** Strategy for waste management by using collective receptacles to mitigate the use of clandestine dumps. WASH strategy to reduce collective risk to urban water with tailored sanitation modules (V.I.D.P.) to reduce environmental pollution and health vulnerability by water source contamination in the communities.

Main Uses:

The sanitation modules V.I.D.P. reduce health vulnerability caused by surface solid waste contaminants (fecal matter) in the collective areas used by inhabitants of the same land (between 3 to 5 families living on the same plot share one module). The receptacles for waste management were installed on the border of Naggo Head (5 units) and Gregory Park (4 units) communities, where each lane has their own receptacle for garbage disposal. A municipal contractor collects the waste from the receptacles.

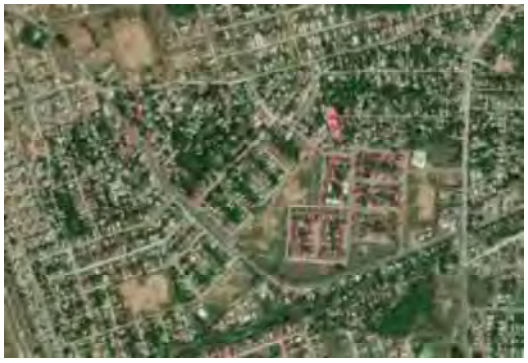
Key question: *In how far is the (environmental) vulnerability reduced (e.g. actual reduction of the community disaster hazard risks)?*

It is considered that the reduction of environmental vulnerability is moderately achieved by installing the sanitation modules inside the communities. This mitigates the disposal of pollutants (fecal matter) in case of potential flooding in streets and collective areas of the communities. It also reduces potential contamination to water source. The implementation of communal receptacles for waste management facilitates the recovery of green areas in Naggo Head and Gregory Park, that were used as clandestine dumps. This helps to reduce health risks and prevent contamination in natural areas. Moreover, it raises awareness about maintaining open areas clean to prevent waste moving towards the communities in case of a flooding and it prevents main drainages to get block by garbage.

General Info:	Existing green areas in the community (m2)		Existing natural areas (m2)
	0.00 m2		~41,000.00
Estimated Population:	~65,000		
	environmental intervention total area (m2)		# of people with direct benefits (#)
	~574		6,386
Type of intervention:	**Estimated m2**	**Who is benefiting**	**Community**
Tailored VIDPs	N/A	Community and Municipality	All
Receptacles for garbage disposal	N/A	Community and Municipality	Naggo Head & Gregory Park



GIS map of the Transect Walk in Naggo Head and New Land



GIS map of the Transect Walk in Gregory Park

ER - Effectiveness:		**ER - Sustainability:**	
On natural areas	**Moderately effective (3)**	Maintenance	**Quite maintained (4)**
On risk reduction	**Moderately effective (3)**	Monitoring risk areas	**Slightly monitored (2)**

The sanitation modules or VIDP's, demonstrated that they are quite effective in reduction of health vulnerability. During the visit, it was observed that the modules have been adopted by the members of the community, which translates into a lower risk of diseases caused by fecal matter that were previously superficial and close to all homes.

Due to its design, it helps to avoid contamination of nearby or superficial water sources. Mainly since most of the water supply connections are informal and leaking they can be contaminated. In an extreme weather condition, since the module sits on a concrete platform that is elevated from ground level, it is less possible that water from the floods infiltrates the dry tanks.

On the other hand, no samples of soil (used to cover the feces after the use of the toilet) was found. Despite this, no bad smells were identified, which also shows that the ventilation system is functional. However, it is considered necessary to protect it with a lid to prevent the rainwater from entering the dry tanks. But to guarantee the effectiveness of the system, it is necessary to have the quantities of soil for its proper use.

The receptacles for waste management are quite effective in reducing informal or clandestine dumps in open areas in Naggo Head and Gregory Park communities. Because of the height of these infrastructures, it is less possible that dogs or goats try to look for food waste. Although it is true that it reduces the presence of garbage in green areas, due to its limited size and the wide demand of this infrastructure, other communities use it and its capacity is reduced. This causes people to leave garbage bags outside the receptacles, which is counterproductive. Likewise, some neighbors report that the garbage collection does not happen periodically and that also affects its functionality in relation to preventing garbage from being exposed.

It was also observed that the receptacles have no roof and this can be a limitation for use in rainy season. Garbage can get wet and if there is much organic waste, it can give off bad odors and attract flies or mosquitoes.

In the sit visit, it was observed that the VIDP's are well maintained. And at the level of management and sustainability of the interventions, it is considered that since a limited number of families have access to each bathroom (between 4 and 5 families) it is expected that their maintenance will be easier to coordinate among family members. It was observed that in most of the toilets visited, there is a person in charge of the cleaning, although it was not possible to determine if there were more members participating in the maintenance. It was observed that the vent pipe has no protection against rain, which can reduce (in the winter season) the speed of drying and eventually could make it more difficult to maintain the toilets.

The use of a double dry tank system for the VIDP's helps to facilitate long-term maintenance, since it allows the rotation of the use of the toilets and, in turn, gives the necessary time for the tank to finish decomposing and drying the solid matter. The only long-term challenge is the process of emptying the tanks, for which it must be uncovered, breaking a concrete plate, which must then be placed and sealed again. This work must be done properly, to avoid water (in case of flooding) to infiltrate the tanks or in the opposite direction, escape of gas or odors that come from the decomposition of fecal matter. However, it is not clear who will be in charge of carrying out this process and what economic implications it will have for the beneficiaries, both for its cleaning and for its repair.

The receptacles are robust infrastructures that require very little maintenance. During the visit it was observed that they are well maintained. However, it is possible that maintenance and cleaning problems arise. Mainly because of the insecurity that is currently perceived by some members of the community. This is due to its location, on the outskirts of the community, in a public abandoned area. Although the interventions are well maintained, it was not observed during the visit that the leaders or members of the community have an early warning system, which could be useful to identify possible risks or prepare for an extreme climate event (e.g. flooding sensitive zones).

Images of the interventions






Left: One of the VIDP's in Naggo Head community; middle up: receptacle in Naggo Head Rd; middle down: Concrete plate to seal dry tank for later use; right: inside view of VIDP (dry toilet and vent pipe).

FACT SHEET: HONDURAS – TEGUCIGALPA

Communities:	**José Angel Ulloa, José Arturo Duarte and Nueva Providencia**
Main Intervention:	**Gray and rainwater drainage with ditches, reforestation, recovered communal park, tire recycling for retaining walls, sanitation modules and tank for harvesting rainwater:** Strategy for the management of surface contamination (gray water) and soil erosion with a drainage system and tailored sanitation modules in the communities. The reduction of environmental vulnerability in nearby natural areas. Reforestation of areas that are sensitive to landslides, due to lost vegetation and clandestine garbage dumps transformed into a communal park or green areas.

Main Uses:

The sanitation project (drainage and sanitation modules) reduces environmental vulnerability caused by surface contaminants in the community. Also, the drainages help to reduce the impact of water discharged into the streams, which helps to protect the natural areas from erosion. The ditches allow a better management of rainwater within the community reducing vulnerability to diseases. Forestation limits the expansion of houses to lower sensitive areas near to seasonal streams. Moreover, it reduces the risk of potential landslides, mainly by soil erosion control. The recycling of materials (like tires) helps to create awareness in the members of the community regarding the potential to reuse materials as a tool to stabilize terraces for different uses and, in general, to create awareness regarding the importance to preserve natural areas. The recovery and integration of a communal park (as a tool to reclaiming an informal landfill) a part of the strategy to protect green areas sensitive to erosion. Also, the communal park can be used as a meeting area in case of an emergency.

Key question: ***In how far is the (environmental) vulnerability reduced (e.g. actual reduction of the community disaster hazard risks)?***

It is considered that the reduction of environmental vulnerability is well achieved by installing drainages for rain and gray water. This mitigates the disposal of pollutants, potential flood in streets and other public or collective areas of the communities. It moreover controls water runoff, thus preventing erosion in natural areas (mainly seasonal streams). The recovery and transformation of marginal areas helps to reduce health risk by pollution sources (clandestine garbage dumps) and potential expansion of the community to lower, high risk, areas in the streams. Reforestation and the improvement of the communal park raises awareness about preserving natural areas in the ravines and open spaces in the community.

General Info:	Existing green areas in the community (m2)	Existing natural areas (m2)
	0.00 m2	~41,000.00
Estimated Population:	~950	
	environmental intervention total area (m2)	# of people with direct benefits (#)
	~574	NI

Type of intervention:	**Estimated m2**	**Who is benefiting**	**Community**
Drainage and ditches system	N/A	Community and Municipality	All
Sanitation Modules	N/A	Community and Municipality	Col. Berlín
Reforestation	188	Community and Municipality	La Ulloa
Recovered community park	368	Community	Duarte



GIS map of the Transect Walk in La Ulloa



GIS map of the Transect Walk in Duarte & Nueva Providencia

ER - Effectiveness:		**ER - Sustainability:**	
On natural areas	**Quite effective (4)**	Maintenance	**Moderately maintained (3)**
On risk reduction	**Moderately effective (3)**	Monitoring risk areas	**Fully monitored (4)**

Gray and rainwater drainage with ditches is quite effective to reduce potential flooding in the communities. Moreover, it mitigates soil erosion produced by superficial runoff water to natural areas. This helps to protect the streams, mainly by conducting the discharges to lower areas and by using trenches to reduce water flow speed.

The ditches reduce environmental vulnerability caused by surface contaminants in the community. The gray water generated by the houses is conducted by ditches without affecting the houses and prevents water from stagnating, which reduces the risk of flooding and the creation of breeding grounds for mosquitoes. During the visit, it was observed that some people collect gray water for other uses (such as watering plants). However, some families are discharging sewage into the drainage system so reusing the water can generate a health problem.

The reforestation zone (next to the communal park) is slightly effective. It might create awareness among some neighbors to protect areas sensitive to landslide. However, is still used as a dump or to burn garbage. The recovery of the park is moderately effective in reducing pollution and erosion. The use of tires for retaining walls is a tool for creating awareness of potential recycling. It was observed that the system has been replicated in many parts of the community. However, these interventions do not always meet the standards proposed by Goal.

The implementation of sanitation modules is very effective. It mitigates superficial contamination in the communities by providing an effective solution to the lack of municipal sewage collectors in most parts of Duarte and Ulloa communities. Also, it controls on the ground pollution, thus improving people's health. It was observed that some of the modules had an improvised harvesting rainwater system, which gives an alternative solution for water consumption for domestic use (as no potable water is needed). Another effective case was located in a primary school. The implementation of the harvesting system helps to meet Sphere's[1] shelter standards, which also reduces water infrastructure's vulnerability in case of an emergency or disaster.

The ditches for rainwater runoff and domestic gray water management are in good condition, which indicates that they are being maintained. However, in various areas garbage was observed in the ditches, specifically in front of the neighborhood stores (*pulperías*), which can reduce their drainage capacity.

The works delivered for the communal park are slightly maintained, there is deterioration and lack of care (paint or gardening). Reforestation areas are not well maintained. The issue of waste management is the main challenge to reduce the presence of garbage in the community. It was observed that members of the community usually burn trash or they dump it towards the main basin. One communal leader explains that this happened because there is no waste collection system inside the community and the only receptacle of garbage is far away. There is also no recycling. In general, although there is a communal organization, the level of maintenance of the interventions is not clear. There is no indication of a community commitment. The leaders indicate that not everyone commits to post-project activities. This might demonstrate that the community does not visualize the improvements as a common good for all, but only for the direct beneficiaries.

On the other hand, it was observed that the sanitation modules are well maintained. Even some families added an artisanal rainwater capture system to expand their water collection. Because the works are new, the biggest challenge at the maintenance level will be when the bio-digester must be cleaned, which must happen after approximately 5 years. It has been indicated that there is an agreement with the municipality to do the cleaning of each one at a cost of 100 Lempiras (~4 USD).

It is important to mention that the risk areas in the communities are well monitored, both by the community (with measuring instruments for rain, fissures in walls, inclination of sensitive areas) as well as by a new project with the World Bank, who gave financing to locate 16 drill points with an early alteration system.

Images of the interventions



Left: drainage ditch constructed in José Arturo Duarte community; middle up: recollecting gray water for reuse; middle down: sanitation modules; right: communal park (with recycled tires).

[1] The Sphere Project (established in 1997) is a voluntary initiative that brings a wide range of humanitarian agencies together around a common aim - to improve the quality of humanitarian assistance and the accountability of humanitarian actors to their constituents, donors and affected populations. The Sphere Handbook, Humanitarian Charter and Minimum Standards in Humanitarian Response, is one of the most widely known and internationally recognized sets of common principles and universal minimum standards in life-saving areas of humanitarian response. The Sphere Project is not a membership organization but governed by a board composed of representatives of global networks of humanitarian agencies; the Sphere Project is a community of humanitarian response practitioners. www.spherehandbook.org/en/1-shelter-and-settlement

Performance Evaluation:
LAC Urban DRR Programming
The Neighborhood Approach

ANNEX 4.3

Support Documents

Focus Groups



USAID
FROM THE AMERICAN PEOPLE

FIU | Extreme Events Institute
FLORIDA INTERNATIONAL UNIVERSITY

Table of Contents

Focus Groups
- Lima – Carabayllo, Peru
- Lima - Independencia, Peru
- Lima - Rimac, Peru
- Medellin, Colombia
- Mixco, Guatemala
- Port-de-Paix and Anse-à-Foleur, Haiti
- Portmore, Jamaica
- Tegucigalpa, Honduras

Level of DRR

- Community members are more capable in recognizing potential risks and know better how to deal with them and reduce them.
- People know how to react in case of an emergency
- People feel safer than before
- Physical works have reduced the potential impact of a disaster
- Human, social, physical and environmental vulnerability has been diminished
- There are less accidents due to the physical works
- Stairs and evacuation route signals can accelerate evacuation
- People constructed their own *pircas* (retention walls)

PW = Physical Works

Effectiveness – Carabayllo FGD

Most effective aspects

- Having people make a household emergency plan and package
- A combination of physical works that strengthen each other
- Stairs improve connectivity
- Training on project proposal development has led to the support of a forestation-irrigation project
- Forming community platforms
- Combining DRR trainings with PW
- Trainings

Least effective aspects

- Community houses are not used often
- Not all communities have their advanced warehouse

Not at all effective	Slightly effective	Moderately effective	Quite effective	Extremely effective
			X	

Influencing factors

- Stronger focus on individual than collective benefits
- Work on three levels at the same time: prevention, reduction, preparation
- Lack of community participation and subsequent appropriation
- Having the knowledge but not all tools to react to an emergency
- Lack of a culture of risk prevention and environmental protection. Lots of awareness raising is necessary
- Project period is short. Many PW, trainings and support are necessary
- Uncompleted PW or tools that are lacking



Community Ownership

- Working with community promotors and brigades allows for follow up, exchange and replication
- Participation of community members in construction of the PW strengthens their knowledge, experience, appropriation and replication
- Training community members to do things rather than doing it for them
- Ownership is strengthened by PWs that facility daily live activities (e.g. stairs and railings)
- Participation and subsequent empowerment of women

PW = Physical Works

Sustainability – Carabayllo FGD

Enabling factors

- Strengthening and forming community structures related to DRR (e.g. platforms)
- Training local promotors and construction workers
- Community boards signed an agreement to maintain the PW. During trainings they were taught how to do this
- Stimulating community participation strengthens appropriation
- Passing on knowledge allows the community to continue DRR activities
- Municipal programs for community project applications
- Promotor platforms develop annual work plan
- Forestation is potentially reducing risks for future generations

Impeding factors

- Change of community leaders every 2 years
- Not many institutions or companies support DRR in communities
- Limited participation of community members can demotivate those that did participate to give follow up
- Lack of (financial) resources to maintain PWs

Not at all sustainable	Slightly sustainable	Moderately sustainable	Quite sustainable	Extremely sustainable
			X	

Institutional Ownership

- Different stakeholders participated in the project: Civil Defense, Municipality
- Municipality is not providing enough support according to the communities leaders
- Different stakeholders are supporting the implementation of the platform work plans: health center, civil defense, police, firefighters



Effectiveness – Independencia FGD

Level of DRR

- Effectiveness on DRR is difficult to measure before an actual event has happened
- People are more conscious about the risk
- People know how to react when a disaster happens
- People feel saver
- Streets have been cleaned
- Vulnerability to a disaster has been reduced
- Forestation reduces the risk of minor landslides and falling stones
- Children have been saved from choking due to the first aid trainings
- Forestation avoids invasion which limits the number of people living in risk zones

Most effective aspects

- DRR training in combination with evacuation routes, safe zones
- Combination of trainings with PW strengthens the effect of both
- Trainings have motivated people to make changes in the community and gave them the capacities to do so
- Evacuation signage shows all community members where to go to in case of a disaster
- Forestation helps to reduce (respiratory) diseases, and damages to houses and people
- Multiplier effect of the trainings
- Irrigation system helped to get the vegetation growing

Least effective aspects

- More PW have to be done, including for the protection and adequate use of the PW that were done
- The trees are not big enough yet to generate the positive effects that are envisioned

Influencing factors

- Participation is stronger in communities where basic services are still lacking
- There are not many entities providing DRR support
- Internal conflicts in communities limits participation
- People focus first on satisfying their daily needs. DRR comes afterwards
- Leaders' capacity and availability to organize the community

"Lamentablemente, las personas, antes de que pase algo, no reaccionamos. Esperamos que nos pase algo para reaccionar"
Líder Volante 3

Not at all effective	Slightly effective	Moderately effective	Quite effective	Extremely effective
			X	

DRR = Disaster Risk Reduction
PW = Physical Works

Sustainability – Independencia FGD

Community Ownership

- Local capacities have been developed
- People are conscious about the risks and eager to reduce them and maintain the PW
- Communities have committed and more capable leaders
- Community members are confident they know how to react in case of a disaster
- Internal divisions limits community leadership and appropriation
- Communities members have been empowered

Enabling factors

- Facilitating irrigation with a bombing system
- Irrigation system is key for the sustainability of the forestation
- Including youth in the project; they are the future leaders and implementers of DRR
- Forestation is a constant reminder of the necessity to protect the hills
- Strengthening capacities of (future) community leaders
- Having communities commit formally to the maintenance of PW with agreed support of other stakeholders such as the Municipality
- Working with communities where people know each other well

Impeding factors

- Not all skills for maintaining PW can be transferred to the communities. This creates dependence on experts
- Community members need refresher courses
- There is much dependence on the Municipality for technical support and access to water to maintain forestation area
- Communities do not trust the municipality
- It is difficult to maintain the future generation (youth) involved

Institutional Ownership

- According to the community leaders, the municipality is not providing the necessary support
- Some municipal staff lack the necessary capacities
- Forestation area is inscribed in SENAC as recreation park
- Municipality does not have the necessary resources to provide follow up
- Agreements will be signed between the municipality and communities for maintenance of the forestation
- Forestation area is municipal property. Present administration is maintaining it but future is insecure
- Municipality is finishing the forestation project and providing maintenance

Green = positive aspects
Red = negative aspects
Yellow = neutral aspects or in some cases positive, in others negative

Not at all sustainable	Slightly sustainable	Moderately sustainable	Quite sustainable	Extremely sustainable
			X	

PW = Physical Works

Effectiveness – Rimac FGD

Level of DRR

- Risk in general is reduced, mostly by reducing vulnerability and, to a lesser extent, threat
- People are less vulnerable knowing how to react to a disaster and having more tools to react
- Threat is slightly reduced by PW like forestation, stairs and reinforcement
- Less (stomach) diseases and health center visits due to better hygiene at the *comedores*
- Evacuation routes and safe zones have been signaled
- Forestation has stopped invasion which limits the number of people living in risk zones
- Community and university members understand the risks, its causes and know how to react
- One building has been reinforced, thus being more resistant in case of an earthquake / -shake

Most effective aspects

- Training on DRR combined with drills
- Leaders aware of necessity of evacuation signage
- Combining training on hygiene with installation of washbasins
- Forestation is positive for physical and mental health of people
- Forestation raises environmental awareness
- Local workers learned new construction methods and have applied these
- Multiplier effect by training trainers at key spots (e.g. *comedores*)
- Starting with sensitization on the importance of DRR
- Training on project proposal development has led to the support of a project by the Municipality
- Training on public administration can be used to get future support

Least effective aspects

- Not many PW were done
- The waste water treatment system was not constructed well, which limits its use and maintenance
- Only 1 of 18 buildings was reinforced because owners did not collaborate
- Limited support and participation of the Municipality
- Few people have an emergency backpack. They expect to receive it instead of making one themselves

Influencing factors

- Divided political power and conflicts within the communities can limit participation
- Lack of trust from communities towards Municipality
- Information and motivation provided by COOPI was key to get people to participate
- Lack of information provided by entities like the Municipality
- Lack of adequate public policies and support mechanisms for revitalization of old buildings
- Lack of meeting spaces, limits participation
- Limited participation, limits effectivity
- Quality in the designs and implementation of the PW

"No regalaron el pescado sino nos enseñaron a pescar."
Dirigente de RIMAC

Not at all effective	Slightly effective	Moderately effective	Quite effective	Extremely effective
		X	X	

DRR = Disaster Risk Reduction
PW = Physical Works

Sustainability – Rimac FGD

Community Ownership

- Part of the population is aware of the risks and acquired knowledge on DRR
- Part of the trained people keeps passing on the knowledge, thus strengthening their knowledge and that of other people
- Local artists have been replicating the art trainings and making of murals
- Where the project was implemented with community members their appropriation of the results and with that their maintenance and care has been strengthened
- Responsibility of care and maintenance is only carried by a small part of the population (those who participated in the project)
- Community involvement has increased due to the project, which foments future scalability
- Community alliances have been strengthened

Enabling factors

- Having a manual and annual plan to train people at other *comedores*
- Local workers learned new construction methods which they can continue to apply without additional training
- Training on public administration and project application can be used to get future support
- Combining training with practice and PW helps to apply and internalize what was learned
- Communities have gained visibility and recognition
- Municipal programs for community project applications

Impeding factors

- No DRR organizational structures were created in the university and communities
- Limited financial resources for DRR (both communities and municipality)
- Maintenance is provided by people from COOPI limiting the potential sustainability
- Dependence on external support
- Inadequate construction of waste water system limits peoples interest in maintaining it
- Using external workers does not strengthen participation and subsequent sensitization and appropriation of the community

Institutional Ownership

- Many different stakeholders participated during the project and can give follow up: municipality, health center, university
- Sustainability would be greater if the Municipality would have contributed more human and financial resources from the start
- Municipal and health personnel are training *comedores* staff
- Public policies on DRR are insufficient
- The health center is monitoring and continuing training in *comedores*
- The local artist collective has gained more visibility and subsequent opportunities to continue the work
- University has gained experience and could continue implementing public administration workshops for communities

Green = positive aspects
Red = negative aspects
Yellow = neutral aspects or in some cases positive, in others negative

Not at all sustainable	Slightly sustainable	Moderately sustainable	Quite sustainable	Extremely sustainable
		X	X	

PW = Physical Works

Level of DRR

- Houses are safer due to trainings, manual and PW
- Many CM learned to recognize risks, how to reduce them, how to stay safe and understood that risk management is their responsibility
- Increased appropriation and collaboration reduces risks and improves potential emergency response
- Families know what to do in case of an emergency (plan prepared)
- VG have reduced the risk of landslides
- Stairs, railings, pavements, evacuation routes, safe areas facilitate evacuation in case of an emergency
- Communities have basic rescue equipment
- Improved electricity network in shops reduced risk of fires
- According to DAGRD worker: risk of fire and landslides has reduced by 60%. Now there are only minor incidents.
- Community Risk Map helped to recognize risks and develop plans
- People have less risk of their house collapsing or getting sick + they feel safer

Effectiveness – Medellin FGD

Most effective aspects

- Dynamic methodologies stimulate participation and sensitization
- The manual empowers to train others and to recognize need of improvements
- High participation of all ages, sexes, professions
- PW have reduced the risk of falling. Previously people died or got seriously injured.
- Houses for improvements were carefully selected, which resulted in CM accepting the selection.
- The way GC approached the communities, defining interventions together
- Combining trainings and tools with PW strengthens knowledge and appropriation
- Less garbage in public areas due to awareness raising and waste separation.
- Trainings to stores improved hygiene and business
- Improved lighting and related safety with solar lamps
- Variety of vegetable gardens provide constant production for food & income, stimulate collaboration, education, tourism

Least effective aspects

- Any new technology should come with sufficient training to understand their functioning, possible use and how to maintain them. Some solar lights stopped working. CM don't know how to repair them
- The timeframe and budget of the project is not sufficient to fulfill all necessities the communities have.
- %>EAÃF:7Ã4;9ÃE;K7ÃÅ8Ã 5A??G@;F;7EÃ?3=7EÃ;FÃ 6;88;5G>FÃFAÃ3FF7@6Ã3>>Ã @757EE;F;7EÃ3@6ÃFÅÃ 7EF34>;E:Ã367CG3F7Ã 5A??G@;FJÃEFDG5FGD7EÃ FAÃ9;H7Ã8A>>AIÃGBÃ
- Some key DRR interventions are still lacking

Influencing factors

- An accident with waste treatment triggered people to change things
- Due to lack of money and time not all interventions could be done
- Some leaders favored specific CM
- Focus on high risk zones was key to stimulate more entities to invest
- GC used well prepared professionals with social sensitivity. The CM felt their necessities were taken into account
- Linkages with many different stakeholders made it possible to do many different interventions
- The project could built upon many already existing interventions

"Acá en Santo Domingo ha sido muy notable la disminución de riesgo. Tan notable ha sido que con la mitigación, con las dos mesas ambientales conformadas, con el semillero de los niños, disminuyó un 60% las emergencias" ,7367DÃ3@FAÃ? ;@9A!ÃBÃ8Ã%)/ '

Not at all effective	Slightly effective	Moderately effective	Quite effective	Extremely effective
			X	

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CM	$ &A??G@;F-7?47DE
DAGRD	$ ';E3EF7D/;E= - 3@397?7@F
EC	$ (>&A?BDA?;EA&A?G@3#

Community Ownership

- CM appropriated more the territory and collaborate, leading to improved caretaking of house and community
- Many different CM participated and learned DRR, waste management and other topics
- Leaders, many women, have been empowered and learned to develop projects
- Leaders would have liked to receive more trainings and tools to become better leaders
- Community committees were strengthened and are recognized by the Municipality.
- &-Ã5A@F;@G7Ã FD3;@;@9ÃAF:7DEÃI; GE7ÃA8ÃF:7Ã?3@G3-
- CM learned their obligation and rights and demand actively support from government
- Environmental community group learned to manage projects and got already more done
- There is strong citizen monitoring. Community group monitors and maintains PW in alliance with institutions through a signed agreement
- C1 is pioneer in applying for projects with participatory budgeting. They got already various PW
- +@6;H;6G3>Ã2)ÃE77?Ã FAÃ47Ã?AD7Ã EGEF3;@34>7ÃF:3@Ã 5A>>75F;H7ÃA@7E

Sustainability – Medellin FGD

Enabling factors

- GC taught them project formulation and management and gave them tools to get support (e.g. community map)
- Shop owners provide information, training and can support during an emergency
- Risk committee monitors risk cases and (landslide, fire) incidents
- Vegetable gardens provide an income and food security, which makes people maintain them. Also because they have seeds nearby (nursery and sales)
- Visually attractive and understandable manuals allow for training others and refreshing what was learned.
- Families have prepared their emergency plan
- C8: People learned to separate garbage, so collectors don't need to take all garbage out on the street in search for the recyclables
- Well developed neighborhood plans offer a roadmap to CM for future steps

Impeding factors

- Due to lack of money it is difficult to give follow up with new interventions
- When implementing new technologies, they should be easy to maintain and repair by CM themselves as to not depend on the installer for their sustainability
- Due to limited time and money not all interventions could be done, which puts in risk the sustainability of others.
- 1:7Ã>35=ÃA8Ã 5AAD6;@3F;A@Ã47FI77@Ã ;@EF;FGF;A@EÃA8Ã6;887D7@FÃ BDA<75FEÃ3@6Ã F;?78D3?7EÃ;?B767EÃ F:7Ã3>;9@7?@FÃA8Ã ;@F7DH7@F;A@EÃ3@6Ã53@Ã 7H7@Ã47Ã 5AG@F7DBDA6G5F;H7Ã

Institutional Ownership

- 23D;AGEÃ;@EF;FGF;A@EÃ BDAH;67ÃEGBBADFÃ3@6Ã ?3;@F7@3@57ÃF:DAG9:Ã E;9@76Ã39D7?7@FE!ÃIAD=;@9Ã5>AE7>JÃI;F:Ã F:7Ã5A??G@:FJÃ3@6Ã :3H;@9Ã7H7@ÃA88;57EÃF:7D7
- Municipality is investing strongly in these communities
- Participatory budgeting helps to create continuity in interventions
- DAGRD supports DRR activities
- FENALCO supports shops
- Police is applying fines for littering
- Support from many different institutions augments possibility of continuing projects with some of them
- +FÃ;EÃ6;88;5G>FÃFAÃ 35CG;D7Ã;@EF;FGF;A@3>Ã EGBBADFÃ8ADÃ:;9:ÃD;E=Ã KA@7E3H;@9Ã D76G576ÃF:7ÃD;E=Ã ?3=7EÃ;FÃ73E;7DÃFAÃ97FÃ EGBBADF

Green = positive aspects

Red = negative aspects

Yellow = neutral aspects or in some cases positive, in others negative

Score: 4,5

Not at all sustainable	Slightly sustainable	Moderately sustainable	Quite sustainable	Extremely sustainable
			X	X

GC	= Global Communities
PW	= Physical Works
VG	= Vegetable garden

Level of DRR

- Retention walls help to avoid soil erosion and potential landslides thus reducing the risk of losing furniture, part of the house, and getting hurt or losing lives
- Some houses have been rebuilt or strengthened reducing the risk of collapsing
- Pavement facilitates rescue and evacuation to safe zones in case of an emergency
- Retention walls also help to ensure that future constructions are done on a secure base without generating new risks
- Mapping helped to understand the risks and define interventions
- People react quicker and better in case of an emergency (e.g. kept a house from burning down)

Effectiveness – Mixco FGD

Most effective aspects

- EW helps to diminish economic vulnerability for some through savings and selling or usage of hygiene products
- Water treatment plant and drainages (where the majority is connected to), reduce exposure of surface contaminants that could pollute the environment or form a health risk.
- Trainings: People are very positive about having learned many different things and put into practice
- Model houses are safer and less cold thus improving health
- Retention walls avoid water, mud and waste flowing into houses, reducing economic, human and physical vulnerability
- Pavement has reduced number and seriousness of accidents by falling, specifically for elderly.
- People prefer concrete over tire walls as they are easier and quicker to build.
- Mapping helped to get to know the physical and social structure of the community

Least effective aspects

- The community vegetable gardens were consumed and not replanted. This might be due to limited scale, lack of access to plants or focus on individual benefits
- EW have been reduced in number and type of activities. Focus on personal saving only
- The tire walls have been effective but CM did indicate they take quite some time to make and people can get hurt while cutting the tires.
- Few EW are generating an income. Most stopped making the hygienic products, because of a lack of time or ingredients
- Lack of pavement still causes pollution and respiratory diseases by dust
- The replication model did not work as expected

Influencing factors

- The level of poverty: People don't have time or money to invest. Income generating activities help to diminish this economic vulnerability
- There are many single mothers who need to be able to combine the activities with taking care of the children
- Land tenure: streets in Vistas have not been paved and the municipality cannot be demanded to do so, as these are private property
- Lack of willingness to collaborate for the benefit of the community. Before starting the project, there should be a clear signed commitment of CM.
- Leadership and organizational capacities should be strengthened.
- Community vegetable gardens should have enough production and access to new plants

"Muros de contención: hay más seguridad. Ya no hay vulnerabilidad. Menos riesgo de derrumbes o que se caiga una casa."
Leader from Cipresales

1) Not at all effective	2) Slightly effective	3) Moderately effective	4) Quite effective	5) Extremely effective
			X	

CM = Community Members
DRR = Disaster Risk Reduction
EW = Empowered Women
PW = Physical Works

Community Ownership

- Community groups are trained and better prepared for DRR, saving and future interventions
- Community is more united and collaborative mostly during and emergency.
- Relation set up between Municipality and communities; leads to more support
- Community participation is still limited. Adequate leadership is lacking
- CM learned how to make walls and replicate the knowledge but funds are lacking and CM still depend on PCI.
- People maintain the walls; some even strengthened them or built on top with own resources.
- One woman has increased her monthly income due to selling creams she learned to make by trainings of PCI.
- Some women keep on making hygiene products for their families or the school.
- In Cipresales CM started to plant flowers in front of their houses

Sustainability – Mixco FGD

Enabling factors

- Requiring the community to be organized in order to be able to participate in the project
- Strengthening already existing organizational structures favors the possibility of achieving sustainability
- Some groups persisted because they fulfill a necessity
- Extending the project period allowed for a more intense strengthening process
- Those activities that generate an income for the family are given follow up to
- When people recognize that interventions help to reduce the risk they live in, they will maintain or even replicate them
- It is easier to get people take up activities on individual than on collective level
- Interest and ability to replicate due to CM having put trainings in practice
- Concrete walls foment leveraging. Challenge is to avoid generating new risks.

Impeding factors

- Interventions that need continuous maintenance and follow up require a clear plan and commitment.
- The standard project period is too short to ensure sustainability of newly established groups
- Due to poverty it is difficult to give follow up to activities; lack of time or CM have unexpected expenses
- For replication materials / funds are often lacking and CM keep depending on PCI support.
- Individual PW are maintained by the people who benefit from them, but nobody takes care of the collective PW. For these it is key to have a community organization that takes up the responsibility.
- A clear handover plan and capacities to be their own agents of change might still be lacking
- Land tenure: having PW in private property makes it difficult for the Municipality to provide maintenance and give follow up

Institutional Ownership

- Potential of sustainability was increased by working with local and national stakeholders from the start.
- Municipality is more present now and mini-munis facilitate communication with communities.
- Government has a subsidy program for housing improvements for which it is easier to apply now that CM are better organized.
- Municipality has not taken on responsibility of treatment plants or Vistas' streets as these are in private property.
- New legislation made water treatment plants obligatory for all communities. The Municipality will have to fulfil this obligation.

Green = positive aspects
Red = negative aspects
Yellow = neutral aspects or in some cases positive, in others negative

Score: 3,5

1) Not at all sustainable	2) Slightly sustainable	3) Moderately sustainable	4) Quite sustainable	5) Extremely sustainable
		X	X	

CM = Community members
DRR = Disaster Risk Reduction
EW = Empowered Women
PW = Physical Works

Effectiveness – Haiti FGD

Level of DRR

The shelters kept people save during the four days that hurricane Irma was most active.

The canal has reduced the number of floodings from aprox. 9 to 5 or 6 a year

PW reduce the risk but lack of maintenance limits their effect and generate new risks

The community could greatly reduce their risks if they stop dumping garbage in the canal and public spaces. This also requires municipal garbage recollection

Most effective aspects

Shelters were the most effective: it was the place where everybody went during hurricane Irma and it kept them safe. There was even electricity during the four days they were there.

The canal has reduced flooding

Transfer of knowledge: people are aware of the fact that the canal reduces risks, they learned how to protect themselves and their kids during an emergency, and how to deal with waste. They also train their kids how to act during a disaster, so this knowledge is replicated.

Creation of jobs for youth

The combination of putting trash cans and teaching waste management made the community cleaner but this stopped when garbage was not recollected

Least effective aspects

People fall into the canal

Garbage bins were removed or vandalized

The canal fills up with trash and mud, the ocean pushes back the water, it still floods

Most people still burn the garbage, throw it in the sea or canal. This comes back when it rains

The shelter in Ans-a-Foleur has a leaking roof and the water tank blew of the roof during hurricane Irma*

Influencing factors

The canal could have been more effective if waste management issues would have been addressed in a more effective way

More than installing bins, solving the waste problem requires raising awareness and a garbage recollection and processing system from the Municipality

Participation of local actors (like the municipality) is key to the effectiveness of the project.

They heard through the radio and a megaphone in the street that hurricane Irma was coming. They put their paper documents in a safe place, packed water and food in a backpack for the whole family and went to the shelter that was retrofitted by the project. There were around 335 people during 4 days.

Not at all effective	Slightly effective	Moderately effective	Quite effective	Extremely effective
		X	X	

DRR = Disaster Risk Reduction
PW = Physical Works
** This was not mentioned during FGD but during the visit to the shelter. No people from Ans-a-Foleur participated in the FGD.*

Sustainability – Haiti FGD

Community Ownership

Community members feel that they should and can apply what they learned during the project on how to protect themselves, their kids and waste management.

Not all communities took the PW up as theirs. They expect WC, the municipality or others, to keep solving their problems

Community members train their children how to act during a disaster

Officially, young male community members are involved in maintenance with Bon Vive Association

Also women clean the area in front of their house

Enabling factors

Youth with better economic options will be less vulnerable to threats.

The fact that all male community members participated in the construction of canals and shelters makes it possible for them to reapply this knowledge and experience for maintenance or new PW

People were taught what to do in case of a disaster and where to go to. They did indeed all go to the emergency shelter during hurricane Irma .

Presence of civil society like Bon vive to maintain canals.

Impeding factors

Lack of local maintenance: People received trainings on how to deal with garbage and clean the canals, but they did not get tools from the project to clean the canals.

There is a culture of throwing trash on the street or in the canal

There is a strong focus on getting external help instead of solving things internally

Institutional Ownership

Institutional ownership is lacking: Municipality is not recollecting garbage. The canal fills up with trash.

Civil society supports the sustainability of the results: Bon vive maintaining the canals with young male community members.

Green = positive aspects
Red = negative aspects
Yellow = neutral aspects or in some cases positive, in others negative

Not at all sustainable	Slightly sustainable	Moderately sustainable	Quite sustainable	Extremely sustainable
		X		

PW = Physical Works
WC = World Concern

Effectiveness – Portmore FGD

Level of DRR

PWs like retrofitting and receptacles helped to reduce problems with heavy rains in 2017

PW and sensitization on waste helped to reduce the risk of flooding as garbage used to block drainages, or float into the houses

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#6;9-9Ã)5,Ã+644;51:1-9Ã)8-Ã468-Ã8-9131-5:Ã:6Ã0)?)8,9ÀÃ

Most effective aspects

CM learned construction, DRR, CPR, WASH, waste and shelter management, map reading, enumeration, evacuation routes

Garbage receptacles and clean up days: some areas are cleaner and better accessible now

Building new and retrofitting houses led to safer and more comfortable living

Land titling augmented willingness to make improvements and helps to attain wealth

Voucher gave people ownership and made them invest more

Construction of toilets improved hygiene

Identifying the levels of risk helps to agree with beneficiary selection; some inconsistencies

Less people get sick due to improved hygiene and environmental protection

By identifying different levels of retrofitting more houses could be addressed, but not all risk has been reduced

Construction skills training for youth (mostly men) with certification gave them (temporary) jobs

Community Resource Center for projects

Least effective aspects

Requiring people to work voluntarily. There is much need to generate an income.

Only NH gets a community resource center; more feel the need for it

Land tenure was not taken into account from the beginning (thus some PW did not meet their goal). Now only those with property papers get retrofitted but these are not necessarily the houses with highest risk

Hygiene is still an issue. More PW and trainings are necessary

CM would like to receive more certified trainings as these might help to get a job

Some complained about the beneficiary selection for retrofitting

Influencing factors

Complex structure of land tenure. Owners do not always want improvements as to not formalize the renter's status. People get evicted. PW do not always reach their goal.

Limited project period and budget can jeopardize overall effectiveness

There is garbage recollection but not frequent enough. New risks are created with garbage accumulating around the receptacles.

Lack of land tenure and insecurity limit the level of participation (e.g. GP)

Many organizations have come without results. This demotivates people to participate.

Access to land titles augments level of participation (NH)

Poverty: people should not be expected to work for free

The urbanization model (plots with various families) makes it possible to install collective toilets thus being more efficient (it would not have been possible to finance individual toilets for every house)

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"Retrofitting of houses [...] helps to give the people of the community a stronger, more resilient housing structure to reside in."
$-),-8Ã .864Ã%)//6 #-),

Not at all effective	Slightly effective	Moderately effective	Quite effective	Extremely effective
		X		

CM = Community Members
CPR = Cardiopulmonary Resuscitation
DRR = Disaster Risk Reduction
GP = Gregory Park
NH = Naggo Head

Sustainability – Portmore FGD

Community Ownership

Communities are better organized and CM collaborate more, specifically women,.

Clarifying land tenure augments willingness to make future improvements, pay tax and demand public services

Some CM participate less, or only in certain activities. This depends on the community

Lack of land tenure and insecurity limit the level of participation and subsequent ownership

A small group cleans and maintains the collective PW.

Community members apply what they learned but require more trainings, preferably with certification to get jobs

Community members call when garbage needs to be recollected and some clean the area afterwards

Enabling factors

PW in private property augments possibility it will be maintained and monitored.

Youth, mostly men, learned construction skills and got certified. They can replicate the learnings and have better job possibilities now

Clarifying land tenure / property ownership stimulates investment and maintenance

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The voucher system stimulates people to invest, creating more appropriation and caretaking

Impeding factors

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Lack of land tenure or long-term lease contracts diminishes willingness to invest in or maintain PW

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(0-Ã<1+16;9Ã+18+3-Ã6.Ã:5-4736>4-5:Ã+)5Ã4)2-Ã1:Ã,1..1+;3:Ã.68Ã15,1<1,;)39Ã*;:Ã)396Ã.68Ã+644;51:1-9Ã)9Ã)Ã=063-Ã:6Ã,-<-367Ã)5,Ã.6+;9Ã65Ã""Ã199;-9Ã

Institutional Ownership

There are institutions that provide training on DRR, emergency response and skills (Red Cross, HEART)

Leaders say that government does not do anything to improve their communities

There is no institution that provides free trainings with certification.

Land agency works on land tenure

Clearer land tenure secures municipal tax income

There is garbage recollection and some help cleaning (Lion and other clubs, police, Municipality)

Green = positive aspects
Red = negative aspects
Yellow = neutral aspects or in some cases positive, in others negative

Not at all sustainable	Slightly sustainable	Moderately sustainable	Quite sustainable	Extremely sustainable
		X		

NL = Newland
PW = Physical Works
WASH = Water, Sanitation and Hygiene

Level of DRR

- Drainages and tire walls have reduced inundations and landslides
- An early warning system was implemented with tools accessible to community members (e.g. rain, fissure, inclination and other meters).
- 3 families have been relocated to a safer area. 19 are to follow soon
- Buildings and other PW in the fault area keep moving and breaking
- They learned how to identify risk zones and how to react in case of an emergency, specifically CODEL but also other community members
- They have the knowledge and tools to act in case of an emergency
- People know which shelter to go to in case of an emergency
- Falling of walls in fault area has reduced by 50% according to perception
- The fault area is too high risk to live. No intervention can be effective in reducing risk 100%

Effectiveness – Tegucigalpa FGD

Most effective aspects

- Drainages have reduced presence of dirty water and related smells, mosquitos and diseases
- Rain, fissure and other meters function as an early warning system. People are aware the buildings are moving
- Painting and improvement of stores, houses, stairs and walls improves (feeling of) security and urban image
- Children know which are the safe zones through drills and trainings
- People fall less due to cleaner streets and stairs. They got tools to clean
- DRR training: People are aware of the risks they live in and know what to do
- Training of trainers: grocery store owners train clients, *pregoneras* train people house by house in various communities and at schools
- Geological study and map helps CODEL to identify where to provide what support
- Map of high risk zones in stores help people to identify the risk they live in and store owner can explain what to do
- Access to water & sewage in some areas

Least effective aspects

- Only 20% of the communities participated in the drills
- Lack of awareness raising and infrastructure for waste management
- Only a limited number of people is being transferred to a safer area
- Evacuation routes are not well signaled
- Some areas still get inundated due to a lack of drainages (overall or being constructed on only one side of the street) or garbage obstructing them
- People in the fault area still live in high risk

Score: 4,5

Not at all effective	Slightly effective	Moderately effective	Quite effective	Extremely effective
			X	X

Influencing factors

- Existing poverty makes that people don't have time to invest in community projects
- Paying people to do the work could be a solution for the previous
- There is little support from external actors due to spatial and social marginality.
- Some people are more focused on their individual or household situation
- Violence and marginality reduce the willingness to collaborate for the community

"El efecto que hizo en mi vida es aprender a vivir en una zona de riesgo y cómo afrontarlo."
Leader from José Ángel Ulloa

DRR = Disaster Risk Reduction
PW = Physical Works

Community Ownership

- CODEL members trained and equipped to respond to disasters.
- New community structures (can) continue trainings, awareness raising and mutual support
- CM are willing to (financially) collaborate to develop projects
- People are monitoring risk meters
- Investments of some CM indicate appropriation of the PW and facilitates their correct functioning
- Small payments to CM have led to clean streets in one but not all communities
- Community members are collaborating more on behalf of the whole community
- Communities have learned how to organize themselves, e.g. organize clean up campaigns
- Links have been established between the three neighborhoods
- People are empowered and proud of their community and what they learned, which they are eager to share
- Part of the population has learned DRR: prevention, protection and reaction

Sustainability – Tegucigalpa FGD

Enabling factors

- Change of image makes it is easier to get support for communities
- Model of *pregoneros* who have already gone and plan to continue going to other communities to train on DRR and construct tire walls.
- 3 people are certified to construct walls with recycled tires. More have experience and are proud and eager to teach others
- Simple technology for EWS facilitates their use and appropriation by CM
- CSR: donation of tires were donated
- Economic vulnerability of stores is reduced by training on financial administration and access to loans
- Network of stores reduces community vulnerability
- Training children regarding waste management and DRR
- Training and participatory construction of tire walls have led to replications but not all are constructed well. These might also be copies from people who did not participate

Impeding factors

- Some CM have connected their gray and even black water outlets to the drainages seeing these as a solution. This can lead to health problems
- In the fault area no intervention will be sustainable; the ground is moving continuously
- People throw garbage on the street which ends up in the ditches and obstructs the drainage, specifically in Duarte and Ulloa
- Lack of funds or other support for DRR
- Demand for tires to use as fuel lowers the possibility of getting these donated for future implementation

Score: 4,5

Not at all sustainable	Slightly sustainable	Moderately sustainable	Quite sustainable	Extremely sustainable
			X	X

Institutional Ownership

- State program for microenterprises supports waste management, DRR and other topics in the communities, but pay is too little.
- GOAL applied a leverage model, stimulating other stakeholders (e.g. the municipality) to also implement PW in the communities.
- Institutions are more willing to invest now that communities have changed
- Lack of municipal waste management
- CM feel that without GOAL the Municipality will not do much and much still has to be done
- Lack of (governmental) programs for DRR

Green = positive aspects
Red = negative aspects
Yellow = neutral aspects or in some cases positive, in others negative

CM = Community Members
CSR = Corporate Social Responsibility
EWS = Early Warning System
NP = Nueva Providencia
PW = Physical Works

Performance Evaluation:
LAC Urban DRR Programming
The Neighborhood Approach

ANNEX 4.4

Support Documents

Interviews



USAID
FROM THE AMERICAN PEOPLE

FIU | Extreme Events Institute
FLORIDA INTERNATIONAL UNIVERSITY

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Interviews
- Lima – Carabayllo, Peru
- Lima - Independencia, Peru
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- Portmore, Jamaica
- Tegucigalpa, Honduras

Carabayllo

National agencies often rely on local government for responsibility of actions: on DRR and more

DRR trained personnel at the municipal level may speed up technical and managerial processes

Use of open access technologies for DRR

Municipalization vs. national control

Implementers play a positive role by enabling ways of communication between the community and authorities

Important to consider municipal projects agenda prior to initiating NGOs' interventions

Recognition that more horizontal arrangement with academia are needed (e.g., for studies)

Local instrumentalization

The highest levels of government tend to compartmentalize and minimize the importance of DRR

Effectiveness

Degree of risk reduction of disaster hazards in the community

↑

Most and least effective aspects

↑

Influencing factors / determinants

Comparison to traditional DRR/NA approaches

There are some quantifiable achievements in DRR

Recognition of DRR in the projects but difficulty to estimate the level of reduction

Legal frameworks on their own do not guarantee DRR

The importance of articulating a common technical/procedural approach on DRR within the municipality

Awareness not only for community but a wide range of actors within communities: merchants, constructors, workers, etc.

There is not acknowledgment of other approaches being used

Widespread recognition that NA benefits both community and authorities

Nature's 'rights' need to be considered more seriously

Awareness is necessary before any DRR endeavor

Physical works as catalyzer

Other disasters may affect implementers' agendas and therefore, projects

Identification of a 'snow-ball effect' when good practices are in place/implemented

Importance of reaching upper levels of power/politics at the municipal levels

El 'Niño Costero' affected how authorities and communities see risks: a window of opportunity for DRR

Authorities awareness/ ownership as initial step

Importance of participatory budgeting for the governance of DRR

Scalability: multi-scalar coordination of actors, and of impact

Community awareness/ ownership as initial step

Recognition that NA benefits sustainability

Multi-dimensionality of sustainability: legal, capacities, knowledge, etc.

DRR activities/investments reflected on municipal budgeting for coming years as evidence of sustainability

Sustainability

Appraisal of sustainability per intervention

↑

Community ownership

↑

Enabling and impeding factors of success

↑

Institutional ownership

Limits of national over local processes: role of municipalities & municipalization

National-local articulation is key, yet gaps need to be filled

Lack of legal frameworks for integrative DRR

Compartmentalization, lack of transversality, vertical and horizontal governance arrangements

Political will at the highest municipal level can make a difference (on sustainability too).

Individual/community awareness is the first step to DRR

Demand for training as evidence of project's success/sustainability

NA is still experimental

Creation of sub-offices and regulations (ordinances) for DRR as evidence of awareness and sustainability

It seems that local authorities are not completely aware of regulations/laws that may benefit DRR in their territories

Lack of interest over single projects: need for a more unified strategy of international projects

MVCS uses 'incentives' for municipalities on DRR

Recognize the limits of DRR

Lessons & recommendations

Continue education and training

Do different or repeat

Project leadership (by implementers) requires consensus and clear communication

Improved communication strategies: multi-level

Risk transfer as DRR mechanism need to be explored

Use of 'models' and 'best practices' within communities may contribute to project's impacts

Community empowerment, and community awareness of different institutional opportunities

Recognition of the 'problem' [awareness] is key for any intervention

Cash transfer as mechanism for DRR

Independencia

Physical works vis-à-vis project's impact: PWs as catalyzer of DRR awareness (for both community and authorities)

Community awareness is seen as base for DRR

Municipal officials turnover as negative-institutional ownership and for DRR

Implementers play positive role by enabling ways of communication between the community and authorities

National agencies rely on local government for the responsibility of actions: on DRR and more

Identification of a 'snowball effect' when good practices are in place/implemented

Urban development integrity v/s compartmentalization

Replicability

DRR knowledge capital

Local instrumentalization

Municipalization v/s national control

Community empowerment

Scale from 1 to 4:
3 [Medium High].

Effectiveness

Degree of risk reduction of disaster hazards in the community

↑

Most and least effective aspects

↑

Influencing factors / determinants

Comparison to traditional DRR/NA approaches

'El Niño Costero' affected how authorities and communities see risks: a window of opportunity for DRR

Role of community leaders (positive/negative)

Governance dynamics will affect results

Nature's 'rights' need to be considered more seriously

Participatory budgeting as governance mechanism: it requires a base to encourage DRR.

Widespread recognition that NA benefits both community and authorities

Implementers play a key role for authorities as they allow them to enter communities that historically have been reluctant to cooperate

'Trust' as a fundamental issue in DRR: recognition of the gap between municipalities and informal settlements

Urban development is not controlled by national actors: lack of coordination

Authorities awareness/ ownership as initial step

Recognition that NA benefits sustainability

Importance of participatory budgeting for DRR governance

Community awareness/ ownership as initial step

Interrelated projects for DRR beyond the interventions: concatenation

Creation of offices/agencies for DRR within local levels is seen as the ultimate solution

Sustainability

Appraisal of sustainability per intervention

↑

Community ownership

↑

Enabling and impeding factors of success

↑

Institutional ownership

Individual/community awareness is the first step for DRR

Diagnosis of community in terms of power relations, governance, and other dynamics seems to be very important

Good municipal management is key when resources are limited

Municipal limitations on DRR set by national regulations: property rights vs. common good

Physical works as catalyzers of local awareness/institutionalization of DRR

Urban development integrity: vertical and horizontal arrangements (governance) are needed

Nation-local articulation is key, however, gaps need to be filled

NA is still experimental

Municipal officials turnover has a negative impact on institutionalization of DRR

It appears that local authorities are not completely aware of regulations/laws that may benefit DRR in their territories

It seems difficult to impact at both the community and national levels, through one project at the same time

Implementers should not rely on government agencies alone to conduct studies: on hazard mapping

Baseline should precede the proposal preparation

Recognize the limits of DRR

Manage the systemic and yet linear (sequential) nature of projects: other forms could be considered

Better articulation of times, agendas, efforts, resources and priorities is needed

Lessons & recommendations

Do different or repeat

Recognition of the 'problem' [awareness] is key for any intervention

Use of 'models' and 'best practices' within communities may contribute to project's impacts

Rímac

Limits of local DRR interventions

Physical works vis-à-vis project's impact: PWs as catalyzer of DRR awareness (for both community and authorities)

Multi-dimensional aspect of interventions (not DRR alone)

Lack of information/coordination to truly assess the degree of DRR

Achievements in DRR are quantifiable

The importance of territorial planning

Recognition of DRR in the projects but difficult to estimate the level of reduction

Effectiveness

Degree of risk reduction of disaster hazards in the community

↑

Most and least effective aspects

↑

Influencing factors / determinants

Comparison to traditional DRR/NA approaches

DRR interventions that impact people's daily activities seem to be more valuable for communities

Articulate and coordinated key actors from the outset appear to improve the development of interventions

Identification of a 'snow-ball effect' when good practices are in place/implemented

Recognition that a more horizontal arrangement with academia is needed (e.g., risk, hazard assessments)

It seems that the highest levels of government tend to compartmentalize and minimize the importance of DRR

Lack of trust in municipality may affect interventions especially when its involvement is imperative

Implementers play a positive role by enabling communication between the communities and authorities

Implementers must have experience and know the legal and institutional context

Local instrumentalization

Municipalization vs. national control

Implementers propitiate a communication channel between municipality and benefited community

Nature's 'rights' need to be considered more seriously

The fragility of personal contacts and informal individual agreements: uncertainty

Legal contexts need to be recognized for each type of intervention

Legal frameworks do not guarantee DRR on their own

Transversal communication among municipal offices is important for multi-dimensional projects: environmental-civil protection, etc.

Disasters pose an opportunity to recognize risks and take future preventive actions

Municipal management is an influential factor in intra-offices coordination for DRR

Role of community leaders or local governance structures for effectiveness and sustainability

Community awareness/ownership as initial step

Scalability: multi-scalar coordination of actors, and of impacts

Authorities' ownership seems to have occurred

Best practices and use of 'change champions'

Limits of interventions: scalability

Local governments are rich in data but poor in processing it

NA is still experimental

Distinguishing interventions for DRR and for emergency

Physical interventions have the potential of being 'seen' on a daily basis and this may affect their perception of development and security

Role of local-community leaders or local governance structures for effectiveness and sustainability

National-local articulation is key, however, gaps need to be filled: institutionalization, municipalization, etc.

Sustainability

Appraisal of sustainability per intervention

↑

Community ownership

↑

Enabling and impeding factors of success

↑

Institutional ownership

Compartmentalization, lack of transversality, vertical and horizontal governance arrangements

Capacities and skills of municipal officials may help to speed up or slow down interventions' processes

Vicious circle of taxes and provision of urban services between municipality and communities: municipalities may have the capacity and responsibility of breaking this circle

Accelerated technological change may pose a challenge: use of open source, popular apps, and standardization may help

Personnel turnover makes development and continuity of interventions difficult

NA is still experimental

Establish spaces of communication to enable the development of effective and sustainable interventions

Awareness as initial step for both community and authorities/decision makers

National strategies on DRR should consider integration and coordination of different actors

Limits of DRR institutions

Personnel turnover affects effectiveness and sustainability of interventions

Recognize limits of DRR

Multi-dimensionality and multiplicity of actors on DRR-Development

Locally specific interventions may need support from a wide range of municipal offices: better project communication is

Seeking proactiveness of municipality in requesting support from national institutions

Lessons & recommendations

Do different or repeat

Looking beyond the indicators of projects: underlying factors and effects

Medellín

Effectiveness

Degree of risk reduction of disaster hazards in the community

↑

Most and least effective aspects

↑

Influencing factors / determinants

Comparison to traditional DRR/NA approaches

Indirect DRR via improvement of unsafe conditions

General belief that DRR was somehow achieved, but not sure at what degree

Limits of small interventions and projects: resources, timespan, etc.

Private-public alliances may benefit/-speed-up transition of local economic activities from informal to formal

People's expectation needs to be handled carefully from the beginning until the end, otherwise may affect negatively

Use of media such as videos and photography to create awareness and willingness

Lack of information and data on informal settlement may obstruct any intervention

Diversity of partners' background may difficult coordination and understanding

Willingness for mutual engagement among project's partners

Strategic actors, such as children's involvement, to incentivize DRR measures among adults

Considering all voices within communities (elderly, people with disabilities, children) may assist comprehensive planning and actions

Concatenation of projects and interventions may deepen the impacts

NA can be a learning process (techniques and methods) for private sector on how to approach informal settlements' economies

NA tends to focus on limited scales such as neighborhoods and families, but by considering other major actors it is possible to get more community engagement and ownership in larger territories [linked to 'Community Ownership']

Flexibility of the NA to be applied to different urban contexts

NA can be seen as more suitable for urban contexts than rural

NA may enable the participation of different sectors such as commerce which can ignite innovative actions and methods

Past experiences with disasters may incentivize people to adopt DRR measures

Organized crime and violence may affect people's willingness to improve their conditions: fear of extortion, bribes, etc.

It seems important to define a level of 'commitment' and 'willingness' within communities prior to project start

Role of implementers in highlighting the social value of physical works

A gender-based approach may have strengthened the involvement of women in the project

Public-private and community partnerships may reduce the number of isolated actions

Complementarity between all partners and high level of experience may positively affect projects' performance

Space/time for correcting and re-evaluating actions during projects appear to be necessary in these highly changing/evolving contexts (informal settlements)

Over usage of a technical approach to address interventions may reduce participation of neighbors

Illegal migration worsens the chances to transform informal situations into formal

Inter-urban migration tends to dominate over rural-to-urban migration in informal settlements

Inter-scalar relationships between individual and community levels within a settlement need to be considered depending of the intervention: business, common space, etc.

Commitment of the project's staff is not always visible but fundamental for people [also linked to Effectiveness]

Continuity of local (municipal) personnel and resources: there must be ownership from both the community and the municipality

Limitation of local, regional, and national institutions in approaching neighborhood issues

Continuity of activities or their expansion after project's end may be seen as sustainability

Role of implementers and some volunteers in the field is so important that they become essential; their withdrawal (re)creates a gap

Sustainability

Appraisal of sustainability per intervention

↑

Community ownership

↑

Enabling and impeding factors of success

↑

Institutional ownership

Although empowered and well-organized, benefited communities will need continuous support and guidance

Participatory design may enable community ownership

Private partners can see the potential of informal settlements' small economies and help to develop innovative ideas: concatenation of projects

Limit of institutions and organization on knowing how to reach sustainable solutions

Consider the benefits of the usage of social media and mobile apps in the future

Consider the limits of small-businesses in informal settlements: capacity, habits, etc.

Continue support for communities after project's end: via municipality or community's resources

More involvement of large companies (food industry) on the neighborhoods' issues: food chain, safety food, etc.

Physical works as 'processes', as catalyzer of social cohesion, empowerment, associativity, etc.

When resources to invest in DRR in neighborhoods and families are scarce, they need to be strategically allocated: dialectic between individual vs. community investment

Space/time for correcting and re-evaluating actions during projects seem to be necessary in these highly changing/evolving contexts (informal settlements)

Careful use of language to avoid false expectations

Lessons & recommendations

Do different or repeat

NA and local interventions are good ideas but they need to expanded in order to achieve more significant impacts

Mixco

Difficulty in measuring DRR

But

Recognition that interventions have helped to reduce disaster risks

Private sector companies likely to limit participation in DRR projects if market opportunities are absent

Willingness and innovative approaches are necessary to collaborate with these communities (private sector)

Community organizations may result better (agile) to coordinate directly with national actors

Spatial location may influence community participation

Implementers enable municipality as well as private actors (market) to enter communities

Lack of commitment from authorities (municipal) may affect inter-institutional relationships and project's impacts

Physical works as catalyzers of the relationship between the municipality and the community: corruption as the opposite

Municipality replicates interventions but not with a comprehensive NA

Effectiveness

Degree of risk reduction of disaster hazards in the community

↑

Most and least effective aspects

↑

Influencing factors / determinants

Comparison to traditional DRR/NA approaches

Private–NGO partnership may help develop market-oriented DRR solutions

Realization from the communities that improvements are possible: belief in themselves and their capacities

Trust needs to develop among institutions

NA approach for private sector may be interesting but needs to be aligned with market opportunities

NA is a relatively new concept for actors

Importance of involving Mayors in the NA approach: highest local authority

Socially responsible businesses and market opportunities may help provide incentives for the private sector

NA approach may help to place/position DRR at minor scales: municipal level

Lack of leadership may negatively influence the management of municipalities: mayors and municipal managers are key

NA may help make informal settlements more visible to local and national governments

Recognition that municipalities are at the front of territorial issues and planning. Their capacities need to be strengthened

Municipality-Community relationship may affect the function of other state institutions in the area: Municipality are the front-line of state presence

Targeting executive officials in DRR may ignite DRR actions more quickly: paradigm change

Implementers may see benefits to their projects and organizations on collaborating with other NGOs: technical alliances

NA enabled technical alliances: Build Change-CEMPRO

Role of women in implementing interventions: they were present in more numbers and willing to contribute

Changing political context may threaten high-skilled personnel continuity

Identification of permanent officers within municipalities may help reduce the negative impact of personnel turnover

Geographic information may help to communicate risks and develop awareness

Neglecting the issue of informal settlements may be part of the problem

Role of implementers in preparing communities for government interactions

Building capacities of local government officials

Personal relations between actors/institutions may help to establish cooperative linkages

The project evaluation done by neighbors should be given more consideration

There is some community ownership but is difficult to measure

Linkages between mobility and access to opportunities: issues for sustainability

Lack of geographically pertinent construction codes: including for seismic design

Importance of empowerment and community organization in demanding attention and action from municipality

Welfare dependency may occur in prolonged projects

Community organizations can establish direct agreements with private companies

Sustainability

Appraisal of sustainability per intervention

↑

Community ownership

↑

Enabling and impeding factors of success

↑

Institutional ownership

Importance of land tenure for the sustainability of interventions: legal matters may impede municipal/governmental involvement

Extreme poverty limits the private sector's involvement in housing solutions directly to people: state *must* play a role here

Mistrust on institutions (private and public) may impede the effectiveness and sustainability of projects/interventions

Personnel turnover may impede the effectiveness and sustainability of interventions

Necessity for agreements at the highest levels: mayors, ministries, etc.

Recognition that municipalities play a major role in local DRR. Organizational hierarchy must be respected

Implementers/projects have facilitated the presence of the state in the benefited communities

Fragility of local processes largely depend on the national processes: decline of the nation-state

Good designs and selection of quality materials may reduce the need for maintenance

Inter-municipal interventions may find problems if legal/political frameworks are not planned before

Importance of awareness and training among municipal (executive) officers

Implementers help municipalities as well as private sector to enter communities

Secure land tenure is fundamental for any investment, for the municipality and people at the household level

Innovative approaches (for private sector) to enter communities may make a difference

Limitation of national institutions on local issues: also willingness to intervene

While effectiveness may be achieved through actors' involvement, it does not secure long-term sustainability: political contexts, changing situations

Identification of the role of knowledge and agents of change for effectiveness and sustainability of projects/interventions

Private sector needs to 'see' commitment from the municipality in order to continue its involvement in social projects

Role of implementers in creating awareness among local governments

Implementers enable better inter-institutional communication and articulation

Key institutions such as survey services need to be reinforced

NA helps establish new and/or potentiate previous relations among institutions: implementers play an important role in it

Implementers/donors (when they are trusted organizations by governments) may help the state organization to create trustworthy relations with other state or non-state institutions

Formal and standard mechanisms do not always work in informal settlements

Limits of municipalities for elaborating urban development plans: integrating DRR

DRR is identified as a process linked to development and planning

Better project communication is needed to disseminate outputs

Importance of an integral approach on neighborhood development: not only social or physical works but both

Physical works as presence of local government: catalyzers

Involving important authorities within the projects may secure continuity and effectiveness

Lack of policies oriented to informal settlements

Lessons & recommendations

Do different or repeat

Generation of information/data such as those from the "matriz de precariedad' can become an important input for decision making

Implemented systems (e.g., drainage) should consider redundancy and backups in case of disasters

Importance of women as part of the work force to improve family economies

Training and skills development should be diverse as communities are: different skills, interests, motivations

Unforeseen variables such as the intensive use of pit latrines in slopes needs to be considered in risk assessments

Local governments need to be more involved: municipalities are at the front line

NA projects may help companies to improve or initiate relations with governments to establish alliances

Haiti

These actions and interventions conducted to reduce risks have not been tracked to prove their effectiveness

Lack of assessments of physical works does not mean that they they are ineffective: shelters and gabions worked well during Hurricane Irma in 2017

Despite good designs and participation processes, inexperienced developers may have affected the effectiveness of the interventions

Physical works have accomplished the mission for which they were designed (not necessarily related to sustainability): gabions and shelters

Effectiveness

Degree of risk reduction of disaster hazards in the community

↑

Most and least effective aspects

↑

Influencing factors / determinants

Comparison to traditional DRR/NA approaches

Lack of agreements with direct and indirect beneficiaries prior to the construction of works and interventions may result in unforeseen (negative) effects

NA approach: participation of locals for the construction of physical works may create jobs and enhance community participation

Physical interventions need to be supported by larger and more comprehensive studies on the area: topological, geological, meteorological, etc.

Hiring locals enhances community participation, awareness, and neighbors' appreciation of the interventions

Lack of comprehension of the problems of informal settlements: reasons, motivations

Contextual and behavioral situations such as capacities for controlling land use, and environmental degradation (e.g., ocean landfill) will affect potential for sustainability

Physical works may or may not require constant maintenance: in some cases private actors can play a role (but it requires attention)

Local governments are considered as key actors in DRR initiatives (NA)

Sustainability

Appraisal of sustainability per intervention

↑

Community ownership

↑

Enabling and impeding factors of success

↑

Institutional ownership

Although agreements and partnerships are important, these must consider institutional limitations beforehand

Declared willingness and commitments from public organizations are not always translated into budget and actions: limits of political will

Communities appreciate the role of implementers over that of the municipality and other public organizations

Use of informal associations that resulted in improved communications among actors

The importance of risk assessments prior to the initiation of projects, to communicate risks to people and authorities

NA may allow a 'concatenation' of interventions from different actors: continuity in a series of projects

Recognition that not only technical skills need to be improved but also social ones: cohesion, empowerment, etc.

The role of implementers and the NA process is highly appreciated by authorities and communities

Lessons & recommendations

Do different or repeat

Portmore

Efectiveness

Degree of risk reduction of disaster hazards in the community

↑

Most and least effective aspects

↑

Influencing factors / determinants

Comparison to traditional DRR/NA approaches

Some hazard mitigation but not clear to which degree this was achieved

Importance of land-tenure as initial step prior to initiating interventions

Better garbage disposal and management has not only helped reduce flooding impacts but also helped organize communities

Land-tenure issues may exacerbate disaster impacts as it hinders relief and reconstruction: solving land-tenure issues makes people more resilient

Miscalculation of costs may have affected partner performance and commitment to the project

Exclusive use of manuals to transfer knowledge [as in retrofitting] appears to be ineffective if not complemented with practice

NGOs may help to reduce the 'distance' [gap] between communities and municipality, generating mutual trust

Recommended period to understand community's dynamics prior to initiating any interventions: 3 months

Mapping and 'verification' of existing data become important prior to any actions on land-tenure

Three possible settlement actor types: landowners, tenants [house owners who build the house] , and "residential lessees" that sublet space from house owners

When 'public' spaces in informal settlements are not established, these need to be negotiated by stakeholders, including the community

Better garbage disposal and management has not only helped reduce flooding impacts but also helped organize communities

Implementers can help local governments and institutions by providing inputs and methodologies to address informal settlements

Commitment of implementer staff can be very important to mobilize people

Civil society may help ignite people's participation and mobilization

Project managers' vision and influence may positively or negatively affect project results

People's mindsets and negative past experiences with NGOs and local institutions may pose challenges for implementation: mistrust

Land-tenure issues may impede any community and individual intervention

Lack of information on communities and people may delay or negatively affect interventions

NA challenges top-down approaches to achieve community ownership

Sustainability

Appraisal of sustainability per intervention

↑

Community ownership

↑

Enabling and impeding factors of success

↑

Institutional ownership

Land tenure solutions may exceed the implementer's capacity and time resource, resulting in unfulfilled expectations and loss of community trust

Surveying communities is necessary to solve land-tenure issues and inform future steps: difficulty for scalability

Involvement of local authorities in the regularization of land tenure is key for effective participation

Miscalculation of costs may have affected partner performance and commitment with the present project as well as compromised future ones

Land-tenure issues may impede economic development of small business

Role of implementers in rendering the informal settlements more visible to local and national authorities

Implementers can help speed up formal registration processes [land-tenure] by supporting people with knowledge, data, and financial resources

Community participation in local government institutions could help make some project gains sustainable: mobilization

Incorporating a suitable conceptualization for DRR [identification of causal factors and drivers] within local government may help sustain the NA approach

Solving land-tenure issues may help to achieve higher levels of community ownership

Community awareness and mobilization facilitate land-tenure surveying

Implementers reach into the community goes beyond that of the local and national governments because of the trust that they establish

Legal processes such as land titles are hard and complicated for communities to accomplish by themselves: NGOs and institution can support and make processes less expensive for people

Implementers may help authorities and government regain the lost trust of the communities

Mutual learning among project's partners: development of spin-offs, concatenation of projects

Development of digital systems and platforms for informal settlements can reflect on the commitment of local governments

Improving conditions of informal settlements may help to achieve other local and national objectives: prioritization of settlements

Governments incorporate or develop new methods and methodologies as the result of project experience

Lack of land titles or lease contracts can be critical for accessing government support and for reconstruction support in case of disasters

Due to legal processes and bureaucracy, land tenure regularization can take several years to be realized: depends on each legal system

Lessons & recommendations

Do different or repeat

Consider involving people from the proposal into the project team

Consider that people trained by the project may leave the neighborhood for better conditions elsewhere

Cohesion with project partners is also important: sharing similar views, approaches, methodologies

Evaluate capabilities of project partners prior to initiating the project

Contemplate reconsidering the project's deliverables based on an initial evaluation of the neighborhood's response to the project and the context

Increase involvement of central government in projects that directly affect neighborhoods

Reviewing similar safety codes from other countries may help establish a better starting-point for developing own codes

Solving land-tenure issues may help achieve higher levels of community ownership

Focus on 'mobilization' and people's commitment as basis for any physical intervention

Some NGOs have better image and credibility in informal settlements than local governments and national institutions

Viewing sanitation, waste management, and land tenure as integral aspects of DRR

Tegucigalpa

Effectiveness

Degree of risk reduction of disaster hazards in the community

↑

Most and least effective aspects

↑

Influencing factors / determinants

Comparison to traditional DRR/NA approaches

People satisfaction on interventions can also be seen as a contribution to DRR

Reliable tools not always available to assess effectiveness in DRR interventions and actions

Implementers enable community participation for more appropriate EWSs

Legal frameworks that may significantly affect interventions [time and resources] need to be considered as scenarios

Stipend for vulnerable youngsters: income source alternative to criminal activities

Voluntary work is a fragile strategy when people are in need

Relocations can be very difficult for people, a high social component is needed: land-tenure is the most complicated one

Workforce development in neighbor-hoods requires 'concatenation' with market studies: SWOT analysis

Emergency management agencies may find it difficult to see a broader perspective of DRM –the implementers can facilitate that change

NA benefits implementer's view on considering neighborhoods as parts of complex systems: cities, countries, development processes

Municipal departments tend to work independently, the implementers can enable better coordination mechanisms

Traditional institutional thinking as Emergency Management apart from DRR has made it difficult to integrate DRR actions

Characterization of territory is very important prior to initiating any intervention –this can be done by government agencies

People participation in design and execution of works has contributed to community appropriation

Land tenure issues need to be solved prior to any intervention as some certainty is needed

Implementers with a comprehen-sive view on DRR and develop-ment may help to integrate better, different development actors

Social control mechanisms (Social audit or *auditoria social*) as an opportunity for people to express and regain power

People participation in design and execution of works has contributed to community appropriation

Sustainability

Appraisal of sustainability per intervention

↑

Community ownership

↑

Enabling and impeding factors of success

↑

Institutional ownership

NA for EWS interventions is being replicated

Informal settlements and land-tenure have become a market opportunity for some people, and this has gone unnoticed by the government

Implementers play the role of mediator and bridge between communities and government

Neighborhood organizations can be a constant entity compared to municipalities, supporting continuity and effectiveness of EWSs

Municipal personnel turno-ver was not a problem, but was an important factor

Vandalism and crime are threats to valuable investments such as EWS technologies

Municipal officials will not engage immediately on NA (holistic) approaches, this requires a planned process of involvement

Generation of codes for drainage

Implementers may help government institutions to see the complexity and multiscalar dimensions of informal settlements

Resilience approach has been incorporated into some institutions, thanks to the implementer

Implementer is appropriating NA by supporting it in international arenas: UN campaigns

Lessons & recommendations

Do different or repeat

Integrate knowledge generated in the project within universities and their professional development programs

More use of low-cost technologies: off-grid energy, free wifi.

Consider the role of women –they are essential for success

Implementers can complement government's need in understanding informal settlements through consult-ing and technical cooperation

Mayors are key to determine the success of a project: capacity and willingness to replicate

Consider housing beyond its physical terms: services, community, quality of life

Donors who provide mid-term feedback can produce positive effects in projects

Performance Evaluation:
LAC Urban DRR Programming
The Neighborhood Approach

ANNEX 4.5

Support Documents
Hazard Assessments





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Hazard Assessments
- Mixco, Guatemala
- Lima - Independencia, Peru
- Tegucigalpa, Honduras
- Medellin, Colombia

Síntesis de informes.

Realizado por Dr. Paulo Ruiz Cubillo

Para la Universidad Internacional de Florida

Aspectos Geológicos Guatemala Zona 10 Mixco, Proyectos Vistas de la Comunidad y Cipresales

Revisión de información previa y campo (documentos y trabajo de campo)

La información previa en su mayoría es un compilado de informes de diferentes agencias. Incluye mapas, de tipo regional. Los mapas locales son muy generales y no cuentan con una topografía adecuada para hacer trabajo en detalle. Hay análisis geotécnicos (caracterización de suelos- Límites de Atterberg, ensayo de compactación, soporte California, análisis granulométrico, contenido de humedad, perfil estratigráfico, compresión triaxial, gravedad específica) y pruebas de infiltración. Los datos de usaron para diseño de muros de contención en cortes. Las bases de datos de lluvias y sismos de Ciudad de Guatemala (CG) no son muy completas y faltan datos, pero se podrían hacer interpolaciones para poder hacer modelaciones. Hay información de ubicación de fallas locales con potencial de generar sismos que disparen deslizamientos. Los meses entre mayo y noviembre son los que tienen mayor probabilidad de que ocurran deslizamientos disparados por lluvia, así como cuando hay huracanes u otros eventos atmosféricos.

Objetivos

1.) Determinar, caracterizar y correlacionar los materiales geológicos que afloran en el sitio de los proyectos. 2.) Evaluar geológicamente las obras que se han construido en los proyectos. 3.) Revisar los estudios de caracterización geomecánica de los suelos y pruebas de infiltración del sitio para el entendimiento de su comportamiento ante ciertos eventos geológicos (sismos) y atmosféricos (lluvia). 4.) Analizar el uso de la tierra actual de los proyectos para la determinación de posibles problemas por riesgo de deslizamientos.

Metodología

Revisión bibliográfica de información previa incluyendo mapas regionales montados en SIG. Revisión de imágenes satelitales disponibles en Google Earth. Revisión de informes de los estudios de suelo y pruebas de infiltración. Visita de campo para caracterización geológica. Se visitaron las plantas de tratamiento y se observaron los muros de contención. En cada uno de los puntos visitados, se tomaron notas, así como fotografías. Finalmente se elaboró un reporte con nuevos insumos que podrían ser de utilidad para la toma de decisiones.

Principales hallazgos

Los proyectos se ubican en el valle fluvial del Río Molimo. La geología del sitio, corresponde con capas de tefra con pómez de color gris a blanco y ceniza gris a negra interestratificada con paleosuelos. Esta geología concuerda con lo descrito en el perfil estratigráfico de los ensayos geotécnicos. La ladera del valle fluvial presenta una pendiente de ~30° es tipo fuerte, donde los procesos denudacionales como deslizamientos podrían ser intensos, y además que existe un peligro extremo de erosión de suelos. Las estructuras que se han construido podrían sufrir impacto por procesos de escorrentía como el que ocurrió en el año 2016 con una sección de las escaleras que llevan hacia la planta de tratamiento de Vistas de la Comunidad. El proyecto está dentro de la zona de Falla Mixco y según los mapas de estructuras analizados hay una falla muy cerca del proyecto. No se observaron evidencias de esta en el campo. Los mapas de fallas y geológico presentados por PCI concuerdan con lo revisado en la bibliografía para la Ciudad de Guatemala. Existe potencial sísmico en la zona de estudio, ya han ocurrido

sismos (1917, 1918, y 1976) en las cercanías. Los Terremotos de México del 2017 no son buenos parámetros para evaluar la resistencia de las obras construidas, debido a que estos generaron aceleraciones bajas en la CG. La susceptibilidad litológica de estos materiales a deslizarse es muy alta debido a que están muy meteorizados es fácilmente ripeable y con baja resistencia a la compresión simple. Basándose en los resultados de los análisis geotécnicos y lo observado en el campo, se puede determinar que por el tipo de suelo, la granulometría arenosa, el ángulo de fricción alto, por la poca cohesión que tienen y el contenido de humedad que presentan, las tefras del proyecto pueden resistir cortes casi verticales hasta de cierta altura, sin embargo cuando hay exceso de agua en esos materiales, esos cortes verticales tienden a colapsar con planos de falla casi rectos y verticales debido a la saturación y que están muy alejados del ángulo de estabilidad de esos materiales. También pueden generar sumideros en condiciones saturadas y de erosión hídrica En el proyecto Cipresal se ha dado un uso sistemático de vegetación autóctona (Isote) para mejorar las condiciones del terreno y reducir la inestabilidad de terreno.

Resultados

En el proyecto afloran depósitos volcánicos de caída que pueden correlacionarse con los mismo depósitos que de tefra que aparecen en el resto Ciudad de Guatemala. Los proyectos analizados en este trabajo podrían estar muy cerca de una de las estructuras secundarias que se han delimitado para la zona de falla de Mixco. Por las características geotécnicas de los materiales que se encuentran en este sitio, la lluvia y los sismos podrían ser disparadores de deslizamientos. Las obras que se han construido para disminuir la vulnerabilidad de los eventos de remoción de masa tienen una incidencia puntual. Esta zona tiene características muy similares otras donde han ocurrido eventos de tamaño considerable a pesar de tener estructuras como muros de contención. El manejo adecuado de las aguas de escorrentía es una de la mejores formas de prevenir este tipo de eventos. En el proyecto se han construido cunetas y se ha mejora en este aspecto. Se ha dado un cambio de uso de la tierra desde el año 2003 según lo observado en la imágenes de Google Earth, la construcción de obras podría haber facilidad la impermeabilización del suelo y favorecido la escorrentía y erosión.

Conclusiones

Las obras que se han construido en los proyectos como, planta de tratamiento, alamedas, pasa manos, escaleras y muros de contención (cuatro diferentes tipos), no parecen tener problemas geológicos puntuales que los puedan afectar directamente. El principal problema al que se podrían enfrentar estas obras es la escorrentía y erosión de materiales como el que sufrió las escaleras del proyecto Vista de la Comunidad que llevan a la planta de tratamiento en el año 2016. La planta de tratamiento de Cipresal no ha presentado ningún problema desde su construcción. Los sismos que tiene mayor potencial para disparar deslizamientos en territorios volcánicos son lo originados por fallas locales, con magnitudes superiores a 4.4 Mw y de profundidad < 10 km. El epicentro del evento debería de estar en un radio inferior a 25 km de distancia para que la energía no se disipe por la distancia. Esto porque las aceleraciones pico generadas por este tipo de sismos a esa distancia del epicentro serían suficientes para generar inestabilidad en los taludes de pendientes fuerte y muy fuerte. Por lo tanto en la zona de estudio las estructuras asociadas con la zona de falla Mixco podrían ser las que potencialmente puedan generar sismos que disparen deslizamientos. Se recomienda hacer un levantamiento de fotografías aéreas de alta resolución y bajo costo con un drone para generar un modelo de elevación digital. Con este modelo se pueden para trazar mejor las líneas de drenaje que se utilizan para manejar el aguas de escorrentía. Es recomendable instalar piezómetros en la zona de los proyectos para así tener un control sobre la influencia del agua subterránea en los movimientos de masa.

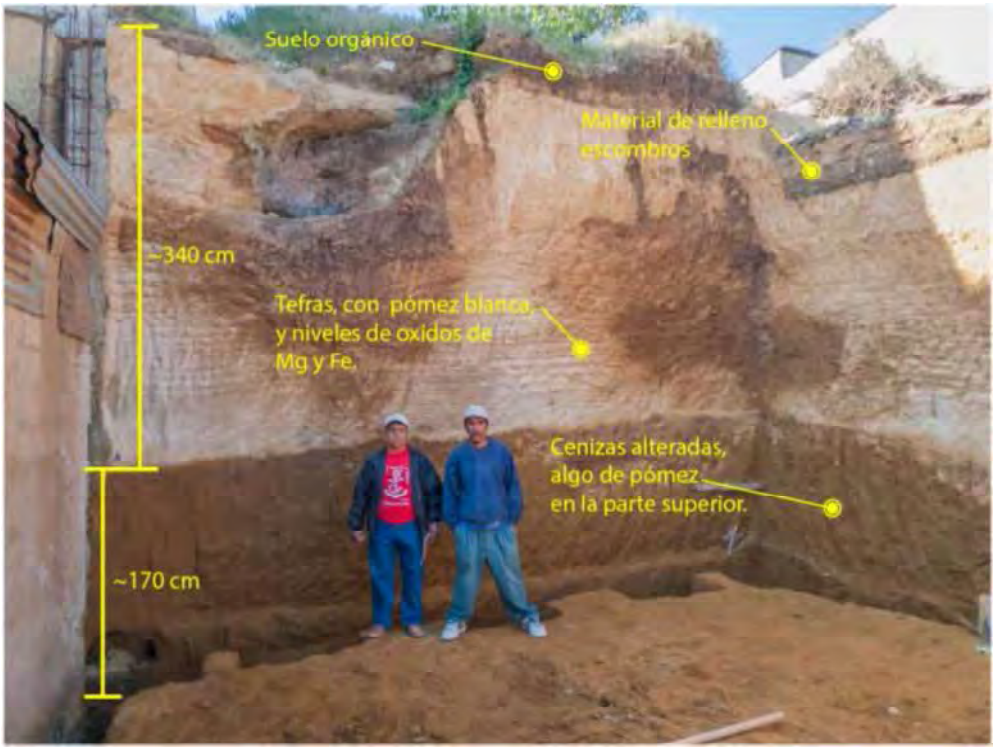


Figura 1. Sección de material aflorando en nivel intermedio de Proyecto Vista de la Comunidad. Se observa una capa inferior de cenizas alteradas (de al menos 170 cm de espesor) sobre la que se va a construir la estructura. Sobre esta capa se observan tefras de caída con un espesor de hasta 340 cm, con pómez blanca y varios niveles ricos en óxidos de hierro y magnetita. Sobre esta capa hay materiales de relleno y una capa de suelo orgánico de unos 20 cm.

Aspectos Geológicos Lima Perú Distrito de Independencia, Proyectos El Volante II y III

Revisión de información previa y campo (documentos y trabajo de campo)

La información previa que se revisó son informes elaborados por el Centro Peruano de Investigaciones Sísmicas y Mitigación de Desastres (CISMID), la Facultad de Ingeniería Civil (FIC), la Universidad Nacional de Ingeniería (UNI), - PREDES sobre peligros múltiples y vulnerabilidad a nivel de distrito, eje zonal y barrio. Además de la revisión de los mapas generados para cada uno de los informes.

Objetivos

1.)Revisar los estudios geológicos y de parámetros geotécnicos, geofísicos de los suelos así como pruebas que se realizaron para el entendimiento de su comportamiento ante ciertos eventos geológicos y atmosféricos. 2.)Visitar el proyecto habitacional El Volante II y III para la observación y caracterización de campo de los materiales geológicos que afloran en el sitio . 3.)Hacer una evaluación geológica de las obras que se han construido en los proyectos para disminuir la vulnerabilidad. 4.)Analizar el uso de la tierra actual que se le está dando a los sitios de los proyectos para la determinación de posibles problemas por riesgo de caía de rocas y guaycos o flujos de roca.

Metodología

Revisión de los informes, mapas e imágenes de Google Earth (peligros geológicos, caracterización geotécnica, peligro sísmico y caracterización dinámica del suelo) del distrito de Independencia. Visita de campo al proyecto acompañado por líderes comunales y el Geól. Juvenal Medina, donde se observaron las rocas que afloran. así como las obras que se construyeron para disminuir la amenaza de flujos de detritos, las obras de reforestación y riego de los árboles. Se tomaron notas, y fotografías. Elaboración de informe con nuevos insumos que podrían ser de utilidad para la toma de decisiones.

Principales hallazgos en revisión de informes

La geología observada en el campo corresponde con lo descrito en el Apéndice A y el mapa de la Geol. Local. Son rocas sedimentarias (areniscas, cuarcitas y lutitas) intruidas por rocas plutónicas con metamorfismo de contacto y zonas puntuales con alteración hidrotermal. También hay depósitos inconsolidados y aluviales En las zonas altas del proyecto afloran las rocas intrusivas (gabros, granodioritas y dioritas) y sus relaciones hidrotermalizadas. En general están sanas y fracturadas. En Apéndice A, se hizo un análisis desde la perspectiva de peligros originados por procesos de dinámica externa (pendientes, caída de rocas, flujos de detritos y suelos inestables) y dinámica interna (Sismo). Se hace una clasificación de pendientes en 3 grupos, pendientes <12 % peligro bajo, entre 12- 20 % peligro moderado y >35 % peligro alto. Por si solos los % de pendientes no dan suficiente información sobre el peligro para caída de bloques. Un análisis más completo debería incluir: 1.) Tipo de litología presente junto con el grado de meteorización. 2.) Dirección y ángulo de buzamiento (rocas sedimentarias) o dirección de las discontinuidades (rocas intrusivas). Estos datos no fueron identificados en el informe por lo que no se pueden hacer estas correlaciones. Esas relaciones podrían indicar si hay zonas con mayor peligro que otras aun con los mismos % de pendientes. Como disparador para la caída de rocas en el informe se menciona un sismo de magnitud 8.8 Mw en la zona de Lima. Sería bueno determinar cuál es la aceleración mínima y no la generada por un sismo tan grande que podría tener potencial para generar caída de bloques en la zona y usar ese evento como disparador. Los sismos de magnitudes inferiores tienen menor tiempo de recurrencia que los sismos grandes. Se hizo un análisis de los flujos de detrito con el método racional definido para un periodo de retorno de 100 años. Sería bueno considerar el cambio climático y modelar eventos más pequeños e

intensos y con frecuencias más cortas. En el Apéndice A, los suelos inestables están bien caracterizados y hay ejemplos claros de impactos negativos en las viviendas cuando se construyen sobre ellos. Las medidas correctivas (construcción de diques y reforestación) para la mitigación del riesgo de desastres parecen adecuadas pero pueden mejorarse. Los muros de contención que se plantean para mitigar los suelos inestables, son una medida adecuada para los espesores y tipos de suelos presentes en la zona. Sin embargo la construcción de viviendas al pie de estos diques representa un peligro muy alto. Los árboles sembrados (una vez maduros) podrían detener bloques pequeños que caigan desde zonas más altas. El principal aporte de la zona reforestada sería la barrera nuevas colonizaciones. El Informe Apéndice C define en base a estudios previos cuatro categorías de suelo según sus características para hacer cimentaciones de casas de habitación. I. Gravas, las cuales presentan las mejores características para cimentaciones de las construcciones. II Arenas, también favorables para que sobre ellas se hagan las cimentaciones de las construcciones. IV Zonas con pendiente fuerte donde afloran rocas intrusivas, que clasifican como no aptas para la construcción debido a la alta pendiente. Finalmente la zona llamada V. y que fue catalogada como materiales transportados de relleno no controlado y desmonte, que no es apta para cimentaciones. Se concuerda con las categorías I, II y V. sin embargo, para la categoría IV, las razones de clasificarla como no apta para la construcción de cimentaciones es la fuerte pendiente y no la calidad de los materiales. No se comparte esta clasificación debido a que usan las pendientes del sitio y que no un criterio geotécnico propio de los materiales que hay en esa zona para determinar su no aptitud. La caracterización dinámica de suelos (Apéndice D) se hizo a partir de estudios previos de microzonificación sísmica y medición de microtremores en forma puntual para estimar el periodo de vibración del suelo. Se definieron 3 zonas. Zona I Periodo < 0.2 s con V de corte entre 200-600 m/s (suelos rígidos) Zona II Periodos ≥ 0.2 s y <0.3 s con V de corte entre 200-500 m (suelos medianamente rígidos). Zona III Periodos ≥ 0.3 s y < 0.4 (suelos flexibles). Como es un estudio de suelos no se hicieron pruebas sobre los afloramientos rocosos en la zonas altas. Sin embargo, para un gabro la V de una onda sísmica sería de entre 6700-7300 m/s muy superior de lo que presentan las Zonas I y II implicando menores vibraciones.

Resultados de observaciones de campo

De lo observado en el campo se determinó que los eventos de remoción de masa que podrían generarse en el sitio son: caída de rocas, volcamiento de bloques, deslizamientos planares en cuña, compuestos y avalanchas de roca. Sobre el poco espesor de suelo y/o depósitos coluviales se podrían dar deslizamientos planares. Los flujos de detritos con poca cantidad de agua (huaycos) son posibles. La construcción de diques de forma artesanal con los mismos materiales que afloran en el sitio, parece una medida adecuada para detener la velocidad y alcance de ese tipo de eventos, sin embargo las casas al pie de los muros implica otro peligro ya que podrían ser impactadas por los bloques que superen el muro.. En el proyecto se ha colocado pasa manos. Estás estructuras se construyen con troncos de árboles de eucalipto. Las uniones son de cuerda. Podrían utilizar otros materiales. Las zonas donde se está haciendo la siembra de árboles y vivero son de alta pendiente esto se está utilizando a favor para hacer el riego por goteo.

Conclusiones

Las obras que se han construido en los proyectos como, muros de contención, campo de reforestación, pasamanos no parecen tener problemas geológicos puntuales que los puedan afectar directamente. Se recomienda hacer estudios detallados sobre sismicidad local que tenga potencial de generar eventos que puedan disparar caída de bloques en la zona. Estudios pensando en el cambio climático y un régimen de mayor cantidad de lluvias en la zona.



Figura 2. En la fotografía se muestran las relaciones que existen entre pendientes fuertes de la zona alta y los sitios donde afloran las rocas intrusivas fracturadas. Además se muestran los sitios donde se ubican los muros de contención de cemento y roca. La línea azul muestra por donde podría bajar el agua en caso de precipitaciones

Video con un ejemplo de un Guayco en una zona similar a la estudiada.

https://www.youtube.com/watch?v=fIY0OK5yuWQ

Aspectos Geológicos Tegucigalpa Honduras, Proyectos Fallas La Ulloa, José A. Duarte, Nueva Providencia y La Berlín

Revisión de información previa y campo (documentos y trabajo de campo)

La información previa corresponde con informes nuevos realizados por GeoConsult S.A. por solicitud de GOAL Honduras. Incluye, informes geológico-geotécnico, una base topográfica a partir de datos LiDAR con ortofografías de alta resolución. Fotos de los procesos constructivos de las obras. Perforaciones con recuperación y descripción de núcleos. Bases de datos de las modelaciones de inundación para diseño de cunetas y deslizamientos. Datos de lluvia de estaciones locales desde el 2016 e información de Radar.

Objetivos

Los principales objetivos de este trabajo son: 1.)Revisar los estudios geológicos-geotécnicos previos. 2.) Determinar, caracterizar y correlacionar en campo los materiales geológicos que afloran en el sitio de los proyectos con lo que se menciona en los informes. 3.)Hacer una evaluación geológica de las obras que se han construido en los proyectos para disminuir la vulnerabilidad.

Metodología

Revisión de los informes previos, datos LiDAR, geológicos y modelaciones de deslizamiento e inundaciones para los 4 sitios intervenidos (Fallas La Ulloa José A. Duarte, Nueva Providencia y La Berlín). Visita de campo al proyecto acompañado por líderes comunales y personal de GOAL Honduras, donde se observaron las rocas que afloran. así como las obras que se construyeron para disminuir la vulnerabilidad de deslizamientos, estaciones de monitoreo de lluvia y geotécnicas. Sitio de construcción de casas nuevas alejadas de influencia de deslizamiento. Se tomaron notas, y fotografías. Elaboración de informe con nuevos insumos que podrían ser de utilidad para la toma de decisiones.

Principales hallazgos

La geología planteada en el informe geotécnico corresponde con: Depósito coluviales cuaternarios, Basaltos cuaternarios y una toba arenosa amarilla Terciaria, hay rellenos y niveles freáticos muy superficiales. En la zona de Ulloa ya habían sido identificados previamente deslizamientos en otros trabajos geológicos. Tras el Huracán Mitch se reactiva la falla del deslizamiento de “La Ulloa” Según el mismo informe, la lluvia en la estación húmeda y el cambio de uso del suelo en sitios de alta susceptibilidad son los disparadores de los deslizamientos. Los sismos podrían disparar deslizamientos en la zona, sin embargo el potencial de un evento importante no es tan alto. Las características geológicas en el Residencial Ciudad del Ángel (proyecto habitacional con casas de clase media-alta que se deslizaron en flujos de lodo) son las mismas que las de Colonia La Ulloa. Actualmente en esta colonia, existe un deslizamiento activo que está afectando diferentes puntos de las comunidades visitadas, así como la carretera principal del Anillo Periférico 3 (AP3). Las evidencias de este deslizamiento son grietas en caminos, cunetas y edificaciones y un desnivel en la carretera del AP3. Las comunidades junto con Goal han construido obras dentro de la zona de influencia de este deslizamiento para tratar de disminuir su impacto. Se está trabajando en reubicar a familias que se encontraban en las zonas más vulnerables. Se construyeron cunetas (de concreto reforzado y mampostería) donde su profundidad responde al resultado de análisis de la topografía LiDAR y modelaciones hidrogeológicas. Transportan agua de lluvia y aguas grises. Algunas de las cunetas construidas han sido afectadas por el deslizamiento y están fracturadas. Los vecinos tienen la percepción de que la construcción de las cunetas ha disminuido la tasa de movimiento del deslizamiento, especialmente durante la estación

lluviosa. En una zona que era un botadero de basura dentro del área afectada por el deslizamiento, se hicieron estudios geotécnicos, luego en el 2015 se dio la construcción de un muro de llantas y se construyó un parque comunitario, ahora es un punto de encuentro. La comunidad ha copiado y experimentado con otras técnicas la construcción de muros de llantas. Algunos combinan muros convencionales y muros de llantas. También en algunas casas se práctica la siembra de lluvia. Hay pluviómetros comunitarios que dan datos dos veces al día. Hay un monitoreo geotécnico sistemático que incluye, 10 fisiómetros instalados en casas ubicadas en la zona del deslizamiento, inclinómetros y piezómetros. Las estaciones (16 en total) transmiten datos en tiempo real. Hay estructuras que se siguen utilizando pese a estar fuertemente afectadas por el deslizamiento (e.g, la Iglesia cerca del parque comunitario). Otras se han reparado hasta 3 veces pese a que se siguen agrietando esto atenta contra la integridad de las personas. En la Escuela del sector de Nueva Providencia, se han hecho varias mejoras, tiene un tanque de cosecha de agua de lluvia y se ha visto favorecida por pasa manos y cunetas, sin embargo en el sector trasero de las aulas más cercanas a la alameda se observaron grietas y evidencias de movimientos por el deslizamiento. En la Berlín se están construyendo las casas nuevas donde se van a reubicar a las familias movilizadas de las zonas más vulnerables al deslizamiento. Hay un manejo sistemáticos de aguas residuales en cada (tanque biodigestor). Se están construyendo sobre lavas (basaltos) sanas con un espesor de suelo con bloques de unos cuantos cm. Los bloques de lava han sido utilizados para construir un muro de gaviones. En este muro también se utilizaron tobas y brechas que son más fáciles de meteorizar por lo que se podrían generar vacios y espacios con los años, además los cortes angulares de los basaltos generan también espacios vacios entre las rocas. El análisis de estabilidad de taludes se hizo con SLIDE 5 y un Factor de Seguridad (FS) de 1.4 en condiciones de lluvia extrema, secas y con sismo. Con planos de falla circulares, planares y combinadas.

Resultados

Hay modelaciones de hidrogeológicas para el manejo de aguas con cunetas y modelaciones geotécnicas para los deslizamientos. Los resultados de estas modelaciones dieron FS por debajo de 1.4 para distintos escenarios. La implementación de la tecnología LiDAR fue esencial para poder llegar a estos resultados en la escala en que se hizo. La construcción de la cunetas y muros de llantas ha creado la percepción en la gente de que el deslizamiento se ha detenido, sin embargo eso solo sería en sitios muy puntuales y no podría afirmar que ha ocurrido en toda la zona afectada. Los datos de monitoreo geotécnico podrían evidenciar o debatir esa percepción. Las casas que se están construyendo en La Berlín no parecen tener ningún problema geológico que las pueda afectar directamente.

Conclusiones

Los datos LiDAR junto con la información geológica (mapas y perfiles) y geotécnica (caracterización) de este proyecto fueron un gran insumo para poder hacer los distintos tipos de modelaciones (análisis de estabilidad de taludes). Todos los proyectos deberían de contar con este tipo de información para trabajar y resolver problemas a escala local. Según los resultados de las modelaciones, se concluye que las condiciones generales de estabilidad son marginales con algunos escenarios más peligrosos que otros como una falla traslacional en La Ulloa. El manejo de las aguas superficiales con las obras que se han construido ha sido importante y podría tener influencia local en el deslizamiento. La información de los pluviómetros locales así como el monitoreo geotécnico en tiempo real de las diferentes estaciones en el proyecto podría ser clave para salvar vidas en caso de un movimiento de masas disparado por lluvias. Las casas de La Berlín no parecen tener ningún problema geológico que las pueda afectar directamente.



Figura 3. En la fotografía se muestra una de las cunetas que se han construido para mejorar el manejo de aguas superficiales. Con esto se ha mejorado la preservación de las calzadas y disminución de infiltración.

Aspectos Geológicos Medellín Colombia, Proyectos Comuna Santo Domingo, El Comprosimo, Comuna 8 Barrio Llanaditas y El Pinal

Revisión de información previa y campo (documentos y trabajo de campo)

El documento consultado corresponde con Revisión y Ajuste al Plan de Ordenamiento Territorial - Medellín, 2014. Realizado por el Departamento Administrativo de Planeación. Se consultaron otros documentos y mapas geológicos de Aptitud Geológica de Medellín. La empresa Global fue la encargada de la ejecución de varias de las obras.

Objetivos

Los principales objetivos de este trabajo son: 1.)Revisar los estudios previos y su componente de geología y geotecnia. 2.) Determinar, caracterizar y correlacionar en campo los materiales geológicos del sitio menciona en los informes. 3.)Hacer una evaluación geológica de las obras que se han construido en los proyectos para disminuir la vulnerabilidad.

Metodología

Revisión de los informes previos. Visita de campo al proyecto con líderes comunales y el Ing. Carlos Gómez Global Colombia, donde se observaron los suelos y rocas que afloran. así como las obras que se construyeron para disminuir la vulnerabilidad. Se tomaron notas, y fotografías. Elaboración de informe con nuevos insumos que podrían ser de utilidad para la toma de decisiones.

Principales hallazgos

El informe de Ordenamiento Territorial de Medellín (OTM) define una zonificación de amenazas por movimientos en masa, inundaciones y avenidas torrenciales en suelos urbano y rural. Hace una clasificación mediante 4 categorías (Muy Baja, Baja, Media y Alta) Los proyectos visitados corresponden con zonas que entran dentro de la categoría media y alta vulnerabilidad. Hay una zonificación de amenaza de detalle como resultado de estudios geotécnicos y de estabilidad de laderas para barrios y sectores de borde de las cuencas. Están caracterizadas como criticidad 3,4 y 5 del modelo probabilístico de la Universidad Nacional de Colombia, el resultado final aplicado es de tipo heurístico cualitativo. Hay un mapa de amenazas de inundación que se hizo con el método geomorfológico físico, identificando los cambios morfológicos y sedimentológicos que permitieron apreciar las áreas que se han inundado recientemente. Por la ubicación (zonas altas de la cuenca donde hay procesos de erosión y no depositación) de los proyectos visitados no se verían afectados inundaciones. En la web se consultó el trabajo de zonificación de la aptitud geológica que clasifica las áreas según su uso y restricción. Los proyectos visitados estarían en Zonas de alto riesgo no recuperables y zonas de riesgo recuperables. En el informe OTM se trabaja con unidades geomorfológicas, niveles de erosión y pendientes de las laderas. Existen datos geológicos del área en otras fuentes consultadas (Mapa Geológico Generalizado de la Dunita de Medellín - INGEOMINAS). Las rocas del área de Medellín corresponden con dunitas metamórficas y anfibolitas. Las condiciones de alta humedad en la época lluviosa y cambios de temperatura han propiciado la degradación de las rocas, formación suelos residuales y arcillas, por la alta pendiente en las laderas de la montañas y el alto contenido de humedad hacen de estos sitios muy susceptibles a la generación de deslizamientos. Los pocos sitios con afloramientos de roca, están muy fracturados y pueden generar caída de bloques. Históricamente los sismos en Antioquia no ha sido afectado severamente a Medellín, debido a su distancia de las fuentes sísmicas. Sin embargo existe una alta vulnerabilidad debido a la gran cantidad de construcciones que no son sismoresistentes. El 17 y 18 de octubre de 1992 hubo un sismo que generó muchos daños la aceleración máxima en

Medellín fue de 0,03 g, el código dice que para esa zona debería construirse para resistir 0,25 g. En la zona de Medellín se encuentran las Fallas Medellín y Santa Rita.

Resultados

En Santo Domingo, los materiales que se pudieron observar son principalmente suelos residuales originados por la meteorización de las rocas del área. Los dos sitios donde se construyeron obras (escaleras y huerta) fueron elegidos por la comunidad debido a que ahí ocurrieron incidentes con afectación directa a la población. Las escaleras llevan al centro de salud y la estación de policía, hay un mural (funciona como punto de encuentro). No presentan algún problema geológico. Se hizo un trabajo para mejorar el manejo de la basura que fue uno de los problemas (variable antrópica en la generación de deslizamientos) identificados por la población. Creación de mesas ambientales mayor educación a la población. Se realizaron otras actividades que integraron más a la comunidad, trabajos con adultos mayores, jóvenes y niños. Se generó la historia del Barrio. Una zona de alta susceptibilidad al deslizamiento, se ha trabajado y convertido en una zona de cultivos con sistema de huertas en terrazas. Hay un vivero en condiciones intermedias. Este espacio se recupera ya que era utilizado por grupos al margen de la ley (las madres de los integrantes de esos grupos siembran ahí), se siembra lechuga, pepino, culantro perejil y otros, estos se le venden a un dueño de un restaurante. Las terrazas son pequeñas, < 2 m son sostenidas con tablas de madera. Proyecto 2 (El Compromiso). Aquí lo más importante es que la comunidad aprendió a gestionar otras ayudas (surgen nueva generación de líderes comunales). En el proyecto original se hicieron pasamanos, escaleras, muros, rutas de evacuación. A nivel puntual las obras construidas no tienen problemas geológicos, a nivel macro siguen estando en zonas de alta vulnerabilidad por las condiciones del sitio. En el proyecto Comuna 8 Barrio Llanaditas, se observó una segunda huerta con un vivero en mejores condiciones, hay escaleras de madera. No se puede sembrar en el suelo porque ese sitio era un botadero, se siembra en estañones plásticos cortados a la mitad. El grupo se ha consolidado más en esta huerta que en la de Santo Domingo. Los productos son vendidos en mercado de campesinos. Se han utilizado estacas y tablas de madera para construir las terrazas. Se han sembrado algunos árboles. Este sistema de terrazas ayuda a detener la escorrentía y procesos de erosión que se daban en este botadero. También se construyeron pasamanos Se construyó un muro de contención pero las personas han utilizado ese muro como basamento para construir casas sobre él. Las casas construidas sobre ese muro son vulnerables a un sismo. Barrio el Pinal, en este sitio se han construido diferentes cercas para las 25 huertas que manejan unas 52 familias. Las cercas se encuentran en buenas condiciones. El principal problema que enfrentan en este barrio, es la colocación en el mercado de los productos que se generan en la huerta. En todas las huertas visitadas hay un problema con una mariposa blanca que se está comiendo los productos. No se ha podido encontrar un producto orgánico efectivo que las controle.

Conclusiones

Las obras que se construyeron en los proyectos no presentan ningún problema geológico puntual que las pueda afectar directamente. Sin embargo, están ubicadas en zonas de alta vulnerabilidad. El éxito del proyecto en Colombia es social. Hay una mayor integración de las comunidades. Estas aprendieron a organizarse, surgieron nuevos líderes comunales que han gestionado otras ayudas y se han podido solucionar otros problemas. El proyecto de las huertas parece funcionar a nivel social (recuperando zonas con problemas sociales y generando una fuente de ingresos), hay que mejorar la colocación en el mercado de los productos. Geológicamente han contribuido a un mejor manejo de aguas de escorrentía y que no se utilicen zonas de alta vulnerabilidad como botaderos de escombros y basura. Se han utilizado insumos como mapas de amenazas y aptitud geológica para ir cambiando en uso del suelo en diferentes sitios de los proyecto y así disminuir la exposición de poblados en zonas de alta riesgo.



Figura 4. En la fotografía se muestra la huerta de la Comuna 8 Barrio Llanaditas. Este sitio era un lugar donde se depositaban escombros y basura, de alta pendiente. Con el sistema de terrazas se ha podido disminuir la escorrentía y erosión en el sitio.

Performance Evaluation:
LAC Urban DRR Programming
The Neighborhood Approach

ANNEX 4.6

Support Documents
Disaster Risk Assessment - Modeling

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Omar Darío Cardona A.
Disaster Risk Consulting

The Disaster Resilience and Climate in the Americas Program (DRCAP)

Consulting Agreement No.800006973-07

Deliverable 1

Prepared for:

FLORIDA INTERNATIONAL UNIVERSITY

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Omar Darío Cardona A.
Disaster Risk Consulting

Introduction

Risk identification is the first step on a comprehensive disaster risk management scheme. Catastrophic risk due to natural hazards should be considered in a prospective way quantifying the damages and losses before the real event occurs and for that task it is necessary to consider events that have not yet occurred. Since there are uncertainties related to when and where the next hazardous event will happen, how severe will it be and how can its physical effects affect the exposed assets, it is important to adopt a probabilistic approach that consider those uncertainties and propagate them through the damage and loss calculation process following a rigorous methodology.

With few exceptions, only limited information is available about catastrophic events that occurred in the past. Even less is known about events that will occur in the future. When considering the possibility of highly destructive events occurring in the future, any risk analysis should use probabilistic analytical models that allow for available historical information to be used in predicting potential catastrophic consequences. The risk evaluation of extreme events should follow a prospective focus, thus anticipating the rates of occurrences of events of different magnitudes, and the consequences that will be associated with each event. Such an evaluation must consider the uncertainties that arise when estimating the severity and frequency of these events.

This report summarizes the results obtained for earthquake risk at the 8 projects considered for disaster risk assessment. It is worth noting that this is an ongoing work, which means that the results here contained are not only partial, but the first step on the diagnosis.

Omar Darío Cardona A.
Disaster Risk Consulting

1 Port-de-Paix and Anse-à-Foleur, Haití

1.1 Location

The city of Port-de-Paix is located on the north coast of Haiti on the Atlantic Ocean, in front of Tortue island and belongs to the Northwest department of the country. For this city, three neighborhoods were selected: Ti Port-de-Paix, Djerilon and Démélus, the first two located on the coast. The city of Anse-à-Foleur also belongs to the Northwest department of the country and is located on the coast, east from Port-de-Paix.



FIGURE 1. LOCATION OF THE NEIGHBORHOODS IN PORT-DE-PAIX AND ANSE-À-FOLEUR

1.2 Seismic Hazard

Seismic hazard curves were obtained for each neighborhood in the cities of Port-de-Paix and Anse-à-Foleur based on the probabilistic seismic hazard assessment from the Global Assessment Report on Disaster Risk Reduction 2015. The curves are presented in terms of the return period as a function of the peak ground acceleration, PGA.

Given the proximity of the neighborhoods no substantial difference is observed in the hazard curves shown in Figure 2, where the acceleration for the three neighborhoods in Port-de-Paix is 116 cm/s² and 119 cm/s² in Anse-à-Foleur, for a 1500-year return period. According to these numbers, both cities have the lowest seismic hazard from all the 8 projects.

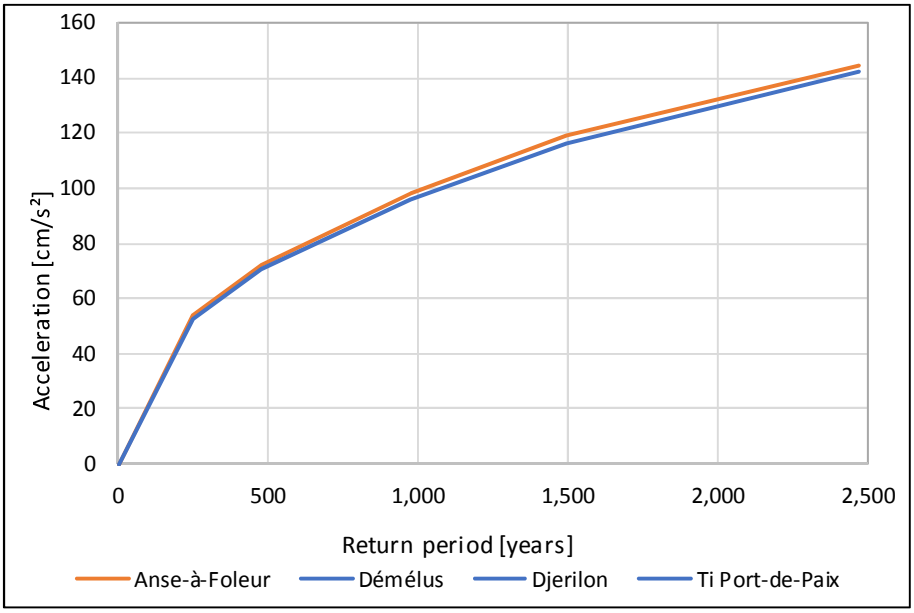


FIGURE 2. SEISMIC HAZARD CURVES FOR THE NEIGHBORHOODS IN PORT-DE-PAIX

1.3 Exposure

To perform a probabilistic risk analysis, it is required to identify and characterize the exposed assets susceptible to suffer damage and losses due to the considered natural hazards. In this case the assets refer to the residential buildings susceptible to suffer damage due to possible earthquakes.

Based on the information received a procedure to determine the inventory of exposed elements was developed and is further explained on Annex 1. Inventory of Exposed Elements

The total constructed area was computed for each neighborhood from the plant area obtained from satellite imagery and from the average number of stories of buildings determined with information from the 2003 General Population Census[1] which reports that most of the dwellings are “low houses”.

The economic replacement value for each constructed square meter was established as the official minimum monthly wage for 2018 which is USD $114.34 in Haiti[2] using the dollar exchange rate as of February 7, 2018. The following table summarizes the data obtained for Port-de-Paix and Anse-à-Foleur.

[1] http://www.ihsi.ht/rgph_resultat_ensemble_b.htm

[2] Average from the lowest income groups (Article 3 and 4) http://www.sgcm.gouv.ht/wp-content/uploads/2017/03/Moniteur-28-juillet-2017-Salaire-minimum.pdf

TABLE 1. GENERAL EXPOSURE DATA FOR PORT-DE-PAIX AND ANSE-À-FOLEUR

Barrio	Number of stories	Constructed area [m²]	Exposed value [USD]
Anse-à-Foleur	1	20,393	$ 2,331,755.37
Démélus	1	37,307	$ 4,265,774.71
Djerilon	1	7,107	$ 812,598.72
Ti Port-de-Paix	2	76,605	$ 8,759,304.53

The construction classes assigned are unreinforced concrete block masonry and mud walls. The information from the Population Census was also used which reports that the most common material used on the walls on urban areas such as Port-de-Paix is cement or block masonry and on rural areas such as Anse-à-Foleur earth has a participation of 30%. In the case of Anse-à-Foleur 30% of the dwellings were modelled as mud walls and the other 70% as unreinforced masonry.

1.4 Risk Assessment

The Table 2 summarizes the results of the seismic risk assessment. The studied neighborhoods in Port-de-Paix and Anse-à-Foleur have an average annual loss of 8,900 Million US Dollar which corresponds to a relative loss of 0.55‰.

TABLE 2. SEISMIC RISK RESULTS FOR PORT-DE-PAIX AND ANSE-À-FOLEUR

Risk Results		
Exposed Value	USD Million	16,169,433.00
Average Anual Loss	USD Million	8,900.93
	‰	0.55
PML		
Return Period	Loss	
years	USD Million	%
20	$19,220.17	0.12
50	$57,131.68	0.35
100	$121,041.42	0.75
250	$276,131.54	1.71
500	$465,902.63	2.88
1000	$756,996.13	4.68
1500	$1,014,633.93	6.28

The Loss Exceedance Curve and Probable Maximum Loss Curve and the Loss Exceedance Probability Curve for different exposure timeframes are presented below.

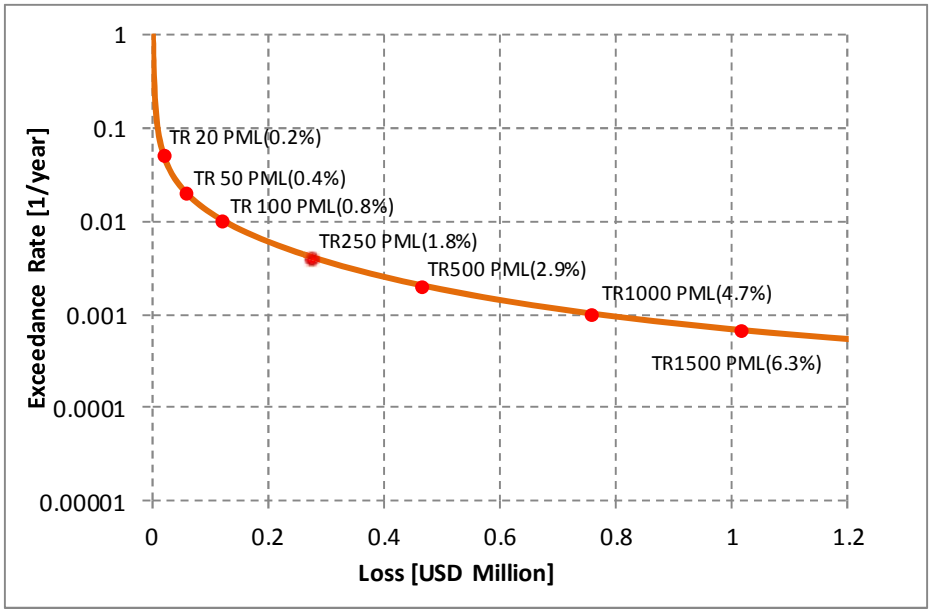


FIGURE 3. LOSS EXCEEDANCE CURVE FOR PORT-DE-PAIX AND ANSE-À-FOLEUR

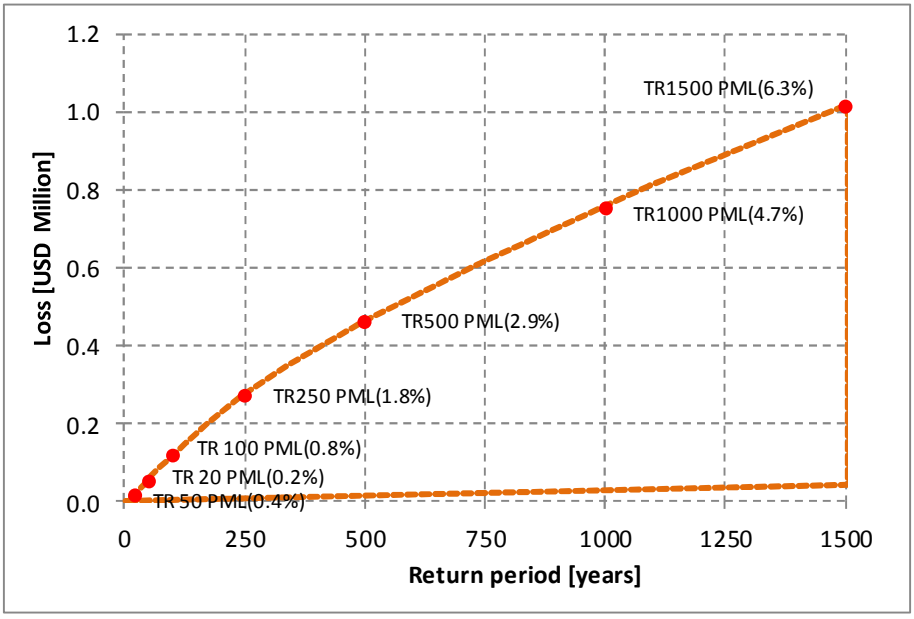


FIGURE 4. PROBABLE MAXIMUM LOSS CURVE FOR PORT-DE-PAIX AND ANSE-À-FOLEUR

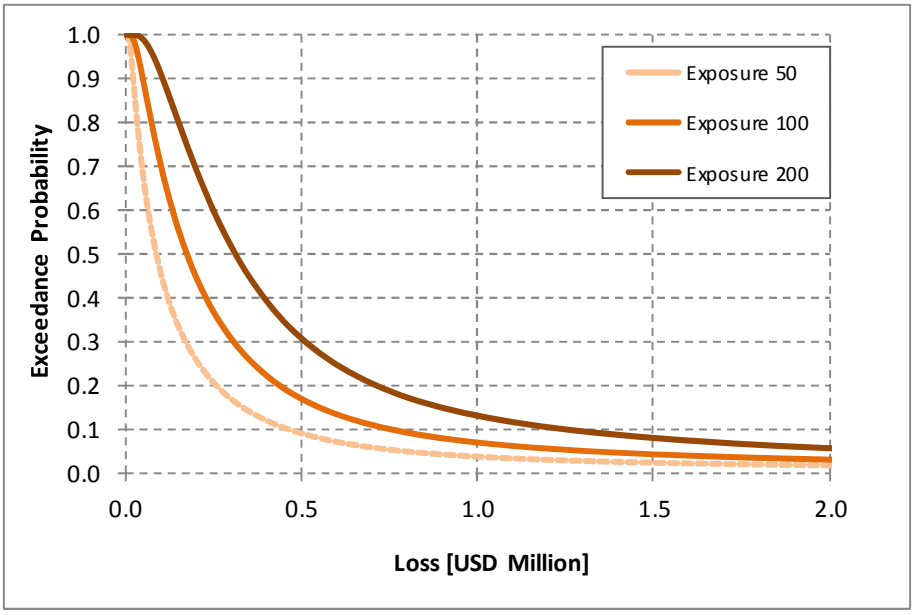


FIGURE 5. LOSS EXCEEDANCE PROBABILITY CURVE FOR DIFFERENT EXPOSURE TIMEFRAMES FOR PORT-DE-PAIX AND ANSE-À-FOLEUR

2 Independencia, Perú

2.1 Location

The District of Independencia corresponds to one of the 43 districts that are part of the Lima Province in Perú. It is located in the northern area of Metropolitan Lima and is bounded on the north by the District of Comas, on the east by the District of San Juan de Lurigancho, on the south by the District of Rímac and the District of San Martín de Porres and on the west by the District of Los Olivos. For this District, two neighborhoods were selected, Villa El Ángel and Volante II & III.



FIGURE 6. LOCATION OF THE NEIGHBORHOODS IN INDEPENDENCIA

2.2 Seismic Hazard

Seismic hazard curves were obtained for each neighborhood in the District of Independencia based on the probabilistic seismic hazard assessment from the Global Assessment Report on Disaster Risk Reduction 2015. The curves are presented in terms of the return period as a function of the peak ground acceleration, PGA.

Given the proximity of the neighborhoods no substantial difference is observed in the hazard curves shown in Figure 7, where the acceleration for the two neighborhoods in Independencia is 252 cm/s² for a 1500-year return period. According to these numbers, the three cities from Peru have the third highest seismic hazard from all the 8 projects.

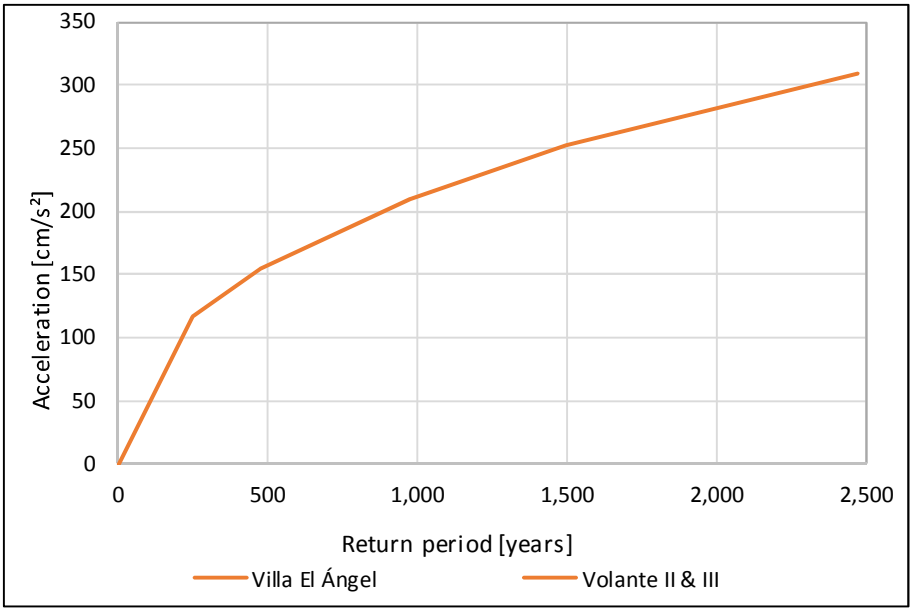


FIGURE 7. SEISMIC HAZARD CURVES FOR THE NEIGHBORHOODS IN INDEPENDENCIA

2.3 Exposure

To perform a probabilistic risk analysis, it is required to identify and characterize the exposed assets susceptible to suffer damage and losses due to the considered natural hazards. In this case the assets refer to the residential buildings susceptible to suffer damage due to possible earthquakes.

Based on the information received a procedure to determine the inventory of exposed elements was developed and is further explained on Annex 1. Inventory of Exposed Elements

The total constructed area was computed for each neighborhood from the plant area obtained from satellite imagery and from the average number of stories of buildings determined with information from online available images and from the Google Street View tool.

The economic replacement value for each constructed square meter was established as the official minimum monthly wage for 2018 which is USD $262.35 in Perú[3] using the dollar exchange rate as of February 7, 2018. The following table summarizes the data obtained for Independencia.

3 https://www.gob.pe/476-valor-remuneracion-minima-vital

TABLE 3. GENERAL EXPOSURE DATA FOR INDEPENDENCIA

Barrio	Number of stories	Constructed area [m²]	Exposed value [USD]
Villa El Angel	2	57,340	$ 15,042,983.89
Volante II and III	2	23,525	$ 6,171,552.81

In this case one construction class was assigned to all the dwellings on the neighborhoods since it was determined from online available images and the Google Street View tool that the most common system used is unreinforced concrete block masonry.

2.4 Risk Assessment

The Table 4 summarizes the results of the seismic risk assessment. The studied neighborhoods in Independencia have an average annual loss of 26,825 Million US Dollar which corresponds to a relative loss of 1.26‰.

TABLE 4. SEISMIC RISK RESULTS FOR INDEPENDENCIA

Risk Results		
Exposed Value	USD Million	21,214,537.00
Average Anual Loss	USD Million	26,824.53
	‰	1.26
PML		
Return Period	Loss	
years	USD Million	%
20	$29,675.10	0.14
50	$90,978.59	0.43
100	$211,815.27	1.00
250	$708,331.41	3.34
500	$1,747,933.37	8.24
1000	$3,895,816.22	18.36
1500	$5,719,570.99	26.96

The Loss Exceedance Curve and Probable Maximum Loss Curve and the Loss Exceedance Probability Curve for different exposure timeframes are presented below.

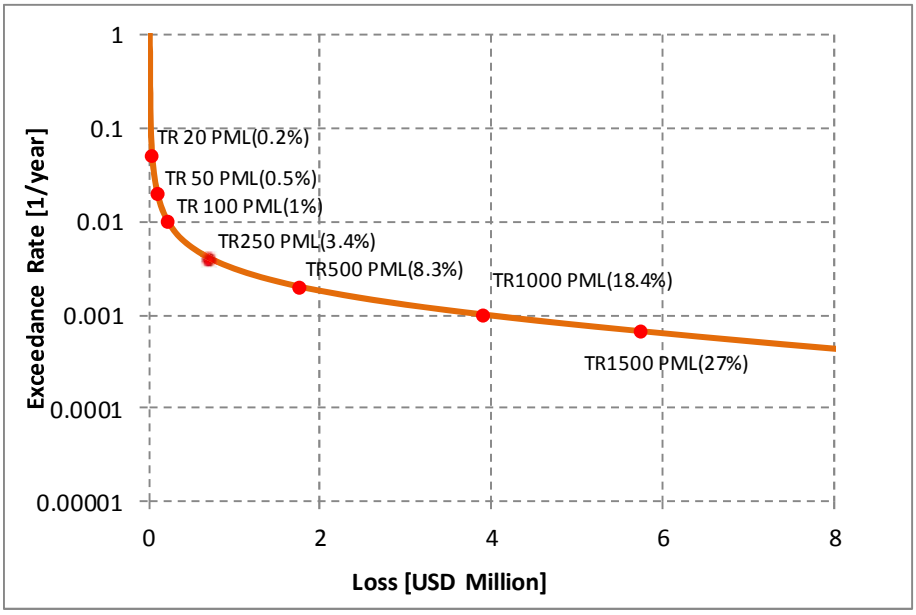


FIGURE 8. LOSS EXCEEDANCE CURVE FOR INDEPENDENCIA

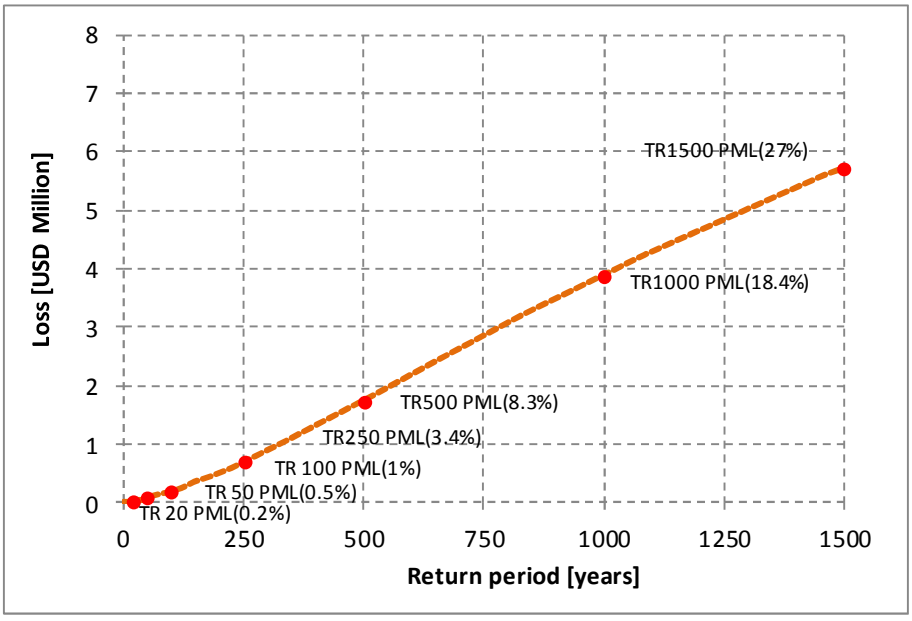


FIGURE 9. PROBABLE MAXIMUM LOSS CURVE FOR INDEPENDENCIA

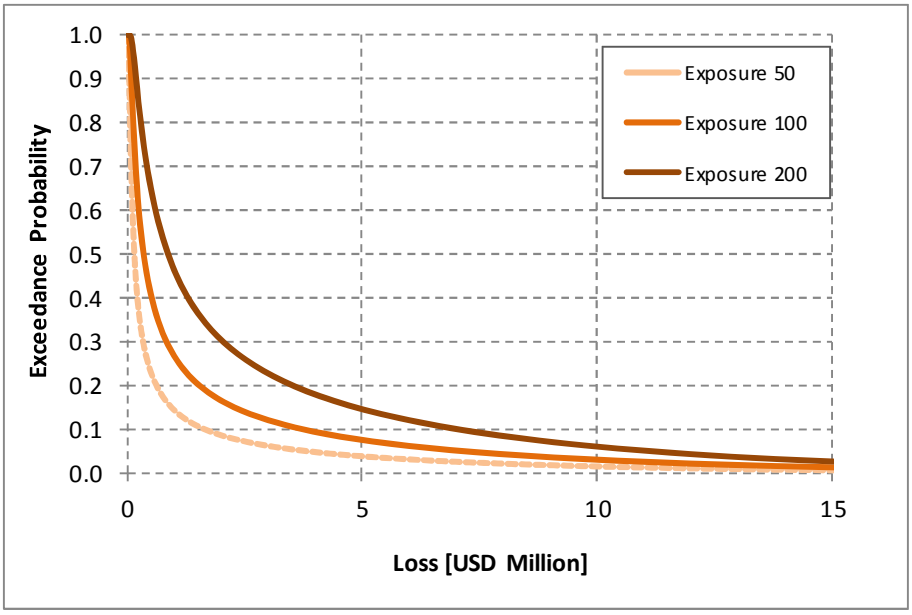


FIGURE 10. LOSS EXCEEDANCE PROBABILITY CURVE FOR DIFFERENT EXPOSURE TIMEFRAMES FOR INDEPENDENCIA

3 Carabayllo, Perú

3.1 Location

The District of Carabayllo corresponds to one of the 43 districts that are part of the Lima Province in Perú. It is located in the Cono Norte area of the province. It borders to the north and east with the Canta Province in the Lima Region, the south with the Comas district and the San Juan de Lurigancho district, and to the west with the Puente Piedra and Ancón districts. For this district, the neighborhood selected corresponds to El Progreso.



FIGURE 11. LOCATION OF THE NEIGHBORHOODS IN CARABAYLLO

3.2 Seismic Hazard

Seismic hazard curves were obtained for each neighborhood in the city of Carabayllo based on the probabilistic seismic hazard assessment from the Global Assessment Report on Disaster Risk Reduction 2015. The curves are presented in terms of the return period as a function of the peak ground acceleration, PGA.

Given the proximity of the neighborhoods no substantial difference is observed in the hazard curves shown in Figure 12, where the acceleration for the six groups of El Progreso neighborhood in Carabayllo is 252 cm/s² for a 1500-year return period. According to these numbers, the three cities from Peru have the third highest seismic hazard from all the 8 projects.

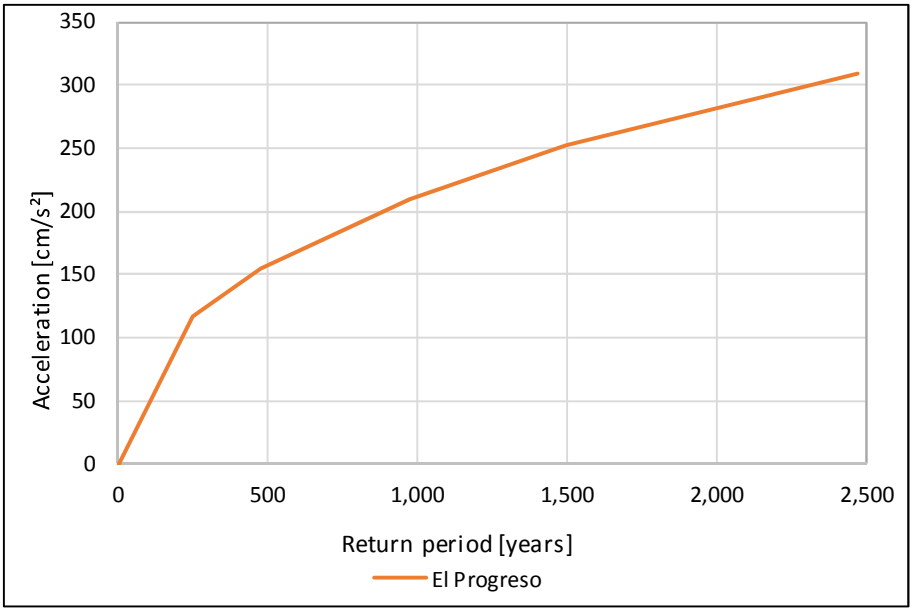


FIGURE 12. SEISMIC HAZARD CURVES FOR THE NEIGHBORHOODS IN CARABAYLLO

3.3 Exposure

To perform a probabilistic risk analysis, it is required to identify and characterize the exposed assets susceptible to suffer damage and losses due to the considered natural hazards. In this case the assets refer to the residential buildings susceptible to suffer damage due to possible earthquakes.

Based on the information received a procedure to determine the inventory of exposed elements was developed and is further explained on Annex 1. Inventory of Exposed Elements

The total constructed area was computed for each neighborhood from the plant area obtained from satellite imagery and from the average number of stories of buildings determined with information from online available images and from the Google Street View tool.

The economic replacement value for each constructed square meter was established as the official minimum monthly wage for 2018 which is USD $262.35 in Perú[4] using the dollar exchange rate as of February 7, 2018. The following table summarizes the data obtained for Carabayllo.

4 https://www.gob.pe/476-valor-remuneracion-minima-vital

TABLE 5. GENERAL EXPOSURE DATA FOR CARABAYLLO

Barrio	Number of stories	Constructed area [m²]	Exposed value [USD]
El Progreso - Group 1	2	119,155	$ 31,259,870.74
El Progreso - Group 2	2	129,792	$ 34,050,383.44
El Progreso - Group 4	2	79,040	$ 20,735,913.07
El Progreso - Group 3-1	2	40,572	$ 10,643,859.87
El Progreso - Group 3-2	2	17,483	$ 4,586,657.30
El Progreso - Group 3-3	2	39,596	$ 10,387,952.00

In this case one construction class was assigned to all the dwellings on the neighborhoods since it was determined from online available images and the Google Street View tool that the most common system used is unreinforced concrete block masonry.

3.4 Risk Assessment

The Table 6 summarizes the results of the seismic risk assessment. The studied neighborhoods in Carabayllo have an average annual loss of 126,147 Million US Dollar which corresponds to a relative loss of 1.13‰.

TABLE 6. SEISMIC RISK RESULTS FOR CARABAYLLO

Risk Results		
Exposed Value	**USD Million**	111,664,636.00
Average Anual Loss	**USD Million**	126,146.57
	‰	1.13
PML		
Return Period	**Loss**	
years	**USD Million**	**%**
20	$168,165.97	0.15
50	$482,227.63	0.43
100	$1,124,926.65	1.01
250	$3,666,040.88	3.28
500	$8,075,573.82	7.23
1000	$15,877,702.39	14.22
1500	$22,167,957.55	19.85

The Loss Exceedance Curve and Probable Maximum Loss Curve and the Loss Exceedance Probability Curve for different exposure timeframes are presented below.

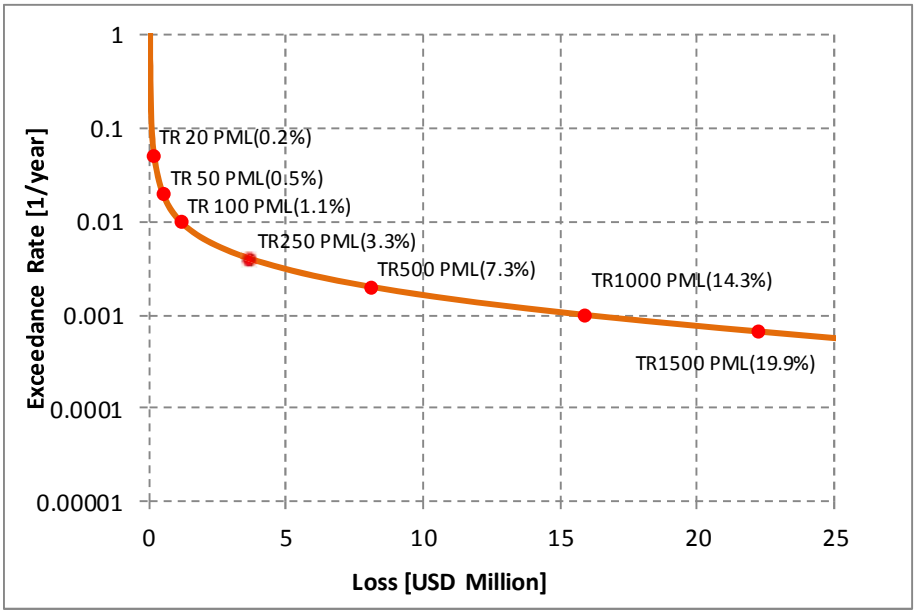


FIGURE 13. LOSS EXCEEDANCE CURVE FOR CARABAYLLO

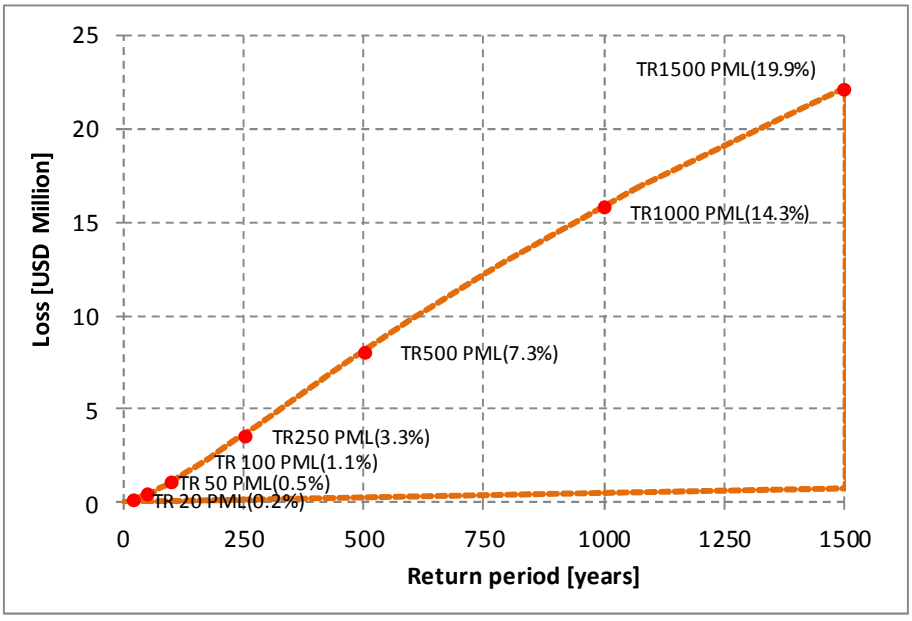


FIGURE 14. PROBABLE MAXIMUM LOSS CURVE FOR CARABAYLLO

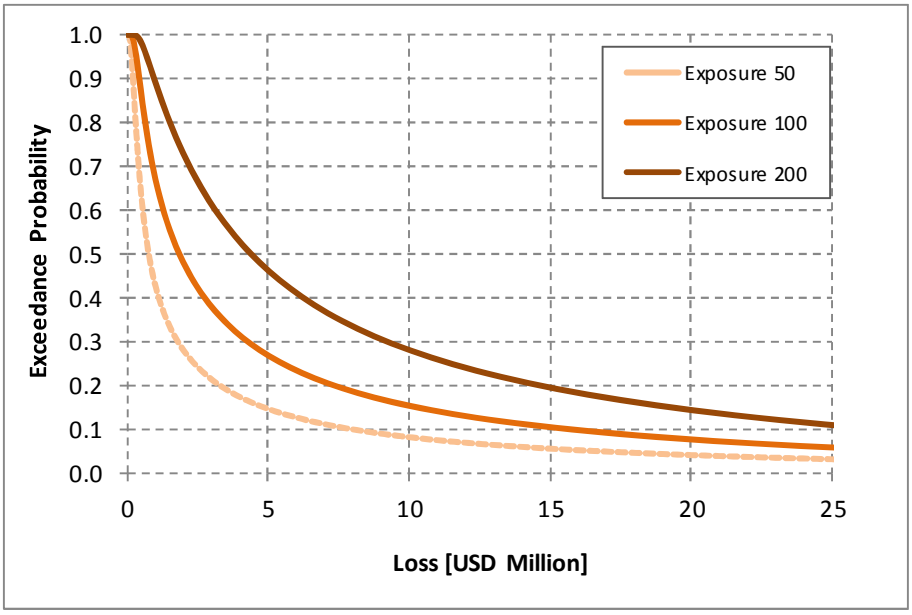


FIGURE 15. LOSS EXCEEDANCE PROBABILITY CURVE FOR DIFFERENT EXPOSURE TIMEFRAMES FOR CARABAYLLO

4 Rimac, Perú

4.1 Location

The District of Rimac corresponds to one of the 43 districts that are part of the Lima Province in Perú. It is located in the north of downtown Lima and bordered on the north by the district of Independencia, on the east by the district of San Juan de Lurigancho, on the south by the Cercado de Lima and on the west by the district of San Martín de Porres. For this District, two neighborhoods were selected, Flor de Amancaes and Leticia.



FIGURE 16. LOCATION OF THE NEIGHBORHOODS IN RIMAC

4.2 Seismic Hazard

Seismic hazard curves were obtained for each neighborhood in the city of Rimac based on the probabilistic seismic hazard assessment from the Global Assessment Report on Disaster Risk Reduction 2015. The curves are presented in terms of the return period as a function of the peak ground acceleration, PGA.

Given the proximity of the neighborhoods no substantial difference is observed in the hazard curves shown in Figure 17, where the acceleration for the two neighborhoods in Rimac is 252 cm/s² for a 1500-year return period. According to these numbers, the three cities from Peru have the third highest seismic hazard from all the 8 projects.

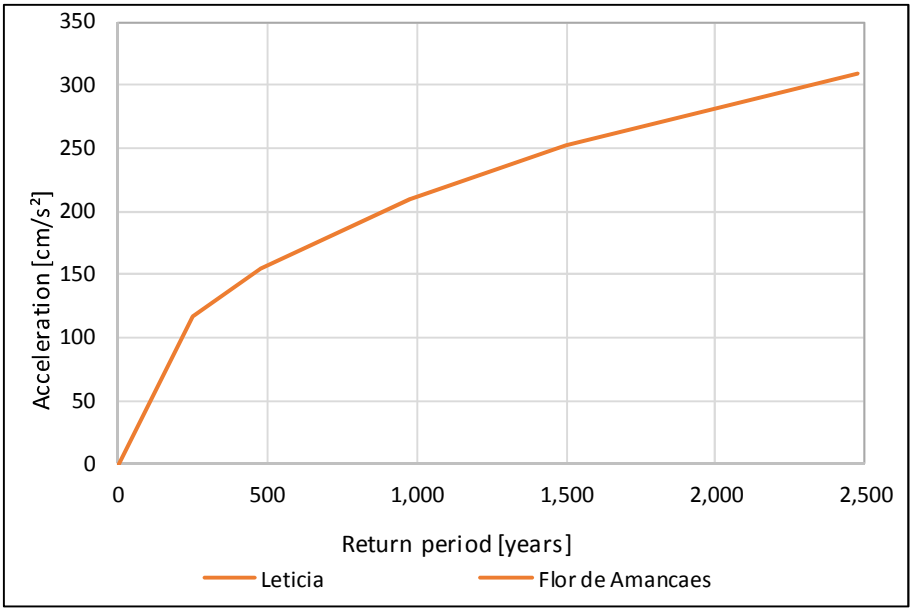


FIGURE 17. SEISMIC HAZARD CURVES FOR THE NEIGHBORHOODS IN RIMAC

4.3 Exposure

To perform a probabilistic risk analysis, it is required to identify and characterize the exposed assets susceptible to suffer damage and losses due to the considered natural hazards. In this case the assets refer to the residential buildings susceptible to suffer damage due to possible earthquakes.

Based on the information received a procedure to determine the inventory of exposed elements was developed and is further explained on Annex 1. Inventory of Exposed Elements

The total constructed area was computed for each neighborhood from the plant area obtained from satellite imagery and from the average number of stories of buildings determined with information from online available images and from the Google Street View tool.

The economic replacement value for each constructed square meter was established as the official minimum monthly wage for 2018 which is USD $262.35 in Perú[5] using the dollar exchange rate as of February 7, 2018. The following table summarizes the data obtained for Rimac.

5 https://www.gob.pe/476-valor-remuneracion-minima-vital

TABLE 7. GENERAL EXPOSURE DATA FOR RIMAC

Barrio	Number of stories	Constructed area [m²]	Exposed value [USD]
Leticia	2	258,167	$ 67,728,945.86
Flor de Amancaes	2	189,600	$ 49,740,812.10

In this case one construction class was assigned to all the dwellings on the neighborhoods since it was determined from online available images and the Google Street View tool that the most common system used is unreinforced concrete block masonry.

4.4 Risk Assessment

The Table 8 summarizes the results of the seismic risk assessment. The studied neighborhoods in Rimac have an average annual loss of 148,977 Million US Dollar which corresponds to a relative loss of 1.27‰.

TABLE 8. SEISMIC RISK RESULTS FOR RIMAC

Risk Results		
Exposed Value	USD Million	117,469,758.00
Average Anual Loss	USD Million	148,977.18
	‰	1.27
PML		
Return Period	Loss	
years	USD Million	%
20	$170,802.09	0.15
50	$518,913.38	0.44
100	$1,215,604.77	1.03
250	$4,073,400.73	3.47
500	$9,909,870.48	8.44
1000	$21,438,072.79	18.25
1500	$31,010,634.81	26.40

The Loss Exceedance Curve and Probable Maximum Loss Curve and the Loss Exceedance Probability Curve for different exposure timeframes are presented below.

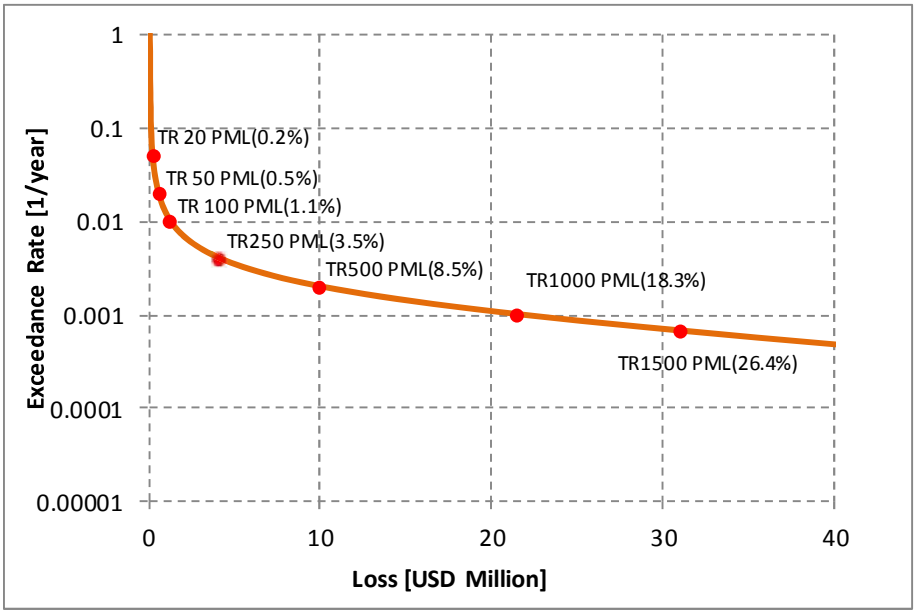


FIGURE 18. LOSS EXCEEDANCE CURVE FOR RIMAC

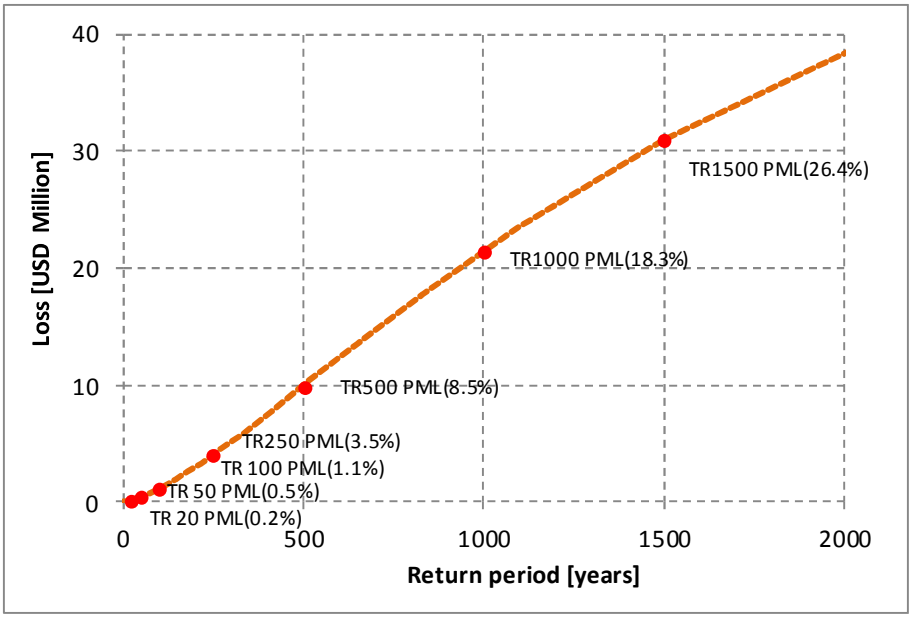


FIGURE 19. PROBABLE MAXIMUM LOSS CURVE FOR RIMAC

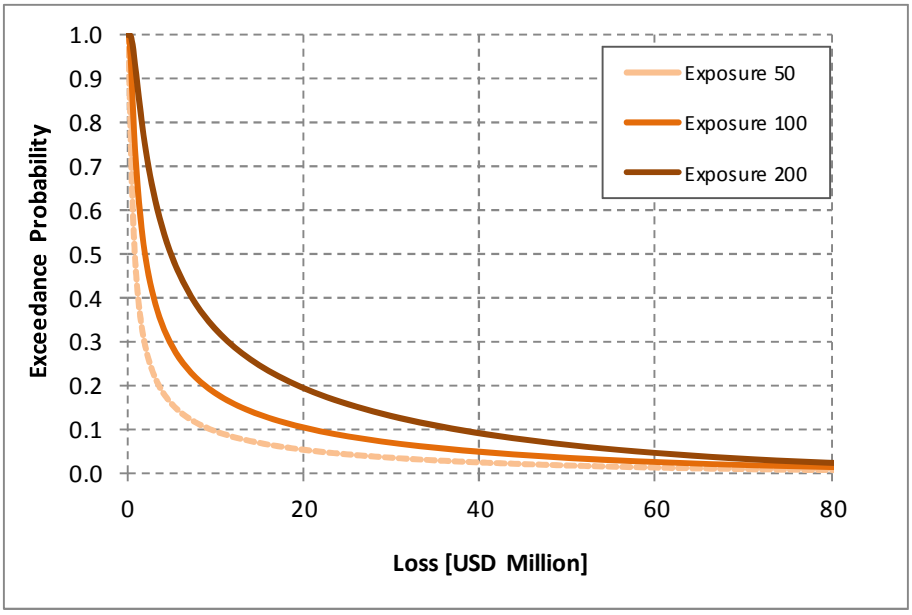


FIGURE 20. LOSS EXCEEDANCE PROBABILITY CURVE FOR DIFFERENT EXPOSURE TIMEFRAMES FOR RIMAC

5 Mixco, Guatemala

5.1 Location

Mixco is a city located in the Guatemala department, in the west end of the capital city with which a direct commercial activity is developed. It limits to the north with San Pedro Ayampuc, San Juan Sacatepéquez and Chinautla; to the south with Villa Nueva; to the east with the city of Guatemala; and to the west with the department of Sacatepéquez. For this city, two neighborhoods were selected, Vistas de la Comunidad and Cipresales.



FIGURE 21. LOCATION OF THE NEIGHBORHOODS IN MIXCO

5.2 Seismic Hazard

Seismic hazard curves were obtained for each neighborhood in the city of Mixco based on the probabilistic seismic hazard assessment from the Global Assessment Report on Disaster Risk Reduction 2015. The curves are presented in terms of the return period as a function of the peak ground acceleration, PGA.

Given the proximity of the neighborhoods no substantial difference is observed in the hazard curves shown in Figure 17, where the acceleration for the two neighborhoods in Mixco is 415 cm/s² for a 1500-year return period. According to these numbers, the city has the highest seismic hazard from all the 8 projects.

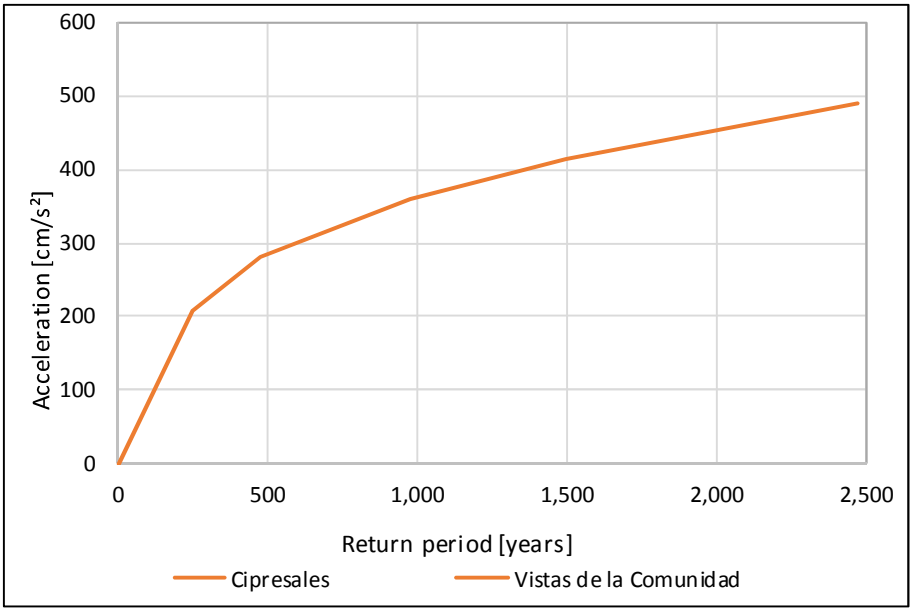


FIGURE 22. SEISMIC HAZARD CURVES FOR THE NEIGHBORHOODS IN MIXCO

5.3 Exposure

To perform a probabilistic risk analysis, it is required to identify and characterize the exposed assets susceptible to suffer damage and losses due to the considered natural hazards. In this case the assets refer to the residential buildings susceptible to suffer damage due to possible earthquakes.

Based on the information received a procedure to determine the inventory of exposed elements was developed and is further explained on Annex 1. Inventory of Exposed Elements

The total constructed area was computed for each neighborhood from the plant area obtained from satellite imagery and from the average number of stories of buildings determined with information from online available images.

The economic replacement value for each constructed square meter was established as the official minimum monthly wage for 2018 which is USD $357.18 in Guatemala[6] using the dollar exchange rate as of February 7, 2018. The following table summarizes the data obtained for Mixco.

6 Average from the values available at http://mintrabajo.gob.gt/index.php/salariominimo.html

TABLE 9. GENERAL EXPOSURE DATA FOR MIXCO

Barrio	Number of stories	Constructed area [m²]	Exposed value [USD]
Cipresales	2	33,873	$ 12,098,821.24
Vistas de la Comunidad	2	14,009	$ 5,003,781.35

In this case one construction class was assigned to all the dwellings on the neighborhoods since it was determined from online available images that the most common system used is unreinforced concrete block masonry.

5.4 Risk Assessment

The Table 10 summarizes the results of the seismic risk assessment. The studied neighborhoods in Mixco have an average annual loss of 61,122 Million US Dollar which corresponds to a relative loss of 3.57‰.

TABLE 10. SEISMIC RISK RESULTS FOR MIXCO

Risk Results		
Exposed Value	**USD Million**	17,102,603.00
Average Anual Loss	**USD Million**	61,121.89
	‰	3.57
PML		
Return Period	**Loss**	
years	**USD Million**	**%**
20	$66,840.42	0.39
50	$225,361.82	1.32
100	$636,897.29	3.72
250	$2,590,000.00	15.14
500	$5,730,932.00	33.51
1000	$8,891,225.95	51.99
1500	$10,560,676.84	61.75

The Loss Exceedance Curve and Probable Maximum Loss Curve and the Loss Exceedance Probability Curve for different exposure timeframes are presented below.

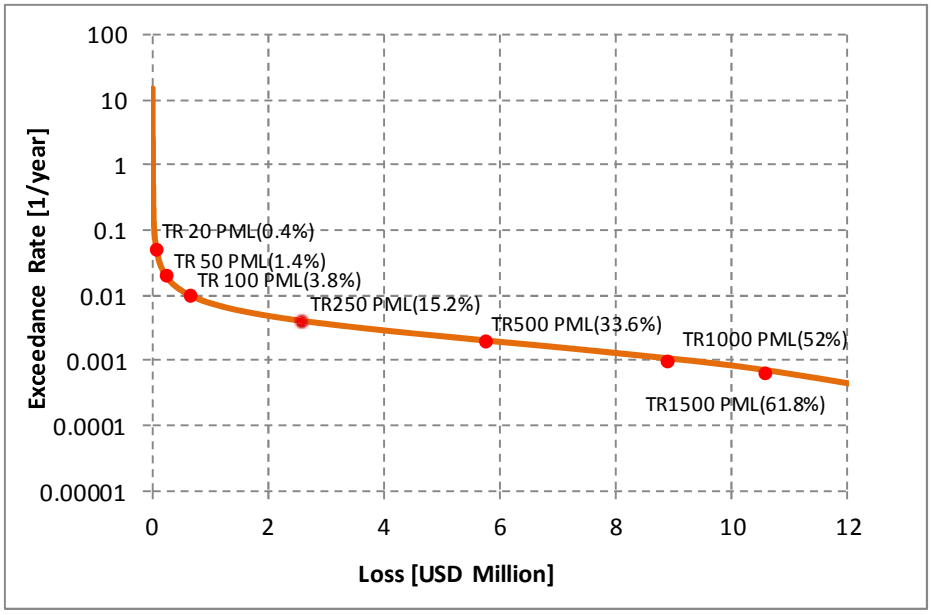


FIGURE 23. LOSS EXCEEDANCE CURVE FOR MIXCO

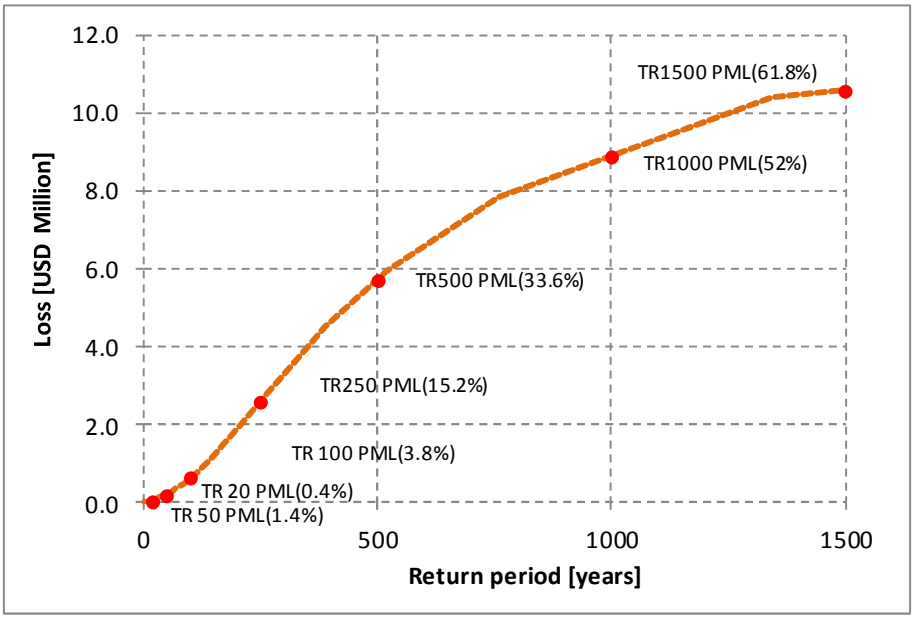


FIGURE 24. PROBABLE MAXIMUM LOSS CURVE FOR MIXCO

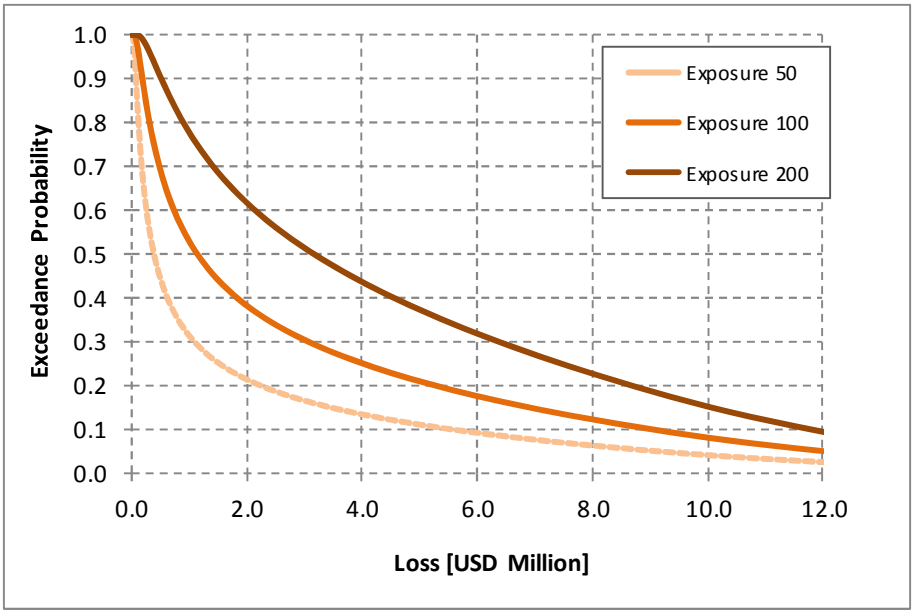


FIGURE 25. LOSS EXCEEDANCE PROBABILITY CURVE FOR DIFFERENT EXPOSURE TIMEFRAMES FOR MIXCO

6 Medellín, Colombia

6.1 Location

Medellín is one of the main cities in Colombia and the capital of the department of Antioquia, it is located in the central region of the Andes Mountains in South America. Their metropolitan area is the second-largest urban agglomeration in Colombia in terms of population and economy. For this city, four neighborhoods were selected, Santo Domingo Savio, El Compromiso, Llanaditas and El Pinal.



FIGURE 26. LOCATION OF THE NEIGHBORHOODS IN MEDELLIN

6.2 Seismic Hazard

Seismic hazard curves were obtained for each neighborhood in the city of Medellin based on the probabilistic seismic hazard assessment from the Global Assessment Report on Disaster Risk Reduction 2015. The curves are presented in terms of the return period as a function of the peak ground acceleration, PGA.

There is a difference observed in the hazard curves shown in Figure 17 because of the location of the neighborhoods, where the acceleration for three of the neighborhoods in Medellin is 363 cm/s² and for the neighborhood of El Pinal is lower at 249 cm/s² for a 1500-year return period. According to these numbers, the neighborhoods of Llanaditas, Santo Domingo Savio and El Compromiso have the second highest seismic hazard from all the 8 projects.

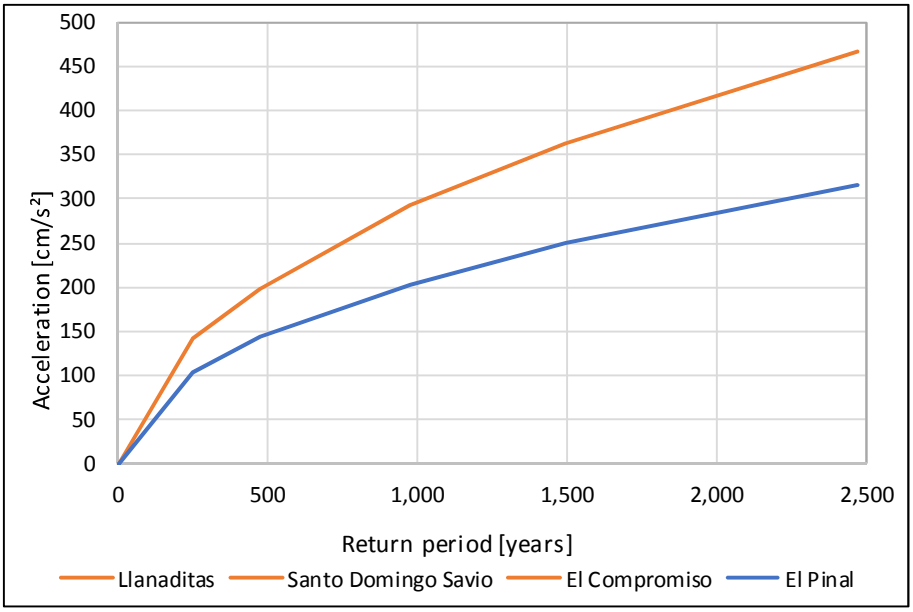


FIGURE 27. SEISMIC HAZARD CURVES FOR THE NEIGHBORHOODS IN MEDELLIN

6.3 Exposure

To perform a probabilistic risk analysis, it is required to identify and characterize the exposed assets susceptible to suffer damage and losses due to the considered natural hazards. In this case the assets refer to the residential buildings susceptible to suffer damage due to possible earthquakes.

Based on the information received a procedure to determine the inventory of exposed elements was developed and is further explained on Annex 1. Inventory of Exposed Elements

The total constructed area was computed for each neighborhood from the plant area obtained from satellite imagery and from the average number of stories of buildings determined with information from online available images and from the Google Street View tool.

The economic replacement value for each constructed square meter was established as the official minimum monthly wage for 2018 which is USD $308 in Colombia using the dollar exchange rate as of February 7, 2018. The following table summarizes the data obtained for Medellin.

TABLE 11. GENERAL EXPOSURE DATA FOR MEDELLIN

Barrio	Number of stories	Constructed area [m²]	Exposed value [USD]
Llanaditas	1	227,120	$ 69,953,439.52
Santo Domingo Savio	1	616,120	$189,766,260.83
El Compromiso	1	139,440	$ 42,947,814.40
El Pinal	1	327,140	$100,759,810.70

In this case one construction class was assigned to all the dwellings on the neighborhoods since it was determined from online available images and the Google Street View tool that the most common system used is unreinforced concrete block masonry.

6.4 Risk Assessment

The Table 12 summarizes the results of the seismic risk assessment. The studied neighborhoods in Medellin have an average annual loss of 557,896 Million US Dollar which corresponds to a relative loss of 1.38‰.

TABLE 12. SEISMIC RISK RESULTS FOR MEDELLIN

Risk Results		
Exposed Value	**USD Million**	403,425,000.00
Average Anual Loss	**USD Million**	557,895.62
	‰	1.38
PML		
Return Period	**Loss**	
years	**USD Million**	**%**
20	$467,595.07	0.12
50	$1,604,255.21	0.40
100	$4,461,897.86	1.11
250	$17,977,699.81	4.46
500	$48,830,259.85	12.10
1000	$103,206,661.13	25.58
1500	$138,942,544.28	34.44

The Loss Exceedance Curve and Probable Maximum Loss Curve and the Loss Exceedance Probability Curve for different exposure timeframes are presented below.

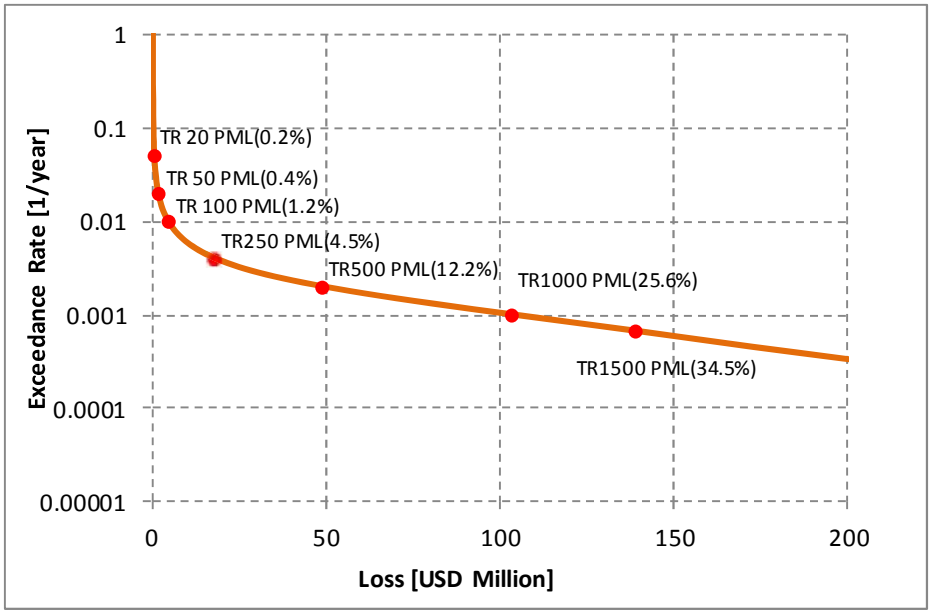


FIGURE 28. LOSS EXCEEDANCE CURVE FOR MEDELLIN

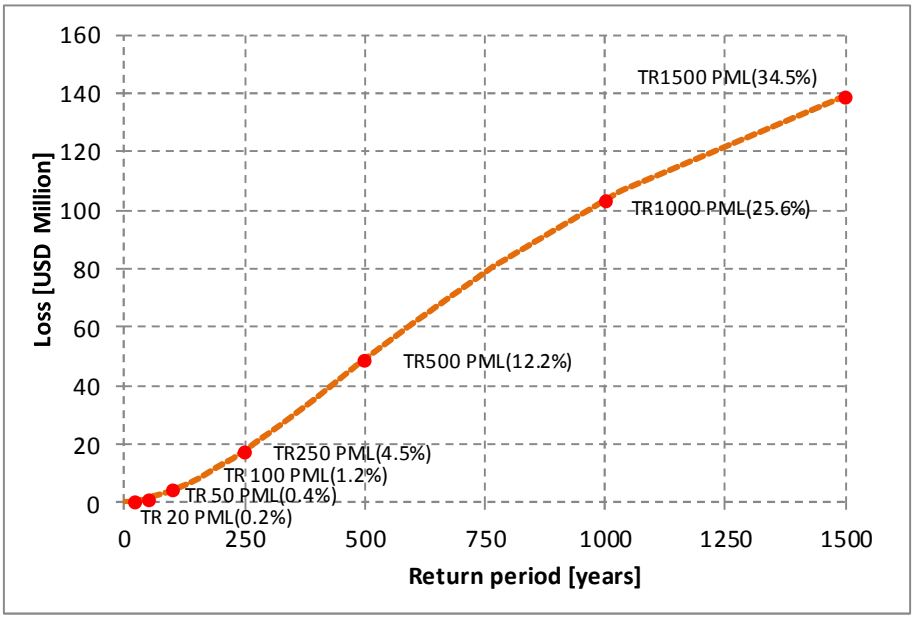


FIGURE 29. PROBABLE MAXIMUM LOSS CURVE FOR MEDELLIN

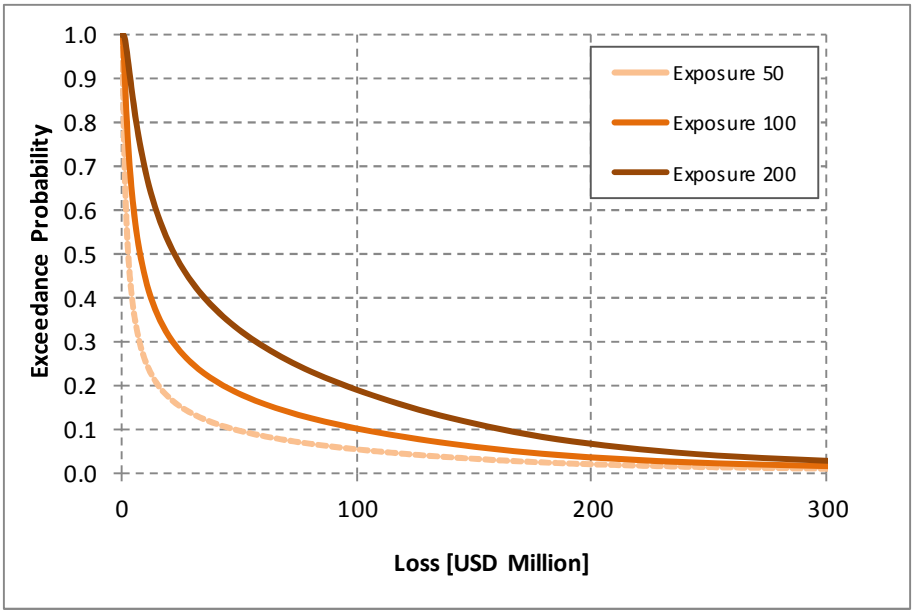


FIGURE 30. LOSS EXCEEDANCE PROBABILITY CURVE FOR DIFFERENT EXPOSURE TIMEFRAMES FOR MEDELLIN

7 Portmore, Jamaica

7.1 Location

Portmore is a large coastal town in southern Jamaica, corresponds to one of the island's most densely populated zones. For this town, three neighborhoods were selected, Gregory Park, New Land and Naggo Head.



FIGURE 31. LOCATION OF THE NEIGHBORHOODS IN PORTMORE

7.2 Seismic Hazard

Seismic hazard curves were obtained for each neighborhood in the city of Portmore based on the probabilistic seismic hazard assessment from the Global Assessment Report on Disaster Risk Reduction 2015. The curves are presented in terms of the return period as a function of the peak ground acceleration, PGA.

Given the proximity of the neighborhoods no substantial difference is observed in the hazard curves shown in Figure 32, where the acceleration for all studied neighborhoods in Portmore is 116 cm/s², for a 1500-year return period. According to these numbers, the city has the fourth lowest seismic hazard from all the 8 projects.

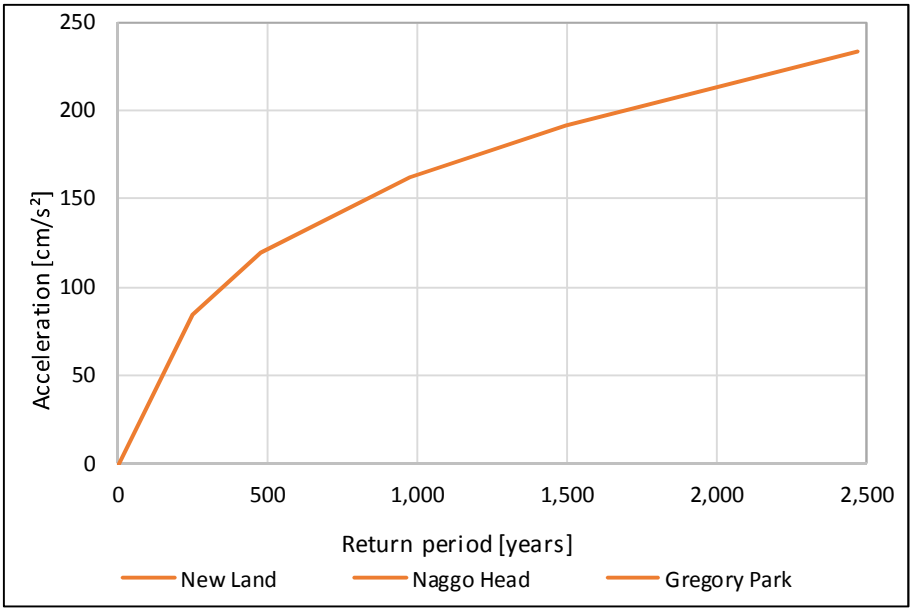


FIGURE 32. SEISMIC HAZARD CURVES FOR THE NEIGHBORHOODS IN PORTMORE

7.3 Exposure

To perform a probabilistic risk analysis, it is required to identify and characterize the exposed assets susceptible to suffer damage and losses due to the considered natural hazards. In this case the assets refer to the residential buildings susceptible to suffer damage due to possible earthquakes.

Based on the information received a procedure to determine the inventory of exposed elements was developed and is further explained on Annex 1. Inventory of Exposed Elements

The total constructed area was computed for each neighborhood from the plant area obtained from satellite imagery and from the average number of stories of buildings determined with information from online available images.

The economic replacement value for each constructed square meter was established as the official minimum monthly wage for 2018 which is USD $198.37 in Jamaica[7] using the dollar exchange rate as of February 7, 2018. The following table summarizes the data obtained for Portmore.

[7] http://jis.gov.jm/minimum-wage-rates-effective-march-1/

TABLE 13. GENERAL EXPOSURE DATA FOR PORTMORE

Barrio	Number of stories	Constructed area [m²]	Exposed value [USD]
New Land	2	286,717	$ 56,875,594.05
Naggo Head	2	152,849	$ 30,320,347.53
Gregory Park	2	603,270	$119,669,618.00

The construction classes assigned are unreinforced concrete block masonry and wood. The information from the 2011 Census of Population and Housing[8] reports that the most common material used on the outer walls on the parish of St. Catherine where the city is located is concrete and blocks followed by wood. In the case of Portmore 30% of the dwellings were modelled as wood and the other 70% as unreinforced masonry.

7.4 Risk Assessment

The Table 14 summarizes the results of the seismic risk assessment. The studied neighborhoods in Portmore have an average annual loss of 65,985 Million US Dollar which corresponds to a relative loss of 0.32‰. The city has the lowest relative average annual loss from all the 8 projects.

TABLE 14. SEISMIC RISK RESULTS FOR PORTMORE

Risk Results		
Exposed Value	USD Million	206,865,560.00
Average Anual Loss	USD Million	65,984.86
	‰	0.32
PML		
Return Period	Loss	
years	USD Million	%
20	$51,246.23	0.02
50	$135,512.84	0.07
100	$412,202.69	0.20
250	$2,000,906.93	0.97
500	$5,926,964.45	2.87
1000	$13,425,338.57	6.49
1500	$19,746,010.98	9.55

The Loss Exceedance Curve and Probable Maximum Loss Curve and the Loss Exceedance Probability Curve for different exposure timeframes are presented below.

[8] http://statinja.gov.jm/Census/PopCensus/2011%20Census%20of%20Population%20and%20Housing%20D.pdf

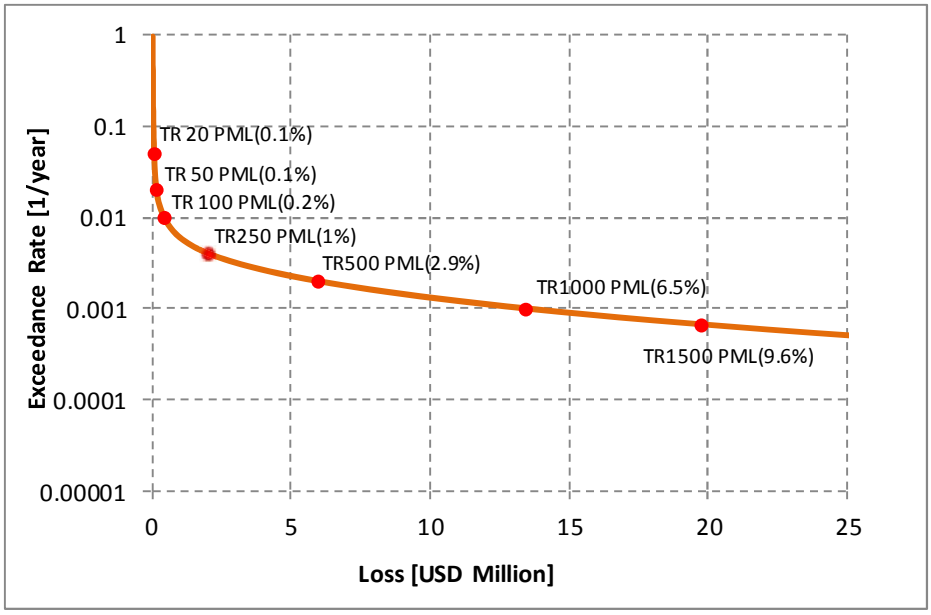


FIGURE 33. LOSS EXCEEDANCE CURVE FOR PORTMORE

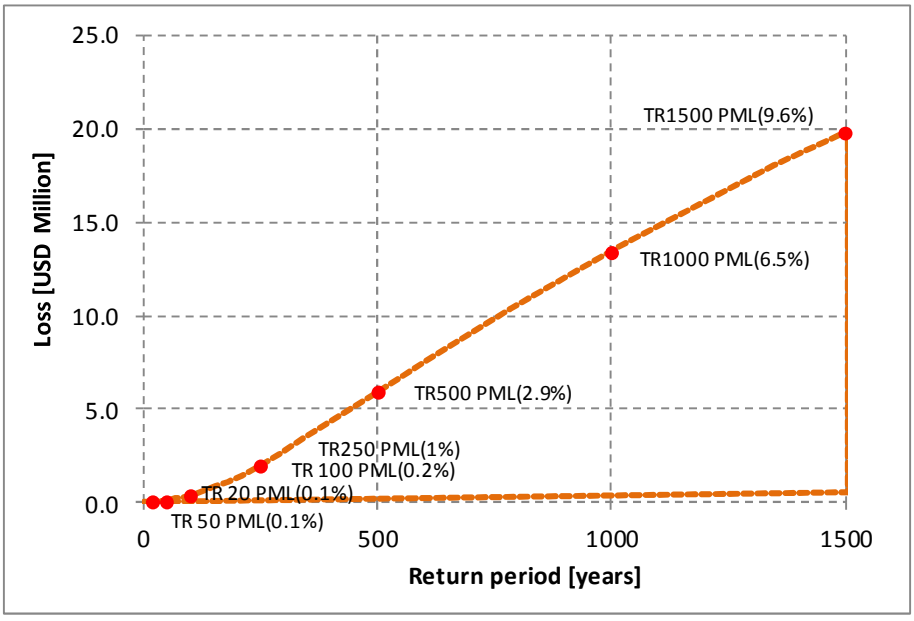


FIGURE 34. PROBABLE MAXIMUM LOSS CURVE FOR PORTMORE

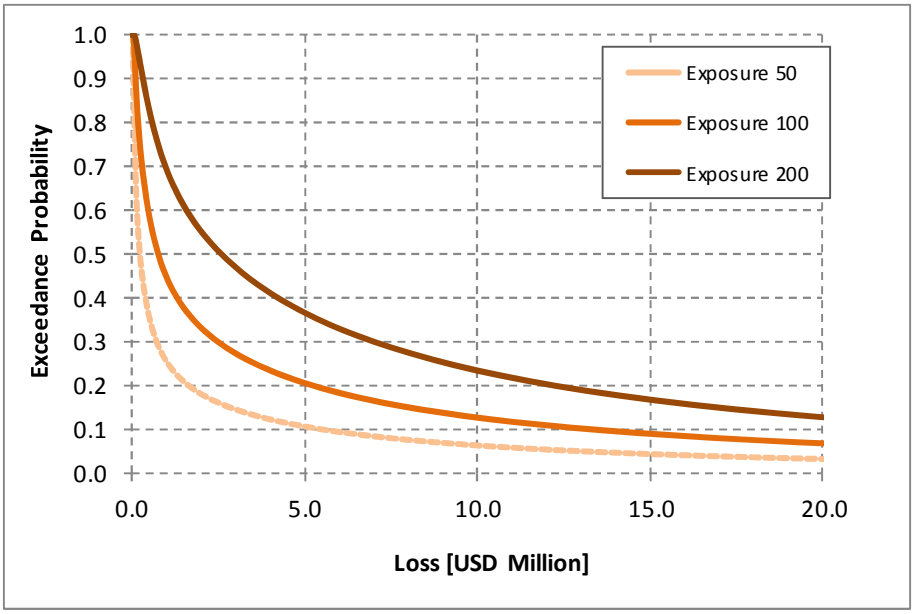


FIGURE 35. LOSS EXCEEDANCE PROBABILITY CURVE FOR DIFFERENT EXPOSURE TIMEFRAMES FOR PORTMORE

8 Tegucigalpa, Honduras

8.1 Location

Tegucigalpa is the capital and largest city of Honduras, the metropolitan area of Tegucigalpa and its twin city Comayagüela are located in a valley surrounded by mountains in the central south mountainous region of Honduras. For this city, three neighborhoods were selected, José Ángel Ulloa, José Arturo Duarte y Nueva Providencia.



FIGURE 36. LOCATION OF THE NEIGHBORHOODS IN TEGUCIGALPA

8.2 Seismic Hazard

Seismic hazard curves were obtained for each neighborhood in the city of Tegucigalpa based on the probabilistic seismic hazard assessment from the Global Assessment Report on Disaster Risk Reduction 2015. The curves are presented in terms of the return period as a function of the peak ground acceleration, PGA.

There is a difference observed in the hazard curves shown in Figure 37, where the acceleration for two of the neighborhoods in Tegucigalpa is 210 cm/s² and for the neighborhood of Nueva Providencia is lower at 159 cm/s² for a 1500-year return period. According to these numbers, this last neighborhood has the third lowest seismic hazard from all the 8 projects.

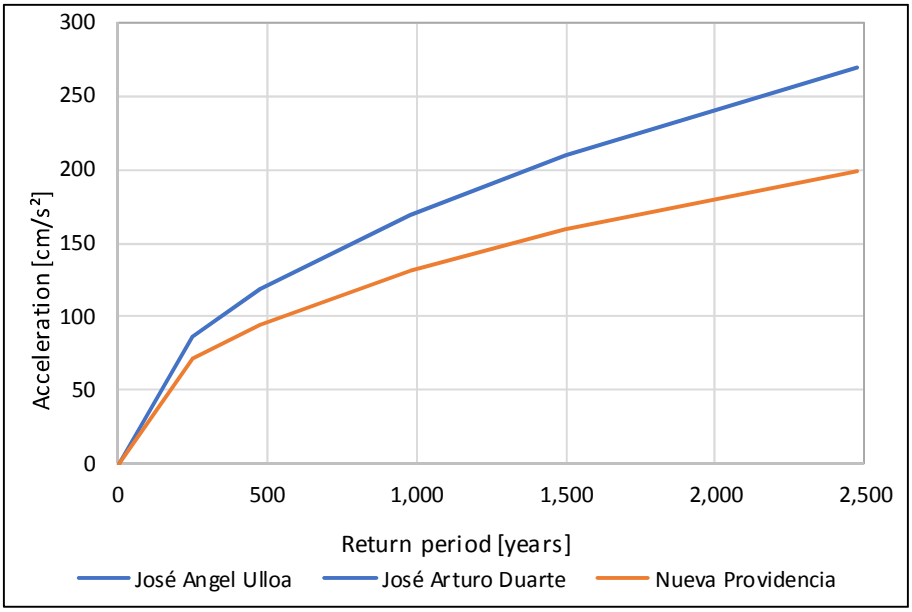


FIGURE 37. SEISMIC HAZARD CURVES FOR THE NEIGHBORHOODS IN TEGUCIGALPA

8.3 Exposure

To perform a probabilistic risk analysis, it is required to identify and characterize the exposed assets susceptible to suffer damage and losses due to the considered natural hazards. In this case the assets refer to the residential buildings susceptible to suffer damage due to possible earthquakes.

Based on the information received a procedure to determine the inventory of exposed elements was developed and is further explained on Annex 1. Inventory of Exposed Elements

The total constructed area was computed for each neighborhood from the plant area obtained from satellite imagery and from the average number of stories of buildings determined with information from online available images.

The economic replacement value for each constructed square meter was established as the official minimum monthly wage for 2018 which is USD $395.48 in Honduras[9] using the dollar exchange rate as of February 7, 2018. The following table summarizes the data obtained for Tegucigalpa.

[9] Average from the construction and manufacture's industry salaries http://www.trabajo.gob.hn/tabla-de-salario-minimo-2018/

TABLE 15. GENERAL EXPOSURE DATA FOR TEGUCIGALPA

Barrio	Number of stories	Constructed area [m²]	Exposed value [USD]
Jose Angel Ulloa	2	351,008	$ 138,815,155.47
Jose Arturo Duarte	2	163,032	$ 64,475,214.96
Nueva Providencia	2	20,387	$ 8,062,750.83

In this case one construction class was assigned to all the dwellings on the neighborhoods since it was determined from online available images that the most common system used is unreinforced concrete block masonry.

8.4 Risk Assessment

The Table 16 summarizes the results of the seismic risk assessment. The studied neighborhoods in Tegucigalpa have an average annual loss of 174,245 Million US Dollar which corresponds to a relative loss of 0.82‰.

TABLE 16. SEISMIC RISK RESULTS FOR TEGUCIGALPA

Risk Results		
Exposed Value	USD Million	211,353,121.00
Average Anual Loss	USD Million	174,245.39
	‰	0.82
PML		
Return Period	Loss	
years	USD Million	%
20	$150,843.37	0.07
50	$319,524.48	0.15
100	$668,329.12	0.32
250	$1,753,251.96	0.83
500	$3,923,921.75	1.86
1000	$9,159,625.75	4.33
1500	$15,126,271.17	7.16

The Loss Exceedance Curve and Probable Maximum Loss Curve and the Loss Exceedance Probability Curve for different exposure timeframes are presented below.

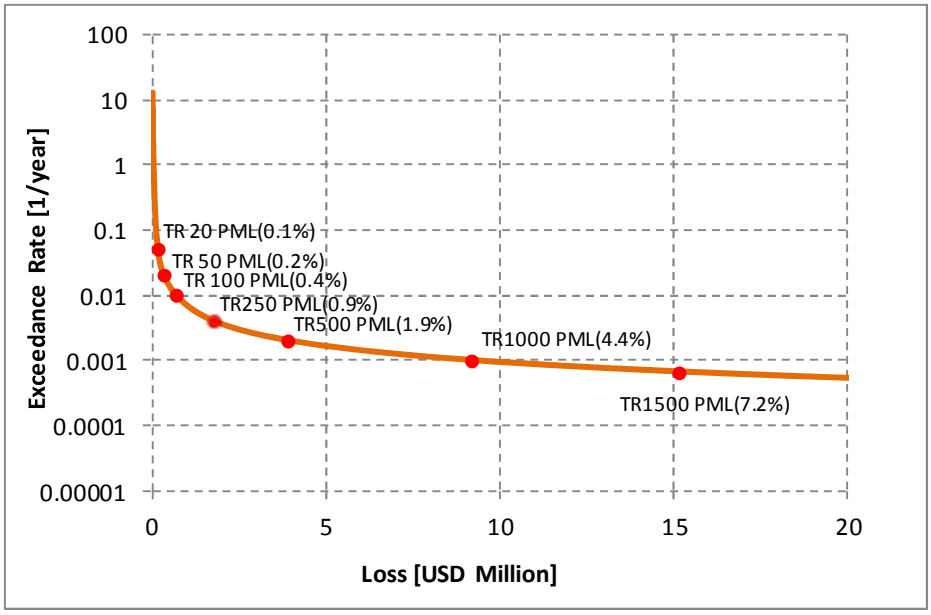


FIGURE 38. LOSS EXCEEDANCE CURVE FOR TEGUCIGALPA

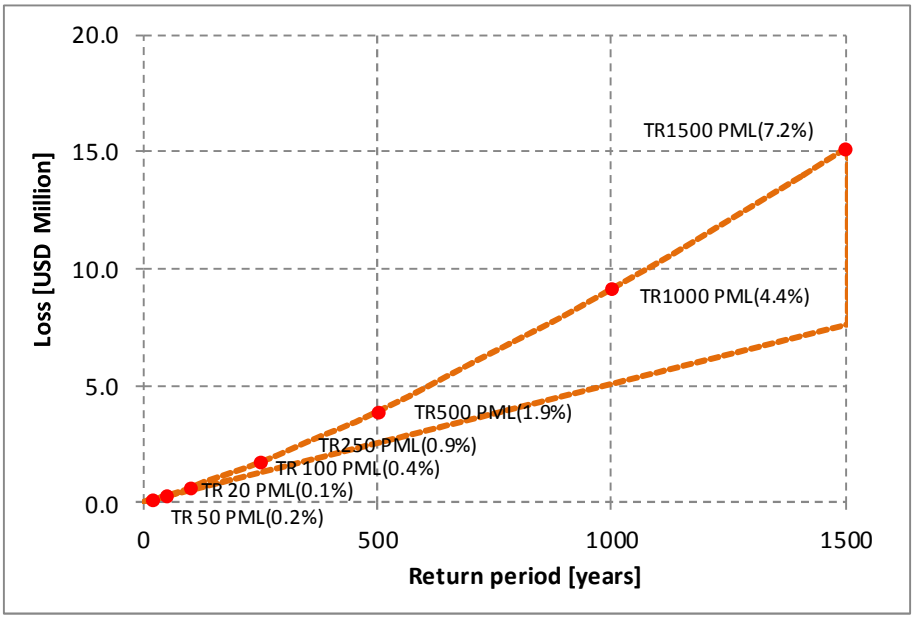


FIGURE 39. PROBABLE MAXIMUM LOSS CURVE FOR TEGUCIGALPA

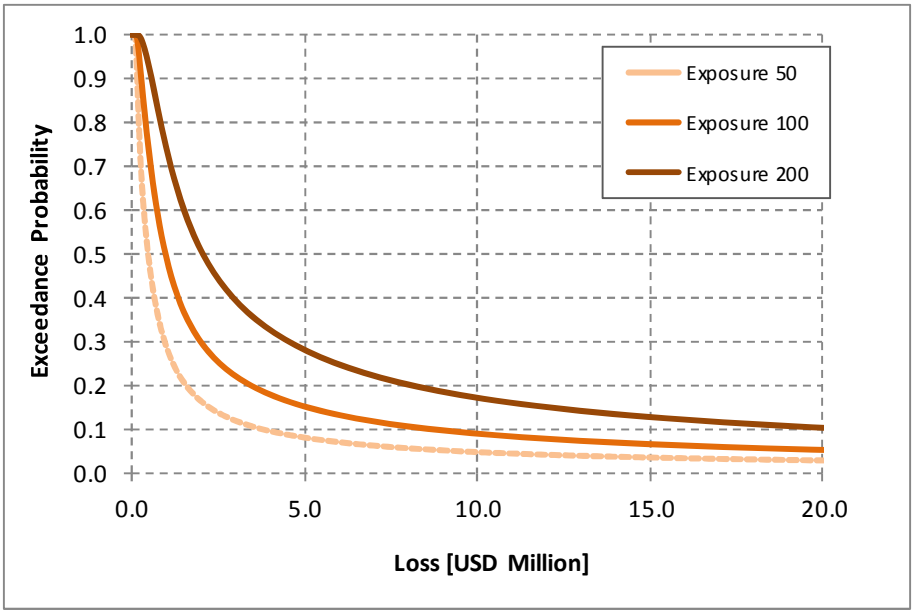


FIGURE 40. LOSS EXCEEDANCE PROBABILITY CURVE FOR DIFFERENT EXPOSURE TIMEFRAMES FOR TEGUCIGALPA

Annex 1. Inventory of Exposed Elements

The exposed elements are essential in risk assessment, because they are the objects on which losses are evaluated, i.e., are the source of potential losses due to being exposed to a hazard and be susceptible of suffering damage. In mathematical terms, the exposed elements provide the maximum possible absolute value of the loss at their geographical location, as well as the summands of the probability density function of the loss of a hazard scenario. That is, they are the integrating element of hazard and vulnerability at each of their locations, and the integrator elements of the total losses for a given scenario. Its proper characterization is of great importance for the correct estimation of losses and once each element is characterized it needs to be appraised in economic terms (usually in monetary units). Also, the assignation of a vulnerability function is required.

The database must include information related to the following topics:

- Location in terms of geographical coordinates
- Geometrical characterization of the asset through a shapefile (points, polylines or polygons). This information is mainly used for the data and results display.
- Replacement value of each asset
- Parameters that allows capturing the vulnerability characteristics that is specified through a vulnerability function. The vulnerability must consider the expected physical damage (direct losses) and/or in terms human impact as a function of the selected intensity for each considered hazard.

Since it was not possible to obtain detailed cadastral register information for the neighborhoods, a survey was made of the inventory of exposed assets based on observations from satellite images and their interpretation. For each neighborhood an estimate of constructed plant area was obtained from polygons constructed over the satellite images. Figure 41 presents an image of the constructed city polygons, digitalized using the tool available on Google Earth. Each polygon is then subjected to a construction density also identified from the satellite images to account for roads, parks, and other areas that cannot be considered as constructed buildings.



FIGURE 41. CONSTRUCTED PLANT AREA ON TEGUCIGALPA'S NEIGHBORHOODS

Furthermore, there is no information related to number of stories, construction systems, areas of construction, exposed values, construction dates or other data which are useful in determining economic, and structural exposure and vulnerability.

To stablish the number of stories and construction classes on the neighborhoods the use of available images and the Google Street View tool was necessary complemented by population statistics, official indicators and other online information. Given the lack of individual information for each register, the assumption of the same number of stories and same construction type for the neighborhood was made with the exception in those cases where different information was available. This information, like any other approximated model of information, is open to improvement, and can be updated and cleaned up using intense fieldwork, or by having detailed property register information available. The quality and resolution of information in an exposure survey defines the reliability and resolution of the results of the risk analysis. With this information, the total constructed area was determined.

Official information and published indicators allowed approximate economic values to be established, which in this case correspond to the official monthly minimum wage per constructed square meter. This value has been accepted as the replacement value for a constructed square meter in residential uses with a poor socioeconomic development, where usually no further information is available.

Therefore, we proceeded to form a database for exposure of buildings, based on the procedures explained above. To summarize, for each project the total constructed area in the neighborhoods was determined (from the plant area, constructed density and number of stories), the total economic replacement value (from the price per square meter and the total constructed area) and lastly, a construction class that represents most of the buildings present.

Omar Darío Cardona A.
Disaster Risk Consulting

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Deliverable 2

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Omar Darío Cardona A.
Disaster Risk Consulting

Introduction

Risk identification is the first step to a comprehensive disaster risk management scheme. Catastrophic risk due to natural hazards should be considered in a prospective way quantifying the damages and losses before the real event occurs and for that task it is necessary to consider events that have not yet occurred. Since there are uncertainties related to when and where the next hazardous event will happen, how severe will it be and how can its physical effects affect the exposed assets, it is important to adopt a probabilistic approach that consider those uncertainties and propagate them through the damage and loss calculation process following a rigorous methodology.

With few exceptions, only limited information is available about catastrophic events that occurred in the past. Even less is known about events that will occur in the future. When considering the possibility of highly destructive events occurring in the future, any risk analysis should use probabilistic analytical models that allow for available historical information to be used in predicting potential catastrophic consequences. The risk evaluation of extreme events should follow a prospective approach, thus anticipating the rates of occurrences of events of different magnitudes, and the consequences that will be associated with each event. Such an evaluation must consider the uncertainties that arise when estimating the severity and frequency of these events.

This report summarizes the results obtained for hurricane risk at Port-de-Paix and Anse-à-Foleur (Haití), and landslide risk at Independencia (Perú), Medellín (Colombia), Mixco (Guatemala) and Tegucigalpa (Honduras). It is worth noting that this is an ongoing work, which means that the results here contained are part of the final diagnosis.

1 Tropical Cyclone Risk Assessment

1.1 Port-de-Paix and Anse-à-Foleur, Haití

1.1.1 Location

Being Costal cities in the Caribbean, Port-de-Paix and Anse-à-Foleur are susceptible to hurricanes.



FIGURE 1. LOCATION OF THE NEIGHBORHOODS IN PORT-DE-PAIX AND ANSE-À-FOLEUR

1.1.2 Tropical Cyclone Wind Hazard

Wind hazard curves were obtained for each neighborhood in the cities of Port-de-Paix and Anse-à-Foleur based on the probabilistic tropical cyclones wind hazard assessment from the Global Assessment Report on Disaster Risk Reduction 2015. The curves are presented in terms of the wind speed for every return period.

Given the proximity of the neighborhoods no substantial difference is observed in the hazard curves shown in Figure 2 for the three neighborhoods in Port-de-Paix where the expected wind speed is 179 km/h and lower in Anse-à-Foleur, where it is expected to be 167 km/h for a 250-year return period. The methodology used in tropical cyclone hazard modelling is further explained in Annex 1.

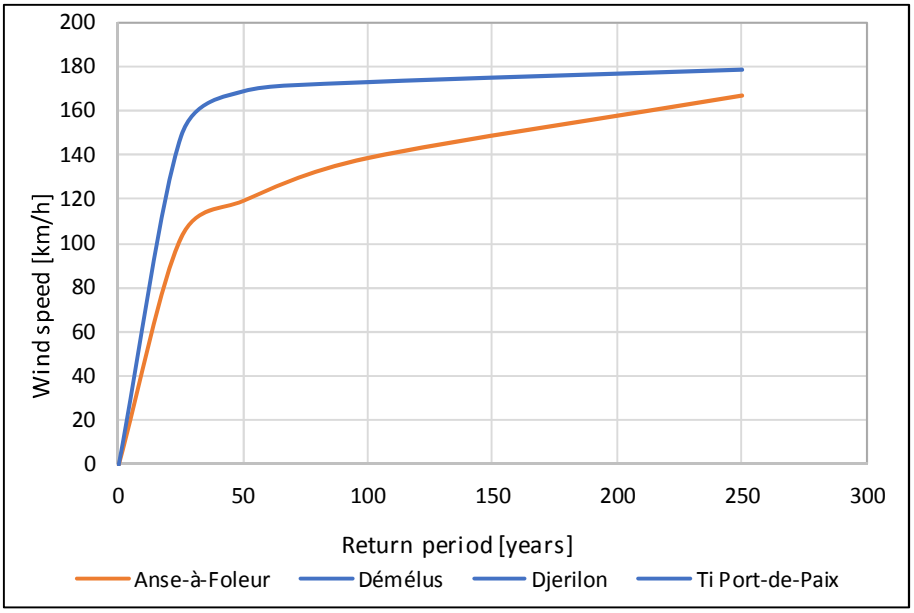


FIGURE 2. WIND HAZARD CURVES FOR THE NEIGHBORHOODS IN PORT-DE-PAIX

1.1.3 Exposure

To perform a probabilistic risk analysis, it is required to identify and characterize the exposed assets susceptible to suffer damage and losses due to the considered natural hazards. In this case the assets refer to the residential buildings susceptible to suffer damage due to possible hurricanes.

Based on the information received a procedure to determine the inventory of exposed elements was developed and is further explained on Annex 3. Inventory of Exposed Elements.

The total constructed area was computed for each neighborhood from the plant area obtained from satellite imagery and from the average number of stories of buildings determined with information from the 2003 General Population Census[1] which reports that most of the dwellings are “low houses”.

The economic replacement value for each constructed square meter was established as the official minimum monthly wage for 2018 which is USD $114.34 in Haiti[2] using the dollar exchange rate as of February 7, 2018. The following table summarizes the data obtained for Port-de-Paix and Anse-à-Foleur.

[1] http://www.ihsi.ht/rgph_resultat_ensemble_b.htm

[2] Average from the lowest income groups (Article 3 and 4) http://www.sgcm.gouv.ht/wp-content/uploads/2017/03/Moniteur-28-juillet-2017-Salaire-minimum.pdf

TABLE 1. GENERAL EXPOSURE DATA FOR PORT-DE-PAIX AND ANSE-À-FOLEUR

Barrio	Number of stories	Constructed area [m²]	Exposed value [USD]
Anse-à-Foleur	1	20,393	$ 2,331,755.37
Démélus	1	37,307	$ 4,265,774.71
Djerilon	1	7,107	$ 812,598.72
Ti Port-de-Paix	2	76,605	$ 8,759,304.53

The construction classes assigned are unreinforced concrete block masonry and mud walls. The information from the Population Census was also used which reports that the most common material used on the walls on urban areas such as Port-de-Paix is cement or block masonry and on rural areas such as Anse-à-Foleur earth has a participation of 30%. In the case of Anse-à-Foleur 30% of the dwellings were modelled as mud walls and the other 70% as unreinforced masonry.

1.1.4 Risk Assessment

The Table 2 summarizes the results of the hurricane risk assessment. The studied neighborhoods in Port-de-Paix and Anse-à-Foleur have an average annual loss of 39,000 Million US Dollar which corresponds to a relative loss of 2.41‰ due to strong winds.

TABLE 2. TROPICAL CYCLONE RISK RESULTS FOR PORT-DE-PAIX AND ANSE-À-FOLEUR

Risk Results		
Exposed Value	USD Million	16,169,433.00
Average Anual Loss	USD Million	39,042.38
	‰	2.41
PML		
Return Period	Loss	
years	USD Million	%
20	$115,604.00	0.71
50	$283,052.20	1.75
100	$1,073,073.35	6.64
250	$2,298,531.30	14.22
500	$3,299,242.25	20.40
1000	$4,275,657.79	26.44
1500	$4,577,036.35	28.31

The Loss Exceedance Curve and Probable Maximum Loss Curve and the Loss Exceedance Probability Curve for different exposure timeframes are presented below.

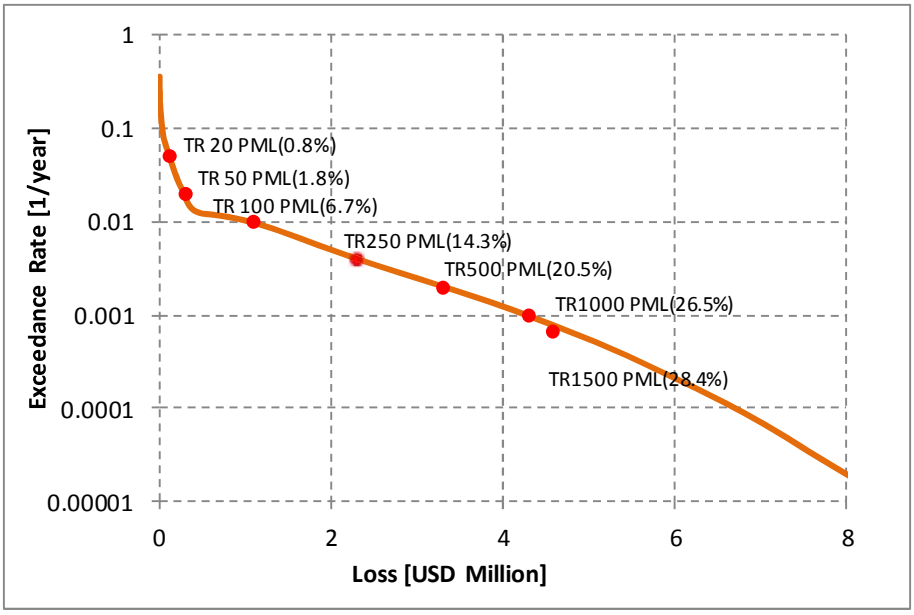


FIGURE 3. LOSS EXCEEDANCE CURVE FOR PORT-DE-PAIX AND ANSE-À-FOLEUR

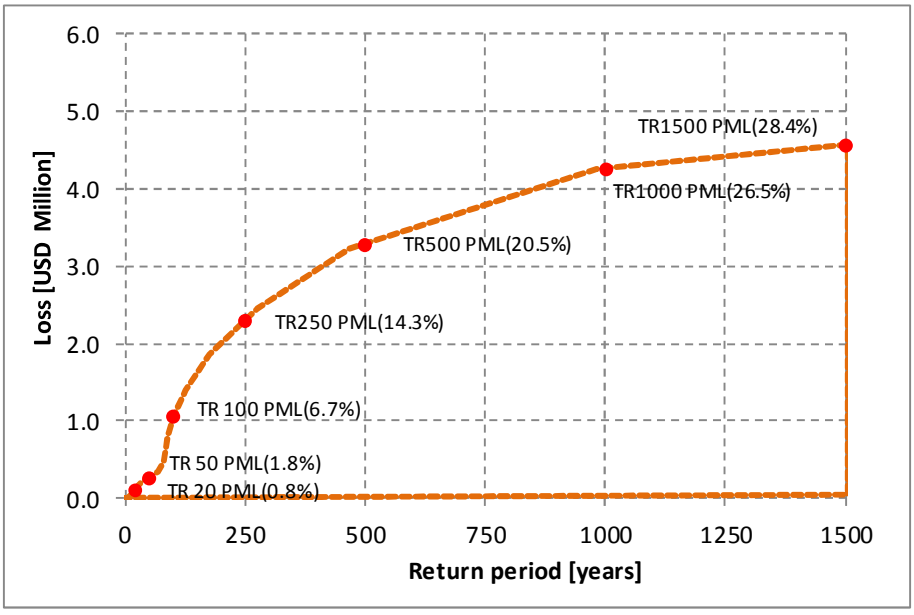


FIGURE 4. PROBABLE MAXIMUM LOSS CURVE FOR PORT-DE-PAIX AND ANSE-À-FOLEUR

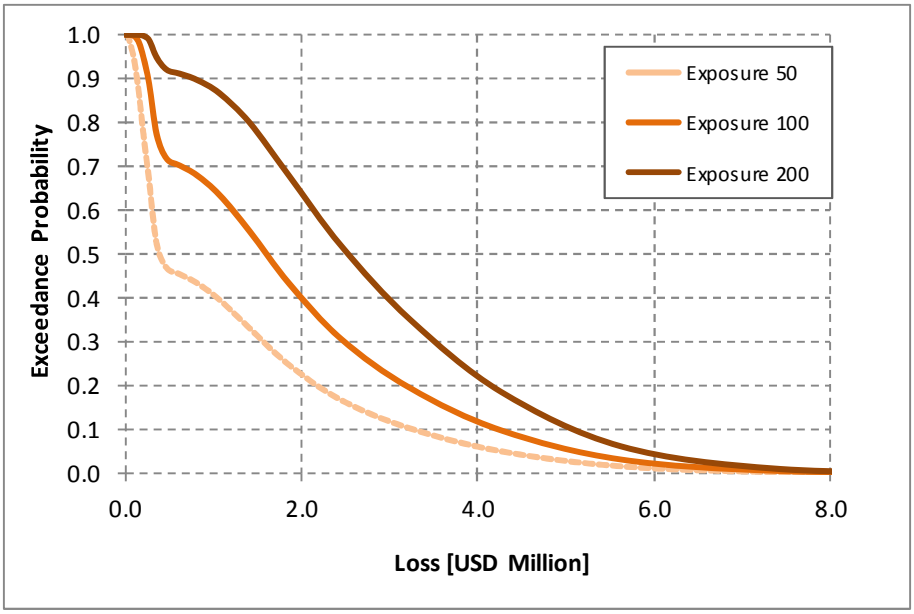


FIGURE 5. LOSS EXCEEDANCE PROBABILITY CURVE FOR DIFFERENT EXPOSURE TIMEFRAMES FOR PORT-DE-PAIX AND ANSE-À-FOLEUR

2 Landslides Risk Assessment

Landslides are one of the most recurrent natural hazards in several parts of the world. Even though the expected loss associated to the occurrence of a landslide is relatively small, compared to those expected for hazards of larger consequences such as earthquakes or hurricanes, their high recurrence makes them of great importance when managing risk, especially at regional or local scales.

In this section we present the landslide hazard risk results for the neighborhoods studied in Independencia (Perú), Mixo (Guatemala), Medellin (Colombia) and Tegucigalpa (Honduras).

2.1 Independencia, Perú

2.1.1 Landslide Hazard

The susceptibility map presented on the report *"Estudio de peligros, vulnerabilidad y riesgo por sismo y lluvias intensas de los barrios El Volante II, El Volante III y Villa El Ángel del distrito de independencia"* by CISMID, and received from FIU for this consultancy project, was used as an input to compute the landslide hazard of the area. For each susceptibility class a probability of occurrence of a landslide was assigned to later compute hazard with the use of different triggering factors. More on the methodology used is presented in Annex 2. Landslides Probabilistic Risk Assessment.

The neighborhoods Volante II and III are located on areas with high and very high susceptibility of landslide occurrence, and Villa El Ángel is located mostly on areas with very high susceptibility but also on areas with high and moderate susceptibility of landslides. Figure 6 shows the susceptibility map.

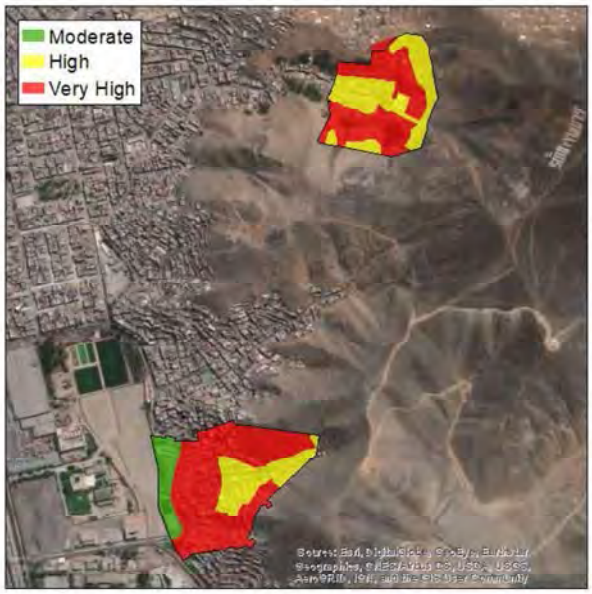


FIGURE 6. LANDSLIDE SUSCEPTIBILITY MAP FOR THE NEIGHBORHOODS IN INDEPENDENCIA

2.1.2 Exposure

To perform a probabilistic risk analysis, it is required to identify and characterize the exposed assets susceptible to suffer damage and losses due to the considered natural hazards. In this case the assets refer to the residential buildings susceptible to suffer damage due to possible landslides.

Based on the information received a procedure to determine the inventory of exposed elements was developed and is further explained on Annex 3. Inventory of Exposed Elements.

The total constructed area was computed for each neighborhood from the plant area obtained from satellite imagery and from the average number of stories of buildings determined with information from online available images and from the Google Street View tool.

The economic replacement value for each constructed square meter was established as the official minimum monthly wage for 2018 which is USD $262.35 in Perú[3] using the dollar exchange rate as of February 7, 2018. The following table summarizes the data obtained for Independencia.

3 https://www.gob.pe/476-valor-remuneracion-minima-vital

TABLE 3. GENERAL EXPOSURE DATA FOR INDEPENDENCIA

Barrio	Number of stories	Constructed area [m²]	Exposed value [USD]
Villa El Angel	2	57,340	$ 15,042,983.89
Volante II and III	2	23,525	$ 6,171,552.81

For this report on landslide risk assessment additional steps were made to increase the detail of the exposed elements. A simulation of buildings around the neighborhoods was made to better model the impact suffered by landslides since this type of hazard given its nature is not homogeneous along the neighborhoods.

In this case one construction class was assigned to all the dwellings on the neighborhoods since it was determined from online available images and the Google Street View tool that the most common system used is unreinforced concrete block masonry.

2.1.3 Risk Assessment

The Table 4 summarizes the results of the landslide risk assessment. The studied neighborhoods in Independencia have an average annual loss of 21,639 Million US Dollar which corresponds to a relative loss of 1.02‰ due to mass movements.

TABLE 4. LANDSLIDE RISK RESULTS FOR INDEPENDENCIA

Risk Results		
Exposed Value	USD Million	21,214,537.39
Average Anual Loss	USD Million	21,638.83
	‰	1.02
PML		
Return Period	Loss	
years	USD Million	%
20	$253,958.33	1.20
50	$419,583.33	1.98
100	$525,583.33	2.48
250	$591,833.33	2.79
500	$613,916.67	2.89
1000	$624,958.33	2.95
1500	$628,138.33	2.96

The Loss Exceedance Curve and Probable Maximum Loss Curve and the Loss Exceedance Probability Curve for different exposure timeframes are presented below.

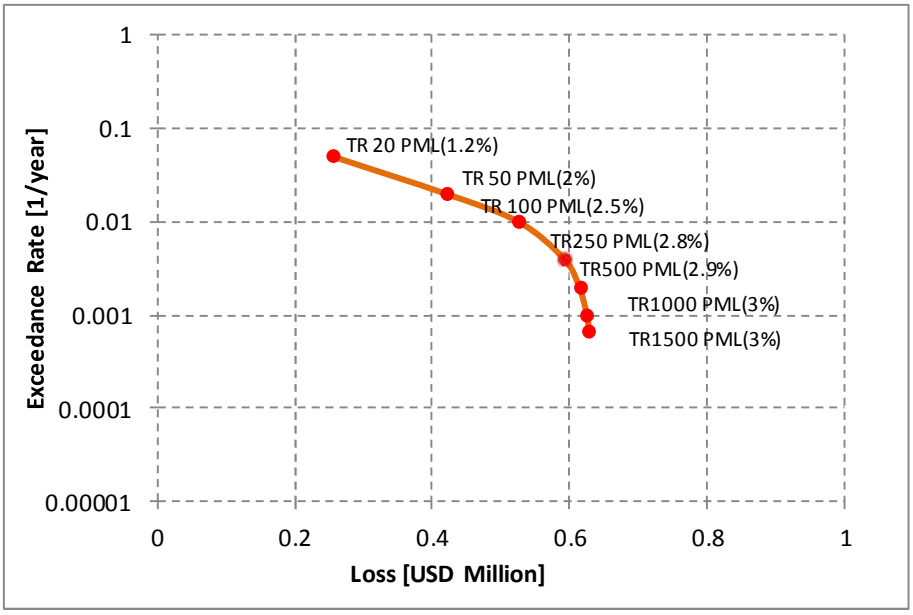


FIGURE 7. LOSS EXCEEDANCE CURVE FOR INDEPENDENCIA

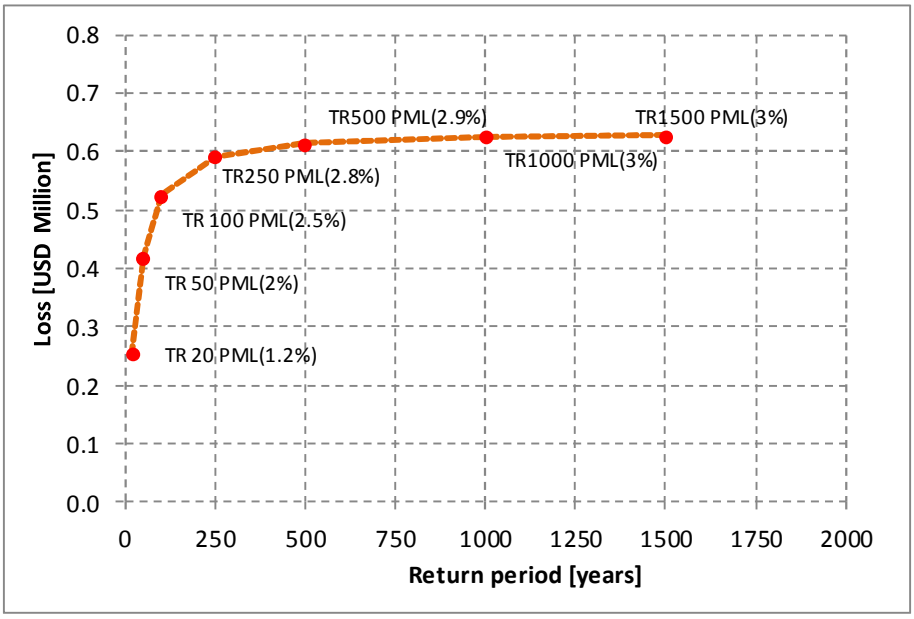


FIGURE 8. PROBABLE MAXIMUM LOSS CURVE FOR INDEPENDENCIA

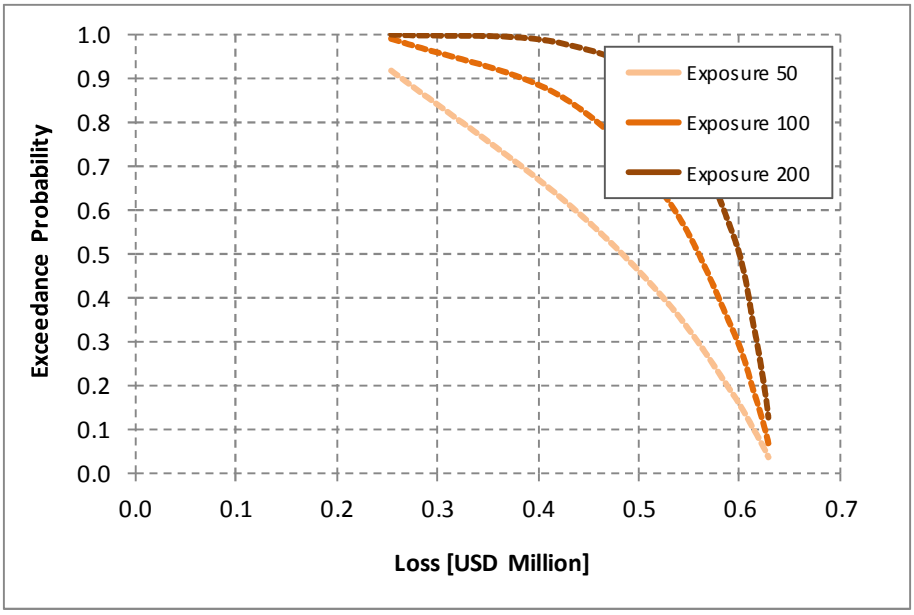


FIGURE 9. LOSS EXCEEDANCE PROBABILITY CURVE FOR DIFFERENT EXPOSURE TIMEFRAMES FOR INDEPENDENCIA

2.2 Mixco, Guatemala

2.2.1 Landslide Hazard

Since there was not a susceptibility map available from the information received for this consultancy project, a susceptibility map found on the municipality of Mixco's website was used and adapted for landslides hazard purposes[4]. For each susceptibility class a probability of occurrence of a landslide was assigned to later compute hazard with the use of different triggering factors. More on the methodology used is presented in Annex 2. Landslides Probabilistic Risk Assessment.

The neighborhoods Vistas de la Comunidad and Cripresales are located mostly on areas with moderate susceptibility of landslides although there are small areas with very high susceptibility present. Figure 10 shows the susceptibility map.

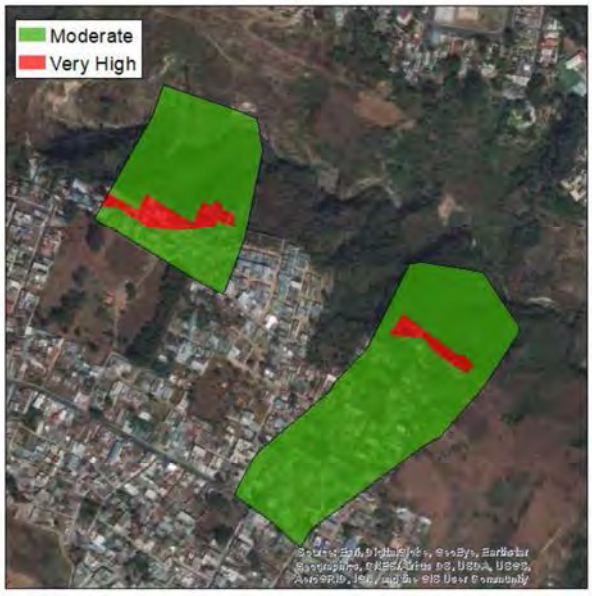


FIGURE 10. LANDSLIDE SUSCEPTIBILITY MAP FOR THE NEIGHBORHOODS IN MIXCO

2.2.2 Exposure

To perform a probabilistic risk analysis, it is required to identify and characterize the exposed assets susceptible to suffer damage and losses due to the considered natural hazards. In this case the assets refer to the residential buildings susceptible to suffer damage due to possible landslides.

[4] https://www.munimixco.gob.gt/wp-content/uploads/2018/02/ZONA-10.pdf

Based on the information received a procedure to determine the inventory of exposed elements was developed and is further explained on Annex 3. Inventory of Exposed Elements.

The total constructed area was computed for each neighborhood from the plant area obtained from satellite imagery and from the average number of stories of buildings determined with information from online available images.

The economic replacement value for each constructed square meter was established as the official minimum monthly wage for 2018 which is USD $357.18 in Guatemala[5] using the dollar exchange rate as of February 7, 2018. The following table summarizes the data obtained for Mixco.

TABLE 5. GENERAL EXPOSURE DATA FOR MIXCO

Barrio	Number of stories	Constructed area [m²]	Exposed value [USD]
Cipresales	2	33,873	$ 12,098,821.24
Vistas de la Comunidad	2	14,009	$ 5,003,781.35

For this report on landslide risk assessment additional steps were made to increase the detail of the exposed elements. A simulation of buildings around the neighborhoods was made to better model the impact suffered by landslides since this type of hazard given its nature is not homogeneous along the neighborhoods.

In this case one construction class was assigned to all the dwellings on the neighborhoods since it was determined from online available images that the most common system used is unreinforced concrete block masonry.

2.2.3 Risk Assessment

The Table 6 summarizes the results of the landslide risk assessment. The studied neighborhoods in Mixco have an average annual loss of 91,800 Million US Dollar which corresponds to a relative loss of 5.37‰ due to mass movements.

5 Average from the values available at http://mintrabajo.gob.gt/index.php/salariominimo.html

TABLE 6. LANDSLIDE RISK RESULTS FOR MIXCO

Risk Results		
Exposed Value	USD Million	17,102,602.67
Average Anual Loss	USD Million	91,820.13
	‰	5.37
PML		
Return Period	Loss	
years	USD Million	%
20	$662,434.96	3.87
50	$1,060,894.64	6.20
100	$1,310,566.04	7.66
250	$1,659,159.28	9.70
500	$2,256,488.31	13.19
1000	$2,516,999.36	14.72
1500	$2,777,510.42	16.24

The Loss Exceedance Curve and Probable Maximum Loss Curve and the Loss Exceedance Probability Curve for different exposure timeframes are presented below.

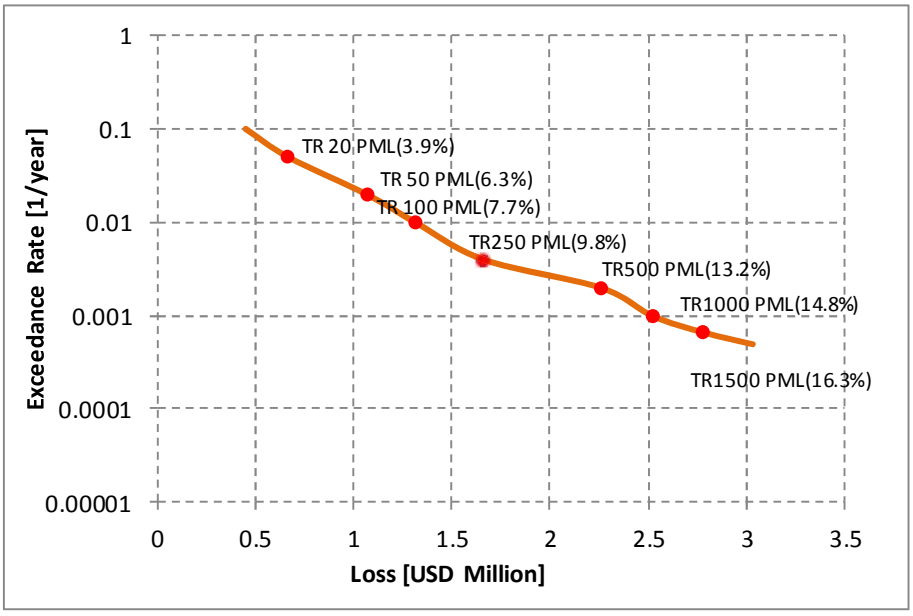


FIGURE 11. LOSS EXCEEDANCE CURVE FOR MIXCO

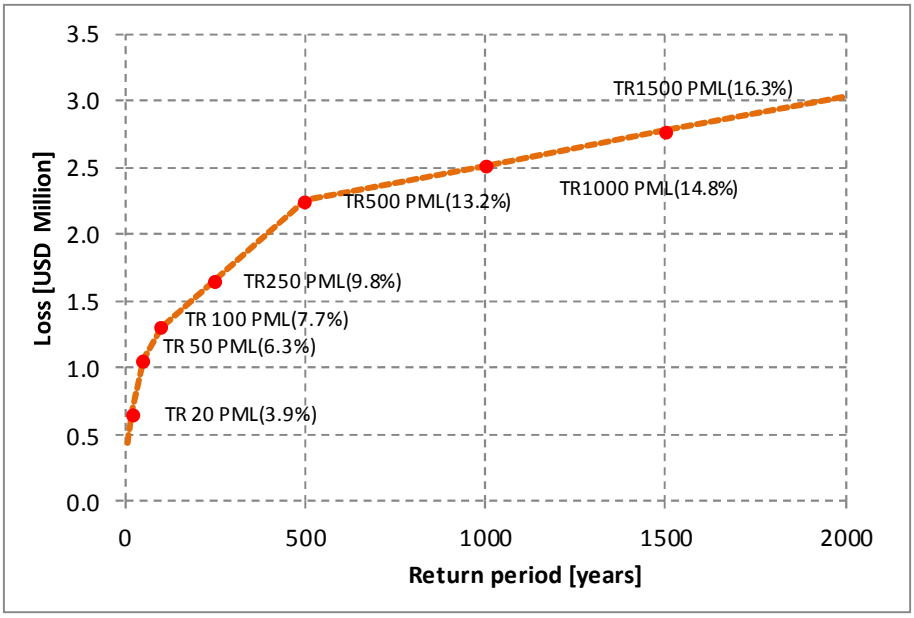


FIGURE 12. PROBABLE MAXIMUM LOSS CURVE FOR MIXCO

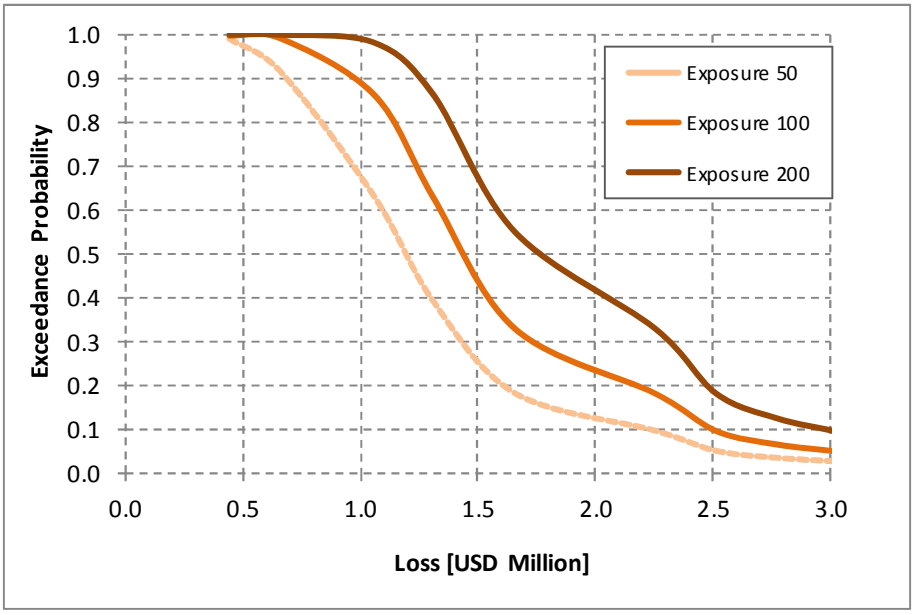


FIGURE 13. LOSS EXCEEDANCE PROBABILITY CURVE FOR DIFFERENT EXPOSURE TIMEFRAMES FOR MIXCO

2.3 Medellín, Colombia

2.3.1 Landslide Hazard

The susceptibility map presented on the *"Revisión y Ajuste al Plan de Ordenamiento Territorial – Medellín, 2014"* by Departamento Administrativo de Planeación, and received from FIU for this consultancy project, was used as an input to compute the landslide hazard of the area. For each susceptibility class a probability of occurrence of a landslide was assigned to later compute hazard with the use of different triggering factors. More on the methodology used is presented in Annex 2. Landslides Probabilistic Risk Assessment.

The neighborhoods Santo Domingo Savio and El Compromiso are located on areas with high, moderate and low susceptibility of landslide occurrence, and El Pinal and Llanaditas are located mostly on areas with moderate and low susceptibility and less on areas with high susceptibility of landslides. Figure 14 shows the susceptibility map.



FIGURE 14. LANDSLIDE SUSCEPTIBILITY MAP FOR THE NEIGHBORHOODS IN MEDELLIN

2.3.2 Exposure

To perform a probabilistic risk analysis, it is required to identify and characterize the exposed assets susceptible to suffer damage and losses due to the considered natural hazards. In this case the assets refer to the residential buildings susceptible to suffer damage due to possible landslides.

Based on the information received a procedure to determine the inventory of exposed elements was developed and is further explained on Annex 3. Inventory of Exposed Elements.

The total constructed area was computed for each neighborhood from the plant area obtained from satellite imagery and from the average number of stories of buildings determined with information from online available images and from the Google Street View tool.

The economic replacement value for each constructed square meter was established as the official minimum monthly wage for 2018 which is USD $308 in Colombia using the dollar exchange rate as of February 7, 2018. The following table summarizes the data obtained for Medellin.

TABLE 7. GENERAL EXPOSURE DATA FOR MEDELLIN

Barrio	Number of stories	Constructed area [m²]	Exposed value [USD]
Llanaditas	1	227,120	$ 69,953,439.52
Santo Domingo Savio	1	616,120	$ 189,766,260.83
El Compromiso	1	139,440	$ 42,947,814.40
El Pinal	1	327,140	$ 100,759,810.70

For this report on landslide risk assessment additional steps were made to increase the detail of the exposed elements. A simulation of buildings around the neighborhoods was made to better model the impact suffered by landslides since this type of hazard given its nature is not homogeneous along the neighborhoods.

In this case one construction class was assigned to all the dwellings on the neighborhoods since it was determined from online available images and the Google Street View tool that the most common system used is unreinforced concrete block masonry.

2.3.3 Risk Assessment

The Table 8 summarizes the results of the landslide risk assessment. The studied neighborhoods in Medellin have an average annual loss of 511,350 Million US Dollar which corresponds to a relative loss of 1.27‰ due to mass movements.

TABLE 8. LANDSLIDE RISK RESULTS FOR MEDELLIN

Risk Results		
Exposed Value	USD Million	403,427,349.12
Average Anual Loss	USD Million	511,357.88
	‰	1.27
PML		
Return Period	Loss	
years	USD Million	%
25	$4,803,519.91	1.19
50	$9,828,171.66	2.44
100	$13,920,908.37	3.45
250	$20,889,225.80	5.18
500	$26,312,861.50	6.52
1000	$38,305,219.33	9.49
1500	$46,010,244.67	11.40

The Loss Exceedance Curve and Probable Maximum Loss Curve and the Loss Exceedance Probability Curve for different exposure timeframes are presented below.

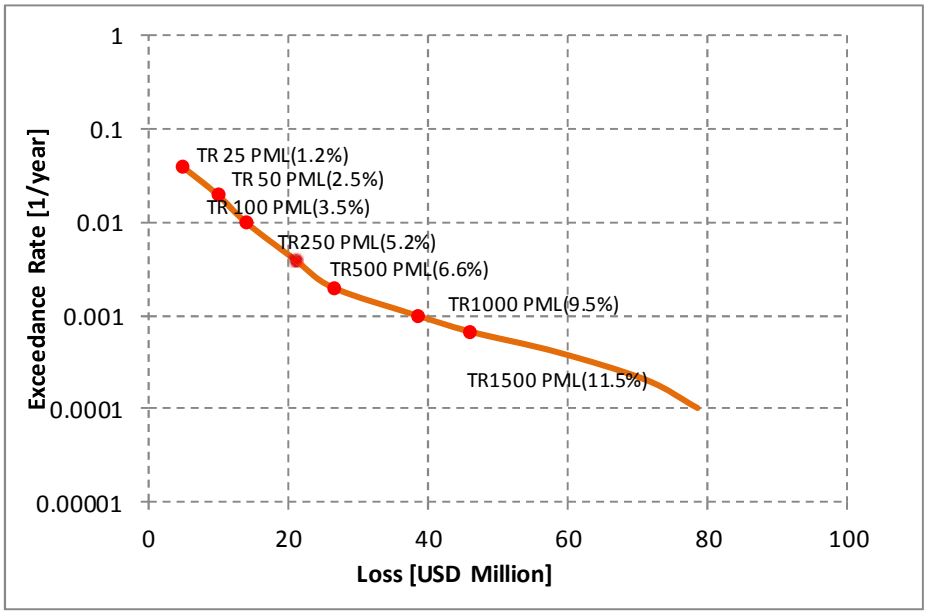


FIGURE 15. LOSS EXCEEDANCE CURVE FOR MEDELLIN

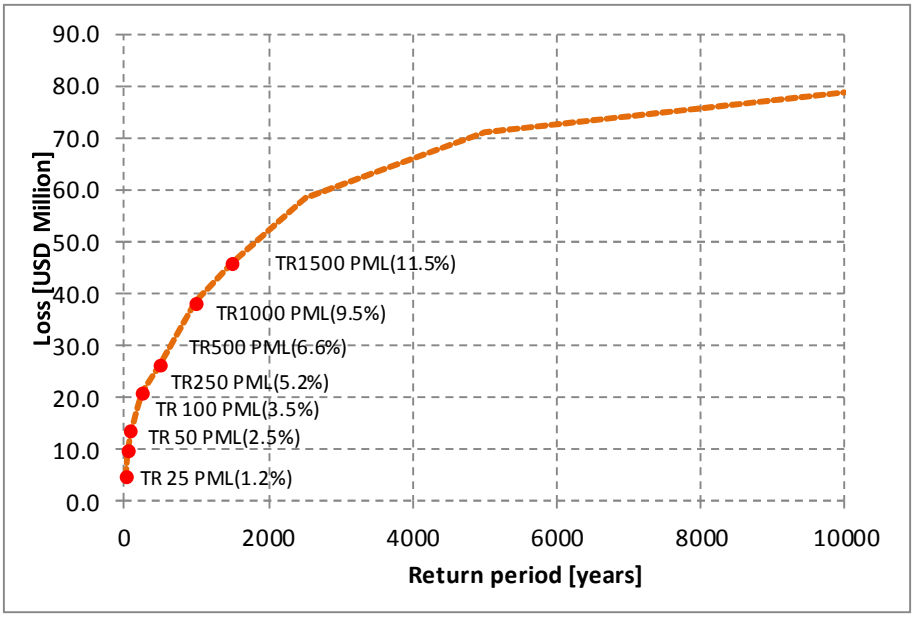


FIGURE 16. PROBABLE MAXIMUM LOSS CURVE FOR MEDELLIN

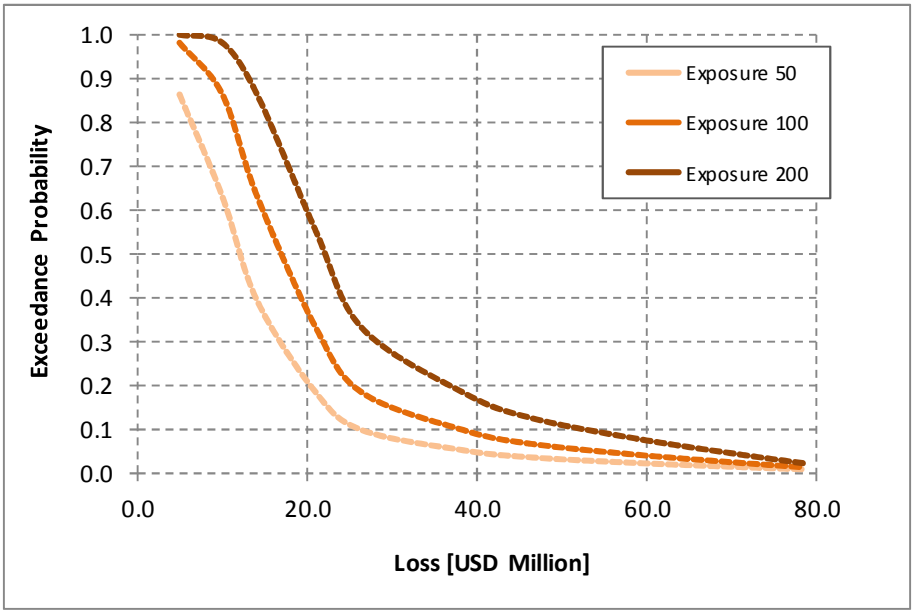


FIGURE 17. LOSS EXCEEDANCE PROBABILITY CURVE FOR DIFFERENT EXPOSURE TIMEFRAMES FOR MEDELLIN

2.4 Tegucigalpa, Honduras

2.4.1 Landslide Hazard

The susceptibility map presented on the report *"Estudio Geológico del Deslizamiento La Ulloa – Caracterización de la susceptibilidad frente a movimientos de laderas"* by Instituto Hondureño de Ciencias de la Tierra, and received from FIU for this consultancy project, was used as an input to compute the landslide hazard of the area. For each susceptibility class a probability of occurrence of a landslide was assigned to later compute hazard with the use of different triggering factors. More on the methodology used is presented in Annex 2 Landslides Probabilistic Risk Assessment.

The neighborhood Jose Angel Ulloa is located on areas ranging from low to very high susceptibility of landslides occurrence, Jose Arturo Duarte is located on areas ranging from very low to very high susceptibility whereas Nueva Providencia is mostly on areas with high susceptibility. Figure 18 shows the susceptibility map.

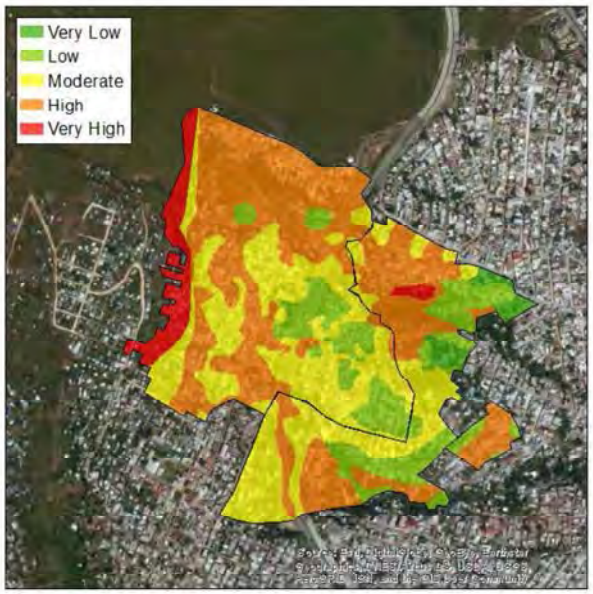


FIGURE 18. LANDSLIDE SUSCEPTIBILITY MAP FOR THE NEIGHBORHOODS IN TEGUCIGALPA

2.4.2 Exposure

To perform a probabilistic risk analysis, it is required to identify and characterize the exposed assets susceptible to suffer damage and losses due to the considered natural hazards. In this case the assets refer to the residential buildings susceptible to suffer damage due to possible landslides.

Based on the information received a procedure to determine the inventory of exposed elements was developed and is further explained on Annex 3. Inventory of Exposed Elements.

The total constructed area was computed for each neighborhood from the plant area obtained from satellite imagery and from the average number of stories of buildings determined with information from online available images.

The economic replacement value for each constructed square meter was established as the official minimum monthly wage for 2018 which is USD $395.48 in Honduras[6] using the dollar exchange rate as of February 7, 2018. The following table summarizes the data obtained for Tegucigalpa.

TABLE 9. GENERAL EXPOSURE DATA FOR TEGUCIGALPA

Barrio	Number of stories	Constructed area [m²]	Exposed value [USD]
Jose Angel Ulloa	2	351,008	$ 138,815,155.47
Jose Arturo Duarte	2	163,032	$ 64,475,214.96
Nueva Providencia	2	20,387	$ 8,062,750.83

For this report on landslide risk assessment additional steps were made to increase the detail of the exposed elements. A simulation of buildings around the neighborhoods was made to better model the impact suffered by landslides since this type of hazard given its nature is not homogeneous along the neighborhoods.

In this case one construction class was assigned to all the dwellings on the neighborhoods since it was determined from online available images that the most common system used is unreinforced concrete block masonry.

2.4.3 Risk Assessment

The Table 10 summarizes the results of the landslide risk assessment. The studied neighborhoods in Tegucigalpa have an average annual loss of 196,000 Million US Dollar which corresponds to a relative loss of 0.93‰ due to mass movements.

[6] Average from the construction and manufacture's industry salaries http://www.trabajo.gob.hn/tabla-de-salario-minimo-2018/

TABLE 10. LANDSLIDE RISK RESULTS FOR TEGUCIGALPA

Risk Results		
Exposed Value	USD Million	211,353,115.66
Average Anual Loss	USD Million	196,000.00
	‰	0.93
PML		
Return Period	Loss	
years	USD Million	%
50	$4,809,031.29	2.28
100	$7,768,616.11	3.68
250	$11,195,058.95	5.30
500	$14,776,272.61	6.99
1000	$17,659,421.13	8.36
1500	$18,536,184.15	8.77

The Loss Exceedance Curve and Probable Maximum Loss Curve and the Loss Exceedance Probability Curve for different exposure timeframes are presented below.

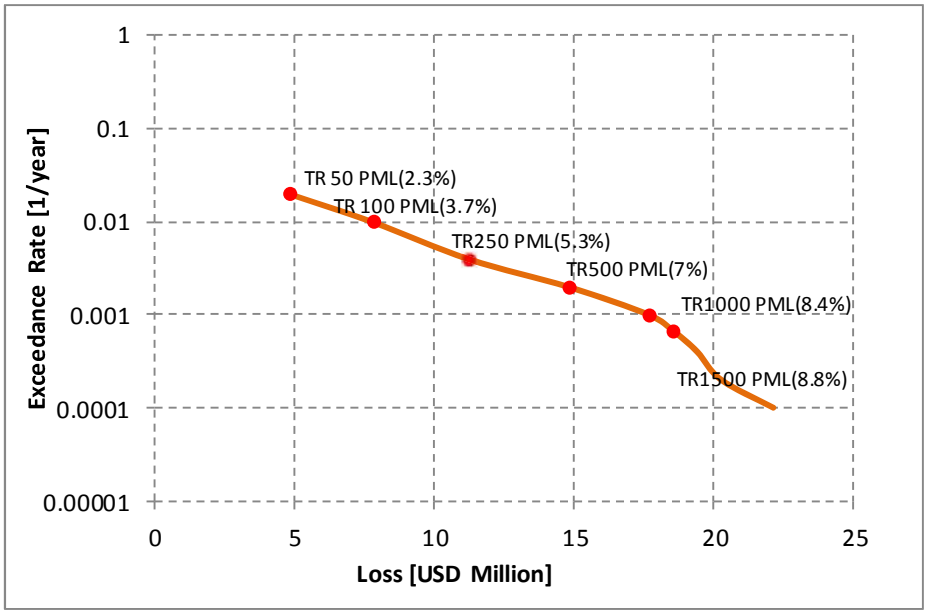


FIGURE 19. LOSS EXCEEDANCE CURVE FOR TEGUCIGALPA

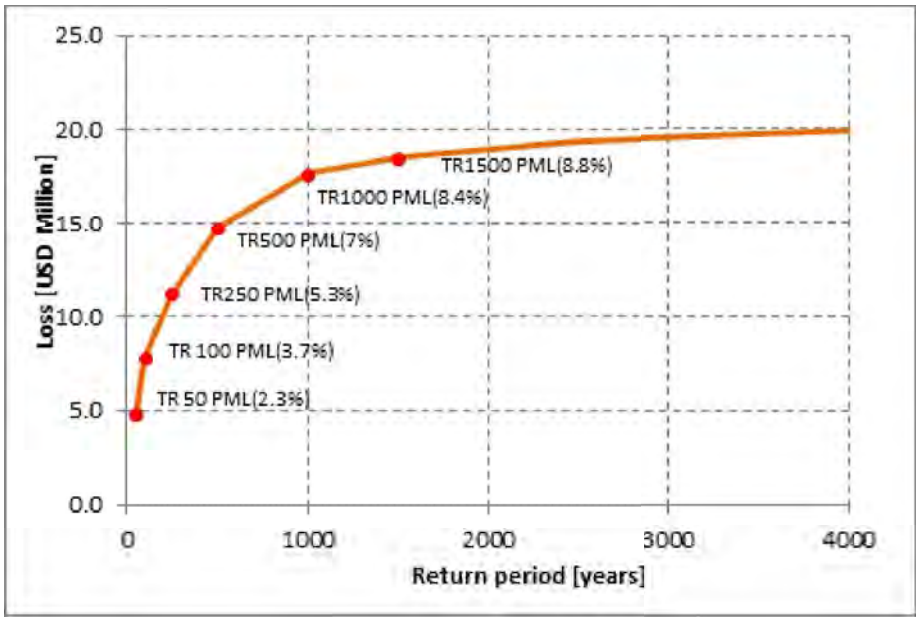


FIGURE 20. PROBABLE MAXIMUM LOSS CURVE FOR TEGUCIGALPA

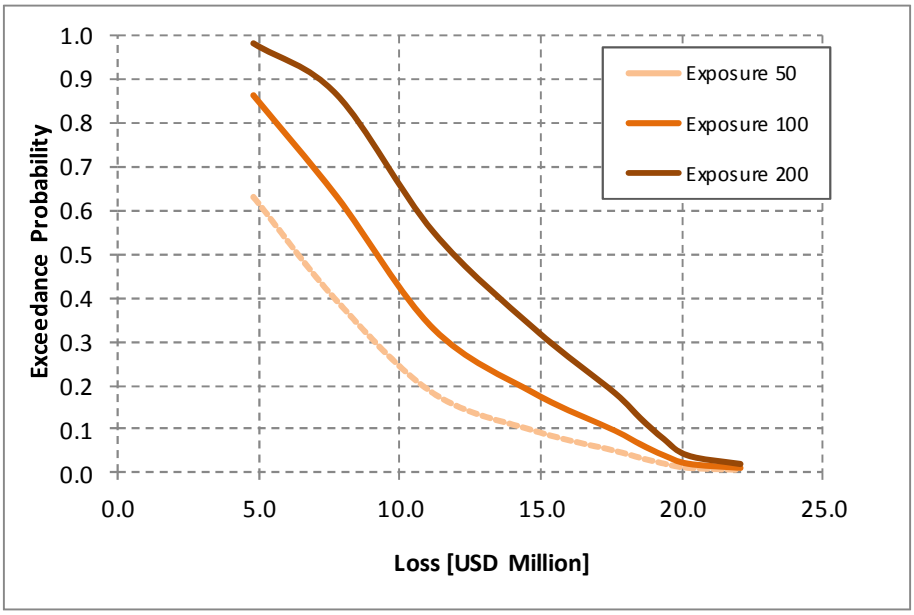


FIGURE 21. LOSS EXCEEDANCE PROBABILITY CURVE FOR DIFFERENT EXPOSURE TIMEFRAMES FOR TEGUCIGALPA

Annex 1. Probabilistic Hurricane Hazard Assessment

This annex presents the probabilistic wind hazard assessment methodology for the Global Risk Assessment of the UNISDR's Global Assessment Report on Disaster Risk Reduction 2015 (GAR15).

Methodological Approach

Tropical cyclones are characterized as highly destructive disasters, with high frequencies of occurrence. The hazard modeling for tropical cyclones considers the effects related to the speed of the wind and rainfall intensity.

The hazard model used here represents the maximum intensities associated with potential occurrence and pace of a tropical cyclone in a territory, using a statistical procedure known as *disturbance*, which allows us to create random trajectories that maintain the main characteristics of the previous trajectories. The hazard is thus represented as a set of stochastic events with average intensities and frequencies of occurrence compatible with the historical information available. The mathematical procedure for calculating wind speed is described below.

Cyclone Tracks Perturbation

For each historical cyclone, a set of one-hundred 'children' tracks was generated following a bi-dimensional Wiener process in which the historical track is artificially disturbed to create a new child track. The disturbing process is presented in Equation 3 for the longitude (X) coordinate of the track points.

$$X(t_{k+1}) = X(t_k) + \Delta X_{k,k+1} + e \qquad \text{(EQ. 1)}$$

Where $X(t_k)$ is the longitude coordinate of a track point at instant t_k, $X(t_k+1)$ is the longitude coordinate of a the next track point recorded at instant t_k+1, $\Delta X_{k,k+1}$ is the known longitude delta between instant k and $k+1$, and e is random variable following a normal distribution with $\mu=0.0$ and $\sigma=0.5$. An equivalent process must be performed simultaneously for the latitude (Y) coordinate. After the perturbation process, the cyclone's main characteristics remain unaltered, which means that each child track point will have the same central pressure and sustained wind speed as the original.

Figure 22 shows the result of applying this perturbation process to the track of 1961 hurricane Hattie. The red thick line is the original track of Hattie, and the gray thin lines are 10 simulations of Hattie obtained by applying the bi-dimensional Wiener process.

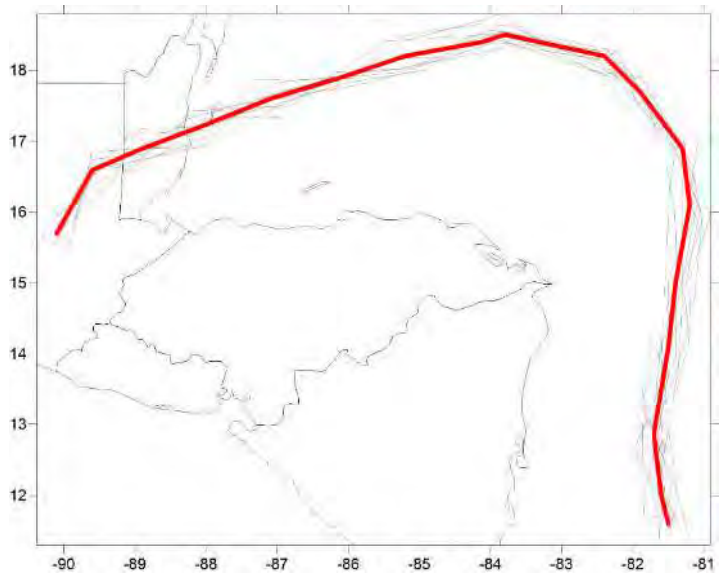


FIGURE 22. TRACK PERTURBATION PROCESS APPLIED TO HURRICANE HATTIE.

Wind Hazard Modelling

For each one of the children tracks, the wind field is calculated over a grid of variable resolution. As summarized by Vickery et al., (2009a), wind field modelling is a three-step process:

1. Given cyclone characteristics such as central pressure and radius to maximum wind (RMW), wind speed at gradient height is calculated. Gradient height is the altitude at which wind speed is completely unaffected by surface conditions. It is usually assumed to be equivalent to a mean wind speed.
2. From the wind speed at gradient height, a mean surface speed is calculated by applying an atmospheric boundary layer (BL) model.
3. Finally, the mean surface speed is modified by site-specific conditions, such as topographic amplification and surface roughness, and set to an averaging time using gust factors.

There have been enormous advances in wind field modelling since the early 1970s when the first studies took place. There are several proposals in the literature to account for each one of the steps presented above. A complete description of the state of the art in wind field modelling can be found in Vickery et al. (2009a).

Gradient Wind Field

The gradient wind speed (V_G) is calculated using the representation introduced by Holland (1980), in which V_G is given as

$$v_G = \sqrt{\left(\frac{RMW}{r}\right)^B \cdot \frac{B \cdot \Delta P \cdot \exp\left(-\left(\frac{RMW}{r}\right)^B\right)}{\rho} + \frac{r^2 f^2}{4}} - \frac{f \cdot r}{2} \qquad \textbf{(EQ. 2)}$$

where r is the observation distance (i.e. the distance from the calculation site to the center of the storm), B is the Holland parameter, ΔP is the pressure gradient ($\Delta P = P_n - P_0$, where P_n is a nominal atmospheric pressure set to 100.5 KPa), ρ is the density of the air, and f is the Coriolis force parameter, defined as

$$f = 2\Omega Sin\phi \qquad \textbf{(EQ. 3)}$$

where Ω is the angular rotation speed of The Earth, and ϕ is the latitude of the cyclone's eye.

The Radius to Maximum Winds (RMW) is calculated as a function of the cyclone's central pressure P_0,

$$RMW = 0.4785P_0 - 413.01 \qquad \textbf{(EQ. 4)}$$

Vickery and Wadhera (2008) found that Holland's B parameter could be modeled as a function of a non-dimensional parameter, A, defined as

$$B = 1.732 - 2.237\sqrt{A} \qquad \textbf{(EQ. 5)}$$

$$A = \frac{RMW \cdot f}{\sqrt{2R_d T_s \cdot \ln\left(1 + \frac{\Delta P}{P_0 \cdot e}\right)}} \qquad \textbf{(EQ. 6)}$$

where R_d is the air gas constant and T_s is the surface temperature of the sea (given in °K).

Surface Wind Speed

The wind speed at gradient height (V_G) is modified to obtain the speed at surface level (10 meters above water or ground, v_{10}) by means of an atmospheric boundary layer model. Vickery et al. (2009b) modeled the variation of the mean wind speed, $u(z)$ with height z, in the cyclone boundary layer as

$$u(z) = \frac{u_*}{k}\left[\ln\left(\frac{z}{z_0}\right) - 0.4\left(\frac{z}{H^*}\right)^2\right] \qquad \textbf{(EQ. 7)}$$

where k is the von-Karman coefficient (k=0.4), u^* us the friction velocity, z_0 is the aerodynamic roughness length, and H^* is the boundary layer height. Vickery et.al. (2009b) modeled H^* as

$$H^* = 343.7 + \frac{0.26}{I} \qquad \textbf{(EQ. 8)}$$

where *I* is the inertial instability, defined by Kepert (2001) as

$$I = \sqrt{\left(f + \frac{2V_G}{r}\right)\left(f + \frac{V_G}{r} + \frac{\partial V_G}{\partial r}\right)} \qquad \text{(EQ. 9)}$$

When applying this model, the term $\partial V_G/\partial r$ is neglected. The friction velocity, u^*, is defined as

$$u_* = \sqrt{\frac{\tau}{\rho}} \qquad \text{(EQ. 10)}$$

where τ is the surface wind shear stress, defined as

$$\tau = \rho \cdot C_d \cdot u^2 \qquad \text{(EQ. 11)}$$

where C_d is the drag coefficient, and u is the surface wind speed.

Site-specific Modifiers of the Wind Speed

Local conditions modify the final value of the wind speed at each geographical location. Within our wind model, the surface roughness and the topographic effect are considered as the main modifiers of the wind speed at local level.

Surface Roughness

Surface roughness is directly considered in the calculation of surface wind speed, by means of parameters z_0 (aerodynamic roughness length) and C_d (drag coefficient). These parameters depend on the type of terrain over which wind speed is calculated. For our model, we use the central value of the ranges proposed by the WMO (WMO, 2010), for seven general classes of terrain (see Table 11).

TABLE 11. TERRAIN CLASSES AND RANGES FOR PARAMETERS Z0 AND CD PROPOSED BY WMO.

Terrain Class	Terrain Description	Roughness Lenght z_o (m)	Surface Drag Coefficient *C10*
Sea	Open sea conditions for all winds speeds, exposed tidal flats, featureless desrt, and tarmac.	0.0002-0.005	0.001-0.003
Smooth	Featureless land with negligible vegetation such as wide beaches and cays, exposed reefs.	0.005-0.03	0.003-0.005
Open	Nearshore water for winds >30m/s, level country with low grass, some isolated trees, airport surrounds.	0.03-0.10	0.005-0.008
Roughly Open	Low crops, few trees, ocassional bushes.	0.10-0.25	0.008-0.012
Rough	Lightly wooded country, high crops, centres of small towns.	0.25-0.5	0.012-0.019
Very Rough	Mangrove forests, palm plantations, metropolitan areas.	0.5-1.0	0.019-0.032
Closed	Mature regular rainforests, inner city buildings (CBD).	1.0-2.0	0.032-0.065

Terrain Class	Terrain Description	Roughness Lenght z_o (m)	Surface Drag Coefficient *C10*
Skimming	Mixture of large high and low-rise buildings, irregular large forests with many clearings.	>2.0	>0.065

Topographic effect

The topographic effect is assessed by identifying wind exposed and protected areas on a Digital Elevation Model (DEM). The topographic effect factor (F_T) is defined by the site topographic exposure, as:

- Low exposure. Corresponds to topographic depressions (i.e. protected site). F_T = 0.8.
- Normal exposure. Corresponds to a flat site. F_T = 1.0.
- High exposure. Corresponds to the top of hills (i.e. exposed site). F_T = 1.2.

For each node in the DEM, given its geographical location (X,Y), its exposure is quantified by searching all four cardinal directions (north, south, east, west). This search is bounded by setting the following limits:

- *Nmax*: Maximum horizontal distance at which the exposure will be evaluated with respect to a fixed location.
- *m*: Reference topographic slope, used to assess the site exposure with respect to the surrounding terrain.

Then, for each site (X,Y) in the DEM, we seek for a site (K,L) until the following condition fails:

$$Z_{K,L} \geq Z_{X,Y} + Z_{Lim} \qquad \textbf{(EQ. 12)}$$

where Z_{Lim}: is the height difference required between sites (X,Y) and (K,L) to obtain a slope *m*.

If the site (K,L) exists, then the site (X,Y) is classified as of low exposure. This corresponds to a topographic depression (see Figure 23). If this condition is not fulfilled, then the mean topographic slope (m_T) between site (X,Y) and site (K,L) is calculated as

$$m_T = \frac{Z_{X,Y} - Z_{K,L}}{D} \qquad \textbf{(EQ. 13)}$$

where D is the distance between site (X,Y) and site (K,L). If $|m_T| \leq m$, then site (X,Y) is classified as of normal exposure (see Figure 24). Finally, if $|m_T| > m$ then site (X,Y) is classified as of high topographic exposure (see Figure 25).

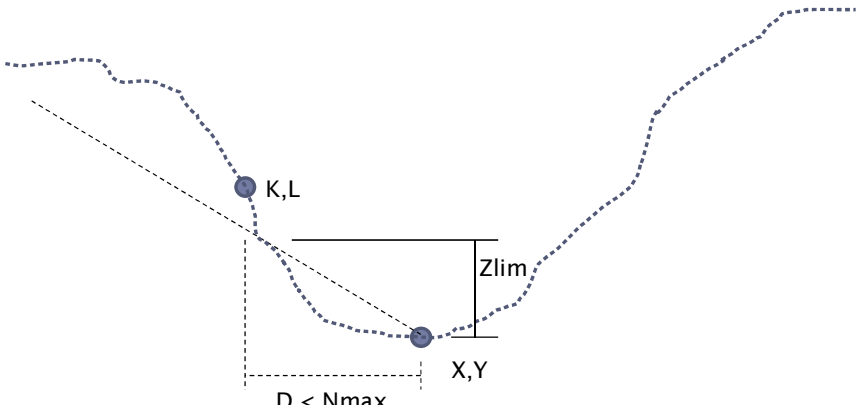


FIGURE 23. SCHEME OF A TOPOGRAPHIC PROFILE WITH SITES (X,Y) AND (K,L). SITE (X,Y) CLASSIFIED AS OF LOW TOPOGRAPHIC EXPOSURE.

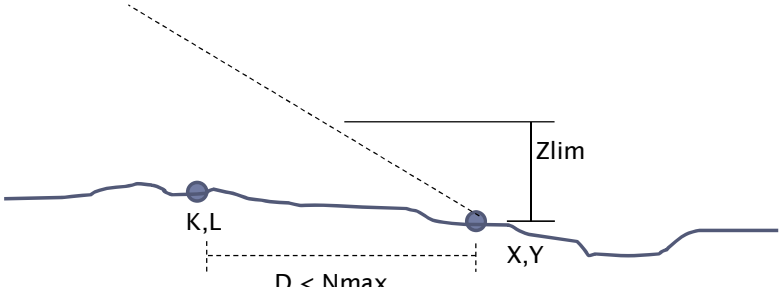


FIGURE 24. SCHEME OF A TOPOGRAPHIC PROFILE WITH SITES (X,Y) AND (K,L). SITE (X,Y) CLASSIFIED AS OF NORMAL TOPOGRAPHIC EXPOSURE.

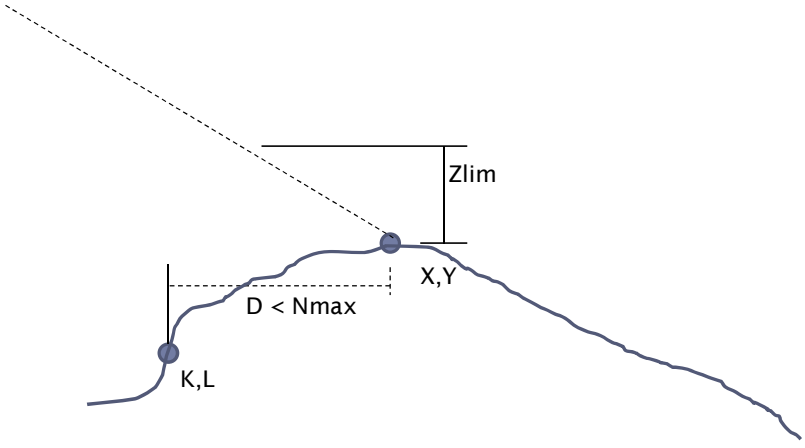


FIGURE 25. SCHEME OF A TOPOGRAPHIC PROFILE WITH SITES (X,Y) AND (K,L). SITE (X,Y) CLASSIFIED AS OF HIGH TOPOGRAPHIC EXPOSURE.

Gust Factor

The vulnerability models used in the risk calculation for GAR correlate loss to the wind speed for 3-seconds gusts. This means that we need to determine the speed for a different averaging time than the one produced by the basic wind field model. The gust factor formulation proposed in ESDU (1983) is used, given that, although it has been developed for extra-tropical storms, several authors conclude that there is no evidence to suggest that gust factors associated with tropical cyclones are different than those associated with extra-tropical storms (Sparks and Huang, 1999; Vickery and Skerlj, 2005).

The gust factor K_τ is defined in ESDU (1983) as

$$K_\tau = 1 + gI_u \qquad \text{(Eq. 14)}$$

where g is the peak factor and I_u is the turbulence intensity. The peak factor g is modeled as

$$g = 1 - 0.193\left[\frac{T_u}{\tau} + 0.1\right]^{-0.63} \qquad \text{(Eq. 15)}$$

where τ is the target gust duration (3 seconds) and $T_u = 3.13z^{0.2}$. The turbulence intensity I_u is calculated as

$$I_u = \frac{7.5\eta\left(0.538 + 0.09\ln\left(z/z_0\right)\right)^{\eta^{16}}}{2.5\left(1 + 0.156\ln\left(u_*/f\cdot z_0\right)\right)\cdot\left(\ln\left(z/z_0\right) + 34.5\, f\cdot z/u_*\right)} \qquad \text{(Eq. 16)}$$

where

$$\eta = 1 - \frac{6\cdot f\cdot z}{u_*} \qquad \text{(Eq. 17)}$$

Finally, the mean wind speed at 10 meters above the water or ground is calculated as

$$v_{10} = u(z = 10m)\cdot F_T \cdot K_\tau \qquad \text{(Eq. 18)}$$

Wind fields are given in terms of the geographical distribution of v_{10}.Therefore, for each historical cyclone one-hundred wind fields are calculated each corresponding to a simulation of the historical track. From the set of wind fields, the expected value and variance of the wind speed is calculated at each grid location, which respectively represent the first natural moment and second central moment of a Gamma probability distribution that defines the random nature of v_{10}. Therefore, there is one probabilistic hazard scenario calculation for each historical cyclone.

Annex 2. Landslides Probabilistic Risk Assessment

A methodological approach for the probabilistic assessment of landslide risk is presented here. In this approach, landslide risk is computed rigorously in a manner that is consistent with nowadays risk assessment methodologies and allows the incorporation of landslide risk in multi hazard risk assessments, giving risk in the same probabilistic terms as for other natural hazards.

Methodological Approach

First, landslide hazard must be defined in probabilistic terms. Landslide hazard may be divided into two main components: landslide susceptibility and triggering factors. Landslide susceptibility measures the probability of occurrence of a landslide in a given location, based on the site intrinsic characteristics such as slope, soil conditions, vegetation coverage, and others. It is a "static" measure of hazard, given the fact that is computed using the current state of a site that hasn't necessarily slide. On the other hand, the triggering factor is usually related to an external action over the static conditions of the site. Triggering factors are usually measured as the minimum required seismic acceleration or accumulated rainfall necessary to create the sufficient instability for the site to slide.

Landslide Hazard

Landslide hazard is defined as the occurrence or not of a landslide in a particular location. In a numerical domain, landslide occurrence is classified as 1 and non-occurrence as 0. Following this definition, landslide hazard may be defined, in probabilistic terms, as a random variable having a Bernoulli distribution.

Landslide susceptibility also follows the Bernoulli distribution. Susceptibility may be interpreted as the probability of occurrence, in static conditions, of a landslide. Given that it is a probabilistic representation of the current conditions of a site or region, it isn't ensuring the occurrence of landslides at a particular location, but only its probability of occurrence.

Susceptibility depends on a great number of variables that may change from case to case, given some important particularities of each study region. This annex doesn't intend to provide a general approach to assess susceptibility. In order to use the proposed approach for risk assessment, susceptibility may be assessed in any way and following expert criteria; the only requirement is that it is expressed as a probability of occurrence given all the intrinsic parameters that may be considered as relevant for each case. Therefore, landslide susceptibility for any region corresponds to the spatial probability of landslide occurrence.

For this case in particular, a set of susceptibility maps were available for each one of the projects. The maps classify every neighborhood in classes or areas according to the potential occurrence of mass movements. To each class a range of probability of occurrence was given and these values are shown in Table 12.

TABLE 12. SPATIAL PROBABILITY OF OCCURRENCE FROM SUSCEPTIBILITY MAPS

Susceptibility class	Probability of occurrence [%]
Very Low	0 – 10
Low	10 – 30
Moderate	30 – 60
High	60 – 90
Very High	90 – 100

The triggering factor also may be defined probabilistically. Both spatial and temporal probabilities are inherent to triggering factors. In this approach, triggering factors are considered as external hazards that influence the occurrence of landslides at each analysis location. The triggering hazards here considered are earthquakes and rainfall only. External hazards are here modeled as a set of stochastic events, each characterized by an annual occurrence frequency, that provide the spatial distribution of the statistical moments of the triggering intensity. Therefore, each triggering hazard event isn't modeled as specific values, but as the geographical distribution of the probability density functions of the hazard intensity. These are continuous probability distributions. Finally, a threshold intensity value must be defined for each location in order to establish the level of intensity that may cause landslides.

Mathematically, the probability of occurrence of a landslide (Pr_L) in a particular site is given by,

$$Pr_L = Pr_S \cdot Pr(I > I_T) \quad \textbf{(EQ. 19)}$$

where Pr_S is the susceptibility of landslide occurrence and $Pr(I > I_T)$ is the probability that the triggering intensity I exceeds the threshold intensity I_T. Given that triggering hazards are modeled as a set of stochastic events, then the landslide probability of occurrence may be computed for each of those events, having each result the same temporal probability or annual occurrence frequency as the triggering event. Therefore, a set of landslide hazard scenarios is constructed where each scenario has the same annual occurrence frequency as the triggering scenario and is defined by two statistical moments: mean and variance. Assuming a Bernoulli distribution, mean and variance are defined as:

$$Mean = Pr_L \quad \textbf{(EQ. 20)}$$

$$Variance = Pr_L \cdot (1 - Pr_L) \quad \textbf{(EQ. 21)}$$

The total hazard probability may be computed as the sum, for each landslide scenario, of the landslide probability, multiplied by the scenario annual occurrence frequency. This given an

annual probability of landslide occurrence at each analysis location, usually referred to as annual occurrence rate (ν_L).

$$\nu_L = \sum_{i=1}^{N} Pr_L \cdot F_i \qquad \text{(Eq. 22)}$$

This provides a probabilistic representation of landslide hazard in terms of occurrence rates. Return period may be computed for each site as the inverse of the annual occurrence rate.

Earthquake as Triggering Factor

The methodology selected for the landlside hazard analysis in this project is one of the most common methods used by engineering and geotechnics in slope stability analysis. This methodology, which is used to obtain the factor of safety, is typically used to take decisions on a specific area of study, that is, a slope. The CAPRA methodology integrates the use of traditional slope analysis methods with SIG technology and the adequate use of statistics in the landslides probabilistic analysis. Figure 26 presents a summary of the suggested methodology.

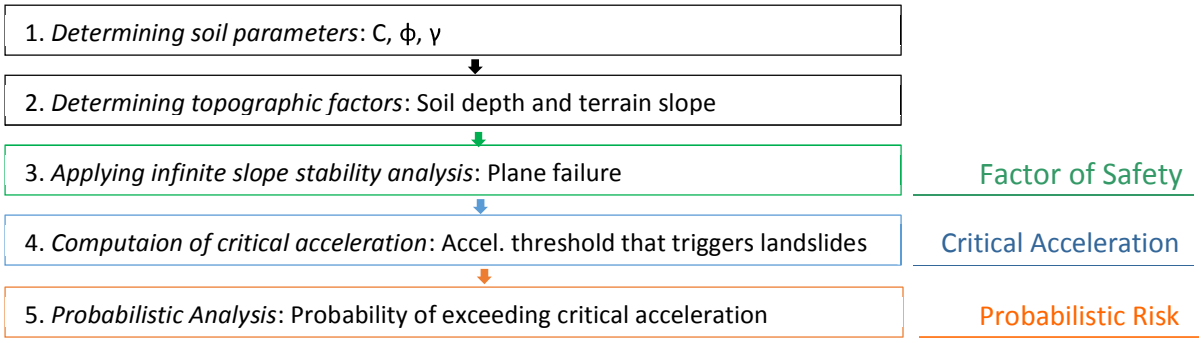


FIGURE 26. SUMMARY OF THE METHODOLOGY

Infinite Slope Stability Analysis

This methodology is based on the fact that in many cases of high magnitude landslides the mass movement is produced by a layer of low resistance material which moves approximately parallel to the surface of the slope. This mechanism, in which the mass movement occurs on relatively plane single surface, is common on rock masses affected by discontinuities such as bedding planes, cooling joints, tectonic origin fractures, and schistosity among others. It is called the infinite slope method precisely because the failure is presented parallel to the surface at a shallow depth and the length of the failure is much larger than its depth (infinitely long). Due to these conditions the edge effects are negligible, and the factor of safety can be obtained based on the Mohr-Coulomb criteria. First the relation between the forces resisting movement and the forces driving movement along the plane of failure must be computed including the cohesive and frictional force, which depend on effective shear strength parameters c' (effective cohesion) and φ' (effective friction angle), the pore water force and the weight of the soil section.

$$FS = \frac{c\prime}{\gamma h \sin\alpha} + \frac{\tan\varphi\prime}{\tan\alpha} - \frac{m\gamma_w \tan\varphi\prime}{\gamma \tan\alpha} \quad \textbf{(Eq. 23)}$$

Where *m* is the relation *z*/*h*, *c'* is the effective cohesion, *h* is the thickness of the layer, *z* is the depth of the water table, γ is the specific weight, γ_w is the water's specific weight, α is the inclination angle of the fault plane, and φ' is the effective friction angle.

Critical Acceleration Computation

The methodology proposed by Newmark (1995) has been used as an approximation to determine the hazard of landslides triggered by earthquakes. It uses a parameter known as critical acceleration, which is defined as the minimum acceleration that would potentially trigger a landslide, and it depends on the factor of safety as shown in the next equation:

$$A_C = (FS - 1)g \cdot \sin\alpha \quad \textbf{(Eq. 24)}$$

Where FS is the static factor of safety and α is the angle from the horizontal plane to the center of mass of the potential landslide, which is approximately the angle of the slope of the terrain. Therefore, the critical acceleration map is a measure of the intrinsic properties of the slope aside from any seismic scenario, meaning that it is the seismic susceptibility to landslides.

Rainfall as Triggering Factor

The rainfall-landslide thresholds play a fundamental role in the hazard and risk modelling due to mass wasting phenomena because they determine the influence associated to the occurrence of rainfall as the triggering factor of landslides. Modelling the landslide hazard triggered by rainfall requires specific information that characterizes the climate conditions of the basin in terms of precipitation depending on its magnitude (total daily precipitation), intensity and temporary distribution.

Precipitation events used to trigger shallow landslides in the study area are the result of a stochastic methodology to generate correlated series of daily precipitation derived from historic records. Due to the lack of data recorded at weather stations in the area, a satellite-based dataset was used to characterize the precipitation regime in the area. CHIRPS (Climate Hazards Group InfraRed Precipitation with Station data) database has global information (50°S-50°N for all longitudes) for more than 30 years of precipitation records, since 1981 (Funk et al., 2015). This database combines satellite information (with a 0.5-degree resolution) with data recorded at weather stations to generate time series for trend analysis. The global daily data for the second version of the dataset can be freely downloaded from ftp://ftp.chg.ucsb.edu/pub/org/chg/products/CHIRPS-2.0. The data is available in raster format (tiff file format) and the 0.5-degree resolution is the most up-to-date[7]. CHIRPS dataset provides complete daily precipitation data for the total study area for 30 consecutive years, from 1981 to 2010.

[7] February 2017.

Data from grid points (90.75W, 14.75N) and (90.75W, 14.25N) was used to interpolate precipitation series for the study location in Mixco, Guatemala. And Data from grid points (87.25W, 13.75N) and (87.25W, 14.25N) was used to interpolate precipitation series for the study location in Tegucigalpa, Honduras.

A total of 30-years of historic records was used to generate 1000-years of stochastic rainfall series by fitting probability distributions for each day of the year. The resulting average precipitation in the area represents the historic records (monthly and annual values) but generates daily events above the historic mean, which have not happened yet. Then, extreme rainfall scenarios can be considered for landslides triggered by rain. From the CHIRPS dataset, the average precipitation in Guatemala City is 1140 mm/year; the monthly distribution of the rainfall is shown in Figure 27. And also, from the CHIRPS dataset, the average precipitation in Tegucigalpa is 1410 mm/year; the monthly distribution of the rainfall is shown in Figure 28.

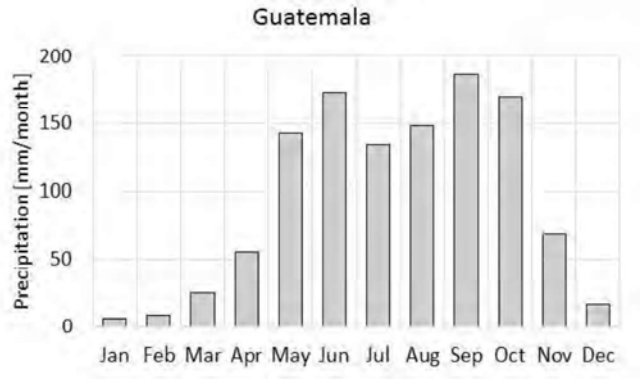


FIGURE 27. MONTHLY DISTRIBUTION OF PRECIPITATION IN GUATEMALA CITY ACCORDING TO STOCHASTIC MODELING OF RAINFALL.

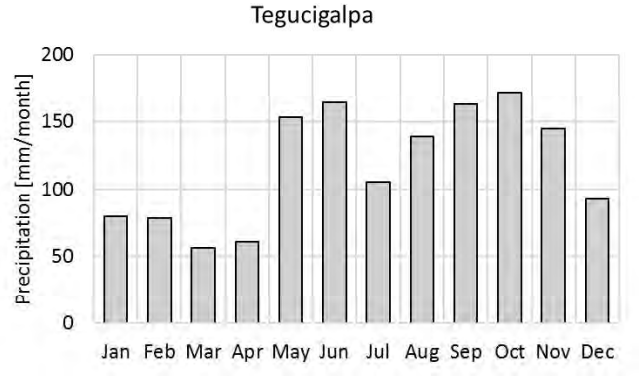


FIGURE 28. MONTHLY DISTRIBUTION OF PRECIPITATION IN TEGUCIGALPA ACCORDING TO STOCHASTIC MODELING OF RAINFALL.

The methodology used in this study also considers the daily distribution of rain. Historic data was not available in weather stations or in the CHIRPS database (only daily records). In this case, a more detailed dataset was used. The Terrestrial Hydrology Research Group at Princeton University published the Global Meteorological Forcing Dataset for land surface modeling, which provides near-surface meteorological data for multiple models. It blends reanalysis data with observations at weather stations and disaggregates it in time and space. The dataset is available in multiple spatial (1.0, 0.5 and 0.25 degree) and temporal scales (monthly, daily, 3-hourly) for 1948-2010; moreover, it is freely available at http://hydrology.princeton.edu/data.pgf.php (Sheffield, Goteti, & Wood, 2006). The 0.25 degree and 3-hourly dataset was used to obtain daily distributions of rain for the study locations. The Figure 29 and Figure 30 show the daily distribution of rainfall in Guatemala City and Tegucigalpa, as a fraction of the total rainfall. Each line in the graph represents a daily distribution of rain, there are 365 lines.

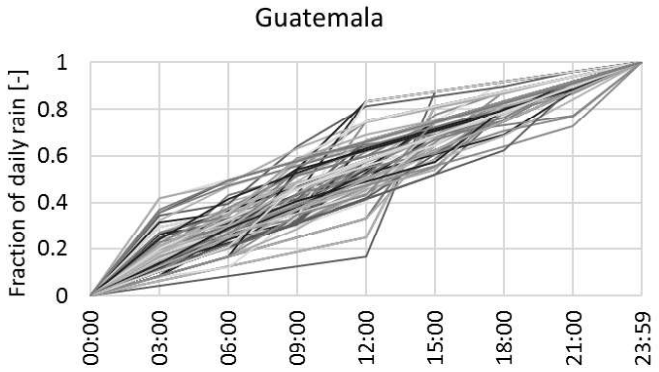


FIGURE 29. DAILY DISTRIBUTION OF PRECIPITATION IN GUATEMALA CITY ACCORDING TO PRINCETON DATASET. THE FIGURE SHOWS DISTRIBUTION OF DAILY RAIN FOR A COMPLETE YEAR (365 DAYS).

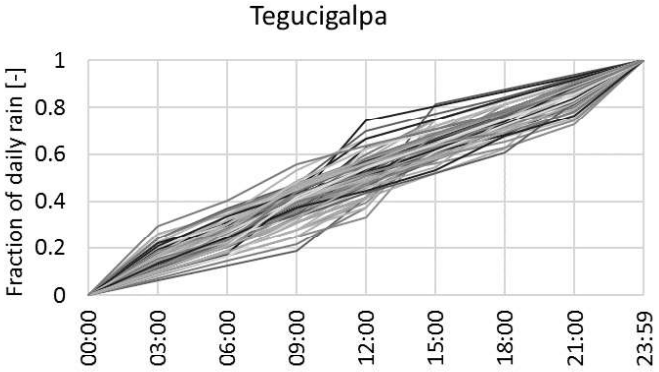


FIGURE 30. DAILY DISTRIBUTION OF PRECIPITATION IN TEGUCIGALPA ACCORDING TO PRINCETON DATASET. THE FIGURE SHOWS DISTRIBUTION OF DAILY RAIN FOR A COMPLETE YEAR (365 DAYS).

Landslide risk

Landslide risk is computed here based on a simple but important assumption: the vulnerability of any infrastructure element exposed to landslide hazard is total. In other words, when a landslide occurs at the location of an exposed asset, all its replacement value is lost independently of the type, magnitude, volume or speed of the landslide, and also independently of the type of exposed infrastructure. Based on this assumption, which is not far from reality, landslide risk may be expressed in probabilistic terms, for each scenario. The statistical moments of the total loss for each landslide scenario may be computed by applying its definition:

$$E(p) = \sum_{i=1}^{NE} Val \cdot Pr_L \quad \text{(Eq. 25)}$$

$$Var(p) = \sum_{i=1}^{NE} (Val - E(p))^2 \cdot Pr_L \quad \text{(Eq. 26)}$$

where Val is the exposed value of each asset, Pr_L is the landslide probability of occurrence at the exposed asset location and NE is the number of exposed assets.

In risk assessment, loss is usually modeled using a Beta probability distribution. For this particular case, a Beta distribution may be used to define loss in probabilistic terms only when the expected value of the losses for each scenario are considerably lower (at least two order of magnitudes) than the total exposed value. This condition should be fulfilled for most practical cases, so we are confident on modeling loss as a random variable with a Beta probability distribution.

Given that loss is defined probabilistically for each landslide scenario, risk may be integrated in order to derive in as loss exceedance curve, and from it in all kinds of risk metrics, such as PML, AAL or bankruptcy probability, that are used in risk assessment for other kinds of natural hazards.

Annex 3. Inventory of Exposed Elements

The exposed elements are essential in risk assessment, because they are the objects on which losses are evaluated, i.e., are the source of potential losses due to being exposed to a hazard and be susceptible of suffering damage. In mathematical terms, the exposed elements provide the maximum possible absolute value of the loss at their geographical location, as well as the summands of the probability density function of the loss of a hazard scenario. That is, they are the integrating element of hazard and vulnerability at each of their locations, and the integrator elements of the total losses for a given scenario. Its proper characterization is of great importance for the correct estimation of losses and once each element is characterized it needs to be appraised in economic terms (usually in monetary units). Also, the assignation of a vulnerability function is required.

The database must include information related to the following topics:

- Location in terms of geographical coordinates
- Geometrical characterization of the asset through a shapefile (points, polylines or polygons). This information is mainly used for the data and results display.
- Replacement value of each asset
- Parameters that allows capturing the vulnerability characteristics that is specified through a vulnerability function. The vulnerability must consider the expected physical damage (direct losses) and/or in terms human impact as a function of the selected intensity for each considered hazard.

Since it was not possible to obtain detailed cadastral register information for the neighborhoods, a survey was made of the inventory of exposed assets based on observations from satellite images and their interpretation. For each neighborhood an estimate of constructed plant area was obtained from polygons constructed over the satellite images. Figure 31 presents an image of the constructed city polygons, digitalized using the tool available on Google Earth. Each polygon is then subjected to a construction density also identified from the satellite images to account for roads, parks, and other areas that cannot be considered as constructed buildings.



FIGURE 31. CONSTRUCTED PLANT AREA ON TEGUCIGALPA'S NEIGHBORHOODS

Furthermore, there is no information related to number of stories, construction systems, areas of construction, exposed values, construction dates or other data which are useful in determining economic, and structural exposure and vulnerability.

To stablish the number of stories and construction classes on the neighborhoods the use of available images and the Google Street View tool was necessary complemented by population statistics, official indicators and other online information. Given the lack of individual information for each register, the assumption of the same number of stories and same construction type for the neighborhood was made with the exception in those cases where different information was available. This information, like any other approximated model of information, is open to improvement, and can be updated and cleaned up using intense fieldwork, or by having detailed property register information available. The quality and resolution of information in an exposure survey defines the reliability and resolution of the results of the risk analysis. With this information, the total constructed area was determined.

Official information and published indicators allowed approximate economic values to be established, which in this case correspond to the official monthly minimum wage per constructed square meter. This value has been accepted as the replacement value for a constructed square meter in residential uses with a poor socioeconomic development, where usually no further information is available.

Therefore, we proceeded to form a database for exposure of buildings, based on the procedures explained above. To summarize, for each project the total constructed area in the neighborhoods was determined (from the plant area, constructed density and number of stories), the total economic replacement value (from the price per square meter and the total constructed area) and lastly, a construction class that represents most of the buildings present.

For this report on landslide risk assessment and due to the characteristics of the landslide hazard additional steps were necessary to detail the resolution of the exposure model. Therefore, we proceeded to form a database for exposure of buildings based on the identification of blocks with homogeneous exposure on Google Earth satellite images, that is, blocks which can be identified to have similar conditions of use or levels of occupation, cost and densities of construction. Each block is then classified in terms of percentages identified for each type of construction, in relation to observations identified.

These homogeneous blocks were then split up, to simulate properties around the city. This process of splitting up consists of making a random allocation of points in each homogeneous block, assigning to each point a cost and occupation consisting of values identified in the block, and a type of construction as a function of the percentages previously defined. The total number of properties located per block is consistent with the density of construction identified and the total exposed value is also consistent with the values determined for previous hazard assessments.



FIGURE 32. DETAILED EXPOSURE MODEL FOR LANDSLIDE RISK ASSESSMENT

Performance Evaluation:
LAC Urban DRR Programming
The Neighborhood Approach

ANNEX 4.7

Support Documents
Cost-Benefit Analysis





Table of Contents

Cost-Benefit Analysis
- Intervention: Access Path
- Intervention: Drainage canal in Port de Paix (PdP), Haiti

DRR INTERVENTION: ACCESS PATHS

Definition: A safe urban footpath that runs through the informal settlement, usually built on slopes, with or without stairs, and with or without handrails for support.

The Neighborhood Approach: From the DRR perspective, the footpath provides a safe and efficient evacuation route toward a safer location following a hazard warning. In their daily routine, residents use the access path to/from their houses for efficient access to/from the community center or other public services/areas. The redesign of the formerly organic, meandering pathways in the informal settlement was done to ensure the best, safest, shortest and most efficient footpaths to connect the houses with public services/areas. The redesign benefits maximum number of people in the neighborhood besides improving connectivity.

The footpaths are used by the residents in their daily routine but are primarily built for safe and quick evacuation following a hazard warning. They are especially useful during the rainy season (which extends for approximately 5 months per year), as the original paths on the natural slopes became muddy and slippery, causing inconvenience and often injuries to residents. People with disabilities, the elderly, and children had limited mobility with the original pathways. The safely constructed footpaths, especially with handrails, aid safe and easy access to all categories of population, including the vulnerable, especially for the purpose of evacuation.

Impact	Without Access Path	With Access Path + Training	Benefit	Data values and Assumptions	Benefit Calculation
DRR scenario: Hazard/Earthquake/Landslide					
Human	Fatalities in houses due to structural collapse	No change	Benefits not quantified		
	Fatalities because of ineffective evacuation (in addition, people with disabilities are excluded from evacuation)	**Reduced loss of life :** •Access paths allow effective and speedy evacuation from neighborhood houses to safe location. •People with disabilities and the elderly can evacuate (handrails and safer footpaths aid in this process). •People know how to react in case of emergency (because of training and awareness components of the project)	**Annual benefit from reduced fatalities during evacuations** = Number of evacuations per year* Value of Statistical Life (VSL)* Number of lives saved because of access paths during evacuation VSL = Value of Statistical Life Lives considered: People with disabilities /Elderly /Pregnant women	Following assumptions are made: 1. 0.5 evacuations per year (to keep the estimate conservative). 2. VSL: The vaue for VSL ($107,000) is used (Viscusi & Masterman, 2017.) 3. We assume that 0.005% of the population (Medellin Population = 115,999; Rimac: 20,987) lives are saved each year because of the access paths during evacuation. This population comprises the vulnerable: the elderly, people with disabilities, pregnant women. 3. We assume that the vulnerable population is able to escape death because of safe access pathways during the evacautions. Without the access paths these people were trapped in their homes despite the hazard warning to evacuate as the original paths were unsafe, tortuous, slippery and thus inaccessible. The redesigned paths have handrails which further assists safe passage of the vulnerable individuals.	Annual benefit (Medellin) = 0.5*107,000*(0.005*115,999) = $310,297 Annual benefit (Rimac) = 0.5*107,000*(0.005*20,987) = $56,140
	Injuries during evacuation	**Reduced injuries because of efficient and safer path for evacuation**	**Annual benefit from reduced cost to state for treatment of minor injuries suffered during evacuations** = 10% of Population *Hospital Cost per Outpatient visit per year * Number of estimated evacuations per year	Number of estimated evacuations per year = 0.5 Medellin Population = 115,999 Hospital Cost per Outpatient Visit (Medellin) = $7.50 (2015 USD) (http://www.who.int/choice/country/col/cost/en/) Rimac Population = 20,987 Hospital Cost per Outpatient Visit (Rimac) = $8.46 (2017 USD) (http://www.who.int/choice/country/per/cost/en/) Assumptions: 1. We assume 10% of the population suffer minor injuries during evacuation, for conservative measure. These are the injuries that could be avoided. Kumar & Bose (2000) indicate that during an earthquake, 20% people suffer injuries from escape from collapsed houses. We assume that out of 20% who are able to escape, half of them (10%) suffer minor injuries that do not require hospitalization, only outpatient care. 2. The hospital outpatient visit costs are taken from WHO site: http://www.who.int/choice/country/ These are costs incurred by the state/public system.	Annual Benefit from avoided injuries (Medellin)= (10%*115,999)*$7.50*0.5 = $43,499.63 Annual Benefit from avoided injuries (Rimac)= (10%*20,987)*$8.46*0.5 = $8,877.50
Physical	Houses are destroyed	No change	Benefits not quantified		
	Loss of all household possessions	Household possessions may be recovered	Benefits not quantified		
Normal Routine					
Time saved b	Make extensive detours to reach destination	**Non-Work Time Savings** Ease of access from community to public service areas, markets and goods. Increased mobility for vulnerable population: people with disabilities, the elderly, pregnant women, children. All these factors save time for community members in tehir daily life, which can be valued as their non-working time savings.	**Non-Working Travel Time savings:** 0.3 * household income per head per hour	Assumptions: 1. The formula for travel time savings is sourced from Gwilliams, 1997. Gwilliams suggests that the World Bank use values of 30 percent of household income per hour for adults and 15 percent for children. 2. *Focus group clearly indicates that residents prefer the redesigned footpaths and say that it increases connectivity and improves times .* 3. Household income for Medellin is estimated based on the household surveys conducted by FIU. Monthly household income per head = $311.43 (2015 USD)	Value of Non-Working Time Savings by the Medellin neighborhood = 0.3* $1.80 = 0.54/hour Value of Non-Working Time Savings by the Rimac neighborhood = 0.3* $2.31 = 0.69/hour

Costs:

The costs of construction and labor of the access paths in Medellin: $20,980 (2015 USD) ; Rimac: $8,424 (2017 USD)

Results:

Medellin Access Path project: BCR (with VSL) = 98.90, BCR (without using VSL) = 12.16

Rimac Access Path project: BCR (with VSL) = 47.43, BCR (without using VSL) = 6.48

The benefits from Value of Non-Work Travel Time savings are not included in the BCR.

Notes:

The sum of the annual benefits from reduced fatalities during evacuation and from reduced cost to the government from avoided injuries are used as the annual benefits for the Cost benefit Analysis.

We assume that the life of the access paths will be 10 years after construction. The Discount Rate used for the analysis is 10%.

DRR INTERVENTION: Drainage canal in Port de Paix (PdP), Haiti

A drainage canal was built in Port-de-Paix to drain/channelize the excess surface water from the area following high rainfall events. The rainy season last five months in Haiti, and along with frequent hurricane impacts, causes area flooding that leads to damage of household goods and impedes livelihoods. The drainage canal runs through the entire neighborhood and keeping it free of flooded waters.

Impact	Without Canal	With Canal	Benefit	Data Values and Assumptions	Benefit calculation
Physical	Flooding is caused during rainy season (5 months a year), heavy rain events, and during the passage of hurricanes. The runoff causes significant flooding leading to permanent damage to household possessions in the community. The time for recuperation from flooding events is long. Extensive damage to household possessions is reported by residents. Based on surveys and focus group results we estimate that every year, 80% of household goods are damaged.	Surveys and focus group reveal that since the building of the canal, the loss of household possessions during extensive rain events has been avoided in the past three years. This includes Hurricane Irma which did not result in major damage; the flooding was effectively absorbed by the drainage canal in time, allowing the families to recover soon after. Surveys reveal that Hurricane Jeanne in 2004 was similar in character to Irma but the impacts were in stark contrast. The neighborhood had suffered major losses in household possessions post Hurricane Jeanne.	Avoided loss of household assets	1. PdP population is estimated as follows: a. house surface area = 76,605 sqm (exposure data, Risk modeling report) b. House surface area = 337.14 sqm (survey) c. Number of houses = 227 (survey) d. Number of people per house = 6.63 (survey) e. Estimated population in PdP = (76,605/337.14)*1/2*6.63 = 753 2. Total Exposed value of dwellings in PdP = $8,759,304.53 (Exposed assets, Risk modeling report) 3. We assume household assets are 10% of the value of the household dwelling. 4. We assume that 80% of the household goods are damaged and lost (based on survey responses)	Benefit from avoided loss of household assets and possessions = 80%*(10% *$8,759,304.53) = **$700,744**
Economic	Interruption of markets and commercial activity due to area flooding	Survey reveals that loss in business activity is reduced to 5 days of flooding. The majority of families in PdP are part of the informal business sector.	Increased business activity from avoided flooding	1. Official minimum monthly wage = $108.71 (USD 2014) (http://www.sgcm.gouv.ht/wp-content/uploads/2017/03/Moniteur-28-juillet-2017-Salaire-minimum.pdf) 2. Daily earnings =$5.02 (USD 2014) 3. Number of PdP people in informal business that area affected = 107 (World Bank Group Report) 4. Number of business days of recovered business activities because of canal (4 weeks)= 23 days	Increased earnings from recovered business days = 23 days * $ 5.02/day * 107 = **$11,777 per year**
Economic	Focus group study reveals that several school days (4 weeks) are lost because of flooding	Loss of school days reduced to 3-5 days (focus group responses)	Increased school attendance during flooding times	1. Number of children in PdP (assumed) = 227 2. Average daily wage rate= $5.02 3. Number of school days total = 200 4. Number of school days missed = 20	Without Canal = 227 children * 20 days lost* $5.02/day = $22,790.80 With Canal= 227 children * 5 days lost * $5.02/day = $5,697.70 Increased school attendance benefit = **$17,093.10 per year**

Costs:

The cost for constructing the drainage canal in the Port-de-Paix communities was $340,000 (2014 USD)

Results:

The Benefit Cost Ratio of the drainage canal project in PdP - 13.19

Notes:

The sum of the annual benefits from avoided loss of household assets an possessions, increased earnings form recovered business days and increased school attendance are used as the annual benefits for the Benefit Cost Analysis.

We assume that the life of the drainage canal will be 10 years . The Discount Rate used for the analysis is 10%.

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Life Satisfaction Survey





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- Life-Satisfaction Approach

Life Satisfaction Approach

Alejandro Arrieta, PhD
Florida International University
April 10, 2018

A major challenge in assessing the value of the USAID/OFDA Neighborhood Approach (NA) is capturing the multidimensional benefits of the program. The NA is characterized by multiple interventions and activities that produce benefits beyond the DRR goals. In this report, we use a comprehensive quantitative approach to assess the value of the Neighborhood Approach based on its impact on life satisfaction understood as Life Satisfaction Approach (LSA). A life satisfaction assessment is combined with income information to convert the effect of the intervention into a monetary figure (Fujiwara and Campbell, 2011). In general, the LSA assesses the marginal willingness-to-pay associated with an intervention, and it captures a broad spectrum of benefits through subjective wellbeing reported in life satisfaction levels (Frey, Luechinger et al., 2010). Recent applications have included valuations of natural disasters like droughts (Carroll, Frijters et al., 2009) and flooding (Luechinger and Raschky, 2009), and the valuation of several nonmarket activities.

Methods

Our approach used field surveys that assessed the life satisfaction of 349 individuals (i) with residence in eight urban settlements benefitted by USAID/OFDA NA projects. The neighborhoods were located in small towns in Haiti, Guatemala, Peru, Colombia, Jamaica, and Honduras, with direct beneficiaries that ranged from 750 to 120,000 residents. Each NA project consisted of up to 14 interventions I^j (j=1,...,14). Life satisfaction (LS_i) was obtained from the survey for each beneficiary i who resides in the neighborhood, based on the answer to the question "generally speaking, would you say you are satisfied with your life?" The answer ranged from 1 (not at all satisfied) to 4 (very satisfied).

Impact of interventions on life satisfaction

We first use multivariate ordinal regression analysis to evaluate the association between each of the 14 NA interventions on life satisfaction (I^j). In particular, we will estimate the following regression models to capture the effect of individual interventions:

$$LS_i = \beta_j I_i^j + \gamma \ln(Y_i) + \alpha X_i + \varepsilon_i$$

Where ln(Y) is the logarithm of family income, X a set of variables that controlled for gender, age, income and wealth, assessed by the possession of household assets (computer, washer machine, phone, car, bathroom) and home ownership. The term ε represents the estimation error. The parameter β_j captures the gains in life satisfaction associated with the intervention j (j=1,...,14), and therefore, it is a measure of the intervention effectiveness. The result of this analysis will help us identify the interventions with the highest impact on life satisfaction improvement.

The dollar value of interventions

Our second step is to assign a dollar value to the gains in life satisfaction using the LSA. To achieve that, we used our previous analysis to find the additional family income ΔY_i that makes the life satisfaction without intervention *j* equal to the life satisfaction with intervention *j*, that is $\widehat{LS}_i^{\sim j} = \widehat{LS}_i^{j}$. This is equivalent to the compensating surplus, or the increase in income necessary to keep the individual without the NA intervention at the same utility level:

$$\widehat{LS}_i^{j}(Y_i, I_i^j = 1) = \widehat{LS}_i^{\sim j}(Y_i + \Delta Y_i^j, I_i^j = 0)$$

From the regression model, the compensating surplus can be computed as follows:

$$\Delta Y_i^j = Y_i - e^{\frac{-\beta_j + \gamma \ln(Y_i)}{\gamma}}$$

Note that ΔY_i^j is equivalent to the individual *i*'s willingness-to-pay to keep intervention *j*. Therefore, the average over all individuals, $\overline{\Delta Y^j} = \frac{1}{N}\sum_{i=1}^{N} \Delta Y_i^j$, is the dollar value per-beneficiary of the gain in life satisfaction associated with intervention *j*.

Cost-benefit analysis

The Incremental Cost-Benefit Ratio ($ICBR^j$) represents the average dollar benefit per 1 US 2017 dollar invested in intervention *j*. It is defined as:

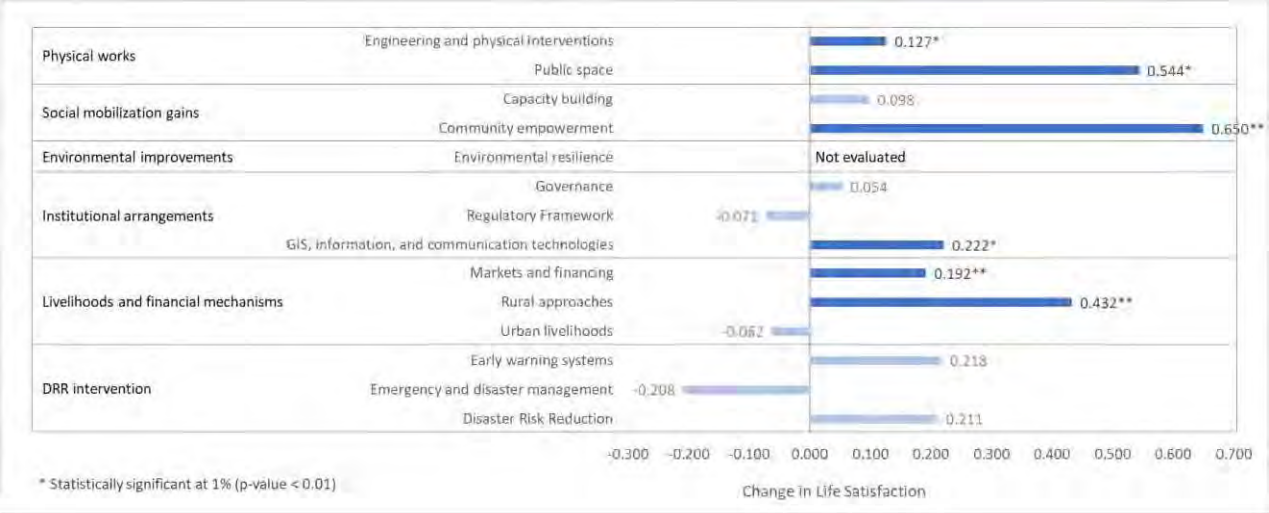
$$ICBR^j = \frac{\overline{\Delta Y^j}}{C^j}$$

Where C^j is the investment cost in intervention j. An ICBR>1 means that benefits are larger than costs, and consequently, that intervention *j* is acceptable. Cost information is provided by the USAID/OFDA NA project, and an ICBR is calculated when this information is available.

Results

Figure 1 presents the results of our estimation for all interventions grouped by categories. The categories with the highest impact on life satisfaction improvement are physical works and social mobilization gains. For example, neighborhoods that received a community empowerment intervention (social mobilization category) increased their life satisfaction by 0.65 points. Considering that on average, the life satisfaction of all neighborhoods in the study was 2.46, the community empowerment intervention produced an increase in life satisfaction of nearly 27%.

Figure 1. Impact of interventions on life satisfaction



Other categories with interventions that had a significant impact on life satisfaction are livelihoods and financial mechanisms (rural approaches intervention and markets and financing), and institutional arrangements (GIS, information and communication technologies intervention). While in most cases the interventions were implemented in several neighborhoods, the rural approach case with the positive impact corresponds only to the Medellin neighborhood so, a generalization of this case should be taken with caution.

Other interventions such as capacity building, governance, regulatory framework, urban livelihoods, early warning systems, emergency/disaster management and disaster risk reduction were not statistically associated to changes in life satisfaction. Environmental resilience was not evaluated. In our approach, life satisfaction changes are obtained by comparing neighborhoods with and without individual interventions. Environmental resilience could not be compared because this intervention was performed on all neighborhoods.

Table 1 presents the dollar value of those interventions that had a statistically significant impact on life satisfaction. The valuation per direct beneficiary ranges from 128 to 323 dollars, and it correlates to the magnitude of the impact of the intervention on life satisfaction. Using the estimated number of direct beneficiaries in all neighborhoods that received the corresponding intervention, the last column of table 1 presents the dollar value of the total gain in life satisfaction in the community. Physical works (public space and engineering and physical interventions) produced the largest gain in value, totaling more than 70.3 million dollars. Social mobilization gains (community empowerment) was the second most important intervention, producing a value gain of 52.2 million dollars.

Table 1. The dollar value of effective interventions

Intervention category	Valuation in 2017 US$		
	Per beneficiary	Direct beneficiaries	Total Value
Engineering and physical interventions	$127.5	166,199	$21,186,771
Public space	$305.6	160,858	$49,156,593
Community empowerment	$322.6	162,038	$52,267,203
GIS, information, and comm. technologies	$193.0	133,499	$25,769,901
Markets and financing	$182.9	154,518	$28,257,791

Rural approaches	$267.0	15,530	$4,147,197

Cost information was limited in most categories for most neighborhoods, except in engineering and physical interventions. Data provided by the USAID/OFDA NA project, suggests that the total investment cost of engineering and physical interventions in all neighborhoods was 1.2 million dollars. With this information, we calculated the ICBR at 17.9, indicating a benefit of 17.9 dollars for every dollar invested in engineering and physical interventions. While cost information is not available for all other interventions, our results suggest that the ICBR could be even bigger for the rest of intervention categories.

Conclusions

We use a life satisfaction approach to recognize the multidimensional benefits of the USAID/OFDA NA projects. Our results suggest that the interventions produced benefits beyond the DRR goals, with broader impacts on the community well-being. In particular, we found that the categories with the highest impact on life satisfaction improvement were physical works (public space and engineering and physical interventions) and social mobilization gains (community empowerment).

The dollar value of the gains in life satisfaction ranged from $128 to 323 dollars per direct beneficiary. Overall, physical works produced the largest gain in value, totalizing more than 49.1 million dollars for public spaces, and 21.2 dollars for engineering and physical interventions. Community empowerment produced the largest benefit at 52.3 million dollars.

While cost information was not available for all interventions and neighborhoods, our results suggest that the USAID/OFDA NA projects where cost-beneficial for the communities. For engineering and physical interventions, the category with most available data, we calculated an incremental cost-benefit ratio of 17.9, which means that for every dollar invested in engineering and physical interventions the neighborhoods improved their well-being in a magnitude equivalent to 17.9 dollars.

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Performance Evaluation:
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ANNEX 4.9

Supporting Documents
New DRR Strategies

USAID
FROM THE AMERICAN PEOPLE

FIU | Extreme Events Institute
FLORIDA INTERNATIONAL UNIVERSITY

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New DRR Strategies

1. Land Tenure Mapping and Regularization
2. Analysis of the Resilience of Communities to Disasters (ARC-D)
3. Resilience Analysis for Social Systems (R4S)
4. Basic Basket Market System
5. Provision and Maintenance of Drainage Systems

New DRR Strategies: 1. Land Tenure Mapping and Regularization

Title: Land Tenure Mapping and Regularization (Habitat for Humanity)

Description: A land tenure initiative is being implemented in the Naggo Head community by Habitat for Humanity as a pilot activity in collaboration with Jamaica's Land Administration and Management Program (LAMP). The initiative helps communities exposed to disaster risk acquire a registered title. Empirically, there is a positive link between land registration and access to credit, housing improvement, and risk reduction. Although there is no clear evidence that property titles alone can guarantee access to credit or even reduce risk (Domeher & Abdulai, 2011), land tenure issues and natural hazards exposure may result in exclusion from aid distribution and post-disaster reconstruction programs, making communities more vulnerable to future disasters. Secure land tenure is critical to assure restoration of shelter of shelter and livelihoods and reduce risks of precariousness in communities (Caron et al., 2015).

Location: Naggo Head, Portmore, Jamaica

Process: The process for obtaining a registered title is explained below.

Step 1: The person applying for the title, *"The Claimant"* engages a Commissioned Land Surveyor to prepare Survey Diagram, that is, a plan of the land being claimed. Survey Diagram is submitted to the National land Agency (Survey Department) for pre-checking. This takes 12-16 weeks.

Claimant gives the Approved Survey Diagram and Proof of Ownership Documents to LAMP or private attorney. Private attorney sends the Application to Tax Administration Jamaica for an assessment and payment of Stamp Duty on the application and Transfer Tax if the owner is appointed a joint owner or a person other than himself to take the title.

Due to duty waivers under the SPA LAMP is not required to assess or settle Stamp Duty and Transfer Tax. This takes 4–5 weeks. Stamp Duty is 1.33%, and Transfer Tax is 5% of the value of the land being registered.

Step 2: LAMP or Private attorney submits Approved Survey Diagram and Application with proof of payment of Stamp Duty and Transfer Tax to the Registrar of Titles, Office of the National Land Agency.

Steps 3 & 4: Application is reviewed by Registrar and if found satisfactory Diagram resent to Survey Department for rechecking. Verified Survey diagram returned to Registrar. This takes 4-5 weeks.

Step 5 & 6: Application sent to Referee of Titles for Approval, Referee's Provisional approval, denial of the application, request for additional information or referral to an Adjudication Committee sent to the Registrar of Titles. This takes 3-4 weeks.

Step 7: If the application is provisionally approved, Registrar sends Notice of Provisional Approval to LAMP or Private Attorney and to Government Gazette for publication.

Step 8: LAMP or Private Attorney Publishes Notice and returns proof of publication to the Registrar (Notice period 6 weeks after publication)

Step 9: Registrar prepares and issues Certificate of Title (4 weeks)

Average System time is 40 weeks for perfect applications, matters referred to Adjudication committee or for additional information would rejoin the process at Step 5.

Costs:

The costs are largely ad valorem and could range between JA$ 235,000 to JA$475,000 (US$1,800 to US$3,800) for a ¼ acre of land valued at JA$1,000,000 or USD 8, 000.

Activity	**Cost (JA$)**	**$US equivalent**
Surveyor's Cost of Survey Diagram	40,000	320.00
Stamp Duty	15,000	120.00
Transfer Tax (in case of nominee other than applicant for title)	37,000	296.00
Registration Fee	10,000	80.00
Final Title Fees	10,000	80.00
Publication Cost (legal notice)	15,000	120.00
Assurance Fund	55,000	440.00
Attorney's Cost	100,000	800.00
Additional Costs:		
If Claiming through the estate of a deceased person		
Transfer Tax on Estate	15,000	120.00
Stamp Duty on Estate	10,000	80.00
Attorneys legal fees on Probate or Letters of Administration	150,000	1,200.00
Subdivision Plan	65,000	520.00

Comments: The land tenure initiative began in April 2017 and as of now all 30 applications filed are in process and have not yet been finalized.

New DRR Strategies: 2. Analysis of the Resilience of Communities to Disasters (ARC-D)

Title: Analysis of the Resilience of Communities to Disasters (ARC-D) Toolkit

Description: As lives and livelihoods of vulnerable populations are constantly threatened and affected by natural hazards, and stresses like climate change impacts and population growth are expected to change the intensity and impact of these hazards, it becomes necessary that disaster resilience of communities be measured. The ARC-D Toolkit informs the transition of humanitarian interventions to longer term development programming and to build back better in the recovery stage. It can facilitate the adoption of a systems approach to resilience building by providing a snapshot of 30 resilience components related to eight critical systems. It informs decision makers in humanitarian and development programs to do no harm to existing disaster resilience capacities at community level.

Location: Tegucigalpa, Honduras

Process: The ARC-D includes a two-part disaster resilience survey, accompanied by a user guidance manual and software. The process includes:

a. A training workshop for a team of facilitators for the application of the toolkit
b. Socialization with community leaders and/or local leaders of the scope of the tool
c. Consensus process and call for participants prior to the application
d. Investigation of secondary sources
e. Interviews with key actors
f. Focus group discussion
g. Digitization of information
h. Building a community resilience report, and
i. Presentation of results.

Costs: The costs of the process in a NA project per community is $3,169.

Comments: The tool is a practical way to measure the disaster resilience at the community level using minimal resources for implementation. It is flexible and adaptable and can be applied in rural, urban and per-urban contexts, in both development and emergency situations. It increases the capacity of communities and the field staff in understanding resilience and taking actions to improve it.

New DRR Strategies: 3. Resilience Analysis for Social Systems (R4S)

Title: Resilience Analysis for Social Systems (R4S)

Description: The R4S includes analysis of context and selection of target population, analysis and selection of critical socioeconomic systems that contribute to the resilience of the target population, application of qualitative and quantitative information gathering techniques, field tours, system mapping, analysis of actors, analysis of risk scenarios, resilience analysis of systems based on determining factors for resilience, development of system maps and risk scenarios, validation workshops and / or presentation of results.

Location: Tegucigalpa, Honduras

Process: The R4S process includes:

a. Design and planning: This phase includes defining the target population, analyzing its context and selecting the critical socioeconomic system. It also includes the design, validation of the consultation instruments (be it a guide of questions for interviews, questionnaires, etc.) and the logistical preparation prior to the work in the field.
b. Field work: includes the field tours and quality control of the application of the different instruments to the key actors identified for the selected system.
c. Digitization and analysis of results
d. Preparation and delivery of reports: In addition to the report, this stage also includes the preparation of the final versions of all the maps of the system generated by the R4S (current system map, stakeholder participation map, risk scenario analysis map, ideal system map), the development of work days to validate the results with partners or participants in the research.
e. Presentation of the results: in an event or in workshops with the different participants in the research.

Costs: The costs of the process in a NA project per community is $37,964.

Comments: The R4S is an instrument developed by GOAL that is still in the validation process, so all the information provided is subject to adaptations and times have been estimated according to the limited experience of its application. In addition, the application time will depend firstly on the quantity and quality of the available information as well as the complexity or number of systems being investigated and secondly, the amount of resources available for its development.

New DRR Strategies: 4. Basic Basket Market System

Title: Basic Basket Market System

Description: This market system intervention model developed in Tegulcigalpa is designed to increase the resilience of livelihoods in neighborhoods with high disaster risks. Through the Pulpería-to-Pulpería intervention model (pulperías are grocery or convenience stores), a process was developed to strengthen the commercialization of the basic basket, since its supply of products and services are initial needs in the emergency response. Strengthening neighborhood stores reduces dependency on large markets and increases resilience to continue supplying basic foods locally, during an emergency. The pulperías are key actors in the social cohesion at the level of the neighborhoods and have the potential to provide the service of information.
For purposes of replication, it is expected to convert the experience of the pulpería-to-pulpería intervention model into a tool that will serve the technicians of business development centers, municipalities, academies, economic development associations and municipalities to promote disaster preparedness, response and recovery in communities through increased resilience of livelihoods.

Location: Tegucigalpa, Honduras

Process: The intervention model comprised the following steps:

a. Analysis of the market system of the basic basket
b. Identification of pulperías
c. Organization of the pulperías network
d. Discussion of joint problems and opportunities
e. Strengthening of capacities
f. Security plan
g. Small works of risk reduction to disaster
h. Seed capital
i. Preparation of sustainable business plan
j. Business diversification
k. Training and conformation of community savings and credit

Costs: The intervention model cost was $49,926.

Comments: The success of this model depends heavily on co-operation between pulperia owners in a particular neighborhood.

New DRR Strategies: 5. Provision and Maintenance of Drainage Systems

Title: Provision and Maintenance of Drainage Systems

Description: This intervention provided the essential process to promote institutional and local participation for the adequate provision and maintenance of drainage systems as a measure of risk reduction to disasters in developing neighborhoods. This was accomplished through a Technical Study of the hazard, execution of risk reduction works, and the strengthening of Water Management Boards.

Location: Tegucigalpa, Honduras

Process: The intervention followed two main phases:

1. Drainage works with the methodology of Projects Executed by the Community (PEC) involved:
    a. Technical studies that included a topographical study (LiDAR) study, geological survey. Hydrological study, and geophysical study
    b. Community training in PEC Methodology included: Project Execution Committee, Committee of Social Comptrollership, and Committee of Maintenance Works
    c. Explanation of the technical studies at the community level
    d. Design of Works and Budgets
    e. Construction of Works via implementation of Pec Methodology
2. Process of Strengthening a Business Model for the Water Management Boards. This included:
    a. Institutional Links
    b. Diagnoses of Water Management Boards
    c. Plan for the strengthening of Water Management Boards
    d. Implementation of Water Boosts Strengthening Plan
    e. Implementation of a Business Model
    f. Review of a plan for the implementation of the a business model
    g. Follow-up to drain cleaning and maintenance plan

Costs: The cost of the drainage systems built in Berlin, the area where 40 families were relocated was $110,528.

Comments: The Project Executing Committee (PEC) is in charge of the selection of labor, material selection, warehouse control, and socialization with the community. The Committee of the Social Comptroller is in charge of supervising the project, and keeping track of project logs. The Committee of the Cleaning and Maintenance Works ensures that the neighbors and the community use them well and routinely maintain each of the infrastructure works executed within the communities.

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ANNEX 5

Tools





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Tools
- Survey (Questionaire)
- Interview Guide for Government Officials
- Focus Group Guide
- Informed Consent

Survey DRCAP 2018

ID-1 Project identification:

[1] Lima-Rímac
[2] Lima-Independencia
[3] Lima-Carabayllo
[4] Medellín
[5] Mixco
[6] Port-de-Paix
[7] Portmore
[8] Tegucigalpa

ID-2 Community: ……

ID-3 Geographical Location: Latitude » ……

ID-4 Geographical Location: Longitude » ……

ID-5 Interviewer Name: ……

ID-6 Supervisor Name: ……

ID-7 Recorder Name: ……

ID-8 Date of Interview: ……

ID-9 Date of Review of Data: ……

QH-1 Are you the person who makes the largest contribution to your family's income? Are you the head of your household? (WAIT FOR ANSWER AND TICK ONLY ONE ALTERNATIVE)

[1] Yes (IS HEAD OF HOUSEHOLD) [2] No

QH-2 Gender of the interviewee (JUST WRITE DON'T ASK)

[1] Male [2] Female

QH-3 What is your age? (WRITE DOWN THE NUMBER OF YEARS)

……

If **QH-1** = No » Ask **QH-4** and **QH-5**

QH-4 Age of Head of Household (YEARS OLD)

……

QH-5 Sex of Head of Household

[1] Male [2] Female

QH-6 Language spoken at home

[1] Spanish
[2] English
[3] Creole
[4] French
[5] Local language

QH-7 Number of Total People in the Household (Take into account all household members. A household is defined as a group of people living under the same roof and sharing food, food expenses, and housework):

……

QH-8 How long have you been living in this neighborhood?

[1] Less than a year
[2] 1–3 years
[3] More than 3 years

QH-9 Where did you live before you came to this neighborhood?

[1] Rural area
[2] Town/Village/Small or intermediate (≤ to 500.000 inhabitants)
[3] Secondary city (500.001 to 1 million inhabitants)
[4] Medium-size city (1 million to 5 million inhabitants)
[5] Large city/Capital city/Metropolitan area (≥5 million inhabitants)

QH-10 Give the reason for the migration:

[1] Economic reason
[2] Violence or conflict
[3] Other (describe): ……

RV-1 Type of Housing

[1] House
[2] Department in a building
[3] Prefabricated house
[4] Hut
[5] Traditional indigenous house type
[6] Space within an old house/building

RV-2 Roofing

[1] Spanish tile roof
[2] Wood shingle
[3] Concrete slab roofs
[4] Zinc
[5] Fiber cement roofing
[6] Fiberglass shingle
[7] Corrugated Asphalt Roof
[8] Found material (plywood, metal, etc)
[9] Thatched roof

RV-3 Floor

[1] Parquet
[2] Ceramic
[3] Wood
[4] Carpet (wall to wall)
[5] Cement tile
[6] Plastic, vinyl
[7] Brick
[8] Soil cement
[9] Earthen floor

RV-4 Exterior walls

[1] Concrete, stone
[2] Brick
[3] Structural panels, blocks
[4] Wood
[5] Fiber cement
[6] Adobe
[7] Found material (plywood, metal, etc.)

DE-1 How many households or families live in this house?

[1] 1 household per house
[2] 2 to 4 households per house
[3] 5 to 7 households per house
[4] 8 or more households per house

DE-2 How many people in your house are between 0 and 14 years old?

……

DE-3 How many people in your house are between 15-64 years old?

……

DE-4 How many people in your house are 65 years and older?

……

DE-5 How many people in your house are visually impaired?

……

DE-6 How many people in your house have hearing impairment or are deaf?

……

DE-7 How many people in your house are physically disabled?

……

DE-8 How many people in your house have mental health impairment?

……

DE-9 How many people in your house don't have any formal education?

……

DE-10 How many people in your house have pre-basic education?

……

DE-11 How many people in your house have basic/primary education?

……

DE-12 How many people in your house have middle school/normal education?

……

DE-13 How many people in your house have middle school education with humanities?

……

DE-14 How many people in your house have middle school education with a specialty?

……

DE-15 How many people in your house have technical education?

……

DE-16 How many people in your house have education from a professional institute?

……

DE-17 How many people in your house have university education?

……

DE-18 Which of the following applies to you with regard to the house you live in? (READ ALL ALTERNATIVES, TICK ONLY ONE FOR EACH)

[1] Own House (fully paid)
[2] Own House (paying for term)
[3] Leased/Rented Property
[4] Housing Provided for work
[5] Free Housing

SC-1 Do you feel a (strong) sense of belonging to this neighborhood?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

If **SC-1** = Yes » Ask **SC-1a**

SC-1a The project contributed to an increased sense of belonging to this neighborhood

[1] Strongly Disagree
[2] Disagree
[3] Neither agree nor Disagree
[4] Agree
[5] Strongly Agree

SC-2 Does living in this neighborhood give you a sense of community?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

If **SC-2** = Yes » Ask **SC-2a**
SC-2a The project reinforced the sense of community among the members of the neighborhood

[1] Strongly Disagree

[2] Disagree

[3] Neither agree nor Disagree

[4] Agree

[5] Strongly Agree

SC-3 Are you generally willing to work together with others on something to improve your neighborhood?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

If **SC-3** = Yes » Ask **SC-3a**
SC-3a he project increased your willingness to work with other community members

[1] Strongly Disagree

[2] Disagree

[3] Neither agree nor Disagree

[4] Agree

[5] Strongly Agree

SC-4 Do you believe your neighbors would help each other during an emergency?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

If **SC-4** = Yes » Ask **SC-4a**
SC-4a The project increased the willingness for collaboration among neighbors during an emergency

[1] Strongly Disagree

[2] Disagree

[3] Neither agree nor Disagree

[4] Agree

[5] Strongly Agree

SC-5 Do you or a family member belong to a community organization? (e.g., parents organization in a school, neighborhood organization)

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

If **SC-5** = Yes » Ask **SC-5a**
SC-5a Please indicate which organizations:

[1] Organization 1 ……

[2] Organization 2 ……

[3] Organization 3 ……

[4] Organization 4 ……

[5] Organization 5 ……

R-1 Does your community have members trained in disaster management with knowledge about existing hazards, vulnerability, and risks in their neighborhood?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

If **R-1** = Yes » Ask **R-1a**
R-1a The project contributed to an increase in the number of community members with knowledge about existing hazards, vulnerability, and risks in their neighborhood

[1] Strongly Disagree

[2] Disagree

[3] Neither agree nor Disagree

[4] Agree

[5] Strongly Agree

R-2 Does your community have motivated members who support disaster risk management activities?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

If **R-2** = Yes » Ask **R-2a**
R-2a The project contributed to an increase in the motivation of community members who support disaster risk management activities

[1] Strongly Disagree

[2] Disagree

[3] Neither agree nor Disagree

[4] Agree

[5] Strongly Agree

R-3 Does your community have a functional Early Warning System (EWS) including drills and evacuation exercises?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

If **R-3** = Yes » Ask **R-3a**
R-3a The project contributed to developing or strengthening a functional Early Warning System (EWS) including drills and evacuation exercises

[1] Strongly Disagree

[2] Disagree

[3] Neither agree nor Disagree

[4] Agree

[5] Strongly Agree

R-4 Are community members involved in the emergency plan implementation?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

If **R-4** = Yes » Ask **R-4a**
R-4a The project contributed to an increase in the involvement of community members in the emergency plan implementation.

[1] Strongly Disagree

[2] Disagree

[3] Neither agree nor Disagree

[4] Agree

[5] Strongly Agree

R-5 Are community members involved in the maintenance of physical works built by the project?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

If **R-5** = Yes » Ask **R-5a**
R-5a The project contributed to an increase in the involvement of community members in the maintenance of physical works built by the project

[1] Strongly Disagree

[2] Disagree

[3] Neither agree nor Disagree

[4] Agree

[5] Strongly Agree

R-6 Are vulnerable groups (e.g., the elderly, people with disabilities) involved in the emergency plan implementation, and maintenance of physical works built by the project?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

If **R-6** = Yes » Ask **R-6a**
R-6a The project contributed to an increase in the involvement of vulnerable groups in the emergency plan implementation, and maintenance of physical works built by the project.

[1] Strongly Disagree

[2] Disagree

[3] Neither agree nor Disagree

[4] Agree

[5] Strongly Agree

R-7 Are women involved in the emergency plan implementation, and maintenance of physical works built by the project?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

If **R-7** = Yes » Ask **R-7a**
R-7a The project contributed to an increase in the involvement of women in the emergency plan implementation, and maintenance of physical works

[1] Strongly Disagree

[2] Disagree

[3] Neither agree nor Disagree

[4] Agree

[5] Strongly Agree

R-8 The project contributed to more physical works built in the community after this project ended. (IF THERE IS NO ANSWER REPLY **R-8A**)
[1] Strongly Disagree
[2] Disagree
[3] Neither agree nor Disagree
[4] Agree
[5] Strongly Agree

R-8a (DO NOT READ)

[1] DO NOT KNOW (DNK) [2] DO NOT ANSWER (DNA)

R-9 The project contributed to strengthening the community by better preparing it to face different disaster risks. (ONLY IF THERE IS NO ANSWER HERE TICK 'DNK' OR 'DNA' IN **R-9A**)

[1] Strongly Disagree

[2] Disagree

[3] Neither agree nor Disagree

[4] Agree

[5] Strongly Agree

R-9a (DO NOT READ)

[1] DO NOT KNOW (DNK) [2] DO NOT ANSWER (DNA)

L-1 Do you have a (proper) land title for your home?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

L-2 Is your home registered at the municipal cadastral?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

L-3 Does your home comply with building regulations?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

PS-1 Could you tell me if you have drinking water line/pipe in your house?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

If **PS-1** = No » Ask **PS-1a**

PS-1a Indicate which of the following is applicable to your home

[1] Household connection (piped water into dwelling/yard/plot)

[2] Public tap or standpipe [5] Protected spring

[3] Tubewell or Borehole [6] Rainwater collection

[4] Protected dug well [7] None of the above

If **PS-1a** = None of the above » Ask **PS-1b**

PS-1b Indicate which of the following is applicable to your home

[1] Unprotected dug well [4] Vendor-provided water

[2] Unprotected spring [5] Bottled water

[3] Surface water (Rivers, ponds) [6] Tanker truck water

PS-2 Could you tell me if you have indoor bathroom/toilet/WC in your house?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

If **PS-2** = Yes » Ask **PS-2a**

PS-2a Indicate which of the following is applicable to your home

[1] Connection to public sewer [4] Simple pit latrine

[2] Connection to septic system [5] Ventilated improved pit latrine

[3] Pour flush latrine

If **PS-2** = No » Ask **PS-2a**

PS-2b Indicate which of the following is applicable to your home

[1] Shared facility of any type [2] No facilities, bush or field

PS-3 Does your home have electricity?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

If **PS-3** = Yes » Ask **PS-3a**

PS-3a Please indicate which of the following is applicable to your home

[1] On the grid, legal [3] Off the grid, generator

[2] On the grid, illegal [4] Off the grid, solar

PO-1 What is the surface area of your house? (Estimation in square meters)

……

PE-1 Do you usually observe garbage in the street, sidewalk, park, or other public areas in your neighborhood?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

PE-2 Do you usually observe raw sewage runoff in your neighborhood?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

PE-3 Is your community exposed to natural hazards?(You can mention the following for examples: Landslides, floods, strong winds, tropical storms, earthquakes, drought)

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

If **PE-3** = Yes » Ask **PE-3a**

PE-3a Indicate which of the following (CAN TICK MORE THAN ONE)

[1] Landslides [5] Earthquakes

[2] Floods [6] Droughts

[3] Strong winds [7] Other (name them)……

[4] Tropical storms

PE-4 Is your community exposed to human-induced hazards?(e.g., Pollution, hazardous materials, mining, gangs, internal conflict)

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

If **PE-4** = Yes » Ask **PE-4a**

PE-4a Indicate which of the following (CAN TICK MORE THAN ONE)

[1] Pollution [4] Gangs

[2] Hazardous material [5] Internal conflict

[3] Mining [6] Other (please describe)……

SA-1 Do members in your community have access to local hospitals?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

SA-2 Do members in your community have access to medical care?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

SA-3 Do children in your community have access to primary education?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

SA-4 Did you participate in cultural activities in the past 12 months?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

If **SA-4** = Yes » Ask **SA-4a**

SA-4a How many times?

[1] 1-2 times [2] 3-5 times [3] More than 5 times

[Head] Do you have access to the following within walking distance of your home?

SI-1 Groceries

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

SI-2 Toiletries

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

SI-3 Household items other than groceries or toiletries(E.g., kitchen and other domestic appliances, furniture, etc.)

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

SI-4 School supplies

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

SM-1 Have you or anyone in your household been badly treated by public agencies (e.g. municipality offices, police, schools) in the last year?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

If **SM-1** = Yes » Ask **SM-1a**

SM-1a Please describe (OPEN ANSWER IN ONE LINE)

……

SM-2 Have you or anyone in your household been refused service by commercial organizations (e.g., grocery stores, banks, drugstore, hardware store) in the last year?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

SV-1 Have you or anyone in your household experienced at least one act of violence in the last year in the neighborhood?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

SV-2 Are you aware of any illegal activities (drug dealing/trafficking weapons/thievery) taking place in your neighborhood in the last year?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

If **SV-2** = Yes » Ask **SV-2a**

SV-2a Please indicate which (CAN TICK MORE THAN ONE)

[1] Drug dealing [3] Stolen property

[2] Trafficking weapons [4] Others (please describe)……

Q-1 Generally speaking, would you say you are satisfied with your life? Would you say you are....? (READ ALTERNATIVES AND TICK ONLY ONE)

[1] Very satisfied [5] (DON'T READ) DNK/DNA

[2] Quite satisfied

[3] Not very satisfied

[4] Not at all satisfied

A-1 We would like to learn what activities you typically do, and how much time you dedicate to them. E.g. going to work, taking the kids to the school, washing, cooking, visiting friends or family, etc. Please list the activities and time dedicated (Average time in hours and quarters of hours, e.g., 3:15)

Activity	Hours	Minutes
1		
2		
3		
4		
5		

I-1 How has the project/intervention affected your activities? (READ ALTERNATIVES ABOVE AND TICK ONLY ONE)

	Effect		
	It had a **positive** effect	It **did not have** any effect	It had a **negative** effect
Activity 1			
Activity 2			
Activity 3			
Activity 4			
Activity 5			

[Head] You said you are <READ **Q-1**> with your life now.
I-2 What would your life satisfaction level be if the project/intervention had NOT been carried out?

[1] Very satisfied
[2] Quite satisfied
[3] Not very satisfied
[4] Not at all satisfied
[5] (DON'T READ) DNK/DNA

D-1 Now, we would like you to think about how your community is exposed to natural hazards. From the following list, identify the hazards which affect your community and their frequency. (READ ALTERNATIVES AND TICK ONLY ONE)

	Very frequent (annually)	Sometimes (every 2-3 years)	Not very frequent (more than 3 years)	(DON'T READ) DNK/DNA
Landslides				
Floods				
Strong winds				
Tropical storms				
Earthquakes				
Droughts				
Others :				

D-2 Could you say that you are safer today thanks to the project/ intervention?

[1] Yes [2] No [3] (DO NOT READ) DNK/DNA

[Head] You said you are <READ **Q-1**> with your life now.
D-3 What was your life satisfaction level BEFORE the project/intervention?

[1] Very satisfied
[2] Quite satisfied
[3] Not very satisfied
[4] Not at all satisfied
[5] (DON'T READ) DNK/DNA

G-1 In the last 12 months, how often have you or your family not had enough to eat? (READ ALTERNATIVES AND TICK ONLY ONE)

[1] Never
[2] Rarely
[3] Sometimes
[4] Often
[5](DON'T READ) DNK
[6](DON'T READ) DNA

G-2 How do you usually cover your health expenses? (WAIT FOR ANSWER AND WRITE DOWN ONLY ONE ALTERNATIVE)

[1] Private insurance
[2] State insurance
[3] Both
[4] Don't have insurance
[5](DON'T READ) DNK/DNA

G-3 Does the salary you receive and your total family income allow you to cover your needs in a satisfactory manner? Which of the following statements describes your situation? (READ THE ALTERNATIVES AND TICK ONLY ONE)

[1] It's sufficient and we can save
[2] It's just sufficient and we don't have major problems
[3] It's not sufficient and we have problems
[4] It's not sufficient and we have major problems
[5] (DON'T READ) DNK
[6] (DON'T READ) DNA

G-4 In a regular month, what is the total family income? Consider all sources of income that all family members receive in a regular month (WRITE DOWN THE AMOUNT IN LOCAL CURRENCY. REPORT THE CURRENCY AND CONFIRM THIS IS A MONTHLY INCOME)

……

G-5 What is your native language? (READ ALTERNATIVES, TICK ONE)

[1] Spanish
[2] Portuguese
[3] Indigenous language/Indian
[4] Other

G-6 What is your marital status? (READ ALTERNATIVES, TICK ONE)

[1] Married/living with partner
[2] Single
[3] Separated/divorced/widowed
[4](DON'T READ) DNK/DNA

G-7 What level of education do you have? What was the last year you completed? (INTERVIEWER, WRITE DOWN ALL THE PERSON SAYS AND PROMPT) What sort of technical school, what sort of institute, etc.? (WRITE DOWN YEAR)

Notes: ……
Year: ……

G-8 What is your current employment situation? (READ THE ALTERNATIVES AND TICK ONE ANSWER.

[1] Self-employed
[2] Salaried employee in a state company
[3] Salaried employee in a private company
[4] Temporarily out of work
[5] Retired/pensioner
[6] Don't work/responsible for shopping and housework
[7] Student

G-9 What ethnicity or race do you identify best with? (WAIT FOR ANSWER AND TICK ONLY ONE)

[1] Asian
[2] Black
[3] Indigenous
[4] Mestizo
[5] Mulatto
[6] White
[7] Other race
[8] (DON'T READ) DNK
[9] (DON'T READ) DNA

G-10 Do you or any member of your family have any of the following goods? (READ EACH ONE OF THE GOODS AND TICK AN ANSWER FOR EACH)

	Yes	No	(DON'T READ) DNA
House in which the parents have a separate bedroom from the children			
Own house			
Computer			
Tablet /Laptop			
Washing machine			
Fixed telephone			
Mobile phone			
Smartphone			
Car			
Hot water			
Sewage system			
At least one meal a day			

Interview Guide for Government Officials (local or national)

1) Introduction by the research team
2) Explain the purpose of this interview and its content
3) Ask for the general data of the person interviewed:

Organization	
Name of person interviewed:	
Position	
Date & Start & end of interview:	
Names of Interviewers:	
Place:	

1) Effectiveness: *Level of Community Disaster Hazard Risk reduction*

a. To what extent has the project contributed to reducing community disaster hazard risks in targeted urban communities? E.g., what changed and how? Ask for changes regarding vulnerability (social, economic, physical, environmental, political, etc.) and per category of intervention: Physical Works Maintenance; Social Mobilization Gains; Environmental improvements; Institutional Arrangements; Livelihoods and Financial Mechanisms; DRR intervention.

Most and least effective aspects:

Comparison to traditional DRR approache:

Influencing factors:

Other questions on effectiveness

b. To what extent did X or Y intervention in the NA influence a change in the relationship between the community and the municipality / institution?

2) Sustainability: *Appraisal of sustainability per intervention*

Will the interventions implemented by the project be maintained over time once the project is completed?

Institutional ownership

Enabling and impeding factors of success

Other questions on sustainability

- How did you continue after the project ended? Which interventions continued, which did not and why?

3) Lessons learned and recommendations

a. What have been the main successes / best practices in the project? (in general and per category of intervention)
b. And the main challenges? (in general and per category of intervention)
c. What areas need improvement / adaptation? (in general and per category of intervention)
d. If you could do the project over again, what would you do differently? What would you do exactly the same? (in general and per category of intervention)
e. What other methods or strategies would you propose to achieve more or better results?

Wrap up:

- Thank the respondent and inform him/her about possible feedback of results / follow up steps.

Observations from the interviewer:

Please fill in below any observations you have regarding the development of this interview, which might have influenced the responses of the respondent(s). Please note down which answers you think might be less valid because of this and why.

Focus Group
Relevant changes (Effectiveness and Sustainability)

By conducting a focus group, it would be possible to understand relevant changes in participants' quality of life, their vulnerabilities (social, economic, environmental, physical, and political, among others), level of knowledge and awareness on urban risks and DRR, and the impacts of projects/interventions on targeted communities.

Procedure:

1. Participants are asked to use cards to write down what changes they have noted resulting from the project/interventions, in terms of:
    a. Acquired knowledge, capacities, empowerment development (e.g., what they have learnt)
    b. Vulnerability: asking specifically on house/plot conditions, income sources, access to healthy food
    c. At the community level: have you noted any reduction of risks or noted that your community is safer with respect to natural hazards?
2. Together in group and using a sheet of flipchart paper, the cards are revised and displayed according to similar topics/areas. This is a participatory process, so cards and topics can be discussed.
3. In group some questions are posed:
    a. How have you utilized what have you learnt (from the project)?
    b. How do you think we can keep (or even improve) the project's benefits/results?
    c. What are the main difficulties to maintain such results? (sustainability)
    d. What aspects of the project did not succeed? What went wrong? Give reasons.

Matrix/layout generated during the group session:

Possible changes following the project/intervention

	EFFECTIVENESS	**SUSTAINABILITY**
Level / Area	**Explanation on the detected change or the lack of it: how it was achieved or why it did not work**	**Has the change been maintained in time? Why? What factors have influenced this?**
Individual level		
Material/physical aspects, works/improvements at home (housing retrofitting, latrines/sewage, water)		
Capacity building and strengthening		
Role/position within the community, empowerment		
Access to market and income sources		
Other issues/needs at personal/family levels		
Community level		
Material/physical aspects at the community public space (WASH, drainage, retaining walls, among others)		
Community organization and relation/position to municipal authorities		
Participation of men and women, youth, vulnerable social groups		
Environmental aspects (e.g. garbage disposal, toxic activities)		
Emergency plans and preparedness (Early Warning Systems)		
Other issues/needs of the community		

Remarking questions:

1) What capacities/skills and resources are needed to maintain or improve the detected practices in the future? Not only financial but training, knowledge, willingness, planning, among others.

2) If you could do things different, what would you change? Why? Or formulated in other words: If other community/neighborhood would like to replicate your experience here, what would you recommend them to do and what would you recommend to avoid/change? And why?

INFORMED CONSENT TO PARTICIPATE IN A RESEARCH STUDY

USAID/OFDA Performance Evaluation: LAC Urban DRR Programming

Good morning, my name is Juan Pablo Sarmiento, and I am the Principal Investigator of the study on "USAID/OFDA Performance Evaluation: LAC Urban DRR Programming". The co-investigators of this study are Vicente Sandoval and Marije van Lidth de Jeude. You have been selected to participate in a research study on Urban DRR Programming. The purpose of this study is to evaluate the effectiveness and sustainability of eight disaster risk reduction (DRR) interventions that were implemented using the Neighborhood Approach (NA) in six Latin American and Caribbean (LAC) countries (Colombia, Guatemala, Haiti, Honduras, Jamaica, and Peru) by the USAID/OFDA. The study will also review the implementing strategy of the USAID/OFDA in the LAC region from 2012 to 2016. The findings will inform future programming decisions and adjustments to ongoing USAID/OFDA urban DRR programming, adding to the evidence base of the NA as a DRR tool.

If you decide to participate in this study, you will be one of 40 government officials and key stakeholders who will be interviewed for this study. You have been selected because of your official position in the local/national level governance of the neighborhood in which USAID/OFDA's urban DRR project was implemented, and your experience with the NA as a DRR tool during this time. Your expertise is highly appreciated and will help inform future policy decisions and adjustments to ongoing USAID/OFDA urban DRR programming in the LAC region and globally. It is expected that future USAID/OFDA urban DRR projects that reach out to other neighborhoods across the LAC region will benefit from more effective and more sustainable projects.

This interview will take between 45 minutes and one hour of your time. If you agree to be in this study, you are expected to respond to the questions. You may withdraw and discontinue participation at any time without penalty. If you have questions while taking part in our study, please stop me at any time and ask. If you feel uncomfortable in any way with any question, please feel free to decline to answer that question or end the interview.

There are no foreseeable risks or benefits to you for participating in this study. There is no cost or payment to you for participating in this study.

You will remain anonymous throughout the research process. We will not include any information that will make it possible to identify you as a subject in any sort of report we might publish about this research. Research records will be stored securely and only the research team and sponsor agencies (United States Agency for International Development) will have access to the records.

If you have any questions for one of the researchers conducting this study, you may contact Juan Pablo Sarmiento at +1(305)348-0346. If you would like to talk with someone about your rights of being a subject in this research study or about ethical issues with this research study, you may contact the FIU Office of Research Integrity by phone at 305-348-2494 or by email at ori@fiu.edu.

Your participation in this research is voluntary and you will not be penalized or lose benefits if you refuse to participate or decide to stop. Do you consent to participate in this project?

INFORMED CONSENT TO PARTICIPATE IN A RESEARCH STUDY

USAID/OFDA Performance Evaluation: LAC Urban DRR Programming

Good morning, my name is Juan Pablo Sarmiento, and I am the Principal Investigator of the study on "USAID/OFDA Performance Evaluation: LAC Urban DRR Programming". The co-investigators of this study are Vicente Sandoval and Marije van Lidth de Jeude. You have been selected to participate in a research study on Urban DRR Programming. The purpose of this study is to evaluate eight disaster risk reduction (DRR) interventions that were implemented by the USAID/OFDA in six countries: Colombia, Guatemala, Haiti, Honduras, Jamaica, and Peru. The findings of this study will inform future decisions of ongoing USAID/OFDA urban DRR programming. It is expected that future USAID/OFDA urban DRR projects that reach out to other neighborhoods across the LAC region will benefit from more effective and more sustainable projects.

If you decide to participate in this study, you will be one of 320 household heads who will be surveyed in six countries. The participation will take between 45 minutes and one hour of your time.

If you agree to participate in this study, you are expected to respond to the questions. You may withdraw and discontinue participation at any time without penalty. If you have questions while taking part in our study, please stop me at any time and ask. If you feel uncomfortable in any way with any question, please feel free to decline to answer that question or end the survey.

There are no foreseeable risks or benefits to you for participating in this study. There is no cost or payment to you for participating in this study.

You will remain anonymous throughout the research process. We will not include any information that will make it possible to identify you as a subject in any sort of report we might publish about this research. Research records will be stored securely and only the research team and sponsor agencies (United States Agency for International Development) will have access to the records.

If you have any questions for one of the researchers conducting this study, you may contact Juan Pablo Sarmiento at +1(305)348-0346. If you would like to talk with someone about your rights of being a subject in this research study or about ethical issues with this research study, you may contact the FIU Office of Research Integrity by phone at 305-348-2494 or by email at ori@fiu.edu.

Your participation in this research is voluntary and you will not be penalized or lose benefits if you refuse to participate or decide to stop. Do you consent to participate in this project?

INFORMED CONSENT TO PARTICIPATE IN A RESEARCH STUDY

USAID/OFDA Performance Evaluation: LAC Urban DRR Programming

Good morning, my name is Juan Pablo Sarmiento, and I am the Principal Investigator of the study on "USAID/OFDA Performance Evaluation: LAC Urban DRR Programming". The co-investigators of this study are Vicente Sandoval and Marije van Lidth de Jeude. You have been selected to participate in a research study of Urban DRR Programming. The purpose of this study is to evaluate eight disaster risk reduction (DRR) interventions that were implemented by the USAID/OFDA in six Latin American and Caribbean (LAC) countries: Colombia, Guatemala, Haiti, Honduras, Jamaica, and Peru. The findings will inform future decisions of ongoing USAID/OFDA urban DRR programming. It is expected that future USAID/OFDA urban DRR projects that reach out to other neighborhoods across the LAC region will benefit from more effective and more sustainable projects.

If you decide to participate in this study, you will be one of 80 community members across six countries who will be asked to participate in focus group studies for this research project. The participation will take approximately one hour of your time.

If you agree to be in this study, you are expected to respond to the questions. You may withdraw and discontinue participation at any time without penalty. If you have questions while taking part in our study, please stop me at any time and ask. If you feel uncomfortable in any way with any question, please feel free to decline to answer that question or end your participation.

There are no foreseeable risks or benefits to you for participating in this study. There is no cost or payment to you for participating in this study.

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Performance Evaluation:
LAC Urban DRR Programming
The Neighborhood Approach

ANNEX 6

List of Respondents





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List of Respondents
- Interviewing participants summary
- Interviewing participants list (Coded)

Interviewing participants summary

from November 6th 2017 to March 9th 2018 (5 months)

Sex/Gender	Count	Percentage
Male	62	59.0%
Female	43	41.0%
Hierarchical/Geographical level		
National officials	31	29.5%
Municipal officials	29	27.6%
Partner (Private, Academia, etc)	20	19.0%
Implementers (NGOs)	24	22.9%
Community leader	1	1.0%

Interviewing participants list

Identification	Sex/Gender	Code for the code-book	Role	Institution/Organization	Project related	Place of interview	Rec.	Date of interview
Implementer 02	Female	PPR02	Consultant	PREDES	Independencia	PREDES offices	YES	November 6, 2017
Implementer 01	Male	PPR01	Board member	PREDES	Independencia	PREDES offices	YES	November 6, 2017
Implementer 03	Male	PPR03	Geological engineer	PREDES	Independencia	PREDES offices	YES	November 6, 2017
Implementer 04	Male	PPR04	Project coordinator	PREDES	Independencia	PREDES offices	YES	November 6, 2017
National official 03	Female	PSB01	Lawyer	SBN	Independencia	SBN offices	NO	November 7, 2017
National official 04	Female	PSB02	Architect/landscape expert	SBN	Independencia	SBN offices	NO	November 7, 2017
National official 02	Male	PMV02	Director	Programa nuestras ciudades, MinVi	Independencia, Carabayllo	MVCS offices	YES	November 7, 2017
National official 05	Male	PCF01	National director	COFOPRI	Independencia, Carabayllo, Rímac	COFOPRI offices	YES	November 7, 2017
National official 01	Female	PMV01	Coordinator	Depto. Política y Regulacion, MinVi	Rímac	MVCS offices	YES	November 7, 2017
National official 08	Male	PCE03	Sub-director Políticas y Planes	CENEPRED	Carabayllo	CENEPRED office	YES	November 8, 2017
National official 07	Female	PCE02	Dir. Dev. & Tech. Assistance	CENEPRED	Carabayllo, Rímac	CENEPRED office	YES	November 8, 2017
Municipal officer 01	Male	PIN01	Manager of the Environ. Area	Independencia municipality	Independencia	Mancomunidad office	YES	November 8, 2017
Municipal officer 02	Male	PMA01	Manager of DRM	Mancomunidad Lima Norte	Independencia	Mancomunidad office	YES	November 8, 2017
Municipal officer 03	Male	PMA02	Manager of Dev. transfers	Mancomunidad Lima Norte	Independencia	Mancomunidad office	YES	November 8, 2017
National official 06	Male	PCE01	GIS	CENEPRED	Rímac	CENEPRED office	YES	November 8, 2017

Implementer 05	Female	PCA01	Researcher & project impl.	CARE	Rímac	COOPI offices, Perú	YES	November 9, 2017
Implementer 06	Female	PCO01	Project manager	COOPI	Rímac	COOPI offices, Perú	YES	November 9, 2017
Implementer 07	Female	PCO02	Implementor	COOPI	Rímac	COOPI offices, Perú	YES	November 9, 2017
Implementer 09	Female	PIR01	Implementor	IRD	Rímac	COOPI offices, Perú	YES	November 9, 2017
Municipal officer 04	Female	PRI01	Sub-manager of Civil Defense	Rímac Municipality	Rímac	Municipal office	YES	November 9, 2017
Implementer 08	Male	PCO03	GIS implementor	COOPI	Rímac	COOPI offices, Perú	YES	November 9, 2017
Implementer 10	Male	PCA02	Implementor	CARE	Rímac	COOPI offices, Perú	YES	November 9, 2017
National official 10	Female	PID02	Dir. Desarrollo y Capacitaciones	INDECI	Independencia, Carabayllo	INDECI office	YES	November 10, 2017
National official 09	Male	PID01	Dir. of Inter. Cooperation	INDECI	Independencia, Carabayllo, Rímac	INDECI office	YES	November 10, 2017
Implementer 12	Female	PSC02	Project participant	Save the Children	Carabayllo	Online	YES	November 28, 2017
Implementer 11	Male	PSC01	Project participant	Save the Children	Carabayllo	Online	YES	November 28, 2017
Municipal officer 10	Male	HPP01	Municipal Civil Protection	Anse-à-Foleur Municipality	Haití (Anse-à-Foleur)	Church/shelter intervention	NO	December 5, 2017
Implementer 16	Male	HWC01	Project participant	WCDO	Haití (Port-de-Paix)	ME office	NO	December 7, 2017
National official 11	Male	HCP01	Director, Emergency Operation Center, Nord Quest region	Directorate for Civil Protection (DPC)	Haití (Port-de-Paix)	DPC office	YES	December 7, 2017
National official 12	Male	HME01	Regional director	Ministry of Environment	Haití (Port-de-Paix)	ME office	YES	December 7, 2017
Community leader 01	Female	PCI01	Voluntary leader of WASH	Vecinos de Villa el Ángel	Independencia	PREDES office	YES	December 11, 2017
Municipal officer 07	Female	PIN04	Manager of Urban Development	Independencia municipality	Independencia	Municipal office	YES	December 11, 2017
Municipal officer 05	Male	PIN02	Manager of Investment and cooperation	Independencia municipality	Independencia	Municipal office	YES	December 11, 2017
Municipal officer 06	Male	PIN03	General Manager	Independencia municipality	Independencia	Municipal office	YES	December 11, 2017
Municipal officer 08	Female	PCR01	Dir. of Business and Tourism	Carabayllo municipality	Carabayllo	Municipal office	YES	December 14, 2017
Municipal officer 09	Male	PCR02	Dir. of Community Participation	Carabayllo municipality	Carabayllo	Municipal office	YES	December 14, 2017
Municipal officer 10	Male	PCR03	Municipal manager	Carabayllo municipality	Carabayllo	Municipal office	YES	December 14, 2017
Municipal officer 11	Male	PCR04	Sub-director of DRR	Carabayllo municipality	Carabayllo	Municipal office	YES	December 14, 2017
Municipal officer 12	Male	PRI02	Sub-director of Environment	Rímac Municipality	Rímac	Municipal office	YES	December 15, 2017
National official 21	Female	CUN01	Assistant Director	UNGRD	Medellín	UNGRD office	YES	January 5, 2018
Partner 04	Female	CUP01	Academic	Escuela de Cs. de la Salud, UPB	Medellín	UPB office	YES	January 6, 2018
National official 22	Male	CDA01	Sub-director	DAGRD	Medellín	DAGRD office	YES	January 6, 2018
Partner 05	Female	CCA01	Manager	Corporación Ayuda Humanitaria (CAH)	Medellín	CAH office	YES	January 7, 2018
Partner 06	Female	CCA02	Director (CEO)	Corporación Ayuda Humanitaria (CAH)	Medellín	CAH office	YES	January 7, 2018
Partner 07	Female	CCA03	DRM coordinator	Corporación Ayuda Humanitaria (CAH)	Medellín	CAH office	YES	January 7, 2018

Partner 08	Female	CCA04	Manager	Corporación Ayuda Humanitaria (CAH)	Medellín	CAH office	YES	January 7, 2018
Partner 09	Female	CFE01	Coordinator	FENALCO Antioquia	Medellín	FENALCO office	YES	January 7, 2018
Partner 10	Female	CFE02	Director	FENALCO Antioquia	Medellín	FENALCO office	YES	January 7, 2018
Implementer 18	Male	CGC02	Project participant	Global Communities	Medellín	FENALCO office	YES	January 7, 2018
Partner 11	Male	CFE03	Project manager	FENALCO Antioquia	Medellín	FENALCO office	YES	January 7, 2018
Implementer 17	Male	CGC01	Country director	Global Communities	Medellín	Telephone	YES	January 9, 2018
National official 15	Female	GCO03	Assistant Director of Cooperation	CONRED	Mixco	CONRED office	YES	January 12, 2018
Partner 01	Female	GMI01	Local coordinator	MICOOPE	Mixco	PCI office	YES	January 12, 2018
National official 13	Male	GCO01	Sub-director Mitigation	CONRED	Mixco	CONRED office	YES	January 12, 2018
National official 14	Male	GCO02	Sub-director Región 1	CONRED-CORRED	Mixco	CONRED office	YES	January 12, 2018
National official 16	Male	GCO04	Sub-secretary	CONRED	Mixco	CONRED office	YES	January 12, 2018
National official 18	Male	GSE01	Sub-secretary	SEGEPLAN	Mixco	SEGEPLAN office	YES	January 12, 2018
National official 20	Male	GMC01	Vice-minister	Ministry of Communication, Infrastructure and Housing	Mixco	PCI office	YES	January 12, 2018
Municipal officer 13	Male	GMM01	Director of COMRED	Municipality of Mixco	Mixco	Mixco municipality office	YES	January 15, 2018
Municipal officer 14	Male	GMM02	Coordinator of Survey service	Municipality of Mixco	Mixco	Mixco municipality office	YES	January 15, 2018
Partner 02	Male	GCE01	Director of social projects	CEMPRO	Mixco	PCI office	YES	January 15, 2018
Implementer 13	Female	GPC01	Director	PCI	Mixco	PCI office	YES	January 16, 2018
Implementer 15	Female	GPC03	Project participant	PCI	Mixco	PCI office	YES	January 16, 2018
National official 17	Female	GIN01	Cartography	IGN	Mixco	IGN office	YES	January 16, 2018
Implementer 14	Male	GPC02	Project manager	PCI	Mixco	PCI office	YES	January 16, 2018
Municipal officer 15	Male	GMA01	General Manager	Mancomunidad Gran Ciudad del Sur	Mixco	Mancomunidad office	YES	January 16, 2018
National official 19	Male	GIN02	Sub-director	IGN	Mixco	IGN office	YES	January 16, 2018
Partner 03	Male	GAM01	Manager	Mexichen-Amanco	Mixco	PCI office	YES	January 16, 2018
Implementer 20	Male	JHA02	Neighborhood coordinator	Habitat for Humanity	Portmore	Habitat office	NO	February 19, 2018
Municipal officer 17	Female	JPM02	DRM coordinator	Portmore Municipality	Portmore	Portmore Municipality office	NO	February 21, 2018
Implementer 19	Male	JHA01	Country director	Habitat for Humanity	Portmore	Habitat office	NO	February 21, 2018
Municipal officer 16	Male	JPM01	Municipal Councilor	Portmore Municipality	Portmore	Habitat office	YES	February 21, 2018
Implementer 21	Female	JHA03	GIS specialist	Habitat for Humanity	Portmore	Habitat office	YES	February 22, 2018
Implementer 22	Female	JHA04	Land tenure specialist	Habitat for Humanity	Portmore	Habitat office	YES	February 22, 2018
National official 23	Female	JLA01	Chief Technical Director	LAMP	Portmore	LAMP office	YES	February 22, 2018
Partner 12	Female	JUT01	Director Urban Planning	UTECH	Portmore	UTECH office	YES	February 22, 2018
Implementer 24	Female	TGO02	Project coordinator	GOAL	Tegucigalpa	GOAL office	NO	March 7, 2018
National official 24	Female	TCO01	Director of Prevention	COPECO	Tegucigalpa	COPECO office	YES	March 7, 2018

National official 28	Female	TCO05	Meteorologist	COPECO	Tegucigalpa	COPECO office	YES	March 7, 2018
Implementer 23	Male	TGO01	Regional director	GOAL	Tegucigalpa	GOAL office	NO	March 7, 2018
National official 25	Male	TCO02	GIS specialist	COPECO	Tegucigalpa	COPECO office	YES	March 7, 2018
National official 26	Male	TCO03	SAT Unit Director	COPECO	Tegucigalpa	COPECO office	YES	March 7, 2018
National official 27	Male	TCO04	Meteorologist	COPECO	Tegucigalpa	COPECO office	YES	March 7, 2018
National official 29	Male	TCO06	EM Sub-commissioned for Tegucigalpa	COPECO	Tegucigalpa	COPECO office	YES	March 7, 2018
National official 30	Female	TCN01	Former director	CONVIVIENDA	Tegucigalpa	GOAL office	NO	March 8, 2018
Partner 13	Male	TUN01	Coordinator of Geological studies	IHCIT-UNAH	Tegucigalpa	IHCIT-UNAH office	YES	March 8, 2018
Partner 14	Male	TUN02	Geologist	IHCIT-UNAH	Tegucigalpa	IHCIT-UNAH office	YES	March 8, 2018
Partner 15	Male	TGE01	Director of Studies	GeoConsult	Tegucigalpa	GeoConsult office	NO	March 8, 2018
Partner 16	Male	TBO01	National Director	National Fire Brigade of Honduras	Tegucigalpa	NFBH office	NO	March 8, 2018
Partner 17	Male	TUN03	Public affairs	UNAH	Tegucigalpa	GOAL office	YES	March 8, 2018
Partner 18	Male	TUI01	Department of Engineering and Architecture	UNITEC	Tegucigalpa	GOAL office	YES	March 8, 2018
Partner 19	Male	TUC01	Director of Laboratory for Engineering	UNICAH	Tegucigalpa	GOAL office	YES	March 8, 2018
National official 31	Male	TCN02	Coordinator	CONVIVIENDA	Tegucigalpa	GOAL office	NO	March 8, 2018
Partner 20	Male	TPP01	Private developer	Private Developer Company	Tegucigalpa	GOAL office	NO	March 8, 2018
Municipal officer 18	Female	TAM01	Land Management Director	AMDC (Municipality of Tegucigalpa)	Tegucigalpa	AMDC office	YES	March 9, 2018
Municipal officer 20	Female	TAM03	Director of Community Management and Human Development	AMDC (Municipality of Tegucigalpa)	Tegucigalpa	AMDC office	YES	March 9, 2018
Municipal officer 21	Female	TAM04	GER specialist	AMDC (Municipality of Tegucigalpa)	Tegucigalpa	AMDC office	YES	March 9, 2018
Municipal officer 24	Female	TAM07	ERSAPS specialists	ERSAPS	Tegucigalpa	AMDC office	YES	March 9, 2018
Municipal officer 25	Female	TAM08	ERSAPS specialists	ERSAPS	Tegucigalpa	AMDC office	YES	March 9, 2018
Municipal officer 28	Female	TAM11	IDEM manager	AMDC (Municipality of Tegucigalpa)	Tegucigalpa	AMDC office	NO	March 9, 2018
Municipal officer 19	Male	TAM02	Land Management specialist	AMDC (Municipality of Tegucigalpa)	Tegucigalpa	AMDC office	YES	March 9, 2018
Municipal officer 22	Male	TAM05	UMGIR director	AMDC (Municipality of Tegucigalpa)	Tegucigalpa	AMDC office	YES	March 9, 2018
Municipal officer 23	Male	TAM06	UGASAM director	AMDC (Municipality of Tegucigalpa)	Tegucigalpa	AMDC office	YES	March 9, 2018
Municipal officer 26	Male	TAM09	AJASAFRAM director	AJASAFRAM	Tegucigalpa	AMDC office	YES	March 9, 2018
Municipal officer 27	Male	TAM10	CODEM director	AMDC (Municipality of Tegucigalpa)	Tegucigalpa	AMDC office	NO	March 9, 2018