ADAPTATION FUND

REGIONAL PROJECT/PROGRAMME PROPOSAL

PART I: PROJECT/PROGRAMME INFORMATION

Title of Project/Programme:	Reducing climate vulnerability and flood risk in coastal urban and semi urban areas in cities in Latin America
Countries:	Chile and Ecuador
Thematic Focal Area[1]:	Disaster risk reduction and early warning systems
Type of Implementing Entity:	Regional Implementing Entity (RIE)
Implementing Entity:	CAF, Development bank of Latin America
Executing Entities:	Ministry of the Environment (Chile) Ministry of the Environment (Ecuador)
Amount of Financing Requested:	13.910.400 (in U.S Dollars Equivalent)

[1] Thematic areas are: Food security; Disaster risk reduction and early warning systems; Transboundary water management; Innovation in adaptation finance.

Tabla de contenido

Reducing climate vulnerability and flood risk in coastal urban and semi urban areas in cities in Latin America

Chile and Ecuador

Project Background and Context:

1. Weather-related disasters have a major impact worldwide. Between 1995 and 2015, 90% of disasters were weather-related and claimed 606,000 lives and affected about 4.1 billion people (UNISDR, 2015). Over the past 20-year period, floods and storms, respectively, accounted for 47% and 40% of all weather-related disasters (UNISDR, 2015).
2. In Latin America, the most obvious risk factor is El Niño Southern Oscillation (ENSO), a recurrent planetary climate phenomenon. El Niño (ENSO´s warm phase) produces an extreme increase in rain and floods in the Pacific coast and central part of South America (i.e., Argentina, Bolivia, south Brazil, Ecuador, Paraguay, Peru, and Uruguay), and a rain deficit and severe drought in Colombia, Venezuela, the Bolivian Andes, the Caribbean and northeast Brazil. The 1997 – 1998 El Niño, one of the strongest in record, produced USD7.5 billion in losses in five Andean countries[2] (CAF, 2000a; CAF, 2000b; OPS, 2000). The most affected countries, at that time, were Ecuador (14.6 % of GDP), Bolivia (7% of GDP) and Peru (4.5% of GDP).
3. The projected climate change will be a major driver that will exacerbate hazards and disaster risk (Figure 1). Latin America and the Caribbean (LAC) is a very vulnerable area. Out of 33 countries, 10 are extremely vulnerable (30%) and eight are highly vulnerable (24%) to the impacts of climate change (CAF, 2014).
4. Coastal areas are more exposed and vulnerable to the negative effects of climate change and the impacts of weather-related disasters. Future sea level rise could severely impact coastal populations by inundation, flooding, coastal erosion and saltwater intrusion (Neumann et al., 2015). Hallegatte et al., (2013) estimated that flood-related loses in the world´s 136 largest coastal cities could increase from ca., USD 6 billion / year in 2005 to USD 52 billion / year by 2050 with projected socio-economic change alone. Climate change could further increase losses to about one trillion per year. In addition, it is anticipated that climate change will produce stronger and more frequent coastal storms and ENSO events (Cai et al., 2014; Cai et al., 2015).

[2] i.e., Bolivia, Colombia, Ecuador, Peru, and Venezuela.

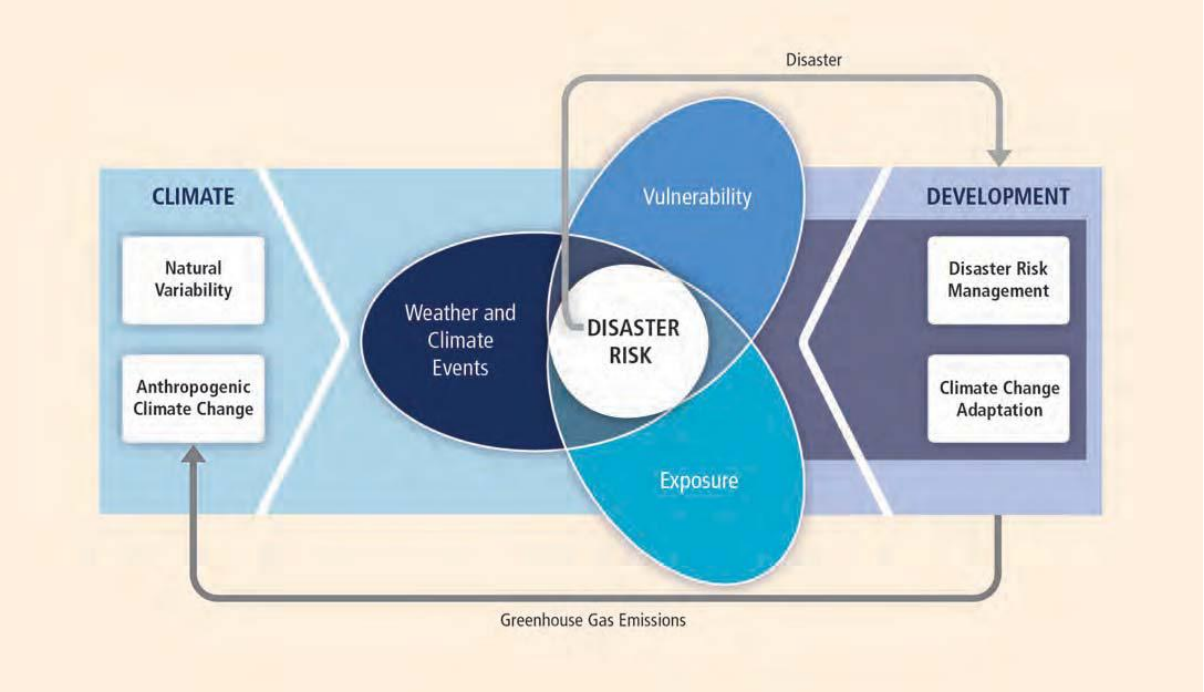

Figure 1. Relationship between disaster risk and climate and development factors (IPCC, 2012).

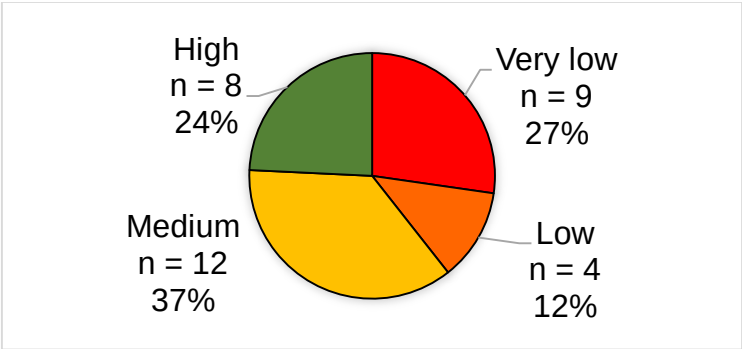

Figure 2. Number of LAC countries according to their adaptive capacity index (CAF, 2014).

5. LAC is the most urbanized region of the world, about 80% of the population live in cities (Escamilla et al., 2008; Hayes-Mitchell & Godfrey, 2008; UN-HABITAT, 2012). Half of the urban population live in cities with less than 500,000 inhabitants, and 14% live in megacities (UN-HABITAT, 2012). A major portion of the population live in coastal areas. About 42% of the population live within a maximum distance of 100 km from the coast (UN-HABITAT, 2012). However, there are extreme cases in the Caribbean, where countries like Montserrat and Aruba have, respectively, 100% and 99.1% of its population living along five kilometres of the seafront (CEPAL, 2012). Four of the eight largest cities of south America ($\geq$ 5 million people) are coastal, and together house about 55 million people.
6. LAC coastal cities (e.g., Buenos Aires, Guayaquil, Lima, Montevideo, Panama, Rio de Janeiro, San Juan, Sao Paulo and Tijuana) are exposed to the impacts of climate change. Reguero et al., (2015) estimated that, without adaptation, more than four million people will be exposed to flooding from relative sea-level rise by the end of this century, and that El Niño increases the threat on the Pacific-coast countries. Sepulveda & Petley (2015) identified that ENSO is a key factor in the initiation of landslides in LAC

7. Adaptation measures are crucial to reduce the risk of severe human and property losses in the coastal areas. However, in LAC the adaptation capacity is quite diverse (Figure 2). Thirteen out of 33 countries (39%) have very low and low adaptation capacity. Also, the population of coastal cities tend to be more vulnerable to climate change. Three of the four largest coastal cities of LAC have very high vulnerability index[3], and the other has a high vulnerability index[4] (CAF, 2014). But the same occurs in smaller cities like Cartagena (1.48 vulnerability index = very high), Panama (2.7 vulnerability index = high) and Montevideo (2.91 vulnerability index = high).
8. The present project focus on the impacts of climate-related risk in coastal cities of LAC. The projected climate change will increase the sea level, modify and intensify the seasonal periods of rain and drought, and result in stronger and more frequent weather events like coastal storms and ENSO. This will in turn, intensify hydro-meteorological hazards and disasters like floods, mudflows and landslides, and produce casualties and economic and infrastructure losses.

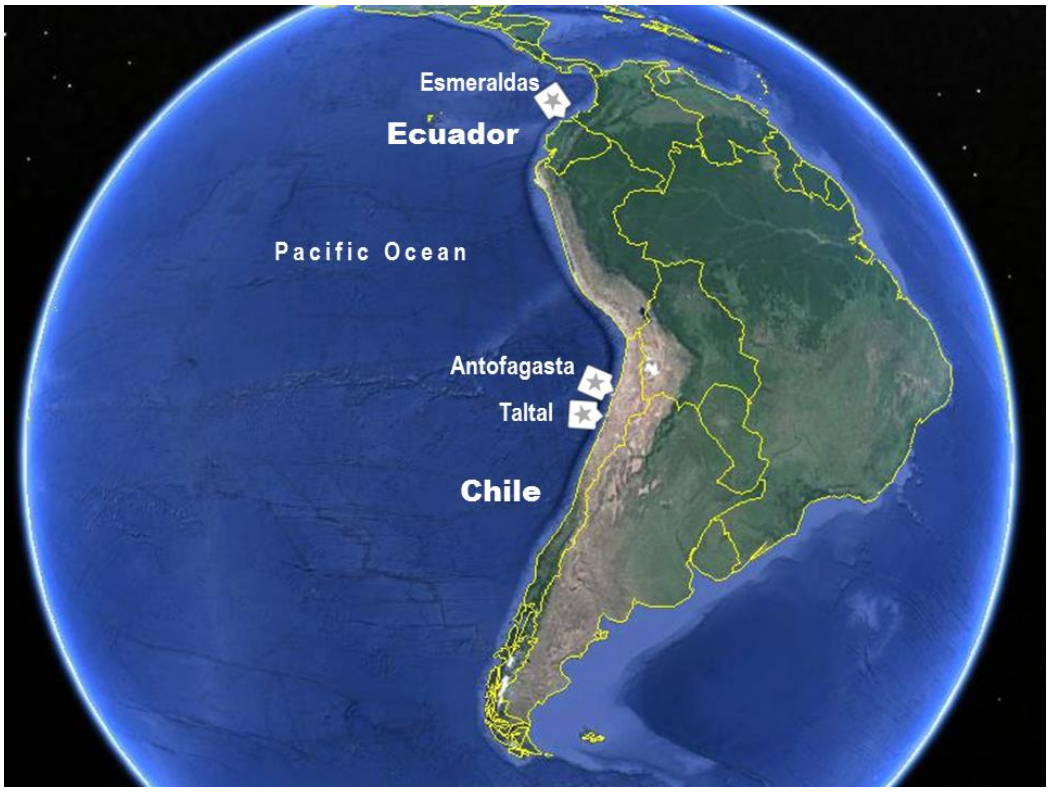

Figure 3. Location of Esmeraldas, Antofagasta and Taltal.

9. The purpose of this regional project is to generate lessons on increasing adaptive capacity to be useful in coastal cities of Latin America and the Caribbean. The governments of Chile and Ecuador have agreed to collaborate and jointly implement an action learning approach to address the issues of climate change adaptation in coastal cities.
10. For this, the governments of Chile and Ecuador have decided to develop practical actions in three small coastal cities (less than 500,000 inhabitants): Antofagasta and Taltal in Chile, and Esmeraldas in Ecuador.
11. These cities were chosen because they:

[3] This index takes into consideration human factors like poverty, education level, access to health services, enforcement of land-use regulations, and displacement. See CAF (2014).

[4] Lima has a 1.65 vulnerability index (very high), Rio de Janeiro has 2.12, Sao Paulo has 2.3, and Buenos Aires has 2.55 (high).

a) reflect different conditions in terms of population size[5] and adaptive capacity (Table 1 and Table 2);
b) face climate-related disaster risks that are typical to coastal cities across Latin America and the Caribbean; and
c) represent adaptation challenges that are common along LAC.

Table 1. Impact of weather-related disasters and adaptive capacity and vulnerability indexes in Chile and Ecuador.

Country	Number of weather-related disasters (1980-2013) [a]	Number of people affected by weather-related disasters (1980-2013) [a]	Adaptive capacity to climate change index (2014) [a]	Vulnerability to climate change index (2014) [a]	Population within 5 km of the seafront (%)[b]
Chile	30	1,110,352	9.40 (high)	9.54 (low)	6.7
Ecuador	30	915,104	4.44 (low)	3.76 (high)	4.3

[a] CAF (2014)

[a] CEPAL (2012)

Table 2. Vulnerability to climate change in the cities of Antofagasta and Esmeraldas (CAF, 2014).

City	Vulnerability to climate change index (2014)	Exposure to climate change index (2014)	Sensibility to climate change index (2014)	Adaptive capacity to climate change index (2014)
Antofagasta	8.48 (low)	9.31 (low)	5.76 (medium)	9.40 (high)
Esmeraldas	1.94 (very high)	3.61 (high)	2.34 (very high)	4.44 low)

12. It is anticipated that climate change will produce stronger and more frequent coastal storms and ENSO events (Cai et al., 2014; Cai et al., 2015), which are a key triggering factor of flooding, mudflows and landslides. The impacts from climate change could be devastating even in countries with high adaptive capacity like Chile (Table 2). The 2015 anomalous mudflows in the Atacama Desert increased Chile´s Climate Risk Index and placed the country among the 10 most affected countries[6] (Kreft et al., 2016). The three chosen cities, like others in the region, face the common challenge of protecting their population and assets from the impacts of extreme weather events, that will become stronger and frequent in the foreseen future.
13. The project will facilitate interaction among practitioners and stakeholders of the three cities to learn from each other, and to develop common knowledge on how to adapt to climate change

[5] Antofagasta is the largest of the three cities with ca., 320 thousand inhabitants. Esmeraldas has about half of the population of Antofagasta (ca., 161 thousand people), and Taltal is a very small city of about 10 thousand people.

[6] The impacts from the anomalous rainfall in the Atacama Desert increased Chile´s climate risk index ranking from number 62 in 2014 to number 10 in 2015 (Kreft et al., 2016).

and to reduce the associated disaster risk. For this purpose, thematic communities of practice[7] (Lave & Wenger, 1991; Wenger, 1998; Wenger et al., 2002) will be established to allow the development of collective learning on specific topics among the three cities. An electronic platform (Figure 21) will facilitate collaboration among project participants, and to share lessons in LAC. It is envisioned that the electronic platform will motivate interest and involvement on risk-based adaptation in coastal cities in the region.

Table 3. Exclusive and non-exclusive functions of Chilean municipalities (Letelier, 2006).

Exclusive functions	Non-exclusive functions
(1) Preparation, approval, and modification of the municipal development plan according to the legal norms in force (2) Local planning, regulation, and design of the building regulation according to the legal norms in force (3) Promotion of community development (4) Enforcement of norms on transportation and public transit on the basis of the general laws defined by the corresponding ministry (5) Implementation of local arrangements for construction and urbanization on the basis of general laws defined by the corresponding ministry (6) Community cleaning and adornment	(1) Education and culture (2) Public health and environmental protection (3) Legal and social assistance (4) Job training, employment, and productive promotion (5) Tourism, sport, and recreation (6) Urbanization and urban and rural roads (7) Construction of social housing and sanitary infrastructure (8) Public transportation and transit (9) Risk prevention and assistance in emergencies or catastrophic situations (10) Support, promotion, and enforcement assistance for town security measurements (11) Promotion of equity between men and women (12) Development of common interest local activities

National and local situation in Chile

14. The Republic of Chile is located in the southern cone of South America. It has a continental land surface of 756,096 km^2 (i.e., the seventh largest nation in South America). In addition, Chile has a large extent of islands and islets (the most conspicuous are the Juan Fernandez archipelago and Pascua Island) and Antarctic territory. The country has a long coastline stretching for about 6,435 km (the world´s 20th largest coastline). The coastal plain extends from the seafront inland until the Chilean Coast Range.
15. The country has a wide range of climate conditions, ranging from warm and cold deserts in the far north, to tundra in the far south. The climate is mainly influenced by the Pacific Anticyclone,

[7] Communities of practice are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis (Wenger et al., 2002).

the southern circumpolar low-pressure area, the cold Humboldt current, the Chilean Coast Range[8] and the Andes Mountains.

16. In 2002, Chile had 15,116,435 people[9]. Women and ethnic groups constituted 50.7% and 4.6% of the population, respectively. Most people lived in cities; 86.6% was urban population. It is projected that Chile´s population in 2020 will be 18.896.684 people. The largest cities are Santiago (ca., 6.1 million people), Concepción and Valparaiso (ca., 1 million people each).
17. The country has a Global Gender Gap Index of 0.698[10] (Annex 10), there is almost complete equality in educational attainment and health and survival, but major gaps in political empowerment and economic participation and opportunities (WEF, 2015).
18. The territory is organized into 15 regions, 54 provinces and 346 communes. They are administered in the following way:
    - Regions are headed by an Intendent, who is appointed by the President of the Republic. Ministries have regional secretaries (SEREMI) which together constitute a regional cabinet that advise the Intendent. The Regional Government prepare and implement the Regional Development Strategy.
    - The provinces are headed by a governor, also appointed by the President of the Republic. The provincial government coordinate the central government decentralized services.
    - The communes are administered by a municipality, headed by an alcalde (i.e., mayor) and a communal council who are elected by public vote. The Municipal government has a set of exclusive and non-exclusive functions (Table 3) and prepare and implement the Communal Development Plan (PLADECO).
    - At the local level neighbours can form "juntas de vecinos" (neighbourhood councils). These are not-for-profit community organizations (regulated by Law 19,418 of 1997), that promote community development, defend the interests and rights of the neighbours and collaborate with government authorities and municipalities.

[8] This is a range which runs along the coast, parallel to the Andes for about 3,000 km. It extends from Morro de Arica in the north (Región de Arica y Parinacota or 15th Region) to Taitao Peninsula (Región de Aysén or 11th Region) in the south. The highest point is Cerro Armazones (ca., 3.064 m altitude) in the Antofagasta region.

[9] Source: XVII National Population Census and VI Housing Census. The 2012 census was considered deficient and the information was not published by the Instituto Nacional de Estadísticas (INE). A new census was organised and executed on 19 April 2017. The results of the 2017 census have not been made public, it is anticipated that the information will be available on August 2017.

[10] 0.00 = inequality / 1.00 = equality.

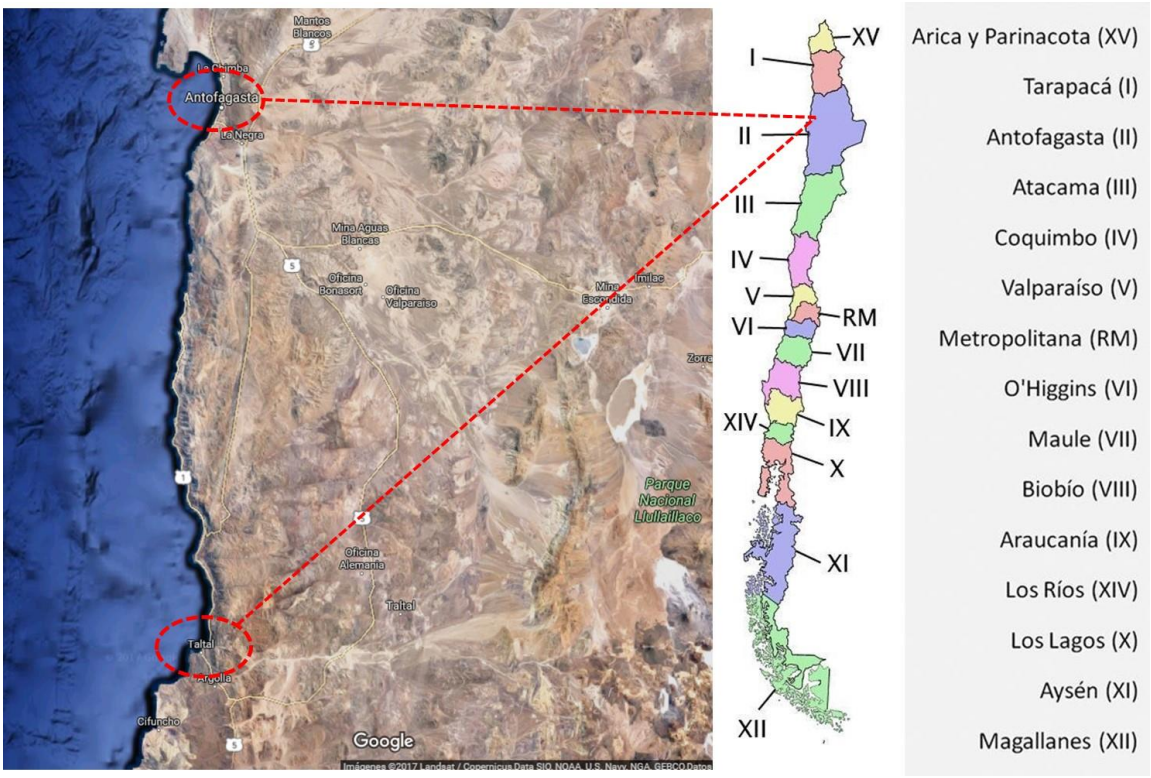

Figure 4. Location of the city of Antofagasta and Taltal.

19. The city of Antofagasta is (a) the capital of the Antofagasta Region[11] (Region II) and the Antofagasta province, and (b) the seat of the Antofagasta commune[12]. The city has about 390 thousand people and is the country´s sixth largest city[13]. It is located in the coastal plain of the Atacama Desert, annual rainfall is about 1.7 mm / year. The economy is centred in copper mining. Antofagasta has the country's highest per capita income, about USD 23,000 per year. The poverty level is low (ca., 5%) and houses have almost full access to potable water, sanitation and electricity[14].
20. The Atacama Desert ecoregion occupies a continuous strip for nearly 1,600 km along the narrow coast of the northern third of Chile from near Arica (18°24' S) southward to near La Serena (29°55' S) (Dillon and A. E. Hoffmann-J 1997). This desert is a sparsely populated virtually rainless plateau, running east from the Pacific Ocean to the Andes Mountains. The average width is less than 100 km. The xeric conditions extend up to1,500 masl on the drier slopes (Börgel 1973). The faulted coastal mountains (mostly 500-1000 m high) are composed of Cretaceous sediments (limestone and sandstone) over more ancient masses of crystalline rocks (Lustig 1970).
21. The Atacama Desert is considered to be one of the driest coastal deserts in the world. Vegetation must contend with an annual rainfall of 0.6 mm in Arica and 2.1 mm in Iquique. The Atacama becomes slightly less arid as it moves southward. The average monthly temperatures

[11] The Antofagasta Region contain three provinces (i.e., Antofagasta, El Loa and Tocopilla) and nine communes.

[12] In the present document, the term "Antofagasta" will be used to refer to the city of Antofagasta, unless otherwise indicated.

[13] Antofagasta is Chile´s most urbanized region. In 1960 the region had 94.8% of urban population, this figure increased to 97.7 in 2002 (INE, 2008).

[14] In 2010, the urban population of Antofagasta region had 100% cover of potable water and 99.7% cover of sewage system. In 2013, 7.1% of houses of the Antofagasta commune had a deficit in sanitation (MDS, 2014a).

in Iquique range from 14.5 oC in September to 21 oC in March (Dillon and A. E. Hoffmann-J 1997).

22. Topography and substrate combine to influence the patterns of moisture availability and areas of suitable habitat. Where isolated mountains or steep coastal slopes intercept the clouds, a fog zone develops with a stratus layer concentrated against the hillsides. The moisture allows the development of fog-zone plant communities termed "lomas" (small hills) near the coast and in lower portions of numerous gorges ("Quebradas") between sea level and 1,100 m. These plant formations also have been called the fertile belt, fog oases or meadows on the desert. Plant communities of the lomas consist of mixtures of annual and short-lived perennial and woody scrub vegetation.
23. Antofagasta has developed bordering the seafront along a narrow strip (Figure 5). The inland limit is a set of coastal hills (part of the Chilean Coast range) that are cutted by 17 gorges (called “Quebradas”) which drain into the city.

Figure 5. Antofagasta’s Quebradas - Gorges.

Figure 6. Downhill view of Quebrada Bonilla Sur.

24. Despite the general high living conditions, Antofagasta has informal neighbourhoods (called campamentos[15]) mainly on the upper hillsides (Figure 9). These are unplanned illegal occupations of public land with deficient infrastructure and services, and roughly constructed houses. Access to affordable housing is a national issue. On this respect, the Ministry of Housing and Urban Development (MINVU) implements a national policy to provide housing solutions to campamento dwellers. Complementary, the Antofagasta Regional Government (ARG) implements a plan to confront the key factors that motivate the appearance and expansion of campamentos (GORE Antofagasta, 2015).
25. The number of people living in campamentos has increased in the recent years. Until May 2014, there were 17 campamentos (608 families) (TECHO, 2013; TECHO, 2014). The oldest was established in 1975 (campamento Juanita Cruchaga), and the most recent in 2012 (campamento Génesis) (TECHO, 2014). The latest figures, from the 2016 cadastre, indicate 44 campamentos[16], where 4,593 families lived (TECHO, 2016) (Figure 9).
26. In the 2015 poll, it was found that women and persons with disabilities constituted, respectively 52.4% and 3.2% of the population of the campamentos (GORE Antofagasta, 2015a). Fifty-one percent were female-headed households. On average, settles had lived 1.5 years in the campamentos.
27. Most of the settlers were South American immigrants[17] (GORE Antofagasta, 2015a; Santana, 2015; TECHO, 2015), and most had migrated to Chile seeking working opportunities (72.6%); 5.9% had migrated because of security reasons. About half of them did not know for how long they will stay in the country[18] (51.3%) and send remittances to their countries of origin (48.7%). A small number of immigrants had an irregular condition (3.4%), and 0.1% were refugees (GORE Antofagasta, 2015a). Campamento dwellers have indicated that a key factor is the difficulty to access affordable housing.
28. In the Antofagasta region, people settle in campamentos mostly because of the high cost of house rental and limitations to access affordable housing (TECHO, 2015). Because of their irregular land-tenure, campamento dwellers cannot formally access public services. TECHO (2015) found that, in the campamentos of the Antofagasta region, 20.6% of the houses have individual water meters (i.e., formal access), 41.2% have informal connections to the public water network, and the others get water from different sources (e.g., tankers, wells). Similarly, only 1.5% of the houses have individual electricity meters, 7.3% of the houses have communal electricity meters, 89.8% have clandestine electricity connections, and 1.5% do not have electricity. Finally, only 6.3% of the houses are connected to the public sewage system, 51.7% use septic tanks, 39.5% use pit latrines, and 2.4% do not have toilets.

[15] The illegal occupation of land is called toma, and the irregular settlement is called campamento. The official definition of campamento used by the Ministry of Housing and Urban Development (MINVU) is "'settlements, usually found in urban areas, of more than eight families living on an irregular land tenure, lacking at least one of the three basic services (electricity, drinking water and sewage system) whose homes are closely grouped together'" (MINVU, 2012). The development of tomas and campamento is a common issue along Chile. It is common that the campamentos develop on unstable hillsides like in Valparaiso (Pino & Ojeda, 2013). The national cadastre of 2016 recorded 660 campamentos, where 38,770 families lived (ca., 116,310 persons) (TECHO, 2016).

[16] This is 78.6% of the campamentos of the Antofagasta region. The campamentos of this region are found mostly in three communes (i.e., Antofagasta, Taltal and Calama) and are located mostly in urban areas (92.9%) (TECHO, 2016).

[17] GORE Antofagasta (2015a) and Santana (2015) report: 40,2% Chileans, 18.8% Colombians, 14.7% Peruvians, 14.4% Bolivians, 2.6% Ecuadorians, and 8.8% other.

[18] The other indicated time spans up to 10 years.

Figure 7. Types of houses in campamentos in Antofagasta (Visit July 2017).

Figure 8. Neighbourhood close to Quebrada Bonilla Sur

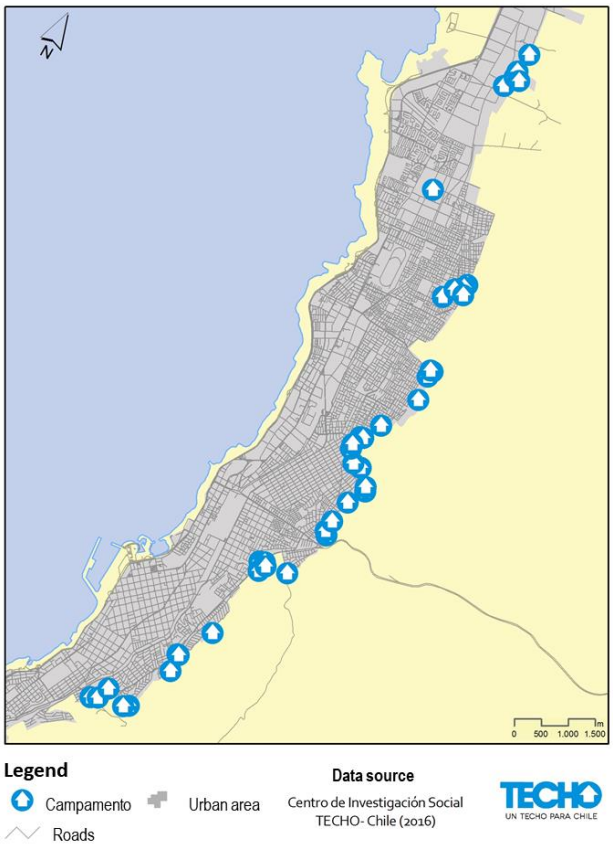

Figure 9. Campamentos in the city of Antofagasta. Source: 2016 national cadastre.

29. Taltal is a small city (ca., 10,400 people in 2013) located about 195 km south of Antofagasta. It is also located in the coastal plain of the Atacama Desert, at the end-point of a large canyon (Figure 10). In 2011 the poverty level was very low (2.7%), well below the national average (INE, 2014b). About 25.1% of houses have sanitation deficit, which is well above the national and regional deficits (i.e., 17.0% and 13.7%) (INE, 2014b).
30. Taltal also has campamentos, though the information available is not as detailed as for Antofagasta. Until May 2014, there were two campamentos with 67 families, one established in 2004 (Tiro al Blanco, 55 families) and the other in 2005 (Eusebio Lillo, 12 families) (TECHO, 2013; TECHO, 2014). The most recent information, from the 2016 cadastre, indicate six campamentos with 400 families (TECHO, 2016) (Figure 11, Table 4).

Figure 10. Location of Taltal.

Table 4. Campamentos in Taltal. Source: TECHO (2016).

Campamento name	Year established	Number of families
Tiro al Blanco	2004	55
Eusebio Lillo	2005	15
22 de enero	2013	65

Luchando por nuestro hogar	2015	210
Vida nueva	2015	30
Salvador Allende	2015	25

Source: Monitor de Campamentos. TECHO-Chile. Online: http://chile.techo.org/cis/monitor/

Figure 11. Location of campamentos in Taltal.

31. Both cities are located in the Atacama Desert, and consequently have very dry conditions. However, the entire region has been affected by intense mudflows caused by flash floods generated by unusual heavy rain. The area is extremely dry and devoid of vegetation; therefore, the hard ground cannot absorb unusual rain.
32. The strongest mudflow recorded was in 1991[19] and was caused by unexpected and sporadic heavy rain (recorded rainfall about 42 mm). The balance was 91 dead,16 missing persons, 8,000 refugees and about USD 71 million in losses (ONEMI, 1994; Melin, 2011). The most recent mudflows occurred in March 2015 in Taltal, and August 2015 in Tocopilla[20]. The March 2015 event affected southern Peru and northern Chile. Campamentos are more vulnerable to mudflows because they tend to locate on the hillsides.
33. Vargas & Ortlieb (1997) found records of seven events of heavy and intense rain between 1916 and 1991. In all cases Antofagasta was flooded, but five times mudflows developed[21]. Garreud & Rutllant (1996) and Vargas et al., (2000) found that the unusual rain episodes which produce

[19] There were mudflows in three coastal cities of the Antofagasta region: Antofagasta, Taltal and Tocopilla.

[20] A coastal city located about 200 km north of Antofagasta. The 2015 mudflow killed three people and 830 people had to be evacuated.

[21] i.e., August 1930, June 1940, May 1982, July 1987 and June 1991.

mudflows are linked to ENSO conditions. Liberto (2015) explain the conditions that generated the 2015 event.

34. After the 1991 mudflow, protection works were built in priority gorges of Antofagasta[22] and in Taltal. Taltal was supposed to be protected with the existing infrastructure. However, in March 2015 the structural measures were insufficient to withhold the strong alluvial flows. A key issue is that existing infrastructure do not incorporate the climate change factor.
35. The present project contributes to implement Chile´s national environmental policy expressed in the National Adaptation Plan (MMA, 2014) and the Climate Change National Action Plan 2017-2022[23] (PANCC-II). These national plans provide strategic guidance for the preparation of nine sectoral plans. Two sectoral plans are related to the present project: (i) the Climate Change Adaptation plan for Cities (to be ready during 2017), and (ii) the Climate Change Adaptation Plan for Infrastructure (under development). The present project will be the first initiative to contribute to implement the adaptation plan for cities.

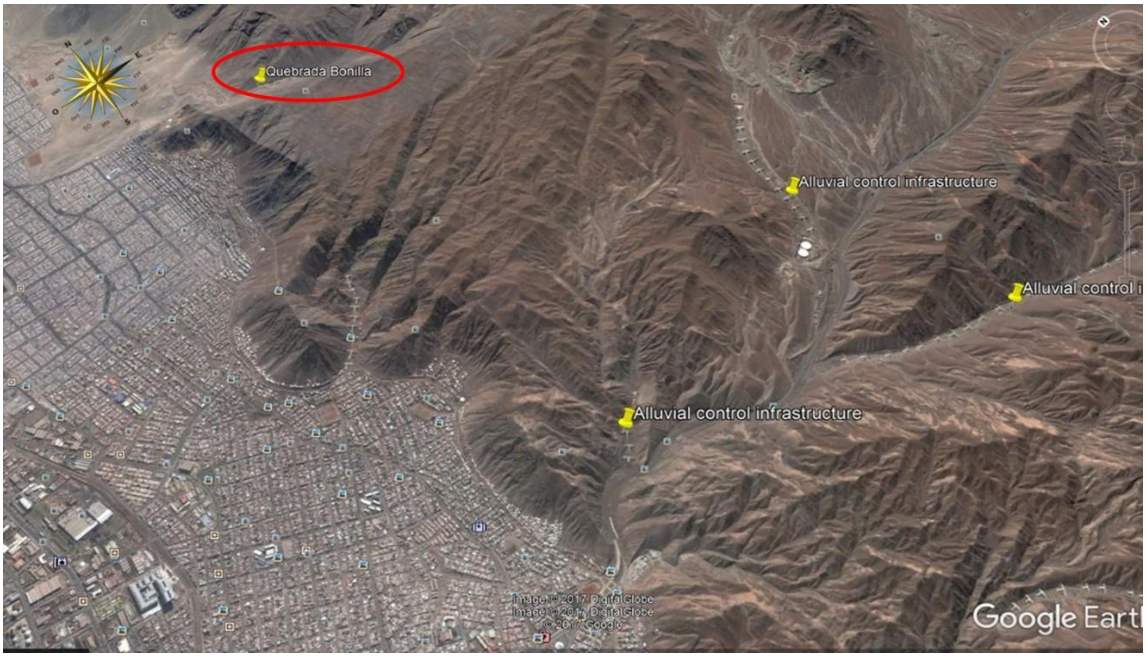

Figure 12. Location of Mudflow Control Infrastructure in Antofagasta.

National and local situation in Ecuador

36. The Republic of Ecuador is located on the northwest of South America. It has a land surface of 257,217 km^2, including the Galapagos archipelago (i.e., the ninth largest nation in South America). The country has 2,859 km of continental coastline. The most notable coastal geographical feature is the Gulf of Guayaquil, an estuarine system, which houses the largest concentration of mangroves in the country and numerous islands and islets.

[22] Infrastructure has been built in four gorges (Quebradas in Spanish): Salar del Carmen, La Cadena, El Ancla and Baquedano. Infrastructure for six additional Quebradas is included in the Antofagasta´s Regional Government – MOP project (i.e., Farellones, La Chimba, El Toro, Jardines del Sur, Riquelme, Uribe). The other five Quebradas do not have a source of funding: Club Hípico, Bonilla, Caliche, Universidad de Antofagasta, and El Huáscar.

[23] The PANCC-II is currently under consultation. The process will finish on 4 August 2016. The consultation workshop in Antofagasta was held on 12 July 2016.

37. The country has four natural regions markedly different in topography, climate and biota. The coast, are the lowlands located between the Andes Mountain Range and the Pacific Ocean, a main feature is the Coastal Range which runs 600 km along from the provinces of Esmeraldas to Guayas.
38. The coast has two distinctive seasons, a rainy season (locally known as “invierno”) from January to April, and a dry season from May to December (locally known as “verano”). The coastal climate is greatly influenced by the oceanographic conditions (Moreano, 1983; Cucalon, 1989). Four climates are found in the coast (Pourrut, 1983), humid to the north and drier to the south. Most of the Esmeraldas province has a tropical megathermic humid climate (annual rainfall between 1000 and 2000 mm), except for the northernmost part of the province (close to the border with Colombia), were uniform megathermic very humid climate is found (annual rainfall >3000 mm). The ENSO has a very strong impact in coastal weather conditions.
39. In 2010, Ecuador had 14.306.876 people (INEC, 2011), of which 62.8% was urban population (Annex 10). About 50% of the population live in the coast. The three largest cities are Guayaquil (2.6 million people), Quito (1.9 million people) and Cuenca (0.9 million). The country has a high Global Gender Gap Index of 0.738, there is almost complete equality in educational attainment and health and survival, and a high level in economic participation and opportunities, but a major gap in political empowerment (WEF, 2015). Also, the country has a low OECD´s Social Institutions and Gender Index[24] (i.e., 0.0422), which indicates low level of gender discrimination in social institutions.

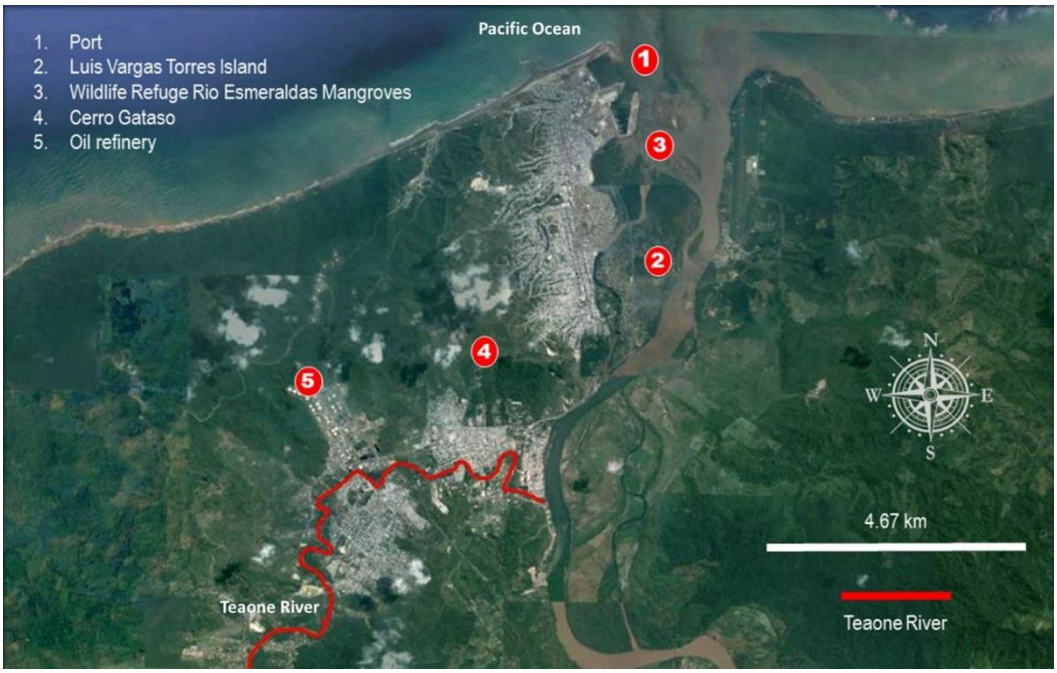

Figure 13. Location of Esmeraldas city.

[24] See http://www.genderindex.org.

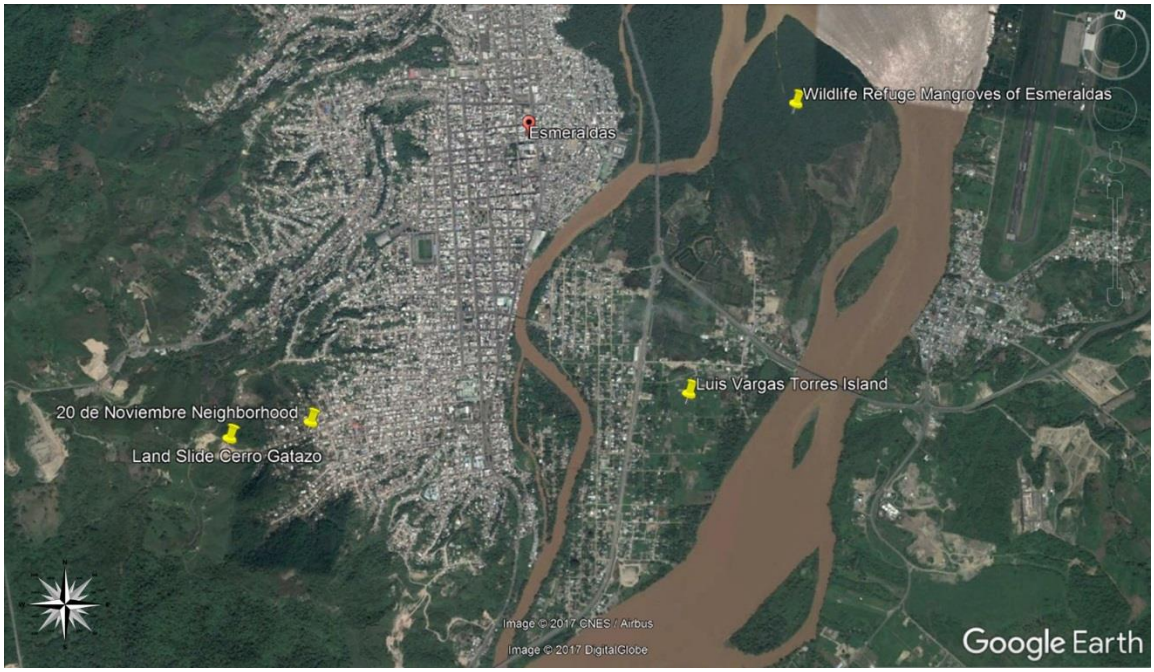

Figure 14. Luis Vargas Torres Island.

Figure 15. Direction of Cerro Gatazo in Esmeraldas.

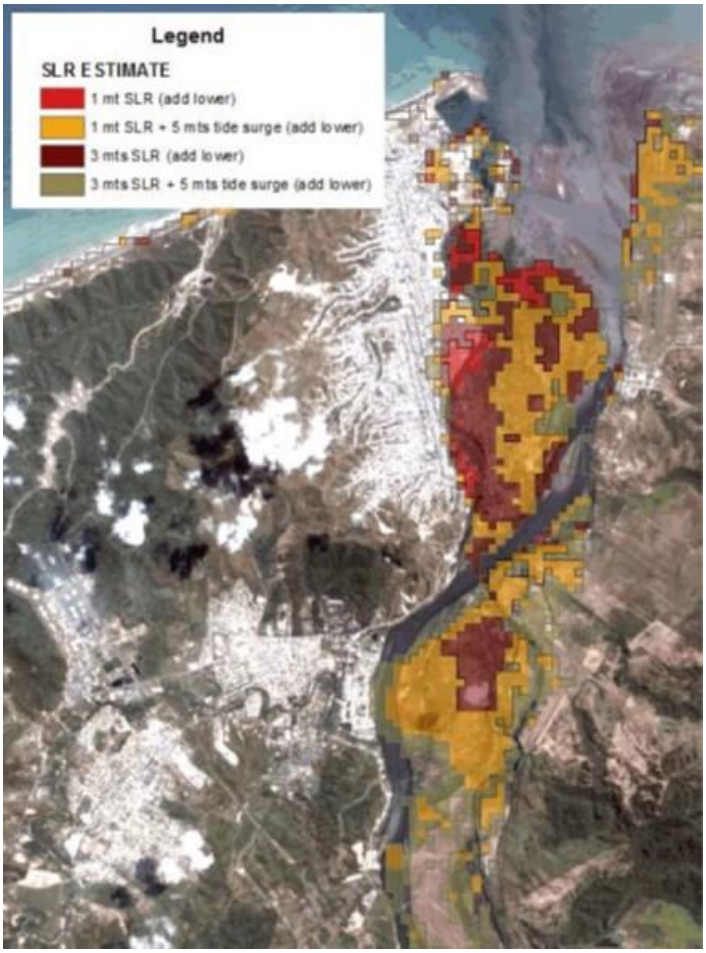

Figure 16. Exposure to sea level rise (SLR) in the City of Esmeraldas (Sierra et al., 2009).

Figure 17. Location of the largest landslide of January 2016 (Image google earth 2017).

40. The territory is organized into 24 provinces, 221 cantons, and 1,500 rural parishes. They are administered in the following way:
    - Provinces are headed by a prefecto and a provincial council, who are elected by public vote. Provincial governments (also called Prefecturas) are responsible for constructing and maintaining the provincial road network, and for environmental management, and the administration of water basins and irrigation systems. They also promote farming production.
    - The cantons are administered by a municipality, headed by an alcalde and a municipal council, who are elected by public vote. The municipal government has a set of competences established by law, those relevant to the present project are (i) to prepare and implement the Development and Land Use Plan (PDOT), (ii) to manage and control land use, (iii) to provide public sanitation services (potable water, garbage collection, sewers and drainage), and (iv) to administer civil defence and fire brigades. The mayor heads and coordinates the canton´s Risk Management Committee (CGR) and the Emergency Operations Committee (COE)[25].
    - The rural parish council (elected by public vote) plan the development and land-use planning of the parish in coordination with the municipal and provincial governments. They also encourage citizen organization and the development of community productive activities.
41. The city of Esmeraldas is the capital of the Esmeraldas province. In 2010, the city had 161,868 people (52.1% women). The majority were afro-ecuadorians (56.5%), the second ethnic group were mestizos (37%); indigenous groups constituted 0.7% of the population. The local economy is very diverse. In the 2010 census, the three main activities were commerce, teaching and agriculture[26]. The city has a major port with cargo, oil and fisheries terminals, and Ecuador´s main oil refinery. However, the poverty level is high. In 2010, 57% of the population had unsatisfied basic needs (NBI) (national 60.1%). The access to water, sewage system, electricity and waste disposal was, respectively, 75.3%, 56.6%, 79.5%, and 77.6%. Esmeraldas has a major issue of informal and un-planned expansion. In 2014, about 70% of the urban area was not in the cadastre.
42. Afro-ecuadorians are considered a vulnerable group. At the national level, this group has lower development indicators than other ethnic groups (with the exception of indigenous people). For example, in 2014 the living conditions survey (ECV) registered for afro-ecuadorians: (i) mean years of schooling 9 years (country level 9.8%), (ii) adult illiterate population ≥15years 7.5% (country level 7.2%), and (iii) functional illiteracy 13.4% (country level 12.7). In 2015, the urban survey of employment and unemployment, registered for afro-ecuadorians income poverty 31.6% (country level 23.3%) and NBI poverty 35.8% (country level 32.9%).
43. The city is located on the west bank of the Esmeraldas estuary (Figure 13). The seafront is a sandy beach, and along the riverside there are a series of sedimentary islands that have been heavily intervened. The most conspicuous is Luis Vargas Torres island which has been populated by informal un-planned neighbourhoods. The island is connected to the east bank of the river and the city by bridges and a main road (Figure 14).
44. In Esmeraldas it exists, the Wildlife Refuge Mangroves of Esmeraldas[27] located at the mouth of the Esmeraldas River in the Pacific Ocean, between the city of Esmeraldas and the parish of

[25] The CGE is a permanent committee focused on risk reduction. The COE functions to attend emergencies and disasters. The Ecuadorian risk management and emergency response system (including early warning) is managed by the Risk Management Secretariat (SGR).

[26] Includes, agriculture, animal husbandry and fishing.

[27] This national protected area, created in 2008, encompasses the remnant mangroves of the city; it has an area of 242 ha of which ca., 37% are mangroves and tropical dry scrubland.

Tachina, where the airport is located. The area includes the mangroves that exist at the mouth of the Esmeraldas River and a nearby area with patches of dry scrub. The mangroves found in this estuary are the last remnants of the extensive forests that existed in the area and that were transformed due to the advance of the city of Esmeraldas and the increase of agricultural areas and pools for shrimp farming. It is an area little known and visited due to the limitations of access and the lack of tourist infrastructure. The project area does not include Ramsar sites or Biosphere reserves. Mangroves in this estuary are the last remnants of the wide-reaching forests once stretching over the area and later transformed by the advance of the Esmeraldas city, and the increase of farming areas and pools for shrimp farming. This is a little-known and rarely-visited area because of access constraints and a lack of touristic infrastructure. Three types of mangrove are present in this protected area: Rhizophora mangle (red mangrove), Laguncularia racemosa (white mangrove) and Avicenia germinans (black mangrove). Some areas have even been invaded by the Acrostichum aureum (ranconcha fern).

45. In Island Luis Vargas Torres, seven types of herons thrive in this protected habitat: White, blue, snowy, striated, brunette, crab-fishing and coronine herons. Their habitat are the mangroves and they can be sighted when they are returning from their eating forages. The area is also the habitat for seagulls, frigates, pelicans, kingfisher, piures, beach shoe, ospreys, jacanas, cormorants, water birds, and swallows. This wildlife´s habitat is located along the Luis Vargas Torres Island mangrove strip; however, an estimation has been made that project´s intervention in this area will be minimal, since these interventions will be implementing disaster risk reduction, early warning systems, local capacity-building components among other activities. A Management Plan is in place at the reserve, as approved by the Ministry of the Environment in year 2015. Due to the presence of the Mangrove Wildlife Refuge, Esmeraldas River Estuary on the Luis Vargas Torres Island, it is important to be aware that the conservation of this may act as an adaptation measure. The project actions will concentrate at the north area of the Luis Vargas Torres Island.in urban areas and will not intervene areas with high value biodiversity.
46. Esmeraldas is divided by Cerro Gatazo (a 260 m height hill) which forms a natural barrier (Figure 13 and Figure 15). Further south the city has developed on the sides of the Teaone river. This river runs northward and makes an eastward turn to join the Esmeraldas river.
47. The area is very humid, annual rainfall in the city is about 800 mm[28]. The Esmeraldas river drains a 21,553 km^2 watershed, it is the country´s fourth largest watershed. The main tributaries are the rivers Guayllabamba and Toachi (which originate in the Andes) and Quininde (which originates in the coastal ridge). It has a flow rate of ca., 300 m^3/s and a sediment discharge of ca., 13,000 t/day. The inter-annual mean discharge is 8.5 billion m^3. The Teaone river drains a 504,89 km^2 watershed with an inter-annual mean discharge of 370 million m^3.
48. The main weather-related risks are flooding by overflow of the Esmeraldas and Teaone rivers, and landslides on the unstable hillsides. Exposure is aggravated by informal and illegal occupation of land along the riverbanks, the sedimentary islands, and the hillsides (Perrin et al., 1998). By 2007, about 60% of the population lived in areas with medium to high risks of floods or landslides (Sierra et al., 2009).
49. The predicted climate change points to hotter and more humid conditions and stronger and more frequent ENSO. In the past, El Niño has aggravated floods and landslides. El Niño 1997 / 1998 destroyed public infrastructure like roads and the water system (CAF, 2000a), and the landslides destroyed about 300 houses (Perrin et al., 1998). The most recent impact was during El Niño 2015 / 2016, between January and April 2016 the city was flooded 20 times, about 16,000 people had to be evacuated (Bonilla, 2016a). Only in January 2016, about 2,600 people had to be evacuated when the Luis Vargas Torres island was flooded (Bonilla, 2016b). The heavy

[28] The 1949 – 1984 annual average recorded in the local weather station (Esmeraldas – INOCAR) was 827.3 mm / year. The 1943-1991 annual average in the airport (Esmeraldas - Tachina) was 800.2 mm / year.

rain also produced landslides. The largest one was in January 2016, in Cerro Gatazo at the end of El Oro street (calle El Oro), but the sustained rain produced that earth continued to move downhill until February.

50. Cerro Gatazo has been a main concern for years. The slopes are intervened, showing a mixture of eroded and barren areas and vegetated areas with grasses and trees. In Cerro Gatazo there are identified more than 15 species of flora such as: Panicum maximum, Cecropia sp., Cordia alliodora, Guadua angustifolia, Heliconia sp., Vernonia baccharoides, Ochroma paramidale, Sida acuta, Albisia guachapele, Inga eduli, Piper aduncum, Mangifera indica, which are not classified as highly valued. During the risk assessment visit and the recognition of the area for the development of the full proposal it was observed that Cerro Gatazo is already an intervened area which has a biodiversity based on pastures. At the beginning of the 2000s, the risk factors were studies and recommendations made (MAE, 2002), and a one-year vegetation trial using vetiver (*Chrysopogon zizanioides*) was executed in four sites of Cerro Gatazo (PNUD, 2005). It was found that vetiver was useful to stabilise the hillsides, but the local population showed low involvement in addressing the hazard. In 2010, the Risk Management Secretariat prepared the baseline studies and a project to build the infrastructure needed to stabilise the hillsides and channel rainwater. The project was presented to CAF as part of a loan to the Government of Ecuador, but was later withdrawn[29].
51. In addition to flooding and landslides, sea level rise could produce that between three and six percent of the city would be temporarily or permanently under water (Sierra et al., 2009). The sedimentary islands and Tachina (where the airport is located) would be the most affected areas (Figure 16).
52. The present project contributes to implement Ecuador´s National Climate Change Strategy (MAE, 2012) and Esmeraldas´ Municipal Climate Change Adaptation and Mitigation Strategy (ONU-HABITAT, 2011).

Vulnerable groups and gender situation

53. According to the Adaptation Fund (AF, 2016), marginalized and vulnerable groups[30] include children, women and girls, the elderly, indigenous people, tribal groups, displaced people, refugees, people living with disabilities, and people living with HIV/AIDS, as well as any groups identified additionally such as seasonal migrants or illegal aliens. The population characteristics in the three cities is summarised in Table 5.

Table 5. Vulnerable groups in Antofagasta, Taltal and Esmeraldas.

Population group	Antofagasta commune	Taltal commune	Campamentos	Esmeraldas (canton)
Total population	389,812[a]	13,296 [a]	Antofagasta 4,593 families [g] (ca., 13,779 persons) Taltal 400 families [g] (ca., 1,200 persons)	154,035 [j]

[29] Ecuador´s Risk Management Secretariat contracted the baseline studies and design of the infrastructure to stabilize Cerro Gatazo hillsides and to channel rainwater to prevent landslides. The project was submitted to CAF as part of a large infrastructure loan request of the Ecuadorian government. But latter the Ministry of Finance modified the loan constituents and took out Cerro Gatazo and other elements, because CAF´s available line of credit was insufficient to cover all the investments that Ecuador required.

[30] The definitions of marginalized and vulnerable groups can be found in Annex 2 of the present document.

Population group	Antofagasta commune	Taltal commune	Campamentos	Esmeraldas (canton)
Children (≤15 years)	22.6% [a] ♂45,065 ♀43,294	23.4%[a] ♂1,577 ♀1,536	32.9% Antofagasta (≤18 years)	32.3% [j] (≤14 years)
Women	47.8% [a]	44.6% [a]	52.4% [h] Antofagasta	52.1 [j]
Older persons (≥65)	8.6% [a] ♂14,959 ♀18,566	9.7% [a] ♂711 ♀581	1.2% [h] Antofagasta	5.5% [j]
Disabled (%)	7.9% [b] (≥2 years) 9.3%[c] (≥18 years)	NA	3.2% [h] Antofagasta	6.5% [k]
Indigenous people (%)	1.81% [d]	1.05% [d]	NA	0.7% [l]
Poverty (%)	5.1% income poverty [e] 14.0% multidimensional poverty	6.3% income poverty [f]	NA	57.0% [l] income poverty 28.4% [l] unsatisfied basic needs

a. Projected population to 2017. Source: INE. Comunas: Población estimada al 30 de junio por sexo y edad simple 2002-2020. Base de datos.
b. Population with disabilities (≥2 years) in 2015 in the Antofagasta region (SENADIS, 2016). For reference, the total national population with disabilities (≥2years) in 2015 was 16.7%
c. Adult population with disabilities in 2015 in the Antofagasta region. Source: SENADIS (2016a). Adult female and male population with disabilities, respectively, 11.8% and 6.7%.
d. 2002 Census (INE, 2005).
e. Estimates for 2015 (MDS, 2016).
f. Estimate for 2013 (MDS, 2015).
g. 2016 cadastre (TECHO, 2016)
h. 2015 (GORE Antofagasta, 2015a).
j. Urban population. 2010 Census.
k. Urban population. 2010 Census. There were, respectively, 10,036 and 529 persons with disabilities in the urban and rural areas of the Esmeraldas canton. Up to June 2017, in the Esmeraldas canton, there were 6,633 persons with disabilities registered in the National Council for Equality of Disabilities (CONADIS). Of this group, 43.8% were female.
l. Esmeraldas canton. 2010 Census.

54. During project preparation stakeholder analyses were prepared for Antofagasta, Taltal and Esmeraldas (Annexes 8 and 9). This allowed to identify that, for the purpose of the present project which is to reduce vulnerability to climate-related floods, mudflows and landslides, the more vulnerable groups are people living on risk areas in the three coastal cities:
    i. In Antofagasta, this is people living along the areas where the runoff flows from the Quebradas through the city into the sea[31] (hazard areas).
    ii. In Taltal, this is the entire city which is located on an alluvial fan (Figure 10, Figure 11).
    iii. In Esmeraldas, this is:
        - the people living in flood-prone areas along the banks of Teaone and Esmeraldas rivers, and
        - the people living on unstable slopes and downhill of Cerro Gatazo.

[31] The maps that show the mudflow risk areas for the Quebradas of the city of Antofagasta are found in the following link: http://www.onemi.cl/mapas/region/antofagasta/.

55. The most vulnerable groups are people living in (i) campamentos located in hazard areas in Antofagata and Taltal, and (ii) informal settlements in Esmeraldas. In various degrees, these people have poor-quality housing, limited access to basic services, and low-income.

56. From the latest available information, the most vulnerable groups have the following characteristics:

- In Antofagasta and Taltal, campamento dwellers are mostly South American immigrants (see paragraph 27), about 51% are female-headed households, about a third are young people (≤18 years), and persons with disabilities and older persons are about 3.2% and1.2%, respectively. Immigrants are not familiar with the territory and its associated risks (Annex 8).
- Concerning the number of inhabitants deemed as Indigenous Populations, regional data collected by the 2006, 2009, 2011 and 2013 National Socioeconomic Characterization - CASEN Surveys have been taken into account. In this regard, Indigenous Populations as follows have been recognized: Atacameño, Aymara, Mapuche, Rapanui, Diaguita and others. On the other hand, and bearing in mind that more up-to-date data was not available, only the data collected in the 2011 Commune Statistical Reports have been taken into account for the commune-addressed review conducted[32].
- Between 2006 and 2009, the Indigenous People´s population recorded in the Antofagasta Region decreased from 38,485 to 30,609, respectively. By 2011, this population increased to 41,611 inhabitants, showing a further increase in 2013 to 50,623.[33]
- Regarding the Taltal commune, Indigenous Population being recognized as born in Atacama were not accounted for in 2003. By 2006 their number had increased to 20 people, while by 2009, their population was 101 inhabitants. The Aymaras, on their part, were unaccounted for in 2003, but in 2006 their population was made up by 12 people, increasing to 162, in 2009. In 2003, the Mapuches were not recognized in the territory, but in 2006 its population was recorded as 41 People, showing a decrease in 2009 to 32 inhabitants. The Rapanuis, meanwhile, were 14 individuals in 2003, later on disappearing from all measurements therefrom. The point should be stressed that, in 2009, out of a total of 12,842 inhabitants, 295 of them are linked with some ethnic group, i.e., only 2.3% of the total population[34].
- In Esmeraldas, the population is mostly afro-ecuadorian. About 52% are women and a third are young people (≤15 years). Persons with disabilities and older persons are, respectively, about 6.5% and 5.5% of the population. About 24% of the urban families are female-headed households (ODNA, 2009).

57. In Antofagasta and Taltal, campamento dwellers form *de facto* organizations with committees that represent their interests. Similarly, in Esmeraldas the "barrios" (neighbourhoods) form *de facto* organizations with elected committees. Women actively participate in these organizations. In Antofagasta and Taltal, the juntas de vecinos and campamento organizations are headed mostly by women (there is strong women leadership). Also, in Esmeraldas, women actively participate in neighbourhood and local organizations. The analyses did not find factors that will impede or limit women´s participation in project activities.

58. In Esmeraldas, two important elements that the project will have to take in consideration are:

- Afro-ecuadorian women have serious limitations to access the labour market and experience domestic violence. Afro-ecuadorian women have better education indicators than afro-ecuadorian males (PNUD, 2008). However, they have serious limitations to access the labour market. The 2006 ECV recorded that afro-ecuadorian women had the highest unemployment rate (i.e., 16.75%, the national female unemployment rate was 9.91%). In

[32] Results Synthesis - CASEN 2013 Survey, Indigenous Peoples´ Populations,Ministry of Social Development.

[33] Results Synthesis - CASEN 2013 Survey, Indigenous Peoples´ Populations,Ministry of Social Development.

[34] Statistical and Communal Reports 2015, Taltal, National Congress Library

2013, this situation improved, but still afro-ecuadorian women had poor employment conditions (Table 6). In addition, a 2011 survey[35], found that in the Esmeraldas province 58.2% of women had experience violence (national average 60.6%); 78.3% of them experienced intimate partner violence (CNIG, 2014).

- In flood-prone areas, families (in particular female-headed households) are reluctant to evacuate because they are afraid of (i) looting of houses, and (ii) unsafe conditions in shelters.

59. The project will intervene in the Luis Vargas Torres island to implement a pilot flood warning system with six informal afro-Ecuadorian neighbourhoods (about 700 families of the estimated 2500 families that live in the island).
60. In Ecuador, National institute of cultural heritage is the responsible to watch over the cultural reality of the country. The National legal and regulatory framework for recognition and protection of physical and cultural heritage in Ecuador is Cultural Heritage Law. This institution works in territory through Regional Technical Offices.
61. For Esmeraldas, in Luis Vargas Torres, according to the newspaper El Comercio some 60 Chachi families occupy an area of the island, where besides preserving the tradition of growing bananas, papaya, sugarcane and yucca, they enjoy the river and the benefits of the mangrove. According to the 2010 census, 600 families lived on the island, of which 100 were chachis. The population has increased in these four years. On the island, 60% of houses are made of cane and mixed construction. The chachis preserve their tradition of building houses with boards and roofs of cade (straw species). The streets have no asphalt and in summer they are filled with dust.
62. Chachis are an indigenous group that live in the tropical forests of the Esmeraldas province, where they reside in family-related communities (called centros Chachi). The national population is about 8000 people, located in 46 centros. Their territory is ca., 105 thousand hectares and is included into three national protected areas. The Chachi families in Luis Vargas Torres island are settlers that came to the city of Esmeraldas to study and work (Bonilla, 2014); they have been affected by former floods (Bonilla, 2016c).

Table 6. Unemployment and underemployment of afro-ecuadorian females. Source: Encuesta Urbana de Empleo y Desempleo - INEC 2013.

Type	Afro-ecuadorian female	National females	Afro-ecuadorian males	National males
Unemployment	9.0%	5.4%	5.8%	3.4%
Underemployment	60.7%	59.0%	50.7%	49.0%

Historical, cultural, artistic, traditional or religious values

63. In both countries where the projects will be carried out, there are no sites, structures with historical, cultural, artistic, traditional or religious values that could be affected by the project. However, there is a small chance of finding archeological remains during construction works. Therefore, contractors will ensure having contingency measures to act in case archaeological remains are found during construction works. Related with intangible forms of culture, both project areas have several representations: artistic, religious, communitarian practices and

[35] The 2011 National Survey on Family Relations and Gender Violence Against Women, prepared by the National Institute of Statistics and Censuses (INEC).

celebrations. The project need to understand these practices to mainstream the different activities of the project and to well communicate with the populations in the neighborhoods areas, also it is important not to disturb the cultural practices and maintain a high standard of respectful with different traditions and behaviours.

64. In Chile, the National legal and regulatory framework for recognition and protection of physical and cultural heritage in Chile is Cultural Heritage Law.

65. Antofagasta is a city of immigrants, which go to work on the mining during the week and leave town during the weekend. However, according to the study Regional Identity "Recognizing diversity for the development of territories", the Antofagasta region is configured based on the "verification of an identity supra-regional, from the great north, which links the former provinces of Tarapacá and Antofagasta, today regions, at least in three common elements: (1) Popular religiosity, accent mariano expressive of the precordillerano religious syncretism; (2) The past nitrate and the construction of a proletarian epic discourse; and (3) A literature and northern history, where their older authors, such as Andrés Sabella Gálvez, gave name to this entity with his novel Norte Grande, constitutes one of the identity nexuses of the Region (SUBDERE, 2009, p.44).

The adaptation challenge and barriers

66. Adaptation to climate change in coastal cities is a main challenge for both countries. On the short term, the three major risks are mudflows in Antofagasta and Taltal, and flooding and landslides in Esmeraldas. These risks are common to other coastal cities in the two countries and other countries of the region, therefore the lessons from the present project could be useful to all LAC. Sea level rise will not be addressed in this project, during project preparation it was obvious that local groups are concerned about the disaster risks that they already face and have produced severe damage.

67. The main barriers that limit adaptive capacity in the three cities are:

    1. Protection works do not incorporate the climate change variable. Existing infrastructure to manage stormwater and mudflows in Antofagasta and Taltal was designed and constructed without incorporating climate change considerations. Antofagasta´s storm water management plan (plan maestro de aguas lluvias[36]) was prepared in 2004 and focus on the 15 gorges that were identified as a priority after the 1991 mudflow. It is clear that the current scenario is different and that future conditions could be even harsher. The severe storms of March 2015 produced heavy rain and mudflows that overpassed the capacity of the existing infrastructure measures in Taltal. The predicted climate change indicates stronger and more frequent storms in the area. Antofagasta and Taltal are affected differently. Antofagasta is mostly affected by coastal storms that influence the coastal range on which the city has developed. In contrast, Taltal is mostly affected by precipitation from the Andes.

       In Esmeraldas, the designs to manage landslides in Cerro Gatazo were prepared in 2010 but did not considered the future scenario of increased rainfall and stronger and more frequent El Niño. There are no detailed plans to address flooding in Esmeraldas.

    2. Early warning systems have limited information to alert people at risk with sufficient time to evacuate. Existing meteorological stations provide rainfall information with short time to act in case of emergency. The situation is critical in Antofagasta because coastal storms affect

[36] Stormwater management plans are required by Law 19525 of 1997. This instrument defines the primary network and mechanisms to evacuate and drain rainwater to protect the local population. MOP is responsible for its preparation, and is compulsory for cities with population >50,000 people.

the gorges that cross the city. In addition, there is very little information about the coastal gorges, which limit the capacity to design effective structural and non-structural measures to protect the population. The same situation occurs in Esmeraldas, the existing meteorological stations[37] do not permit to detect rain build-up in the watershed with sufficient time to alert the local residents of probable flooding and landslides.

In addition, there are limited means to alert the population and to guide them to secure locations. The three cities have well developed means to alert people from tsunamis[38], but there are no evacuation maps and signalled evacuation routes for mudflows and flooding.

3. Limited capacity to address informal occupation of land in high risk areas. About 24% of Latin America's urban population live in informal settlements (UN-HABITAT, 2015). Informal occupation of land in urban areas is a complex issue with intricate social, cultural, political and economic root causes (Vargas Llosa, 2004; Fernandes, 2011). Dealing with illegal occupation of land is a complex and delicate issue in both countries. In Chile, the competence belongs to the Ministry of Housing and Urban Development, who has a long-term programme focused on improving living conditions of people inhabiting campamentos[39]. In 2011, 70% of people living in campamentos were in areas with risk of flooding and landslides. People in risk areas would have to be relocated, which has a high social and political cost (Anon, 2015; Muñoz, 2015). The ARG implements a plan to increase the number of affordable houses and build temporary neighbourhoods to relocate families situated in high risk areas (GORE Antofagasta, 2015; Muñoz, 2016).

   In Esmeraldas, the situation is more complex because of the high level of informality in land tenure. The municipality has applied administrative measures, like not allowing regularization of lots located in risk areas, but this does not address the root causes nor reduce hazard exposure. Over the years, there has been political resistance to enforce zoning regulations and deal with informal land tenure.

4. Local technical staff with limited capacities to mainstream climate change adaptation and disaster risk reduction (DRR). The municipal staff do not have sufficient skills to integrate DRR in the development planning process and their workplans and daily activities, nor to link actions of DRR and adaptation to climate change. Current development plans for Antofagasta and Taltal do not incorporate climate change adaptation, also weather-related risk is mentioned but not addressed. The municipality of Esmeraldas has incorporated climate change and risk management into the development plan (GAD Esmeraldas, 2012a) and has strategies for risk and disaster management[40] (GAD Esmeraldas, 2012b) and adaptation to climate change[41] (ONU-HABITAT, 2011). However, implementation of this plans has been very limited. Municipal officers have not been able to engage and motivate political decision-makers to advance on DRR.

5. Local population not fully aware of climate-related risks. The interviews with local stakeholders revealed that there is no clear understanding of the link between the weather-related disasters and climate change (Annexes 8 and 9). The future climate scenarios and the probable worsening of existing risks are not in the common dialogue. Sea level rise is

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[37] There are two coastal stations in the seafront of the city and the airport. Two additional stations are located on Sagüe (on the Esmeraldas river) and Teanone – Tabiazo (on the Teaone river).

[38] Antofagasta and Taltal have sirens to alert of tsunamis.

[39] MINVU (2012) recorded in 2011 a national total of 657 campamentos hosting 27,378 families (i.e., 83,862 people, 39% were under 18 years of age). e[ad] (2010) summarize the strategies to address campamentos. The most recent campamento cadastre was prepared in 2016 (TECHO, 2016).

[40] This strategy was prepared with support from OXFAM and the European Commission.

[41] This strategy was prepared with support from ONU-HABITAT within the framework of UN-HABITAT 's Cities in Climate Change Initiative (ONU-HABITAT, 2010).

perceived as a very far risk factor and therefore is not seen as a short-term priority. This contributes to the fact that local population does not demand that elected authorities address adaptation as a priority matter.

An additional factor is that the major events are not frequent. Therefore, the impetus of the response and interest after a disaster, decreases and gets diluted with time. Also, memory of past events faints with time, currently there are no mechanisms to encourage the transmission of knowledge to new generations. Major events are anecdotally remembered, like the 1991 mudflow in Antofagasta or El Niño 1982 / 1983 and 1997 / 1998 in Esmeraldas, but the lessons learned are not passed to younger groups.

68. The present regional project will contribute to address these barriers by developing practical adaptation actions under a learning approach. A key element will be to establish communities of practice (Lave & Wenger, 1991; Wenger, 1998; Wenger et al., 2002) among practitioners and key stakeholders of the three cities. Women will be motivated to form part of the communities of practice to ensure that their perspectives and experience are mainstreamed in the learning process. It is expected that these communities of practice will mature during project implementation and become a catalyst of change. Lessons will be disseminated within each country, between countries and in LAC, to motive action on climate change adaptation in coastal cities. Specific project actions to address the main barriers are listed in Table 7.

Table 7. Project actions to address the main barriers that limit adaptive capacity in Antofagasta, Taltal and Esmeraldas.

Barrier	Project action
1. Protection works do not incorporate the climate change variable	Update Antofagasta´s stormwater management plan incorporating the climate change factor (output 1.1) to guide future investments to cope with foreseeable stronger and more frequent coastal storms. Prepare green infrastructure plan for Esmeraldas (output 1.2) to protect the city from flooding and landslides caused by the foreseeable increase in rainfall associated with stronger and more frequent El Niño. Update protection infrastructure designs and constructions incorporating the climate change factor for Quebrada Bonilla[42] (output 2.1) and Cerro Gatazo (output 2.2) to reduce vulnerability of local population and develop methodology and experience for mainstreaming the climate factor in infrastructure works.
2. Early warning systems have limited information to alert people at risk with sufficient time to evacuate.	Increase capacity to forecast hydrometeorological hazards and strengthen early warning systems. Install meteorological radar in Esmeraldas, storm detection system in Antofagasta, and meteorological stations in both Antofagasta and Esmeraldas (outputs 3.1 and 3.2).

[42] The experience on mainstreaming the climate factor into Quebrada Bonilla mudflow protection works and Antofagasta´s stormwater plan will be used by ARG to improve protection works in the region.

Barrier	Project action
	Expand public warning systems in Antofagasta and Taltal to alert and evacuate the local population in case of mudflows (output 4.1). Prepare and implement a pilot community-based flood warning system in Luis Vargas Torres Island (Esmeraldas) (output 4.2), prepare climate-adjusted flood and landslide risk maps for the city and signal the evacuation routes and safe areas (output 4.3)
3. Limited capacity to address informal occupation of land in high risk areas.	Raise awareness of local population about the danger of setting on high-risk areas through the implementation of communication and education strategies (output 6.1) and an initiative to invigorate cultural memory (output 6.2).
4. Local technical staff with limited capacities to mainstream climate change adaptation and disaster risk reduction.	Develop and implement an online course on risk-based adaptation in coastal cities for local governments´ officers (output 5.1).
5. Local population not fully aware of climate-related risks.	Develop and implement communication and education strategies (output 6.1) and an initiative to invigorate cultural memory (output 6.2).

Project Objectives:

69. The project objective is **to reduce vulnerability to climate-related floods, mudflows and landslides in three coastal cities by mainstreaming a risk-based approach to adaptation, building collaboration and networking, and developing a culture of adaptation.** The project focus on the hydrometeorological hazards of mudflows in Antofagasta and Taltal, and flooding and landslides in Esmeraldas. The expected mid-term impacts are improved enabling conditions to sustain DRR adaptation in the three cities. In the long-term, it is expected that this will result in improved adaptive capacity. It is also envisioned that the lessons of the project are useful to other countries in Latin America and the Caribbean, and other regions of the world.

70. The project is organised into three components:

    a. Component 1 will focus on priority actions to increase resilience in the three cities. Four outcomes will be generated by mainstreaming DRR into local planning, building infrastructure which incorporate climate-related variables, improving climate monitoring, and strengthening the existing early warning and response systems.

    b. Component 2 will focus on strengthen the capacities of local government officers and communities, as well as fortifying connections between communities and local and national government. Two outcomes will be generated by developing an online training course on risk-based adaptation for municipal and government officers and technical staff, and implementing communication and education strategies to increase local awareness and contribute to build cultural memory. The online course will be open to professionals from other coastal cities of Latin America and the Caribbean.

    c. Component 3 will focus on nurturing the project´s communities of practice and to document and disseminate the lessons. The backbone of the regional project are the communities of practice that allow the development of collective learning on specific topics. Five communities of practice will be developed. This component includes:

i. An electronic platform to facilitate interaction and collaboration among project participants of both countries (e.g., teleconference, webinars), and the dissemination of lessons for the benefit of other coastal cities in the region and the world. It is expected that this platform will serve to motivate further participation of other coastal cities in the region.

ii. Nurturing the communities of practice and facilitating networking among practitioners.

iii. The systematic documentation of lessons in different formats (e.g., YouTube channel, formal documents) and their world-wide dissemination through various channels (e.g., mailing list server, twitter, website).

71. The rationale of the regional project is to generate practical lessons on risk-based adaptation in coastal cities with different adaptive capacities and disseminate the lessons to Latin America and the Caribbean to motivate interest and involvement of other cities of the region.

Project Components and Financing:

Project Components	Expected Outcomes	Expected Outputs	Countries	Amount (USD)
1. Priority Actions to increase resilience	Outcome 1. Enhanced plans and green infrastructure reduces vulnerability to floods, landslides and mudflows in two coastal cities	1.1. Stormwater management plan for Antofagasta [USD 418,472]	Chile	9,632,043 (74.78% of A+B)
		1.2. Green infrastructure plan for Esmeraldas [USD 323,392]	Ecuador	
	Outcome 2. Reduced vulnerability to floods, landslides and mudflows in two coastal cities	2.1. Mudflow control infrastructure in Antofagasta [USD 4,637,592]	Chile	
		2.2. Landslide mitigation works in Esmeraldas [USD 2,440,392]	Ecuador	
	Outcome 3. Improved climate monitoring and means to alert the local population .	3.1. Weather radar in Esmeraldas and a storm detection system in Antofagasta [USD 1,136,937]	Chile and Ecuador	
		3.2. Increased number of meteorological stations in Antofagasta, Taltal and Esmeraldas [USD 166,937]	Chile and Ecuador	
	Outcome 4. Improved means to respond to floods, landslides and mudflows	4.1. Enhanced public warning system in Antofagasta and Taltal [USD 250,392]	Chile	
		4.2. Pilot flood warning system in Esmeraldas [USD 120,992]	Ecuador	
		4.3. Evacuation route maps and signals in Antofagasta, Taltal and Esmeraldas [USD 136,937]	Chile and Ecuador	
2. Strengthen capacities for adaptation.	Outcome 5. Local governments with improved capacity to design and implement adaptation measures	5.1. Course on risk-based adaptation in coastal cities [USD 229,937]	Chile and Ecuador	1,252,011 (9.72% of A+B)

	Outcome 6. Local population and government personnel with increased awareness of climate-related risks (floods, landslides, mudflows)	6.1. Public communication and education strategies for Antofagasta, Taltal and Esmeraldas. [USD 436,137]	Chile and Ecuador	
		6.2. Narrators´ initiative initiated [USD 585,937]	Chile and Ecuador	
3. ICTs and partnership between coastal cities in Latin America .	Outcome 7. Lessons and best practice on reducing vulnerability to climate related flooding, landslides and mudflows in coastal cities have been shared in the region.	7.1. Electronic platform to facilitate communication among stakeholders and dissemination of lessons and best practice [USD 440,937]	Chile and Ecuador	1,030,874 (8.0% of A+B)
		7.2. Lessons and best practice documented and disseminated [USD 589,937]	Chile and Ecuador	
Subtotal project activities cost [A]				11,914,926
6. Project Execution cost [B] [7.49% of A+B]				965.074
7. Total Project/Programme Cost [A+B]				12,880,000
8. Project/Programme Cycle Management Fee charged by the Implementing Entity [C] [8% of A+B]				1,030,400
Amount of Financing Requested [A+B+C]				13,910,400

Projected Calendar

Milestones	Expected Dates
Start of Project/Programme Implementation	October 2018
Mid-term Review (if planned)	October 2021
Project/Programme Closing	October 2023
Terminal Evaluation	April 2023

PART II: PROJECT / PROGRAMME JUSTIFICATION

A. Project Components Description

72. The project strategy is based on active learning and sharing knowledge to empower local authorities and communities, and contribute to build resilient cities. The project will cultivate communities of practice among practitioners and stakeholder of both countries to foster the development of collective learning. The main elements of the strategy are:

    a. Develop experience on how to build better to withstand climate- related hazards. This includes (i) updating the designs of Antofagasta´s stormwater plan and protection works for Quebrada Bonilla, and Esmeraldas´ construction works to stabilize Cerro Gatazo, and (ii) building the public works in Quebrada Bonilla and Cerro Gatazo. These actions will facilitate learning on incorporating the climate variable into protection works. In addition, a green infrastructure plan will be prepared for Esmeraldas, and a first element will be implemented in Cerro Gatazo to complement grey infrastructure.

    b. Enhance disaster preparedness by (i) using a weather radar in Esmeraldas, a storm detection system in Antofagasta, and an increased number of meteorological stations to anticipate risk situations and gain time to alert the local population, and (ii) strengthen involvement of local groups, including installing sirens to alert of danger, publicize evacuation maps, and establish public emergency drills to promote rapid and effective response to floods and mudflows.

    c. Prepare an on-line regional training course on risk-based adaptation for municipal officers and technical staff of coastal cities. This will contribute to strengthen local capabilities and empower municipal officers to mainstream DRR at the local level.

    d. Increase awareness and empower local communities through public communication and education strategies and develop a narrators' initiative to strengthen cultural memory for climate-related DRR.

    e. Share lessons by systematically document, exchange and disseminate experience and learning within each country, between both countries and with other coastal cities of LAC.

73. The project is organized into three components and seven outcomes. Fourteen outputs will be produced. The results framework is on page 104, and the multiyear workplan is found in Annex 6.

Component 1. Priority actions to increase resilience

74. This component will generate four outcomes dealing with building better to withstand climate-related hazards and enhancing disaster preparedness. It is the largest component of the project, concentrating 74.78% of the total project cost.

Outcome 1. Enhanced plans and green infrastructure reduces vulnerability to floods, landslides and mudflows in three coastal cities

75. To generate this outcome, the stormwater management plan for Antofagasta[43] will be updated, and a green-infrastructure plan for Esmeraldas will be prepared.

[43] Chile´s rainwater law (Law 19,525) establish that stormwater plans are prepared for cities with more than 50,000 inhabitants.

Antofagasta´s stormwater management plan

76. The stormwater management plan is the tool which identify priority alluvial control infrastructure, the primary and secondary routes to direct the flows, and the public works needed to conduit the runoff to the sea. Antofagasta´s current plan (i.e., Plan Maestro de Evacuación y Drenaje de Aguas Lluvias de Antofagasta) was prepared in 2004 and does not incorporate the climate-variable. Based on the experience of updating Antofagasta´s stormwater management plan, guidelines will be prepared on introducing the climate variable in these plans[44]. The guidelines will be published in digital format and disseminated. It is foreseen that the lessons from mainstreaming the climate variable into Antofagasta´s stormwater management plan will be useful to other cities in Chile, Ecuador and the region.
77. This plan is crucial for the design and implementation of future public works to protect the population from mudflows. It will be a pivotal element for the on-going public investments in alluvial control works. On this respect, it is important to highlight that:
    - There is a regional infrastructure plan which includes targets for 18 alluvial control works (11 in Antofagasta´s gorges and seven in the cities of Taltal and Tocopilla) (MOP, 2012).
    - In response to the impacts of the March 2015 anomalous climate events, the Antofagasta Regional Government and MOP signed an agreement (hereon the ARG – MOP agreement) to expand the infrastructure to protect from mudflows the cities of Antofagasta, Taltal and Tocopilla[45] (DOH, 2015). The total investment will be about USD 84.2 million.
78. The ARG - MOP agreement[46] "mudflow disaster mitigation and evacuation of rainwater, Antofagasta Region 2015-2020" was signed on 30 July 2015, as approved by Decree 232 of the Ministry of Finance of 27 July 2015 (Annex 11). It will be funded with resources from the National Fund for Regional Development (40%) and MOP (60%), and will be executed by the MOP´s Directorate of Hydraulic Works (DOH). The total investment between 2015 and 2020 will be CLP 56,152,340,000 (about USD 84.2 million). The agreement and Executive Decree 232 are included in Annex 11.
79. The purpose of the ARG – MOP agreement is to extend mudflow protection in the region, by building pending protection works and preparing pre-feasibility studies for stormwater management. The agreement explicitly states "the objective of the agreement is to expand the execution of the Plan for Alluvial control of Antofagasta, Taltal and Tocopilla, from a 40.4% expected net maximum flow coverage for 15 gorges with urban risk in 2014, to a 82% coverage in 2020; in Taltal coverage will expand from 79.6% in 2014 to 100% in 2020; in Tocopilla coverage will expand from 81.8% in 2014 to 100% in 2020. The plan also includes advancing the design of several works of the stormwater management plans of the cities of Antofagasta, Calama, San Pedro de Atacama, Sierra Gorda, among other works" (Annex 11).
80. In Antofagasta and Taltal, the ARG – MOP agreement will fund 10 projects (Table 8):
    I. Two designs:
        - Antofagasta - Design for stormwater primary evacuation ways.
        - Taltal - Redesign of stormwater primary evacuation ways.
    II. Eight Construction works:

[44] i.e., guidelines to update stormwater management plans to cope with climate-related mudflows in coastal cities

[45] The aim is to reach, by 2020, 100% cover in Taltal and Tocopilla (2014 cover was 79.6% in Taltal and 81.8% in Tocopilla) and 82% in Antofagasta (2014 cover was 40%) (DHO, 2015).

[46] This is a second ARG – MOP agreement to cover mudflow protection. The first one was signed in 1999, it funded the construction of mudflow protection works in the four gorges that produced most of the damage during the 1991 mudflow (i.e., Quebradas Salar del Carmen, La Cadena, El Ancla y Baquedano). Construction works were executed between 1999 and 2008.

- Antofagasta - Mudflow protection works in six gorges: (1) Farellones, (2) La Chimba, (3) El Toro, (4) Jardines del Sur, (5) Riquelme, and (6) Uribe.
- Taltal - (1) mudflow protection works in via baja and Quebrada Cortaderas, and (2) construction of new decantation ponds to increase retention capacity.

81. The present project will be a catalyst in the implementation of the ARG-MOP agreement, by facilitating mainstreaming climate-change considerations into the process of updating Antofagasta´s stormwater management plan (output 1.1) and therefore influencing the design of alluvial control works in the region. The experience gained by DOH will be useful to other regions of Chile. The ARG has issued letter endorsing the present project proposal; in the last paragraph, it is indicated that "the results of this project will be inputs to internalize the climate variable in future designs of alluvial control works of projects in the region" (Annex 16).

Table 8. Projects to be implemented in Antofagasta and Taltal as part of the ARG-MOP agreement (2015-2020).

	Project	Phase	Milestone for completion	Total cost (thousand CLP of 2015)
1.	Alluvial control works in Quebrada Farellones (Antofagasta)	Execution	2017	5,424,121
2.	Alluvial control works in Quebrada La Chima (Antofagasta)	Execution	2019	11,176,830
3.	Alluvial control works in Quebrada El Toro (Antofagasta)	Execution	2020	7,487,790
4.	Alluvial control works in Quebrada Jardines del Sur (Antofagasta)	Execution	2020	8,174,807
5.	Alluvial control works in Quebrada Riquelme (Antofagasta)	Execution	2020	3,035,639
6.	Alluvial control works in Quebrada Uribe (Antofagasta)	Execution	2020	4,978,739
7.	Alluvial control works in Taltal (via Baja and Quebrada Cortaderas)	Execution	2015	3,255,000
8.	Construction of primary routes for the evacuation of rainwater in Antofagasta, Calama and Sierra Gorda	Design	2017	805,000
9.	Redesign of alluvial way in Taltal	Design	2016	150,000
10.	Emergency works in Taltal and construction of new decantation ponds	Execution	2016	4,932,000
			Total (CLP)	49,419,926,000
			About USD	74.1 million

Esmeraldas green infrastructure plan

82. To prepare a green infrastructure plan for Esmeraldas (output 1.2), technical staff from the Municipality of Esmeraldas (GADE) and other local entities will be trained on the use of green

infrastructure for DRR, and a situation analysis will be prepared. The plan will focus mainly on protection from flooding and landslides and will operationalize the municipal strategies for risk and disaster management (GAD Esmeraldas, 2012b) and adaptation to climate change (ONU-HABITAT, 2011).

83. The green infrastructure plan will be socialized with local stakeholders and formally adopted. To facilitate implementation, municipal regulations will be updated to mainstream the use of green infrastructure in local land use planning. This will be pioneer work, since green infrastructure is still a relatively new area of work in Ecuador. In addition, it is foreseen that the lessons and experience acquired will be useful to other cities in Chile, Ecuador and the region.
84. Finally, a demonstration pilot will be designed and implemented to stabilize hillsides by revegetating Cerro Gatazo. This will complement the grey infrastructure intervention (see output 2.2), and will facilitate the comprehension of the practical application of green infrastructure in the city. It is estimated that ca., 100 ha will be revegetated, but the exact figure and location will be decided during project implementation in close coordination with the team that update the infrastructure designs to stabilise the slopes (output 2.2). Four plant species have been recommended for use on the hillsides: (i) guarango (*Caesalpinia spinosa*), (ii) algarrobo (*Prosopis juliflora*), (iii) huaje (*Leucaena leucocephala*), and (iv) vetiver (*Chrysopogon zizanioides*) (MAE, 2002). The species to be used in specific sites will be decided during project execution.
85. The project will motivate that the revegetated areas of the hillside in Cerro Gatazo (output 2.2) be declared as protected forests by the GADE in collaboration with MAE, with the intention of preventing them of being inhabited in the future.

Outcome 2. Reduced vulnerability to floods, landslides and mudflows in two coastal cities

86. To generate this outcome, infrastructure will be built in Quebrada Bonilla in Antofagasta (output 2.1) and Cerro Gatazo in Esmeraldas (output 2.2).

Mudflow control infrastructure in Quebrada Bonilla

87. The Quebrada Bonilla flows through Antofagasta. It has two branches (Bonilla norte and Bonilla sur) (Figure 18, Figure 19). In 1991, the mudflows from Bonilla sur caused severe damage in the city.
88. Protection works on this gorge are not included in the previously mentioned ARG – MOP project to build alluvial control infrastructure (Table 8). After Antofagasta´s 1991 mudflow, the gorges that cross the city were ranked according to the size of the watershed and the number of people located in the alluvial fan (hazard area). The Quebrada Bonilla is number 11 on this rank. The first ARG - MOP agreement of 1999, funded protection works on the four gorges with the highest priority. The second ARG - MOP agreement of 2015 (Annex 11; Table 8) will fund protection works in the following six gorges. Therefore, the works in Quebrada Bonilla could not be executed until financial resources are available, most probably after 2020.
89. The Quebrada Bonilla has a total drainage area of 6.7 km^2 (3.4 km^2 in Bonilla norte and 3.3 km^2 in Bonilla sur). About 12,840 people live in the mudflow hazard area (Figure 19). There are three campamentos on the risk area, where 125 families live (TECHO, 2016) (Table 9, Figure 20).

Figure 18. Location of Quebrada Bonilla with no Mudflow Control Infrastructure in Antofagasta.

Table 9. Campamentos located in the mudflow risk area of Quebrada Bonilla.

Campamento	Established	Number of families
Víctor Jara	2001	25
Mujeres Unidas	2007	56
Nueva Esperanza – Villa Esperanza	2013	34

Source: TECHO (2016). Online: http://chile.techo.org/cis/monitor/

90. The required infrastructure for Quebrada Bonilla was designed ca., 14 years ago (Annex 11). It comprises a series of 14 decantation ponds[47] and 36 concrete retaining walls (31 in Bonilla North and five in Bonilla South). The infrastructure was designed with a 50-year return period horizon, but did not consider the influence of climate change. The redesigns of the infrastructure for Quebrada Bonilla with the climate change scenarios and the Environmental and Social Risk assessment per Unidentified Sub-Projects USP will help the final designs and sub-projects.

91. The present project will finance updating the designs, including climate change considerations, and the construction of part of the infrastructure[48]. This experience will generate methods and tools that will be directly used in the other public works planned until 2020 within the ARG – MOP agreement (Annex 11) and protection infrastructure in other parts of Chile and LAC.

[47] Seven decantation ponds in Bonilla norte, designed to retain 41,959 $m^{3,}$ and seven decantation ponds in Bonilla sur, designed to retain 82.300 m^3.

[48] The project budget includes USD 4.3 million for infrastructure in Quebrada Bonilla (budget note 16). This will not be sufficient to cover all the infrastructure required, which was estimated in about USD 18 million, without considering the climate change factor. MOP will prioritize the investment.

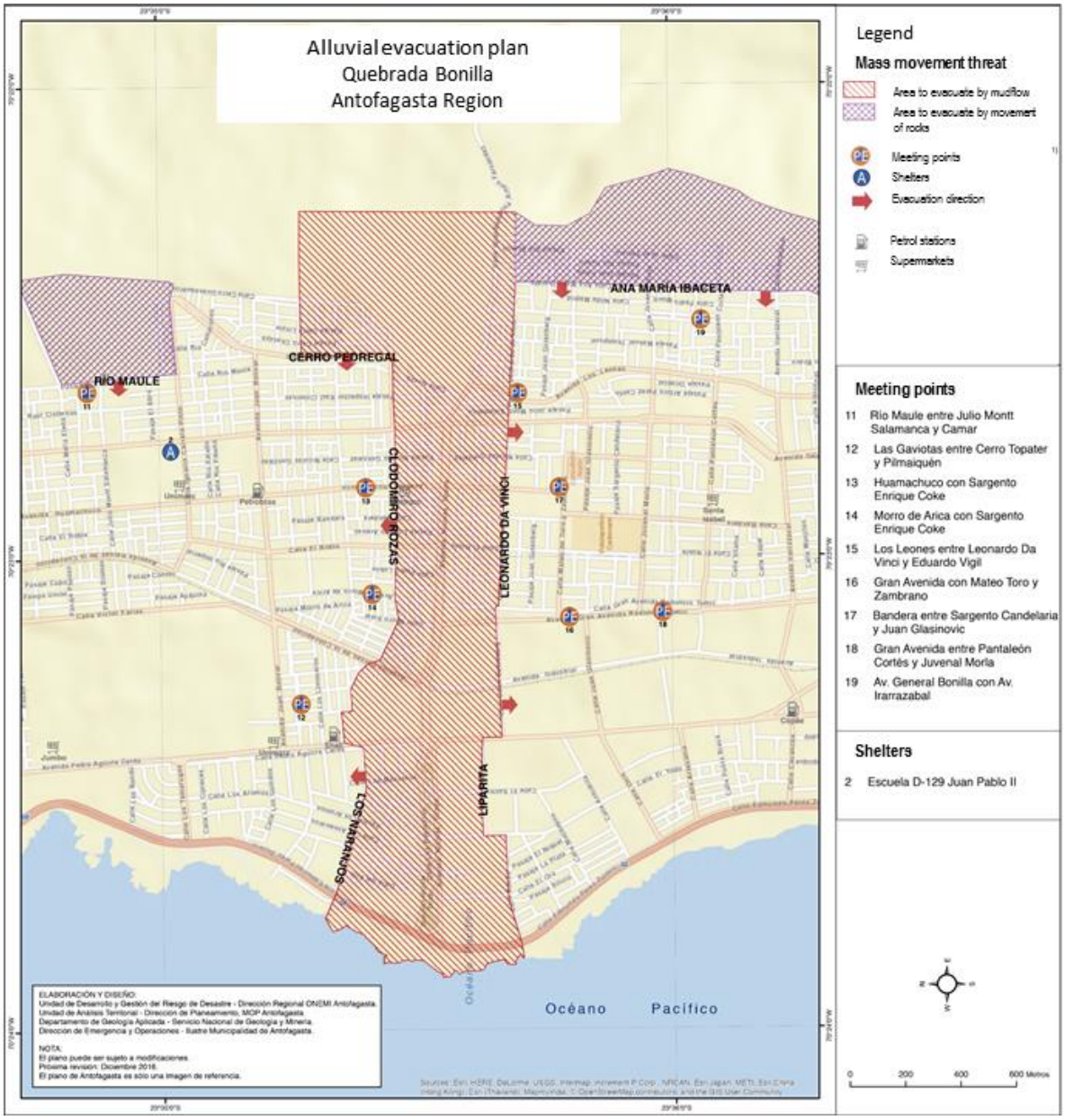

Figure 19. Area of mudflow risk in Quebrada Bonilla (Antofagasta). Source: ONEMI.

Source: Monitor de Campamentos. TECHO-Chile. Online: http://chile.techo.org/cis/monitor/

Source: Monitor de Campamentos. TECHO-Chile. Online: http://chile.techo.org/cis/monitor/
Note. Villa Balmaceda is a large campamento (900 families) that is outside of the mudflow risk area of quebrada Bonilla.

Figure 20. Location of campamentos on the mudflow risk area of Quebrada Bonilla.

Landslide mitigation infrastructure in Cerro Gatazo

92. The infrastructure to stabilize Cerro Gatazo was designed in 2010, the estimated budget was USD 2.6 million (Annex 12). The design includes a combination of control and restraint works, which includes (i) profile conformation of slopes, (ii) construction of collection and drainage channels, (iii) construction of retaining walls where necessary, (iv) anchor works were necessary, and (v) vegetation of slopes. Examples of gabion and green infrastructure in the following pictures.

93. The present project will finance updating the designs to include the climate variable and the control and restrain works (grey infrastructure). GADE will update the basic studies with counterpart resources. The terms or reference for these studies are found in Annex 5. The grey infrastructure works will match the use of vegetation to stabilize the hillsides (output 1.2) (paragraph 84). The experience in Cerro Gatazo will generate lessons to mainstream climate change consideration into landslide control works. The experience will be documented and disseminated to be useful in the country and LAC. The redesigns of the both grey and green infrastructure (the species for this are not determined during the design phase) in Cerro Gatazo with the climate change scenarios and the Environmental and Social Risks Assessment per Unidentified Sub-Projects USP will select the most appropriate sub-projects.
94. The protection works, both grey and green infrastructure, will guard the neighboorhood “20 de Noviembre”, where the 2016 landslide destroyed 38 houses). This is an old settlement, the neighbourhood was established on 20 November 1971 by migrants from the northern part of the Esmeraldas province. There is a *de facto* committee that represent the neighbourhood interests and needs.

Outcome 3. Improved climate monitoring and means to alert the local population

95. To generate this outcome, climate monitoring equipment (outputs 3.1. and 3.2) and early warning systems (outputs 4.1 to 4.3) will be enhanced.
96. A meteorological doppler radar will be installed in Esmeraldas and a storm detection system in Antofagasta (output 3.1) to improve storm monitoring and extend the window of time to alert the population of probable heavy rain and risk of hydrometeorological hazards.
97. The project will finance (i) the analysis to identify the best location both for the radar (Esmeraldas) and the storm detection system´s sensors (Antofagasta), (ii) the equipment, (iii) a set of spare parts, and (iv) training in the equipment´s use and maintenance. Counterpart resources will be used to install the infrastructure (e.g., radar tower) and communication links.
98. The Storm Detection System consists in lightning detectors, devices that detect, count and measure lightning produced during thunderstorms. The measure includes three main

components: optical, magnetic and electrostatic pulses and the devices work connected to a network. The system allows a high temporal and special resolution monitoring that substantially improves the immediate forecast of the impact of a storm by issuing meteorological warnings, with a few hours in advance and a precision of minutes in terms of data arrival time. A forecast of this nature would allow the authorities to focus their resources in a specific area, without wasting time and capacities, and to alert the community regarding the danger of flood, alluvium and lightning. The proposal includes the acquisition and putting into operation of four storm sensors and contract services of the Storm Detection System for the area. The new sensors will strategically be located in zones along the area. The selection of sites, installation and commissioning of the surface and high-altitude sensors will be carried out under the standards used by the Meteorological Directorate of Chile (DMC) for these types of actions.

99. In Chile, the Meteorological Directorate of Chile will manage Antofagasta´s Storm Detection System and feed the information to the National Emergency Office' s (ONEMI) early warning system[49]. In Ecuador, the radar will be managed by the Provincial Government of Esmeraldas (GADPE) in collaboration with the National Meteorological and Hydrological Institute[50] (INAMHI). The information will feed the Risk Management Secretariat´s (SGR) early warning system.

100. To complement and validate the radar and storm detection system information, additional automatic meteorological stations will be installed in the watersheds of Antofagasta, Taltal and Esmeraldas (i.e., Teaone and Esmeraldas rivers). MOP -- through its Directorate of Waters (DGA) -- and GADPE, respectively, will operate and maintain the meteorological stations in Chile and Ecuador.

101. Ecuador has interesting experience using meteorological radars that could be useful for DMC in future projects. INAMHI manage a set of three radars to monitor rainfall in Quito, and another set of three radars operate in the south of Ecuador, managed by local entities[51]. The project will foster collaboration and exchange of experiences among the organizations of both countries.

102. The localization of the radars meteorological stations and storm detection system are not precisely defined at this stage, there are consider USP. AF ESP will be screened for all USP during implementation phase to define the sub-projects in compliance with AF ESP.

Outcome 4. Improved means to respond to floods, landslides and mudflows

103. To generate this outcome, public warning systems will be expanded.

Enhanced public warning system in Antofagasta and Taltal

104. In Antofagasta and Taltal sirens will be installed to alert the local population of mudflow danger (output 4.1). This will be complemented with evacuation maps, on-site signals to mark

[49] At project start, an agreement will be signed between MOP, DMC and ONEMI to establish operational procedures, information flow, and to guarantee that the information from the storm detection system and meteorological stations (paragraph 100) is expedited to the national weather forecast and early warning systems.

[50] GADPE has no previous experience managing climate monitoring. However, GADPE is committed to develop a provincial weather monitoring system. The present project will be an opportunity to develop a decentralised monitoring system based on INAMHI´s former experience. INAMHI will oversee the installation and operation of the radar (paragraph 95) and the meteorological stations (paragraph 100) to ensure they comply with the required standards to guarantee data quality, adequate equipment performance and integration with the national meteorological network. An agreement will be signed between GADPE and INAMHI to establish operational procedures, information flow, and to guarantee that the information from the radar and meteorological stations is expedited to the national weather forecast and early warning systems.

[51] This is part of the project "operational rainfall monitoring in southern Ecuador" (BE 1780/31-1 (short name RadarNet-Sur), sponsored by the German Research Foundation. One radar is managed by the Provincial Government of Loja, the other by Technical University of Loja (UTPL), and the last by Cuenca´s Empresa de Telecomunicaciones, Agua Potable y Alcantarillado (ETAPA).

the evacuation routes, and annual evacuation drills (output 4.3). Local inhabitants are familiar with the use of sirens and evacuation procedures for tsunamis[52]. However, people living on risk areas will have to be trained to recognise the mudflow alert and the corresponding evacuation procedures.

105. Local community leaders from juntas de vecinos and campamento committees will be identified on each gorge and trained to facilitate community action, to guide people to safe areas, and to contribute to guard the sirens and on-site signals. Evacuation plans and procedures will consider the special needs of women, children, older persons and people living with disabilities. Given the role of women in campamentos organizations and their leadership in their communities, it is expected that women can have an active role in this activity.

106. The drills will integrate early-warning, communication and evacuation to allow people and local authorities to practice their actions in case of mudflows. ONEMI will coordinate and implement all these actions in close collaboration with the two municipalities and relevant entities[53] (e.g., Carabineros, fire brigades).

107. The present project will support ONEMI´s current efforts. On 16 July 2016, for the first time, there was a mudflow evacuation drill in Antofagasta (Quebradas Uribe and Baquedano, about 18,500 people live in the area) (Anon, 2016a; Anon, 2016b). Also, ONEMI is preparing and disseminating mudflow evacuation maps for each gorge that indicate the evacuation routes, and the location of meeting points and shelters[54].

Pilot flood warning system in Esmeraldas

108. In Esmeraldas, a pilot flood warning system will be implemented in collaboration with six neighbourhoods of Luis Vargas Torres island[55]. The pilot will serve as a learning exercise and demonstration (output 4.2). It is anticipated that this experience will catalyse the development of a flood warning system for the entire city.

109. Luis Vargas Torres island is a high-risk area. In January 2016, 95% of the island was flooded and the population had to be evacuated. There are no precise figures, but it is estimated that about 6,000 families live in the island. The pilot will cover ca., 700 families from the six neighbourhoods previously mentioned. These neighbourhoods are located on the southwestern part of the island, and are integrated mostly by afro-Ecuadorians and some mestizos.

110. The pilot will include the use of sirens to alert the local community, and annual drills to test the plan and to prepare local groups. ONEMI´s experience using sirens and preparing evacuation procedures will serve to develop the pilot in Esmeraldas.

111. Like in Chile, local leaders will be trained to facilitate evacuation of vulnerable groups and take community action to guard the sirens and private property. Women will be encouraged to partake as evacuation guides.

112. The pilot will be implemented by GADE, in close coordination with SGR and relevant entities (e.g., police, fire brigades). There will be close coordination with the police to implement actions

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[52] ONEMI manage a nationwide tsunami evacuation alert siren system which includes Antofagasta and Taltal.

[53] To manage the alert system, ONEMI will require to have technical information from pertinent entities - e.g., DMC´s North Regional Meteorological Centre (CMR Norte), MOP - which have the means to generate and validate information about the condition of rainfall in the gorges and other contingencies. During project implementation, this operation will be aligned with ONEMI´s requirements with respect to alert operations.

[54] The maps are found in the following link: http://www.onemi.cl/mapas/region/antofagasta/

[55] Six neighbourhood committees: 12 de mayo, Cordero Crespo, 20 de noviembre, Pianguapi, 29 de agosto, and Habana.

to prevent looting during emergencies, and to have secure shelters suitable to accommodate the needs of women, children, older persons and people living with disabilities.

113. In addition, the project will:

- Assess the condition and provide maintenance to the existing footbridges that will be the main route to be used to evacuate the island during a flood.
- Prepare a flooding evacuation map for the Luis Vargas Torres island, based on an updated climate-adjusted flood hazard map. The evacuation routes and procedures will take into account the needs of vulnerable groups like older persons, children, and the Chachi families that live in the island (see page 26).

Evacuation route maps and signals in Antofagasta, Taltal and Esmeraldas

114. The project will contribute to update the mudflow evacuation maps for Antofagasta and Taltal (output 4.3). The maps, in large format (e.g., banners or large posters), will be placed in high-transit areas to sensitise and inform people living in risk areas. The maps will also be available in digital from through pertinent websites and social media. In addition, signals will be installed to guide local people through evacuation routes and into shelters.

115. In Esmeraldas, the project will contribute to prepare a flooding evacuation map and a landslide risk map. These maps will (1) be placed in high-transit areas to inform people living in risk areas (large format to be used), and (2) be available in digital form through pertinent websites (e.g., GADE, GADPE, SGR) and social media. In addition, signals will be installed to mark the flooding evacuation routes and landslide risk areas.

116. In all cases, the preparation of the evacuation maps will take into account the needs of vulnerable groups like children, older persons and people living with disabilities.

Component 2. Strengthen capacities for adaptation

Outcome 5. Local governments with improved capacity to design and implement adaptation measures

117. To generate this outcome, a regional online course will be developed (output 5.1). The Civil Protection Academy[56] of Chile (APC) will lead this action, in coordination with Ecuadorian partners. The course will focus on mainstreaming risk-based adaptation in coastal cities, with a module dedicated to explain the linkages between gender, climate change and adaptation measures, and will be aimed at officers from local governments.

118. Former experience with similar online training will be analysed (e.g., NOAA´s digitalcoast) and partners (e.g., local universities, international cooperation) will be identified and invited to participate. The course will have a blended approach, combining self-paced activities with online group sessions to interact with trainers and other participants.

119. The project will finance (i) the development of the course, (ii) the training of trainers, and (iii) three courses to be open in years 3, 4 and 5. The courses will be open to personnel from the local governments of Antofagasta, Taltal and Esmeraldas, and other cities of the region. It is expected that after project end, the course will be maintained and updated by APC or another partner.

[56] APC develop and offer in-person and online training courses (/www.onemi.cl/historia/).

Outcome 6. Local population and government personnel with increased awareness of climate-related risks (floods, landslides, mudflows)

120. To generate this outcome, public communication and education strategies will be implemented in the three cities (output 6.1) and an initiative to strengthen cultural memory will be developed (output 6.2).

Public communication and education strategies

121. The communication and education strategies will be inclusive, gender-sensitive and aimed at (i) strengthen community awareness and ownership of climate-related risks, and (ii) engage local groups into risk-based adaptation. These strategies will be a network to articulate messages across project actions, and will motivate and encourage networking among stakeholders to cultivate social capital. The aim will be that key stakeholders get in contact and develop communication channels and constructive relationships.

122. Social inclusion will be at the core of the communication and education strategies. Therefore, actions will:

i. consider the needs and concerns of the range of vulnerable groups, such as limited reading capabilities or media literacy, and the need of large print or braille; and

ii. foster ample participation (e.g., disadvantaged children, older people) and dialogue.

These strategies will also be gender-sensitive, since it has been proven that the lack of a gender perspective in dissemination and communication exacerbates the negative impacts that a disaster can have (UNISDR 2009). This entails using appropriate communication channels, that reach both men and women (and may be different depending on who is targeted) and ensuring that messages are understandable and accessible for everybody.

123. In the Luis Vargas Torres island, the communication and education strategies will include actions to support the conservation of the Wildlife Refuge Mangroves of the Esmeraldas River (located in the northern tip of the island) and to inform and engage the Chachi families that live in the island.

124. Implementation of the strategies will be based in the municipalities, in close coordination with climate change officers of the ministries of environment. The local strategies will be articulated to larger scale initiatives on climate change adaptation communication and education.

125. The strategies will be jointly assessed and reviewed every year by project partners. This will allow for exchange of lessons among project partners of the three cities, and to adjust to incorporate views and interests from local communities and vulnerable groups. It is expected that after project end, this kind of work will be embedded into the actions of the municipalities and local interest groups.

Narrators´ initiative

126. The project will support adapting the concept of “narrators” used in Japan to local conditions in Chile and Ecuador. Narrators is a tool to maintain a living memory of past events and to transfer knowledge to new generations (i.e., build cultural memory). It was developed and applied in the city of Nishinomiya after the devastating 1995 Great Hanshin Earthquake. A pilot of the narrators’ methodology was tested in Valdivia (Chile) between 2012 and 2014 in cooperation with the Japan International Cooperation Agency (JICA) (Rosales, 2014).

127. To adapt the narrators’ concept, local and international experience will be compiled and analysed. There is interesting experience in strengthening cultural memory for climate-related DRR (EDUCEN, 2015). Also, key partners and communication channels will be identified, like

storytelling, music or street theatre. Local partners (e.g., dance groups, actors, musicians) will be identified, and if needed will be assisted by more experienced external partners[57] to initiate and catalyse local efforts of the narrators' initiative.

128. The narrators´ initiative will be grounded on social inclusion. Therefore, women, children, older people and people living with disabilities will be encouraged to integrate this initiative. Also, their particular needs (e.g., wheelchair access, sign language) will be taken into consideration for the design of the various activities. The capabilities and experience of older persons will be crucial for the narrators´ initiative. They are a repository of knowledge and preservers of cultural and social identity. The project will promote the preservation and use of oral history, and traditional tales and songs.

129. A learning by doing approach will be used, with continuous exchange of experience among the groups working in the three cities. A first two-year round will be implemented and evaluated. Afterwards, the strategy will be adjusted and tested in a final two-year round of actions. At project end, it is envisioned that the narrators´ initiative will be anchored in local groups and the municipalities.

130. The Ministry of Environment of Chile (MMA) will lead the narrators´ initiative in both countries, in close coordination with Ecuador´s Ministry of Environment (MAE). The initiative will be executed from within the three municipalities, and will be closely articulated with the communication strategies (output 6.1), and the other adaptation actions (e.g., mudflow control works, pilot flood warning system in Esmeraldas). Local partners, the municipalities and the ministries of environment will form a community of practice to strengthen cultural memory on disaster-risk adaptation.

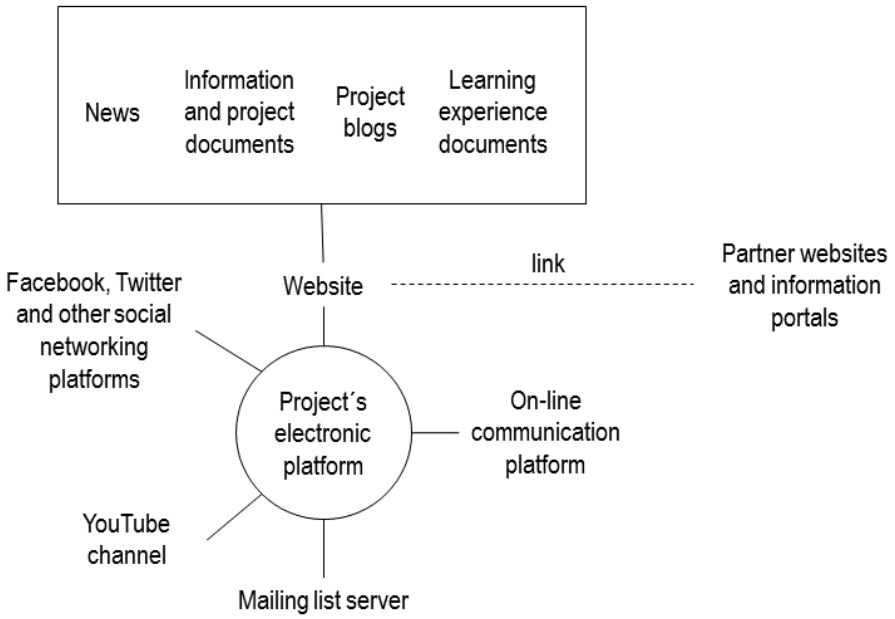

Figure 21. Electronic platform of the project.

[57] For example, Latin Latas is a Colombian collective of musicians which works with local groups to promote environmental protection. Also, the International Storytelling Network has members in both countries. Finally, dance groups of the Luis Vargas Torres island had expressed their interest to participate.

Component 3. ICTs and partnership between coastal cities in Latin America

Outcome 7. Lessons and best practice on reducing vulnerability to climate related flooding, landslides and mudflows in coastal cities have been shared in the region

131. This outcome is the backbone of the project´s learning process. To generate this outcome:
- a set of communities of practice will be established and nurtured,
- a regional electronic platform will be developed (output 7.1) (Figure 21), and
- the lessons and best practice will be documented and disseminated (output 7.2).

132. The project team will systematically work with the communities of practice, document experiences and lessons and disseminate them through the electronic platform and complementary media. It is envisioned to have five communities of practice:
   a. Introducing the climate-variable in the design and construction of adaptation infrastructure (outcomes 1 and 2).
   b. Climate monitoring to strengthen early warning systems (outcome 3).
   c. Early warning and response systems (outcome 4).
   d. Raising public awareness and engagement (outputs 5.1 and 6.1).
   e. Narrators as a tool to cultivate cultural memory (output 6.2).

   Gender and social inclusion will be cross-cutting topics in all communities of practice. Women and other vulnerable groups (e.g., older people) will be encouraged to be part of the communities of practice.

133. Cultivating and supporting the communities of practice is a critical element of the project. On-line blogs will be maintained by project partners to serve as field journals and document advances and lessons. Learning experience documents[58] (for a wide audience) will be prepared to systematize lessons and best practice, and propose recommendations for future action. Also, technical documents will be prepared for professional audiences. Along this process, female scientists will be invited to participate and analyse the experiences and lesssons.

134. The regional on-line platform has two elements:
   a. A web-based communication platform (e.g., SKYPE for business / WebEx) and other electronic media (e.g., Twitter, WhatsApp, Facebook) to facilitate interaction and virtual meetings and webinars among project participants.
   b. An array of media to document and disseminate information and lessons. This includes:
      i. A mailing list server to distribute messages, news and information.
      ii. A YouTube channel to post a set of short videos (<5 minutes/video) to present experience, lessons, best practice and anecdotes. This channel will be rooted in the concepts of participatory video (Lunch, 2004; Lunch & Lunch, 2006), whereby practitioners and community members use video to document their experiences and knowledge and to express their ideas and perspectives (i.e., tell their own story).

[58] Nine learning experience documents are planned: 1. incorporating the climate change factor into stormwater management plans in Chile, 2. preparation of green infrastructure plan in Esmeraldas, 3. incorporating the climate change factor into mudflow control infrastructure in Antofagasta, 4. incorporating the climate change factor into landslide control in Cerro Gatazo (Esmeraldas), 5. Use of weather radar/ storm system to enhance early warning systems, 6. mudflows warning system in Antofagasta and Taltal, 7. pilot flood warning system in Esmeraldas, 8. communication and education strategies to increase public awareness of climate-related disaster risk, and 9. contribution of narrators to sustain cultural memory on climate-related risks and disasters.

iii. A set of social network accounts (e.g., Twitter, Facebook, Instagram) to distribute messages and allow interaction among project participant and interested groups.

iv. A website dedicated to adaptation in coastal cities. The website will be linked the partners' portals and relevant information sites, and will contain:

- News.
- Project information and documents.
- Blogs that document specific experience. It is foreseen to have one blog for each output.
- Learning experience documents.
- Technical documents.

135. To complement virtual communication, there will be in-person meetings between project partners of both countries. Women will be encouraged to participate in these meetings. It is planned to have four thematic exchange visits:

- pilot stabilization of Cerro Gatazo to control landslides (in Ecuador),
- early warning and response systems to climate-related events (in Chile),
- public awareness strategies (in Chile), and
- narrators' initiative (in Ecuador).

Exchange visits will be open to participants from other countries.

136. The mid-term Review (MTR) and Terminal Evaluation (TE) will contribute to the project´s learning process and will be inputs to the communities of learning.

137. To close the project there will be public events in Antofagasta, Taltal and Esmeraldas. These will include technical talks and informal activities to present results and learnings to stakeholders and general public. A final memoir will be prepared and disseminated with executive summaries in Spanish, English, French and Portuguese.

138. After project end, CAF will maintain the regional on-line platform. It is envisioned that it will develop into a working space to promote risk-based adaptation in coastal cities of Latin America and the Caribbean.

Alternative approaches that were considered and not adopted

139. Annex 13 summarise the alternative approaches that were analysed but not adopted.

B. New and innovative solutions to climate change adaptation

140. The project has three main elements of innovation:

a. First, the development of tools and methods to incorporate climate change into infrastructure design and construction. As mentioned before (paragraph 67), the existing protection infrastructure does not incorporate climate considerations and it is very likely that new infrastructure will be built without considering the foreseen conditions of stronger and more frequent rainfall to be caused by climate change. Therefore, it is necessary that new infrastructure is climate resilient to the potential increases in extreme weather events. However, there is limited experience on how to implement this adaptation measure.

The project will support the development of three pieces of pioneer practical experience:

i. To update Antofagasta´s stormwater management plan to channel and evacuate the larger volumes of water generated by the expected increase in extreme weather

events. It is very probable that the plan will require to upgrade the existing stormwater system and the construction of new stormwater facilities.

ii. To update the design of mudflow control infrastructure in Quebrada Bonilla (Antofagasta). With 2015´s Taltal mudflow it became evident that existing structural measures will be insufficient to cope with the projected impact of the climate change. Therefore, it is probable that the existing design and size of the decantation ponds and retaining walls (Annex 11) need to be changed.

iii. To update the design of landslide mitigation works in Cerro Gatazo (Esmeraldas) to cope with stronger and more frequent El Niño conditions. The design will combine grey and green infrastructure.

In all cases, the existing designs will be analysed and adjusted considering the foreseen conditions associated with future changes in climate. The experience and lessons of each case will be documented and systematised in guidelines that will be published in electronic format. The guidelines will have a prompt direct application. In Chile, there are 33 cities with more than 50,000 people that already have stormwater management plans; none of them consider the future changes associated with climate change and will need to be upgraded to be climate resilient. Similarly, the guidelines will contribute to introduce climate change considerations into the new mudflow protection infrastructure that is planned to be built in the Antofagasta region.

b. Second, to develop hands-on practice on the preparation of the green infrastructure plan for Esmeraldas. As mentioned before, urban green infrastructure is a new field in both countries. The work in Esmeraldas will explore forms to use elements like vegetated slopes to control landslides and mangrove swamps, permeable pavers and rain gardens to manage urban flood risk.

c. Third, to adapt the narrators' concept to local conditions and use it to fortify cultural memory. The existing experience in Chile indicate that the core concept is valid, but actions need to be inclusive and culturally appropriate. Therefore, the project will support:

i. Documenting from different perspectives (e.g., older persons, women, children, campamento dwellers, emergency services) the existing memory of climate-related disasters (e.g., Antofagasta´s 1991 mudflow, Taltal´s 2015 mudflow, El Niño associated floods in Esmeraldas).

ii. Supporting that local groups explore forms to transmit messages about climate-related hazards and disasters to the public and the new generations. It is anticipated that multiple channels will be explored, like street theatre, music and dance.

This will be a completely new approach to contribute to climate change adaptation by cultivating cultural memory. The lessons from this initiative have a high potential of application and replication in both countries and the entire region.

C. Economic, social and environmental benefits and mitigation of negative impacts, in compliance with the Adaptation Fund ESP.

Social benefits

141. The main benefits from the project will be (i) to protect the population of the three cities, and (ii) to reduce the risk of casualties.

Protected population in Chile

142. In Chile, the project will benefit the entire population of Antofagasta and Taltal, which is at risk of mudflows caused by extreme weather events (ca., 403 thousand people in 2017, Table

5). These people will benefit by having early warnings, information and knowledge to act in case of emergency and expedite evacuation, when necessary.

143. The direct beneficiaries are the people living in hazard areas. This is the population that will have to be evacuated in case of emergency: (i) about 116 thousand people from Antofagasta´s 17 gorges (Saavedra, 2016), and (ii) the entire population of Taltal (ca., 13,000 people). This includes people living in campamentos, which are the most vulnerable groups. The project intervention will contribute to protect the estimated 4,593 families that live in campamentos in Antofagasta (TECHO, 2016) (Figure 9), and the estimated 400 families living in campamentos in Taltal[59] (Figure 11, Table 4).

144. The population of Antofagasta will also benefit from weather-proof protection infrastructure that will be built / strengthened in the near future based on the updated stormwater management plan.

145. The protection works in Quebrada Bonilla will directly benefit about 12,840 people that live in the mudflow hazard area, including the three campamentos[60] (ca., 125 families) located there (Figure 20, Table 9). These people will benefit from weather-proof protection infrastructure that will mitigate the impact from mudflows.

146. The experience gained in Antofagasta and Taltal[61] will indirectly benefit a much larger population, since it can be applied in other parts of Chile.

Protected population in Ecuador

147. In Ecuador, the entire population of Esmeraldas will benefit from the project; this is about 161 thousand people. These people will benefit by having early warnings, information and knowledge to act in case of emergency and expedite evacuation, when necessary.

148. Direct beneficiaries will be the people that live in flood and landslide hazard areas (ca., 60% of the city´s population). The works in Cerro Gatazo will directly benefit ca., 500 people that live in the hazard area (Barrio 20 de Noviembre). The direct beneficiaries of the pilot flood warning system will be ca., 700 families living in six neighbourhoods of Luis Vargas Torres island[62] (about 28% of the families that live in the island).

149. Coverage of the weather radar comprise most of the Esmeraldas and Teaone river areas within the province. Therefore, radar information will provide valuable inputs to the province-level early warning system and benefit the population located in flood-prone areas.

150. The experience gained in Esmeraldas[63] will indirectly benefit a much larger population, since it can be applied in other parts of the country.

Social inclusion

151. The project has mainstreamed social inclusion in key actions (e.g., outcomes 4, 6 and 7). This will provide additional social benefits in both countries and generate lessons that will be useful for the entire region.

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[59] The latest census of campamentos executed by TECHO in 2016 recorded 44 campamentos in Antofagasta (4,593 families) and 6 campamentos in Taltal (400 families) (TECHO, 2016).

[60] i.e., Víctor Jara (25 families), Mujeres Unidas (56 families) and Villa Esperanza (34 families).

[61] For example, introducing the climate variable in Antofagasta´s stormwater management plan and Quebrada Bonilla´s protection infrastructure, use of a storm detection system to forecast rainfall and feed early warning systems, build cultural memory through the narrators´ initiative.

[62] Six neighbourhood committees: 12 de mayo, Cordero Crespo, 20 de noviembre, Pianguapi, 29 de agosto, and Habana.

[63] For example, use of a weather radar to forecast rainfall and feed early warning systems, introducing the climate variable Cerro Gastaso protection works, preparing a green-infrastructure plan for the city, implementing a community-based flood early warning system, build cultural memory through the narrators´ initiative.

152. The key stakeholders and vulnerable groups benefit - related to each outcome are summarised in Table 10. Key stakeholders and vulnerable groups.

Table 10. Key stakeholders and vulnerable groups.

Output	Key public stakeholders	Key private stakeholders	Vulnerable groups	Beneficiaries
1.1. Stormwater management plan for Antofagasta	MOP, Municipality of Antofagasta	Population of Antofagasta living on mudflow hazard areas (gorges) (ca., 116 thousand people)	One-parent homes, children, older persons and people living with disabilities who live in mudflow hazard areas	Population of Antofagasta (ca., 403 thousand people)
1.2. Green infrastructure plan for Esmeraldas	Municipality of Esmeraldas, Ministry of Environment	People living in flood-prone areas along the banks of Teaone and Esmeraldas rivers, and people living on unstable slopes and downhill of Cerro Gatazo (ca., 60% of the city´s population).	People living in informal settlements located on flood-prone and landslide-prone terrain. Mainly: one-parent homes, children, older persons and people living with disabilities.	Population of Esmeraldas (ca., 161 thousand people)
2.1. Mudflow control infrastructure in Antofagasta	MOP, Antofagasta Regional Government	People living on the mudflow hazard area of Quebrada Bonilla (12,840 persons).	One-parent homes, children, older persons and people living with disabilities who live on the mudflow hazard area of Quebrada Bonilla	People living on the mudflow hazard area of Quebrada Bonilla (12,840 persons).
2.2. Landslide mitigation works in Esmeraldas	Municipality of Esmeraldas	People living on barrio 20 de noviembre downhill of Cerro Gatazo (ca., 500 people)	One-parent homes, children, older persons and people living with disabilities who live on barrio 20 de noviembre	People living on barrio 20 de noviembre downhill of Cerro Gatazo (ca., 500 people)
3.1. Weather radar in Esmeraldas and a storm detection system in Antofagasta	Meteorological Directorate of Chile, ONEMHI, Municipality of Antofagasta, Municipality of Taltal	Population of Antofagasta living on mudflow hazard areas (gorges) (ca., 116 thousand people) Population of Taltal (ca., 13,000 people)	One-parent homes, children, older persons and people living with disabilities who live in mudflow hazard areas	Population of Antofagasta (ca., 403 thousand people) Population of Taltal (ca., 13,000 people)
	Provincial Government of Esmeraldas, INAMHI, Risk Management Secretariat Municipality of Esmeraldas	People living in flood-prone areas of the city of Esmeraldas	People living in informal settlements located on flood-prone areas. Mainly: one-parent homes, children, older persons and people	People living in flood prone areas along the Teaone and Esmeraldas rivers in the Esmeraldas province.

Output	Key public stakeholders	Key private stakeholders	Vulnerable groups	Beneficiaries
			living with disabilities.	
3.2. Increased number of meteorological stations in Antofagasta, Taltal and Esmeraldas	MOP, Meteorological Directorate of Chile, ONEMHI, Municipality of Antofagasta, Municipality of Taltal	Population of Antofagasta living on mudflow hazard areas (gorges) (ca., 116 thousand people) Population of Taltal (ca., 13,000 people)	One-parent homes, children, older persons and people living with disabilities who live in mudflow hazard areas	Population of Antofagasta (ca., 403 thousand people) Population of Taltal (ca., 13,000 people)
	Provincial Government of Esmeraldas, INAMHI, Municipality of Esmeraldas,	People living in flood-prone areas of the city of Esmeraldas	People living in informal settlements located on flood-prone areas. Mainly: one-parent homes, children, older persons and people living with disabilities.	People living in flood prone areas along the Teaone and Esmeraldas rivers in the Esmeraldas province.
4.1. Enhanced public warning system in Antofagasta and Taltal	ONEMHI, Municipality of Antofagasta, Municipality of Taltal	Population of Antofagasta living on mudflow hazard areas (gorges) (ca., 116 thousand people) Population of Taltal (ca., 13,000 people)	One-parent homes, children, older persons and people living with disabilities who live in mudflow hazard areas	Population of Antofagasta (ca., 403 thousand people) Population of Taltal (ca., 13,000 people)
4.2. Pilot flood warning system in Esmeraldas	Municipality of Esmeraldas, Provincial Government of Esmeraldas, Risk Management Secretariat	About 700 families that live in six neighbourhoods[64] in Luis Vargas Torres island (ca., 28% of the 2,500 families that live in the island).	One-parent homes, children, older persons and people living with disabilities in the target neighbourhoods. About 60 Chachi families that live in the island.	700 families that live in the six target neighbourhoods.
4.3. Evacuation route maps and signals in Antofagasta, Taltal and Esmeraldas	ONEMHI, Municipality of Antofagasta, Municipality of Taltal	Population of Antofagasta living on mudflow hazard areas (gorges) (ca., 116 thousand people) Population of Taltal (ca., 13,000 people)	One-parent homes, children, older persons and people living with disabilities who live in mudflow hazard areas	Population of Antofagasta (ca., 403 thousand people) Population of Taltal (ca., 13,000 people)
	Municipality of Esmeraldas, Risk Management Secretariat	People living in flood-prone areas along the banks of Teaone and Esmeraldas rivers, and people living on unstable slopes and downhill of Cerro	People living in informal settlements located on flood-prone and landslide-prone terrain. Mainly: one-parent homes, children, older persons and	Population of Esmeraldas (ca., 161 thousand people)

[64] Six neighbourhood committees: 12 de mayo, Cordero Crespo, 20 de noviembre, Pianguapi, 29 de agosto, and Habana.

Output	Key public stakeholders	Key private stakeholders	Vulnerable groups	Beneficiaries
		Gatazo (ca., 60% of the city´s population).	people living with disabilities.	
5.1. Course on risk-based adaptation in coastal cities	Civil Protection Academy of Chile, Ministry of Environment of Chile, Ministry of Environment of Ecuador	None	Local government officers that attend the course which are head of single-parent families, elder, women, or have disabilities	Local government officers of the Municipality of Antofagasta, Municipality of Taltal, Municipality of Esmeraldas, and other municipalities from Chile, Ecuador and the Latin America and Caribbean region.
6.1. Public communication and education strategies for Antofagasta, Taltal and Esmeraldas.	Municipality of Antofagasta, Muncipality of Taltal, Municipality of Esmeraldas, MOP, ONEMI, Ministry of Environment of Chile, Ministry of Environment of Ecuador	Population of Antofagasta living on mudflow hazard areas (gorges) (ca., 116 thousand people) Population of Taltal (ca., 13,000 people) People living in flood-prone areas along the banks of Teaone and Esmeraldas rivers, and people living on unstable slopes and downhill of Cerro Gatazo (ca., 60% of the city´s population).	One-parent homes, children, older persons and people living with disabilities who live in hazard areas	Population of Antofagasta (ca., 403 thousand people) Population of Esmeraldas (ca., 161 thousand people) Population of Taltal (ca., 13,000 people)
6.2. Narrators´ initiative initiated	Municipality of Antofagasta, Muncipality of Taltal, Municipality of Esmeraldas, Ministry of Environment of Chile, Ministry of Environment of Ecuador	Population of Antofagasta living on mudflow hazard areas (gorges) (ca., 116 thousand people) Population of Taltal (ca., 13,000 people) People living in flood-prone areas along the banks of Teaone and Esmeraldas rivers, and people living on unstable slopes and downhill of Cerro Gatazo (ca., 60% of the city´s population).	One-parent homes, children, older persons and people living with disabilities who live in hazard areas	Population of Antofagasta (ca., 403 thousand people) Population of Esmeraldas (ca., 161 thousand people) Population of Taltal (ca., 13,000 people)
7.1. Electronic platform to facilitate communication among stakeholders	Municipality of Antofagasta, Muncipality of Taltal, Municipality of	Population of Antofagasta living on mudflow hazard areas (gorges) (ca.,	One-parent homes, children, older persons and people living with	Population of Antofagasta (ca., 403 thousand people)

Output	Key public stakeholders	Key private stakeholders	Vulnerable groups	Beneficiaries
and dissemination of lessons and best practice 7.2. Lessons and best practice documented and disseminated	Esmeraldas, Ministry of Environment of Chile, Ministry of Environment of Ecuador	116 thousand people) Population of Taltal (ca., 13,000 people) People living in flood-prone areas along the banks of Teaone and Esmeraldas rivers, and people living on unstable slopes and downhill of Cerro Gatazo (ca., 60% of the city´s population).	disabilities who live in hazard areas	Population of Esmeraldas (ca., 161 thousand people) Population of Taltal (ca., 13,000 people) People and pubic officers from other municipalities from Chile, Ecuador and the Latin America and Caribbean region.

Economic benefits

153. The main economic benefits will be to safeguard public and private assets in the three cities. A proxy of the economic value is the losses recorded in previous events:
    a. Antofagasta´s 1991 mudflow produced ca., USD71 million in losses, 493 houses were destroyed, and 2,464 houses had serious damages (ONEMI, 1994; Melin, 2011).
    b. Taltal´s 2015 mudflow, which surpassed the existing protection infrastructure, damaged 27 houses. The municipality invested USD 1.3 million in rehabilitation works. In addition, MOP invested USD 4 million to rehabilitate and strengthen protection structures, and USD 4.5 million to build additional protection structures (Rojas, 2015; Santana, 2016).
    c. In Esmeraldas, the landslides generated by El Niño 1997 / 1998 destroyed about 300 houses (ca., 2000 – 3000 people lost their properties) (Perrin et al., 1998). Also, the water system was damaged and did not operate for 45 days, the cost of this damage was ca., USD 1.3 million (CAF, 2000a). Also, a landslide broke a main oil pipeline close to the refinery, producing a spill of 8,700 barrels of crude oil and 3,500 barrels of diesel (CAF, 2000a).

Environmental benefits

154. The main environmental benefits are related to the impacts of flooding, mudflows and landslides in local biodiversity. But these impacts have not been assessed.
155. In Ecuador, an additional long-term benefit will be the implementation of a green infrastructure plan in Esmeraldas. In the short-term, an area will be revegetated on Cerro Gatazo to contribute to stabilize the hillsides (output 2.2). The exact area will be defined during project execution, but it is estimated that it will be about 100 ha. At the moment, the hillsides are highly intervened, therefore introducing new vegetation will have a positive impact.

Gender considerations

156. Men and women have different roles and responsibilities within their communities. Gender inequality is present in access and control over assets, natural resources, knowledge, capacities and opportunities, and can lead to different levels of vulnerability.
157. A study of 141 countries over 20 years on disasters impact over women's and men's life expectancy shows a gendered disparity in mortality rates from natural disasters and their

aftermaths (Neumayer & Plümper, 2007). Results presented include: (i) natural disasters lower women's life expectancy more than men's (either more women are killed or they are killed at a younger age than males); (ii) the greater natural disaster's death toll, the greater gender gap in life expectancy; and (iii) the higher women's socio-economic status, the weaker the effect on the gender gap in life expectancy.

158. In this view, the Hyogo Framework for Action (2005 – 2015) calls for an integration of a gender perspective "into all disaster risk management policies, plans and decision-making processes, including those related to risk assessment, early warning, information management, and education and training". Sendai Framework for Disaster Risk Reduction (2015 – 2030) goes further, and calls upon relevant stakeholders, at the national and local level, to "invest in, develop, maintain and strengthen people-centred multi-hazard, multisectoral forecasting and early warning systems, disaster risk and emergency communications mechanisms, social technologies and hazard-monitoring telecommunications systems; develop such systems through a participatory process; tailor them to the needs of users, including social and cultural requirements, in particular gender; promote the application of simple and low-cost early warning equipment and facilities; and broaden release channels for natural disaster early warning information".

159. Project design has taken into consideration gender differences and has identified outputs and activities where women can have more of a leading role. Also, gender perspective has been mainstreamed in a number of project actions like evacuation plans, education and communication strategies, and the narrators' initiative, to ensure that both women and men's needs are addressed.

160. A detailed Gender Analysis was dedicated to the project, which can be viewed in Annex 17.

Measures to avoid / mitigate negative impacts

Impacts from the construction of infrastructure in Quebrada Bonilla and Cerro Gatazo

161. Like any public works, the constructions in Quebrada Bonilla and Cerro Gatazo will produce temporary impacts like increased noise, and emission of dust and combustion gases. In addition, there will be risk of personnel accidents and contamination from waste and spills. Similarly, there will be temporary impacts during maintenance of the infrastructure. In Quebrada Bonilla, the decantation ponds and drainage ways will have to be cleaned annually (i.e., remove garbage). After a mudflow, the sediment and debris will be removed from the decantation ponds, the retaining walls and the drainage ways. The Cerro Gatazo's infrastructure will require recurrent cleaning of debris and vegetation from the storm and surface water drains.

162. To prevent impacts and manage risks, MOP and GADE will obtain the corresponding environmental permits, and will prepare and implement an Environmental and Social Management Plan, which will be revised and actualized every year depending on the development of the project.

Potential impact from revegetation of Cerro Gatazo

163. The plant species to be planted in Cerro Gatazo will have to contribute to hold and consolidate the ground. Four species have been recommended for use on the hillsides, including vetiver and huaje (MAE, 2002), which are introduced species widely used in Ecuador.

164. Vetiver is a perennial grass native from India, but widely used worldwide for slope stabilization. It is a non-invasive species (Joy, 2009) that was used, with positive results, in trials to stabilize the hillsides of Cerro Gatazo in the early 2000s (PNUD, 2005).

165. Huaje is native from Mexico and central America, it is widely used in Ecuador´s mainland for various purposes (e.g., fodder, wood, revegetation) (Aguirre, 2012; Grijalva et al., 2012), but considered an invasive species in the Galapagos archipelago. It is listed as one of the '100 of the World's Worst Invasive Alien Species' for its spread in several countries (GSID, 2016).

166. The plant species to use will be decided during project implementation. However, to prevent impacts, the selection criteria will include:

    a. Preference to use native species.
    b. If a non-native species is a best choice, no species listed on IUCN´s Global Invasive Species Database[65] could be used.

167. Before execution, GADE will provide a written report indicating the list of plant species to be used for slope stabilization and the criteria used for their selection according to the suggestions given by the MAE.

D. Cost-effectiveness analysis with a regional approach

168. The AF investment will benefit about 557 thousand people in the three cities which are highly vulnerable to climate-related disasters. The project will contribute to strengthen the adaptive capacity in these cities, reducing the level of future impacts.

169. The project will also serve as a catalyst to the planned investment of ca., USD 84,5 million to build infrastructure to protect from mudflows the cities of Antofagasta, Taltal and Tocopilla (DOH, 2015; Saavedra, 2016) by providing practical guidelines to incorporate the climate variable in new construction works.

170. At the moment, the municipality of Esmeraldas has financial limitations. Therefore, this project will make possible to execute actions that could not be financed in the short-term. The public works in Cerro Gatazo is a long waited initiative that has not been possible to finance before.

171. The project will ensure the cost-effectiveness of resources by allocating AF funds to activities and products with high catalytic potential, such as:

    a. Participatory learning process based in communities of practice to generate lessons and best practice on disaster-risk adaptation.
    b. Systematic documentation and dissemination of lessons.
    c. Design and implement a communication strategy focused on specific interests and channels of key stakeholders.
    d. Use of an electronic platform to: (i) disseminate lessons learned and outcomes of the project, and (ii) facilitate communication and articulation among stakeholders and interest groups.
    e. Support the development of lessons and best practice that are highly replicable worldwide.

172. The regional approach will facilitate south-south cooperation and the foreseeable future application of learnings in other coastal cities of the region. The backbone of the project is the exchange of know-how, experience and lessons among local and national authorities and stakeholders in both countries. The main tool will be communities of practice to facilitate horizontal collaboration.

173. Some examples of the benefits of a regional approach are:

    a. Exchange of experience and learnings on:
        i. the use of meteorological radar and the storm detection system between INAMHI, GADPE, DMC, and MOP,

[65] www.iucngisd.org

ii. early warning systems among ONEMI, DMC, INAMHI, SGR and the three municipalities, and

iii. mainstreaming risk-based adaptation in coastal cities between MMA and MAE.

b. Expanding the narrators' concept that was first applied in Chile to be useful in a new cultural setting in Esmeraldas, and the possibility to applying it in other coastal cities of the region.

174. The regional approach also opens the opportunity to make available experience and lessons to a wider community of interested groups in Latin America and the Caribbean.

175. CAF will be a catalyst of this process by facilitating access to worldwide experiences and encouraging partnerships among the project participants.

E. Consistency with national or sub-national sustainable development strategies

176. At the international level, the project is in line with the Sendai Framework for Disaster Risk Reduction 2015 – 2030. It also includes elements of the former Hyogo Framework for Action 2005-2015. The focal points for this matter are ONEMI in Chile and SGR in Ecuador. Also, the project will contribute to enhance knowledge and understanding, and to strengthen dialogue and coordination on line with the Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts and article 8 of the Paris Agreement under the United Nations Framework Convention on Climate Change (under ratification).

177. The project is in line with CAF´s climate change adaptation programme (CAF, 2013). This programme has five lines of action; the present project is in line with:

a. Line of action 2. To strengthen institutional capacity of public and private sectors of the region on climate change adaptation. The project will contribute to the following actions:

i. Action 2. Implementation of training of public and private sector to promote the importance of planned climate adaptation and the development of policies, plans and strategies to adapt to climate change. The present project will contribute to this action by implementing a regional online course on risk-based adaptation in coastal cities for local government officers.

ii. Action 3. To strengthen hydrometeorological data collection to feed climatic models. The project will contribute to this action by improving weather monitoring in the three selected cities.

b. Line of action 3. To promote on the ground concrete adaptation measures in response to pressing needs of Latin America and Caribbean countries. The project will contribute to action 7, which is to further the funding of infrastructure which is resilient to climate change. The present project will contribute to this action by mainstreaming the climate factor into Antofagasta´s stormwater management plan, and the designs and construction of protection infrastructure in Quebrada Bonilla (Antofagasta) and Cerro Gatazo (Ecuador).

c. Line of action 4. To support knowledge generation and management on adaptation to climate change. Component 3 of the present project is in line with this line. It will facilitate documenting and disseminating knowledge and best practice on risk-based adaptation in coastal cities.

178. At the national level, the project is in line and will contribute to the following Chilean instruments:

a. The National Adaptation Plan (MMA, 2014). The plan has eight strategic lines of action. The present project is in line with the following lines:

i. Line 7. Incorporate climate change in regional and local environmental management. This line focus on articulating sectoral and national adaption policies with local and regional development policies. The project contributes to the following activities:

1. A21. Incorporate climate change adaptation and mitigation actions into municipal and local environmental management through instruments such as municipal environment certification (SCAM) and national environmental certification of education establishments. This action seeks to incorporate the climate factor into municipal policy, planning and management. The project will contribute to this action by working directly with the municipalities of Antofagasta and Taltal. Project adaptation specialist will be based within the municipalities (Figure 23) and the public communication and education strategies will be executed by the municipalities (output 6.1).
2. A22. Incorporate climate change adaptation and mitigation actions into sustainable community or sustainable neighbourhood programmes. The project will contribute to this action by implementing public communication and education strategies and the narrators´s initiative (outputs 6.1 and 6.2).

ii. Line 8. Information for decision making on disaster risk management. The project contributes to the following activities:

1. A24. Incorporate information of extreme hydrometeorological events (present and foreseen) in the preparation and updating of risk maps, including climate change threat, vulnerability and exposure variables. The project will contribute to this action by preparing and disseminating evacuation route maps and installing evacuation signals (output 4.3).
2. A26. Develop a training programme for public entities, technical staff and other stakeholders at national, regional and local levels, on disaster risk reduction adaptation to climate change, which includes, among other topics, climate change impacts, adaptation, risk perspective, and non-traditional adaptation alternatives such as green infrastructure and ecosystem-based adaptation. The project will contribute to this action by developing and executing a regional course on risk-based adaptation in coastal cities (output 5.1).

The project will also contribute to implement the Climate Change National Action Plan 2017-2022 (currently under public consultation), and the sectoral adaptation plans for cities and infrastructure that are under development.

b. National Plan for Civil Protection (Decree 156 of 12 March 2002). This plan set the foundations, organizational structure, responsibilities and procedures to address emergencies in Chile. The project is in line with this plan and will contribute by improving weather monitoring and strengthening the mudflows early warning system (outputs 3.1, 3.2, 4.1, and 4.3).

c. The National Policy for disaster risk management (ONEMI, 2014). This policy sets five strategic axes, the project is in line with the following elements:

i. Strategic axis 2. Strengthen monitoring and early warning systems. This axis focusses on providing to the civil protection national system adequate information to properly assess risks and take sound decision. The project will contribute to the following specific objectives:

1. Specific objective 1. Strengthen the monitoring systems to promptly detect threats, within the competences of each actor, on a continuous 24/7 system. The project will contribute to this objective by upgrading weather monitoring with a meteorological radar in Esmeraldas, storm detection system in Antofagasta and meteorological stations in both sites (outputs 3.1 and 3.2).

2. Specific objective 4. Support the development of technical agencies that have human and technical resources to monitor diverse threats and fulfil their specific functions. The project will contribute to this objective by strengthening local functions. DMC will manage Antofagasta's storm detection system and DGA will manage the meteorological stations (outputs 3.1 and 3.2). The data and information will feed the early warning systems.

ii. Strategic axis 3. Promote a prevention and self-protection culture. The project will contribute to the following specific objectives:

1. Specific objective 1. To include disaster risk reduction concepts and approach into formal, non-formal and informal education. The project will contribute to this objective through the public communication and education strategies and the narrators´ initiative (outputs 6.1 and 6.2).
2. Specific objective 3. Contribute to train professionals on disaster risk reduction. The project will contribute to this objective through the regional online course on risk-based adaptation in coastal cities (output 5.1).
3. Specific objective 6. To promote the disaster risk reduction approach into public and private sectors. The project will contribute to this objective through the public communication and education strategies and the narrators´ initiative (outputs 6.1 and 6.2).

d. Antofagasta´s Regional Plan for Infrastructure and Water Resources Management to 2021 (MOP, 2012). This plan includes strategic action B2 which is to protect the population from mudflows or floods. The plan includes a set of targets for construction of mudflow protection works in Antofagasta and Taltal, and six projects to build new protection works (i.e., projects 31, 33, 34, 35, 62, and 63). The present project will complement the planned activities by updating Antofagasta´s stormwater management plan and building climate-proof mudflow protection infrastructure in Quebrada Bonilla (outputs 1.1 and 2.1). In addition, the lessons and experience from these two actions will serve to guide the incorporation of the climate factor into other protection works.

e. The project is consistent with Antofagasta´s Communal Development Plan 2013 – 2022 (MdA, 2012) and Taltal´s Communal Development Plan 2022 (MdT, 2015). In both cases, the project will contribute to mainstream risk-based adaptation concepts and approach into municipal work. A project´s adaptation specialist will be based within each municipality (Figure 23). This will allow for day-to-day interaction with municipal officers during the five years of project implementation. In addition, municipal execution of the public education and communication strategies will contribute to build interest and familiarity with risk-based adaptation. Finally, municipal officers will take course on risk-based adaptation in coastal cities, this will contribute to increase technical capacities and to interact with peers from other cities.

f. The project will contribute to Antofagasta´s and Taltal´s communal plans for civil protection (MdT, 2012) by advancing on practical actions to address mudflows (e.g., evacuation maps, evacuation drills, signal of evacuation routes, enhanced early warning and alert system and increased public awareness).

179. The project is in line and will contribute to the following Ecuadorian instruments:

a. National Climate Change Strategy (MAE, 2012), in particular specific objectives 7 and 8. The national strategy covers the period 2012 – 2025. It defines eight priority sectors for climate change adaptation, two of them are human settlements (number 7) and risk management (number 8) which is transversal to all the other sectors. The present project is in line with two specific objectives of the adaptation line of work:

i. Specific objective 7. To include integrated risk management to weather related extreme events in public and private sectors. Within this objective, the project will contribute to three key actions:

1. Action 2. Integrate risk management in present and future infrastructure plans and programmes, motivating innovation and continuous improvement of infrastructure quality and safety. The project will contribute to this action by developing experience on mainstreaming the climate change factor into the design and construction of protection infrastructure in Cerro Gatazo (output 2.2), complemented with green infrastructure (output 1.2). The development of a green infrastructure plan for Esmeraldas will allow to explore the use of natural elements to cope with climate change adaptation. In addition, the lessons and experience in Cerro Gatazo will be useful to other infrastructure projects.
2. Action 4. Encourage the generation and updating of early warning systems, which include the risks of extreme weather events from possible climate change scenarios, for the priority sectors. The project will contribute to this action by improving weather monitoring (outputs 3.1 and 3.2) and the existing Esmeraldas´ early warning system. In addition, the pilot flood warning system in Luis Vargas Torres island (output 4.2) will generate experience and lessons to be replicated in other areas.
3. Action 6. Promote public participation and social organization as mechanisms to support implementation of responses to climate change related extreme weather events as part of integrated risk management. The project will contribute to this action by preparing evacuation route maps (output 4.3) and implementing public education and communication strategies (outputs 6.1 and 6.2).

ii. Specific objective 8. To implement measure to increase the response capacity of human settlements to cope with the impacts of climate change. Within this objective the project will contribute to three key actions:

1. Action 2. Promote public participation and social organization to facilitate implementation of response measures to cope with extreme climate events linked to climate change. The project will contribute to this action by preparing evacuation route maps (output 4.3) and implementing public education and communication strategies (outputs 6.1 and 6.2).
2. Action 3. Promote the generation of specific information and its access to GADs about possible impacts from extreme climate events under possible climate change scenarios. The project will contribute to this action by improving weather monitoring (outputs 3.1 and 3.2) and the existing Esmeraldas´ early warning system

b. National Comprehensive Security Plan (MCS. 2014), in the policy framework assigned to SGR. This plan covers the period 2014 – 2017 and establishes the overall policies and assign responsibilities within the national security framework. The project contributes to implement the public policies related to risk management.

c. Sectoral Agenda for Risks Management (SGR, 2014), in particular policy 2 aimed at promoting a risk management culture, policy 3 aimed at coordinate and articulate the decentralised national system for risks management, and policy 4 aimed at strengthening international cooperation. The present project is in line with policy 3: to coordinate and articulate the national decentralized risk management system to protect people, communities and nature from natural and anthropic threats. Under this policy, the project will contribute to the following strategies:

i. Strategy 3.7. To promote programmes for risk-reduction and mitigation and adaptation to climate change, with emphasis on priority sectors, priority groups and fragile ecosystems. The entire project will contribute to this strategy. A key element will be to improve local capacity to design and implement adaptation measures in Esmeraldas (outcomes 5 and 6).

ii. Strategy 3.3. To improve and integrate the monitoring and early warning systems to identify and mitigate social and environmental threats and vulnerabilities from natural and anthropic risks. The project will contribute to this strategy by improving weather monitoring (outputs 3.1 and 3.2) and the existing Esmeraldas´ early warning system.

d. Esmeraldas´ Municipal Development and Land Use Plan (GAD Esmeraldas, 2012a), in particular environmental section, strategic line 10 to strengthen the municipal system for risk management. This plan covers the period 2012 – 2022. Strategic line 10 is to advance the operation of the municipal integrated risk management system. Within this strategic line, the present project contributes to the following actions:

i. PYSA 49. Strengthen organisms for emergency coordination. The project contributes to this action by strengthening weather monitoring and the early warning system (outputs 3.1, 3.2, 4.2 and 4.3).

ii. PYSA 50. Permanent education, communication and prevention campaigns. The project contributes to this action by implementing public communication and education strategies (output 6.1) and the narrators´ initiative (output 6.2).

iii. PYSA 52. Institutional strengthening, through COE´s technical working groups. The project contributes to this action by strengthening weather monitoring and the early warning system (outputs 3.1, 3.2, 4.2 and 4.3).

iv. PYSA 53. Strengthening of the early warning system. The project contributes to this action by strengthening weather monitoring and the early warning system (outputs 3.1, 3.2, 4.2 and 4.3).

v. PYSA 55. Execution of works to reduce and mitigate risks in vulnerable settlements. The project contributes to this action by designing a green infrastructure plan for Esmeraldas (output 1.2), constructing landslide mitigation works in Cerro Gatazo (output 2.2), executing a pilot flood warning system in Luis Vargas Torres island (output 4.2), and preparing and disseminating evacuation route maps and installing evacuation signals (output 4.3).

e. Esmeraldas´ Municipal Strategy for Risks and Disaster Management (GAD Esmeraldas, 2012b). in particular:

i. Strategic objective 2. To reduce disaster risk in medium and high vulnerability human settlements. The project will contribute to the following action lines:

1. Action line 3. To promote the design and construction of mitigation works on hillsides with landslide risk. The project contributes to this action by revegetating Cerro Gatazo as part of the green infrastructure plan for Esmeraldas (output 1.2) and complementing the landslide mitigation works (output 2.2),
2. Action line 5. To identify, adequate and extend evacuation routes and safe areas, in accordance with existing threats. The project contributes to this action by preparing and disseminating evacuation route maps and installing evacuation signals (output 4.3).
3. Action line 6. To design, implement and strengthen early warning systems to allow a better reaction to the multiple threats that have been identified. The project contributes to this action by strengthening weather monitoring and the early warning system (outputs 3.1, 3.2, 4.2 and 4.3), including the pilot flood warning system in Luis Vargas Torres island.

4. Action line 7. To promote the execution of biannual evacuation drills in coordination with community, and public and private organizations. The project contributes to this action by implementing flood emergency drills as part of the pilot flood warning system in Luis Vargas Torres island (output 4.2).

ii. Strategic objective 3. To strengthen institutional capacities to implement a risk management approach in planning and land use processes (institutional strengthening). The project will contribute to action line 13 that is to train personnel from public and private institutions on risk management, including preparation of contingency plans, evacuation plans, interior signage, protection / safety elements, and evacuation routes (train personnel on risk management). The project will contribute to this action by hands-on training as part of the pilot flood warning system in Luis Vargas Torres island (output 4.2) and through the regional online course on risk-based adaptation in coastal cities (output 5.1).

iii. Strategic objective 4. To reduce economic, social and environmental vulnerability of the human and natural systems to mitigate and adapt to climate change. (reduce vulnerability). The project will contribute to action line 17, which is to develop hillside reforestation plans to prevent landslides. The project contributes to this action by revegetating Cerro Gatazo as part of the green infrastructure plan for Esmeraldas (output 1.2) and complementing the landslide mitigation works (output 2.2),

iv. Strategic objective 8. To implement non-structural works to reduce social vulnerability, through linking the Risk Management and Climate Change Unit and the Municipal Risk Management Committee with organized civil society. The project will contribute to the following action lines:

1. Action line 35. Form neighbourhood and parish emergency committees. The project will contribute to this action with the pilot flood warning system in Luis Vargas Torres island (output 4.2)
2. Action line 36. Form and train a network of neighbourhood and parish community leaders for risk management and adaptation to climate change. The project will contribute to this action by hands-on training as part of the pilot flood warning system in Luis Vargas Torres island (output 4.2)
3. Action line 37. Establish recreational spaces for collective learning on disaster risk reduction. The project will contribute to this action with the narrators´ initiative (output 6.2) which will develop capacities of local groups to use recreational activities, like dance or story-telling, to cultivate collective memory on disaster risk reduction.
4. Action line 39. Communication campaigns on preventive measures to cope with adverse events, through public media (radio, press, television). The project contributes to this action by implementing public communication and education strategies (output 6.1) and the narrators´ initiative (output 6.2).
5. Action line 41. Establish spaces linking community - local government to reduce vulnerability of the organizational fabric. The project contributes to this action by implementing public communication and education strategies (output 6.1) and the narrators´ initiative (output 6.2).

v. Strategic objective 9. Consolidate the decentralized national risk management system in Esmeraldas canton with participation of authorities, institutions and community. The project will contribute to action line 42, which is to promote the permanent functioning of the canton´s integrated risk management system. The project will contribute to this line by strengthening weather monitoring and the early warning

system (outputs 3.1, 3.2, 4.2 and 4.3), including the pilot flood warning system in Luis Vargas Torres island.

f. Esmeraldas´ Municipal Climate Change Adaptation and Mitigation Strategy (ONU-HABITAT, 2011). The project is in line with strategic objective 2, which is to reduce social, economic and environmental vulnerability of the human and natural systems to cope with the climate change. In particular, with action line 1 on planning and land use. Within this action line, the project will contribute to:

   i. Specific objective1.3. To reforest hillsides and form natural barriers to protect riversides. The project will contribute to this objective by revegetating Cerro Gatazo as part of the green infrastructure plan for Esmeraldas (output 1.2).

   ii. Specific objective 1.4. To build green spaces within the urban area. The project will contribute to this objective by preparing Esmeraldas´ green infrastructure plan and revegetating Cerro Gatazo (output 1.2).

F. National technical standards (environmental, building codes and others) complies with the Adaptation Fund ESP.

The proposed activities will adhere to all national regulations and technical standards, in both Chile and Ecuador, particularly those relating to concrete adaptation measures, including green infrastructure, civil works and reforestation developed under Component 1.

Detailed description on expected outputs, relevant standards and procedures along with the measures to ensure compliance with ESP are elaborated below (Section III.C).

Construction works technical standards

180. The update of Antofagasta's stormwater plan will comply with Law 19525, published on 10 November 1997. It establishes that the primary network for rainwater evacuation and drainage will be under MOP´s responsibility and the secondary network will be under MINVU´s responsibility. MOP will prepare these plans, that are compulsory for cities with more than 50,000 inhabitants. Stormwater plans will be approved by Executive Decree signed by the ministries of public works and of housing and urban development. There are no specific guidelines or technical standards for the preparation of the stormwater plans.

181. The design and construction of infrastructure in Quebrada Bonilla will comply with pertinent Chile´s building standards. Mandatory and referential standards are available in MINVU´s website[66]. MOP will approve the designs and infrastructure for Quebrada Bonilla. This will ensure compliance with national technical standards and building codes.

182. The design and construction of infrastructure in Cerro Gatazo will comply with the Ecuadorian building code (NEC-15), adopted by Ministerial Agreement 0028 of 19 August 2014 and updated by Ministerial Agreement 0047 of 15 December 2014[67]. The Directorate of Public Works of the Municipality of Esmeraldas will approve the designs and infrastructure to ensure compliance with all national technical standards and local regulations.

[66] http://proveedorestecnicos.minvu.cl/normas-tecnicas-obligatorias/

[67] The elements of the norm of construction are found at http://www.habitatyvivienda.gob.ec/norma-ecuatoriana-de-la-construccion/

Environmental licences

183. In Chile, the construction works in Quebrada Bonilla will require an Environmental Qualification Resolution. In Ecuador, the works in Cerro Gatazo, and the installation and operation of the weather radar and the meteorological stations will require an Environmental Registry.

184. Chile´s environmental regulatory framework is based on the Environmental Law (Law 19,300[68]) amended by Law 20,417 of 2010[69], and Supreme Decree 40/2012 [70]of 2012 (regulation for the environmental impact assessment system). Article 10 of Law 19,300 list the types of activities that will be subject to the environmental impact evaluation system (SEIA). Two types of environmental permits exist: Environmental Impact Study (EIA) and Environmental Impact Declaration (DIA). An EIA applies to projects that may generate high-level impacts; article 11 of Law 19,300 establishes that a project with any of the following characteristics has to present an EIA:

    a. Risk to the health of the population, due to the quantity and quality of effluent, emissions and waste.
    b. Significant adverse effects on the quantity and quality of renewable natural resources, including soil, water and air.
    c. Resettlement of human communities, or significant alteration of the systems of life and customs of human groups.
    d. Location at or near populations, resources and protected areas, priority conservation sites, protected wetlands, glaciers, that may be affected, as well as the environmental value of the territory in which it is intended to deploy.
    e. Significant change in terms of magnitude or duration, of the scenic or tourism value of an area.
    f. Alteration of monuments, sites with anthropological, archaeological, historical value and, in general, belonging to the cultural heritage.

    Projects included in the categories of article 10, but which do not have the characteristics listed in article 11, must present a DIA.

    Both EIA and DIA are subject to public consultation. The Environmental Evaluation Service (SEA) has established guidelines to conduct the public consultation process (SEA, 2013).

185. The existing designs for the protection works in Quebrada Bonilla already include the DIA that was approved in 2001. However, because the designs will be updated to incorporate the climate variable, the DIA will be updated. Therefore, MOP will prepare and submit the updated DIA to the SEA. SEA will conduct the review process, which is managed online, and issue an Environmental Qualification Resolution (RCA). For a DIA, the review process takes ca., 60 working days and has no cost. Existing mudflow protection works presented DIAs and obtained RCAs. The cost of preparing the DIA is included in the project budget (see budget note 14).

186. Ecuador´s environmental regulatory framework is based on the Environmental Management Law ((Ministerial Agreement 061 of 2015; Law 37 of 1999, coded in 2004), the environmental impact evaluation system (Ministerial Agreement 061 of 2015) and complementary regulations. Article 14 of Ministerial Agreement 061 established two types of environmental permits: (i) Environmental Registry, and (ii) Environmental Licence. There is an online

[68] http://bcn.cl/1uywi

[69] http://bcn.cl/1vze7

[70] http://bcn.cl/1uvqa

catalogue[71] which list the projects, works and activities that require an environmental permit and the corresponding permit type (article 22 of Ministerial Agreement 061). Article 24 indicates that the Environmental Registry is issued to projects, works and activities with low environmental impact and risk. Article 25 indicates that the Environmental Licence is issued to projects, works and activities with medium or high environmental impact and risk. To obtain an Environmental Licence, an Environmental Impact Assessment (EIA) must be submitted, and the review process is subject to public consultation.

187. The construction of Cerro Gatazo´s protection works (output 2.2) and the installation and operation of the weather radar and the meteorological stations (outputs 3.1 and 3.2) will require an Environmental Registry. The process to obtain the Environmental Registry is managed online (suia.ambiente.gob.ec), and consists on completing an online formulary and paying a fee of ca., USD180; the permit is issued automatically. For the construction works in Cerro Gatazo, GADE will obtain the corresponding environmental registry. For the weather radar and meteorological stations, GADPE will obtain the corresponding environmental registries. CAF has requested more stringent measures and will require the preparation of environmental impact assessments and the implementation of environmental management plans for these three project elements.

Meteorological equipment and data

188. The weather radar, the storm detection system and meteorological stations will comply with technical and operational specifications and requirements stipulated by the corresponding national authorities, DMC in Chile and INAMHI in Ecuador. This will ensure that the equipment comply with required specifications and is integrated into the national weather monitoring systems.

189. To ensure compliance, interinstitutional agreements will be signed. The signature of these agreements will be a pre-requisite before purchasing the radar, the storm detection system and the meteorological stations.
    a. In Chile, an agreement will be signed between MOP (who will operate and maintain the meteorological stations), DMC (who will operate the storm detection system) and ONEMI to establish operational procedures, information flow, and to guarantee that the information is expedited to the national weather forecast and early warning systems.
    b. In Ecuador, an agreement will be signed between GADPE (who will operate and maintain the radar and meteorological stations) and INAMHI to establish operational procedures, information flow, and to guarantee that the information from the radar and meteorological stations is expedited to the national weather forecast and early warning systems.

190. The information from meteorological monitoring will feed the early warning systems within the existing operational framework and institutional arrangements.
    a. In Chile, DMC and MOP will feed the data to ONEMI within the framework of the National Plan for Civil Protection (Decree 156 of 2002) which includes the Communal Committees for Civil Protection and Emergency and the COEs of Antofagasta and Taltal.
    b. In Ecuador, GADPE will feed the information to INAMHI and SGR within the framework of the national integrated system which includes the municipal and provincial Risk Management Committees and COEs.

[71] The catalogue is found at http://suia.ambiente.gob.ec/catalogo_ambiental;jsessionid=TXc7k+eULLCzbtscHz6RsykX

Early warning systems

191. The actions to strengthen the early warning systems in Antofagasta and Taltal (e.g., mudflow evacuation maps, emergency sirens) will be administered by ONEMI to ensure compliance with existing specifications, integration with the national framework and articulation with the communal civil protection plans.

192. The actions to strengthen the early warning systems in Esmeraldas will be administered by GADE to ensure compliance with the municipal strategy for risks and disaster management (GAD Esmeraldas, 2012b) and the national framework.

Compliance with AF Environmental and Social Policy

193. All project interventions will comply with the AF Environmental and Social Policy. A screening of risks was completed under Section II.L (Annex 14) and mitigation measures Section III.C Annex 15 and controls will be put in place to ensure that the project will not exacerbate inequalities, harm the environment, causing negative impacts to marginalized or vulnerable groups.

194. Ongoing consultations with the environmental entities of both countries, as well as, local governments took place during project design and will continue at all stages of the project to ensure that all unidentified sub-projects (USP) and activities comply with the relevant technical standards. Workshops were carried out in Chile and Ecuador to share the project concept and exchange experiences. These workshops were crucial for finalize the project design. (See more details on Section II.I)

G. Describe if there is duplication of project with other funding sources

195. No duplication with other funding sources was found. However, the project will have synergies with the following projects:

- Third National communication (3NC) and First Biennial Update Report (BUR). This is a GEF funded project (GEF ID 5478) under implementation in Ecuador. The executing agency is MAE, and the GEF implementing agency is UNDP. The project objective is to prepare the third national communication on climate change and the first biennial update report. The investment is USD 852,000. The present project will use the results of 3NC, in particular the outcomes of the climate change models and the guidelines for climate change adaptation.
- ARG - MOP agreement "mudflow disaster mitigation and evacuation of rainwater, Antofagasta Region 2015-2020". This is a government project under implementation (Annex 11). The executing agency is DOH. The project will build mudflow control works in Antofagasta and Taltal (DOH, 2015; Saavedra, 2016) (paragraph 80, Table 8 and Annex 11). The total investment is CLP 56,152,000,000 (about USD 84.5 million). The present project will provide practical guidelines to incorporate the climate variable in new construction works.

196. The project will seek collaboration with UNISDR´s Regional Platform for Disaster Risk Reduction of the Americas[72] and the Resilient Cities Campaign[73].

[72] http://www.unisdr.org/we/coordinate/regional-platforms

[73] http://www.unisdr.org/we/campaign/cities

H. Learning and knowledge management component .

197. Component 3 of the project focus on learning and knowledge management. It comprises one outcome (i.e., outcome 7) and two outputs (i.e., outputs 7.1 and 7.2).

198. The backbone is the regional platform that will facilitate communication and collaboration among project partners and dissemination of information and lessons (Figure 21).

199. The main tool will be communities of practice (Lave & Wenger, 1991; Wenger, 1998; Wenger et al., 2002) among practitioners and key stakeholders. The communities of practice will facilitate common learning and the development of social capital. It is envisioned to have five communities of practice:

    a. Introducing the climate-variable in the design and construction of adaptation infrastructure.
    b. Climate monitoring to strengthen early warning systems.
    c. Early warning and response systems.
    d. Raising public awareness and engagement.
    e. Narrators as a tool to cultivate cultural memory.

200. The main instruments will be:

    a. Project blogs. These will be on-line and will serve as field journals to document experience and lessons. It is envisioned to have one blog per output.
    b. YouTube channel. It will contain short videos prepared mostly by project participants and local stakeholders. However, it will also include videos prepared by the project team and partners.
    c. Learning experience documents. These will be concise communication documents (i.e, accessible to a wide audience) that systematize lessons and best practice. Each document will include executive summaries in Portuguese, French and English to be useful to all countries in the region. It is anticipated to produce nine documents.
    d. Technical documents. These will be documents aimed at practitioners and professionals to present, in a formal format, experience, results, guidelines and recommendations. Each document will include executive summaries in Portuguese, French and English to be useful to all countries in the region. The number and nature of these documents will be decided during project execution.
    e. Memories of exchange visits. Four thematic exchange visits are planned. A memoir of each visit will be prepared to record discussions, joint analyses and recommendations. The memoirs will be communication documents to be accessible to a wide audience.
    f. Mid-term review report. The project will use the independent mid-term evaluation as part of the learning process. The full document will be shared will all partners, and accessible through the regional on-line platform. A brief will be prepared for the use of the general public, decision makers and other stakeholders.
    g. Terminal evaluation report. The independent final evaluation will also nurture the project´s learning process. The full document will be shared will all partners, and accessible through the regional on-line platform. Also, a brief will be prepared for the use of the general public, decision makers and other stakeholders.
    h. Project memoirs. This will be a communication document that summarise the project´s achievements and lessons, as well as opinions and anecdotes from project partners and stakeholders. It will include executive summaries in Portuguese, French and English to be useful to all countries in the region

I. Consultative process: List of stakeholders, with particular reference to vulnerable groups, including gender considerations, in compliance with the AF ESP.

201. During project preparation, there were inception and validation workshops, and stakeholder analysis in Antofagasta, Taltal and Esmeraldas. Following the request from the Adaptation Fund, there was additional consultation to local groups in the three cities.

Inception workshops

202. Before the inception workshops, MMA, MAE and the consultants in charge of the stakeholder analyses made a quick survey to identify local organizations and stakeholders to be invited. National and local entities and main stakeholders were invited by MMA in Chile and MAE in Ecuador.

203. The inception workshops were aimed to present the pre-concept, have feedback and initiate the project preparation process. In both workshops a roadmap was prepared, outlining the milestones to prepare the project proposal. The memoirs of the workshops (including list of participants) were distributed to all participants and are found in Annex 4.

204. The Antofagasta inception workshop was held on 4 May 2016. It included the stakeholders from Taltal; transportation was provided to bring the persons from Taltal to Antofagasta (a two-hour trip). Thirty-five people from Antofagasta and Taltal participated; 14 were females (40%). Participants included representatives of neighbourhood organizations, the two municipalities, and national entities (e.g., MOP, ONEMI, MINVU).

205. The Esmeraldas inception workshop was held on 16 May 2016. Twenty-eight people participated; three were females (10.7%). Participants included representatives of neighbourhood organizations, GADE, GADPE and national entities (e.g., INOCAR).

206. The inception workshops had the following elements:

    a. Presentation of the project concept (as approved by the Adaptation Fund). Participants were introduced to the project concept and were able to provide comments and recommendations.

    b. In group sessions, a participatory situation analysis was prepared. Participants identified key issues and suggested their root causes and constraints.

    c. Using maps of the cities, participants located the most critical sites and analysed the situation on priority sites. The result was a preliminary list of intervention sites to be analysed afterwards.

    d. Finally, participants analysed the proposed project elements (outcomes and outputs) and proposed adjustments and changes. For example, at this stage the idea of a weather radar for Esmeraldas was first discussed.

Stakeholder analyses

207. After the inception workshops, stakeholder analyses were prepared, covering each of the three cities (Annexes 8 and 9). In-depth interviews and focus groups were used to obtain perceptions, views and recommendations about the project proposal and its elements. These studies included a review of information on the social and economic situation of the cities and the identification of gender issues to be taken into account in the project.

208. The focus groups and in-depth interviews included (i) juntas de vecinos[74] (neighbourhood councils) and campamentos in risk areas of Antofagasta and Taltal, (ii) residents of flood-prone

[74] Juntas de Vecinos are community organizations that represent the people that reside in a neighbourhood. Their purpose is to defend the rights of the neighbours and collaborate with the State and the municipality. The neighbourhood councils are regulated by Law

areas (riversides along Teaone and Esmeraldas rivers and Luis Vargas Torres island) and landslide risk areas in Esmeraldas, and (iii) civil society organizations. In the focus groups and in-depth interviews local groups were presented the project concept and asked to comment the proposed actions, as well as to suggest modifications. This allowed to assess the options to work with specific groups. The campamentos and neighbourhood organizations of the main risk areas where the project will intervene[75], where visited and consulted.

209. In the focus groups and interviews with juntas de vecinos and campamentos in Antofagasta and Taltal, participants ranked high the proposed actions and provided recommendations that were incorporated into the project:

- Ensure that the education strategies include children (9 – 12 years old) and people that live in the risk areas.
- In alluvial risk areas, use means / media to facilitate that the local community identify and remember the risks[76].
- Campamentos are illegal settlements, therefore these groups have limited access and influence in the decisions of the local authorities (e.g., municipalities, ARG).
- Unlike local residents, the immigrants in campamentos are not familiar with the natural history of the area (e.g., former mudflows) nor are aware of the mudflow impacts. Also, they seem unwilling to move to safer areas.
- The municipality is perceived as the key entity to address mudflow emergencies.

210. In Esmeraldas, the focus groups and interviews included a range of barrios located on landslide and flood risk areas (Annex 9). There was support to the proposed actions and recommendations / comments that were incorporated into the project:

- The families that live in the risk areas have household and community vulnerability. They consider that cannot access / afford living in safer areas. Therefore, relocation will be traumatic, unless appropriate support is provided.
- There is limited comprehension of hydrometeorological hazards and the impacts from climate change.
- There is dissatisfaction with the emergency response from the municipality and pertinent public entities.
- Many households do not evacuate to guard their property. Pillage has been common in former emergencies. Measures need to be taken to safeguard the population and prevent looting of houses.
- Women, mostly in female-headed households, are concerned about the safety and security of their families in strange environments or improvised shelters.
- There are no maps that show the risk areas for floods and landslides, nor evacuation maps / procedures that indicate safe routes and shelters.
- Sirens and other related equipment must operate under extreme situations. Power failures are common during floods. Also, this equipment has to be protected from stealing and vandalism.

19,418 of 1997 and its subsequent updates and modifications. The municipalities maintain lists of the Juntas de Vecinos of their territory.

[75] In Quebrada Bonilla (Antofagasta): campamentos Víctor Jara, Mujeres Unidas and Villa Esperanza. In Cerro Gatazo (Esmeraldas): barrio 20 de noviembre. In Isla Luis Vargas Torres: neighbourhood committees 12 de mayo, Cordero Crespo, 20 de noviembre, Pianguapi, 29 de agosto, and Habana.

[76] This recommendation motivated the action to install evacuation route maps in large format in high-transit areas (see page 36).

Validation workshops

211. The second round of consultation (validation workshops) focused on the analysis of the final project draft. These workshops served to confirm partner engagement and contributions. The Antofagasta workshop was held on 19 July 2016; like in the inception workshop, transportation was also arranged to bring the persons from Taltal to Antofagasta. The Esmeraldas workshop was held on 22 July 2016. The memoirs of the workshops (including list of participants) were distributed to all participants and are found in Annex 4.

212. Twenty-four people participated in the Antofagasta validation workshop; eleven people were females (45.8%). The key elements of the agenda were: (i) presentation of the draft PRODOC, (ii) presentation of the results of the stakeholder analysis, (iii) group work, and (iv) preparation of a roadmap to finalise the PRODOC. Two groups were formed, one analysed components 1 and 3, and the other components 2 and 3. The group work focused on reviewing the proposed outcomes, and present recommendations for adjustments and to solve pending issues.

213. Ten people participated in the Esmeraldas validation workshop. The only female present was CAF´ climate change officer. The key elements of the agenda were: (i) presentation of the draft PRODOC, (ii) group work, and (iii) preparation of a roadmap to finalise the PRODOC. Participants analysed the proposed outcomes and budget, and proposed recommendations for adjustments and to solve pending issues. Finally, contributions and participation of local organizations in the various project outcomes were confirmed. On this meeting, it was confirmed that six neighbourhoods of Luis Vargas Torres island and the barrio 20 de Noviembre will participate and contribute, respectively, to actions in the pilot flood warning system and the landslide mitigation in Cerro Gatazo.

Meetings of project partners

214. There were also in-person and virtual meetings with the project partners:

    a. In Chile, the project partners are MMA, MOP, DMC, ONEMI, the Municipality of Antofagasta, and the Municipality of Taltal. A meeting was organised with the Chilean Agency for International Cooperation for Development (AGCID) to obtain their input to the project proposal. AGCID is the National Implementing Entity (NIE) of the Adaptation Fund in Chile.

    b. In Ecuador, the project partners are MAE, the Municipality of Esmeraldas, GADPE and INAMHI.

Additional consultation to local groups

215. Five consultation meetings were organised with local groups during June and July of 2017. The purpose of the meetings was to have contributions and comments from local groups that might not have participated in the inception and validation workshops.

216. The meetings were organised in collaboration with MMA in Chile and MAE in Ecuador. The date, time and place were consulted with local groups to make sure that women and men could attend the meetings.

217. On each meeting, the project proposal was presented. Participants were provided with copies of the results framework (including budget allocations). Afterwards, there was a plenary to answers questions and have initial comments. Later, there was group work to analyse the elements of the project proposal. Finally, there was a plenary where groups presented their results and there was an open discussion. The meetings were managed to ensure that women could openly express their ideas.

Meeting with Barrio 20 de Noviembre

218. The meeting was held on the afternoon of 23 June 2017, in the barrio´s community house. Thirty-eight people participated, including women and older people.

219. There was support to the proposed actions and recommendations / comments that have been incorporated into the project:

- Promote that the municipality take immediate action to advance the works in Cerro Gatazo (e.g., baseline studies). This will shorten the time for implementation of the protection works.
- Ensure that communication actions and warning alerts use the radio stations with most local audience.
- The evacuation plans must take into account the needs of people with disabilities.
- Make sure that there are secure meeting points and shelters to accommodate people during emergencies.
- To motivate women participation on risk training, include complementary activities that suit their interests.
- People live in risk areas because they have no means to move somewhere else.

Meeting in Luis Vargas Torres island

220. The meeting was held in the morning of 24 June 2017, in Leonidas Grueso George School. Forty-four people participated, including women, older persons and differently-abled people.

221. There was support to the proposed actions and recommendations / comments that have been incorporated into the project:

- Include mangrove forestation and reforestation within Esmeralda´s green infrastructure plan.
- Ensure that the people is alerted with sufficient time to evacuate or take protective measures.
- Establish local women´s groups to support emergency actions.
- Women can coordinate and support community activities.
- It is valuable to pass experience to the new generations.
- The sirens have to be guarded against vandalism and must operate under extreme conditions like electricity failure.
- During past floods, there were power outages and communication failures. Cell phones and text messages may not be available during emergency.
- The footbridges are in poor state. They are the main evacuation way to cross to the mainland.

Meetings in Antofagasta

222. There were two meetings in Antofagasta in juntas de vecinos located in the mudflow risk area of Quebrada Bonilla.

223. The first meeting was held in the afternoon of 6 July 2017, in the community centre of the Junta de Vecinos Villa Irarrazabal. Twelve people participated, all neighbours were women.

224. There was support to the proposed actions and recommendations / comments that have been incorporated into the project:

- Ensure that the sound of mudflow sirens is different from the existing tsunami sirens.
- Evacuation protocols must consider the needs of children, older persons and people with disabilities.
- People need to be trained how to correctly evacuate during mudflows.

225. The second meeting was held in the afternoon of 7 July 2017, in the community centre of the Junta de Vecinos Esperanza Nuestra. Twenty neighbours participated, 17 were women.

226. There was support to the proposed actions and recommendations / comments that have been incorporated into the project:

- People are not aware of climate change and its impacts.
- It is important to build the alluvial control infrastructure in Quebrada Bonilla.
- Campamento dwellers are more vulnerable to mudflows because of their low-quality constructions.
- The narrators´ initiative is interesting. It will need to promote participation of children and older people.
- It is necessary to ensure the grant from the Adaptation Fund, and start the project in 2018.

Meeting in Taltal

227. The meeting was held in the morning of 7 July 2017, in the cultural centre of Taltal. Sixteen neighbours participated, including Taltal city mayor[77].

228. There was support to the proposed actions and recommendations / comments that have been incorporated into the project:

- It will be very valuable to have means to alert people with sufficient time to evacuate. The last mudflow was devastating, it ran through the city and isolated the population.
- The cost and effort of recovery and reparations is very high. The removal of debris from the retaining pools is still ongoing.
- Campamentos are vulnerable, but their informal condition limit public action.
- The evacuation procedures must consider the needs of children, older citizens and people with disabilities.
- It is laudable to have included culture into the project. It is necessary to cultivate and develop cultural manifestations and to strengthen collective memory. It is advisable that communication actions and the narrators´ initiative foster participation of diverse local groups and artists.

J. Funding requested justification

Component 1

Baseline

229. Antofagasta and Taltal have high risk of mudflows, the most recent were in 2015. Antofagasta's stormwater management plan was prepared in 2004 and does not include the climate change variable. The existing infrastructure does not cover all the gorges that cross Antofagasta, and Taltal´s protection infrastructure was not able to contain the flows of the extreme weather event of 2015.

230. The ARG – MOP project will invest about USD 84.5 million to build additional infrastructure in the region, including Antofagasta and Taltal (see page 35 and Table 8). However, there is no guarantee that the climate change variable will be introduced in the designs and construction works. The ARG – MOP project does not include Quebrada Bonilla, which contains about 12,840 people along the hazard area.

[77] It is important to highlight that Taltal city mayor has personally participated in all meetings during the preparation of the presente project.

231. Esmeraldas has high risk of flooding and landslides. Cerro Gatazo is an area of main concern, but the municipality has not been able to finance actions to stabilize the hillsides. The most recent landslide occurred in January 2016 after heavy rain associated with El Niño. Infrastructure designs were prepared in 2010 but funding could not be secured.

232. Esmeraldas´ Municipal Strategy for Risks and Disaster Management includes the use of vegetation to contribute to stabilize hillsides and to protect the riverbanks. However, the use of urban green infrastructure is a new matter, and there is no experience on the development of a comprehensive approach. Also, the municipality has financial limitations to advance on this front.

233. The areas of Antofagasta, Taltal and Esmeraldas have weather monitoring systems operated by DMC and MOP in Chile and INAMHI in Ecuador. This information is passed, respectively, to ONEMI and SGR to support decision making within the early warning systems. A main limitation is that rainfall information from weather stations gives short time to warn the population of events that might cause mudflows, floods or landslides. This in turn, affect the efficiency of the early warning systems. In addition, there are limited means to alert the population and guide them to secure areas. The cities do not have evacuation maps and marked routes for mudflows and floods.

Scenario with AF contribution

234. The AF investment will allow to update Antofagasta's stormwater management plan introducing the climate change variable. This will be a major catalyst that will influence the ARG - MOP investment in protection works. Also, the project will finance updating the design for Quebrada Bonilla´s infrastructure, introducing the climate change variable, and construct part of the protection works. This exercise will provide hands-on experience that will be useful for the other infrastructure to be built in the cities.

235. The present project will enable the construction of grey and green infrastructure in Cerro Gatazo incorporating the climate change variable. This will greatly reduce the future risk of landslides in the city. In addition, the AF contribution will make possible to advance in the preparation of a green infrastructure plan to further advance Esmeraldas´ Strategy for Risks and Disaster Management.

236. With the AF investment weather radar and storm detection system will be installed in Esmeraldas and Antofagasta, respectively. This will expedite to have information about the location and velocity of precipitation that could affect the cities, and to anticipate anomalous situations. Having more time to decide the best course of action and to alert the population will greatly improve the adaptive capacity of Antofagasta, Taltal and Esmeraldas. This will be complemented with actions to enhance the public awareness systems. The project will allow to have sirens to alert the population, evacuation maps and marked evacuation routes. The investment in Esmeraldas will aid to implement a participatory pilot flood warning system with local residents. This experience will be valuable for future development in the city.

Component 2

Baseline

237. Current development plans for Antofagasta and Taltal do not incorporate adaptation, and in Esmeraldas, despite having specific strategies, implementation is very limited. A key barrier is that municipal officers have limited capacities to mainstream adaptation and DRR.

238. In addition, the local population of the three cities is not fully aware of the climate-related risks, nor engaged into advance adaptation to climate change. Lessons and experience from previous weather-related disasters faints with time and is not being passed to new generations.

Scenario with AF contribution

239. The AF investment will allow to develop an on-line regional course on risk-based adaptation in coastal cities. The course will contribute to enhance the skills of local officers and facilitate networking among practitioners that face similar challenges. Two additional benefit are that the course (i) will include a module to explain the linkages between gender, climate change and adaptation measures, and (ii) will be open to officers from other countries.

240. The project contribution will allow to engage local stakeholders into climate change adaptation action. This will be a valuable catalyst to reduce vulnerability and to build social capital.

241. Finally, the contribution of the AF will support ground-breaking work to develop forms to build cultural memory in support of DRR. The existing narrators experience will be expanded and adapted to local conditions. This has a high potential for replication in other parts of both countries and the entire region.

Component 3

Baseline

242. Despite the urgent need to advance climate change adaptation in coastal cities, there is no mechanism to promote networking and exchange of experience and tools. The existing platforms are general in the areas of climate change adaptation or coastal zone management. For example, the SPINCAN[78] project in which Chile and Ecuador participate within the framework of the Permanent Commission for the Southeast Pacific (CPPS) does not include climate change adaptation.

Scenario with AF contribution

243. The AF investment will make possible to develop a regional platform specialized in adaptation and DRR in coastal cities. The platform will be initiated with the experience from Antofagasta, Taltal and Esmeraldas, but it is envisioned to be further expanded with facilitation from CAF.

K. Sustainability of the project outcomes

Environmental sustainability

244. In general, the project will have positive environmental impacts. However, to guarantee environmental sustainability, the public works will obtain the pertinent environmental permits to ensure compliance with corresponding regulations and requirements (see paragraphs 183 and 187).

Social sustainability

245. The project includes a participatory and inclusive approach, and emphasizes the involvement of key stakeholders.

246. Four key elements that have been incorporated in the project design to ensure social sustainability are:

    a. Establish and cultivate communities of practice to facilitate that practitioners collaborate to address common problems and develop relationships based on trust. These communities of practice will include gender and social inclusion as cross-cutting issues.

[78] Southeast Pacific data and information network in support to integrated coastal area management (SPINCAM) is a regional project funded by the Flemish Government of the Kingdom of Belgium. The second phase is under implementation.

b. Implement inclusive public communication strategies to empower and engage local communities.
c. Foster local initiatives to build cultural memory through various means.

247. The public communication strategies and narrators´ initiative will contribute to develop the basis to sustain risk-based adaptation after project closure. It is intended that local groups and stakeholders internalise the importance and need to implement adaptation measures and introduce it into the social agenda of the three cities.

Institutional sustainability

248. The project is anchored in the pertinent national and local authorities responsible for climate change adaptation and DRR.
249. In Chile, the project is grounded in the Ministry of Environment. MMA has the mandate to promote climate change adaptation and has the capacity to work at the national and local levels. MMA will be able to sustain and capitalise project results.
250. MOP has the mandate to implement protection works, including the management of stormwater. Also, it has sufficient capacity to sustain and capitalise project results. MOP (through DGA) has agreed to operate and maintain the meteorological stations to be installed in the area.
251. DMC -- part of the General Directorate of Civil Aviation -- is the national meteorological authority and the meteorological service provider for civil aviation. DMC has agreed to operate and maintain the storm detection system to be installed in the area.
252. ONEMI has the mandate to coordinate the early warning and response systems. It has agreed to capitalise on the project to advance the work on DRR.
253. The municipalities of Antofagasta and Taltal head the COE in case of emergency. They have agreed to execute the public communication and education strategies and to mainstream climate change adaptation into their programmes.
254. In Ecuador, the project is grounded in the Ministry of Environment. MAE has the mandate to promote climate change adaptation and the capacity to work at national and local levels.
255. INAMHI is responsible for weather and climate monitoring and has long experience managing the national meteorological network and feeding information to the early warning systems. It will provide advice and technical support to GADPE to develop local capacities for weather monitoring. GADPE is willing to develop a provincial meteorological network that support early warning. During project implementation, GADPE will develop its capacities to operate and maintain the weather radar and meteorological stations on the long term.
256. The municipality of Esmeraldas has technical and operational capacities to contribute to execute project activities and to sustain them after project end.

Financial sustainability

257. Project partners have agreed to sustain the elements they will manage. For example, DMC and GADPE will, respectively operate and maintain the weather radar and the storm detection system as part of their routine operation. The post-project sustainability of actions is ensured by integration into institutional budgets of the project partners.

Replication

258. There is high probability of replicating the lessons and best practice from the project. AF resources have been strategically assigned to activities with high potential to catalyse

learnings. For this purpose, experience and lessons will be systematically documented and disseminated through an electronic platform accessible worldwide.

259. The narrators´ initiative, grounded on local culture, might be a useful tool for Latin America and the Caribbean.

L. Environmental and social impacts and risks identification in compliance with the AF ESP

260. The project has been designed to generate positive environmental and social impacts, using climate change planning for the decision making, green infrastructure, and knowledge exchange and through participation of stakeholders (communities, national, local and regional authorities). The adaptation measures proposed are medium and small-scale and are culturally appropriate activities. The adaptation measures proposed have been selected together with the communities of Chile and Ecuador. None of the Outputs, activities or unidentified sub-projects (USP) are expected to cause negative environmental nor social impacts or exacerbated the actual conditions, if they are designed and executed following the mechanisms and mitigation measures proposed in this project.

261. The proposed project seek to fully align with the Adaptation Fund's Environmental and Social Policy, to fulfil this requirement the whole project, with their outputs and activities has been screened against the 15 principles to identify respective environmental and social risks and impacts.

262. The results of the initial screening shows that Component 2 and 3 are categorized as low risk (Category C) because no adverse environmental or social impacts are caused by the sub-activities planned, related with: capacity building, education strategies (Risk-based adaptation courses), communication, narrators´ initiatives, lessons and best practices dissemination (Section II.A) .

Component 1 is categorized as medium risk (Category B), especially related with Outcome 2 and 3 (O2. Reduced vulnerability to floods, landslides and mudflows in two coastal cities and O3. improved climate monitoring and means to alert the local population). These outcomes involve certain risks and uncertainties that can be easily mitigated following ESMP and the USP mechanism throughout all the implementation phase. Therefore, the entire project is categorized as Category B, medium risk.

263. A detailed screening process has been carried out for all the activities of the project (Annex 14) to identify potential environmental and social risks and impacts to afterwards identify mitigation measures that will avoid, minimize or mitigate these risks. The project will work to ensure that all measures are implemented with the highest standard following the ESMP Annex 15 to ensure compliance with 15 principles of AF ESP.

264. The potential risks identified and mitigation measures planned are presented in Table 11 below.

265. An Environmental and Social Management Plan including Grievance Mechanism and a monitoring, evaluation and oversight program are also included in Annex 15 including a specific description of the process for environmental and social safeguarding for unidentified sub-projects – USPs (i.e. activities that need technical specifications to be determined during implementation of the project such as outputs 1.1, 1.2.b, 1.3, and 1.4), clearly describing roles

and responsibilities. The USP identified under Component 1 are basically, partially designed activities.

Table 11. Risks screening of the project at design stage using the 15 principles of the AF's ESP.

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks - further assessment and management required for compliance
Principle 1: Compliance with the Law (Principle that always applies)		Potential risk identified: Insufficient alignment with laws and technical standards, especially related to implementation of concrete infrastructure works and climate monitoring under Component 1, Outcome 2 and Outcome 3. National and local authorities were consulted during the project design to ensure compliance with all relevant laws and technical standards, also for USP such as the pre-chosen grey and green interventions for Cerro Gatazo and Quebrada Bonilla. When the final infrastructure designs were ready and all sub-activities clearly planned, the project IE assume the compromised for screen the AF´s ESP, following the ESMP (Annex 14). All the staff associated with the project will be aware of national laws, technical standards and procedures of each country and comply with all the requirements, especially attention will be done during implementation of unidentified sub-projects under Component 1. A monitoring system will be put in place to systematically follow the project and the compliance with National laws and regulations. Specific procedures to comply with environmental regulations in both countries can be reviewed in Section II. F. of this proposal. As the final designs of Cerro Gatazo and Quebrada Bonilla need actualization with climate change scenarios, this Unidentified Sub Project will need to undergo detailed screening, a consultation process, the development of safeguard measures and a strict approval method developed. This is described in Section III.C and Annex 14.
Principle 2: Access and Equity		Potential risks identified: Possible interruption of water supply, energy services or roads / streets accessibility.

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks - further assessment and management required for compliance
		The project will provide fair and equitable access to benefits in an inclusive manner. The project will not intentionally or deliberately impede access to basic health services, clean water and sanitation, energy, education, housing, safe and decent working conditions, and land rights. Temporary disruption of main road access in nearest neighbourhood in Cerro Gatazo (Esmeraldas), due to the mitigation work in place and the stone material's mobilization may cause alterations in the lifestyle of the neighbourhood. See Annex 7 –Figure 17 for the Location of the largest landslide of January 2016 (Image google earth 2017). The consultative process Annex 4, during design phase conducted in Esmeraldas, Antofagasta and Taltal, were a key moment to define the priority interventions. Similar consultation process will continue to define precisely the direct and indirect beneficiaries specially related with USP interventions. To incorporate the needs of vulnerable groups and ensure an equitable access to project benefits and consultative process, a new stakeholder analysis will be carry out identifying the vulnerable groups living in target communities and hazard areas. During the design stage this process already started (Annex 8 and Annex 9). Ensure the assistances of all beneficiaries to workshops, consultancy process and socialization of the project or USPs will be done by an adequately informing and engaging key stakeholders and vulnerable groups in project actions with equal access. Public communication and education strategies as well as the narrators' initiative will be adopted to address all the population (regardless of gender, age, race, ethnicity or nationality).

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks - further assessment and management required for compliance
		Throughout the project implementation, the IE and EE will ensure that there will be neither discrimination nor favoritism in accessing project benefits, working with all the stakeholders and improving participatory methodologies and grievance mechanism following up the AF's ESP. As the final designs of Cerro Gatazo for the grey and green infrastructure are not actualized including climate change scenarios, this Unidentified Sub Project will need to undergo detailed screening, a consultation process, the development of safeguard measures and a strict approval method developed. This is described in Section III.C and Annex 14.
Principle 3: Marginalized and Vulnerable Groups.		Potential risks identified: The project might impede an access to basic services such as clean air, energy and housing, safe may be affected. This referred to Component 1. There is a risk that the project may impose adverse impacts on marginalized and vulnerable groups including children, women and girls, the elderly, indigenous people, displaced people, refugees or people living with disabilities taking into account possible mobility restriction presented during the implementation of the gray and green infrastructure in Esmeraldas. This referred to in Component 1. The project implementation will avoid any adverse impacts on marginalized and vulnerable groups including children, women and girls, the elderly, indigenous people, displaced people, refugees and people living with disabilities. The project has a highly participatory approach and incorporates specific actions to involve marginalized and vulnerable groups. In the project design phase, a beneficiary analysis was conducted to map their respective socioeconomic conditions in Antofagasta, Taltal and Esmeraldas (Annexes 8 and 9). The study allowed identification of the most vulnerable

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks - further assessment and management required for compliance
		groups, living in (i) slums (campamentos) located in hazard areas in Antofagata and Taltal, and (ii) informal settlements in Esmeraldas. In various degrees, these people have poor-quality housing, limited access to basic services and low-income. USPs will be screened in a complete manner during implementation project.
Principle 4: Human Rights (Principle that always applies).	The project will respect and promotes human rights at all the stages of the interventions. Even though, some structural conditions are beyond the scope of the project interventions. The project will strongly promote and advocate with the governments to improve the daily life of the beneficiaries. The mitigation works and all the capacity building activities will help the people make their life better and increase the realization of human rights. Both countries have ratified the core international human rights treaties. the principle of universalism of the human rights will be translation into practice in the specific subjects, such as: adaptation measures, reduce vulnerability, reduce the risks of future disasters and help the people of this neighbourhoods to have voice and autonomy and to be prepared for future disasters among others. The project will mainstream a human rights-based approach, by ensuring the compliance with the realization of human rights, as established in the Universal Declaration, as well as, the other international instruments related with. The project would contribute the development of the capacities of the “duty bearers” to fulfill his duties and with the “rights holders” to claim their rights. Human rights issues were addressed with recognition during the consultation meetings with local populations in the design process. Concerns on the marginalized and vulnerable groups were	

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks - further assessment and management required for compliance
	communicated and considerations on women, the elderly, children and people with disability were raised in the development of evacuation protocols. As the final designs of Cerro Gatazo and Quebrada Bonilla need actualization with climate change scenarios, this Unidentified Sub Project will need to undergo detailed screening, a consultation process, the development of safeguard measures and a strict approval method developed. This is described in Section III.C and Annex 14.	
Principle 5: Gender Equality and Women's Empowerment		Potential risks identified: Either women or men has unequal opportunities to participate taking into account their working schedules or lifestyles, this referred to in Component 1, Component 2 and Component 3. Communication and public awareness activities have to reach to all the population. The project has to promote equal opportunities for both women and men. Socialization and consultation processes have consider both lifestyles. Both women and men may have adverse effects during the implementing process if schedules, lifestyle and responsibilities are not taken into account. Consultation processes will take into account lifestyle schedules to guarantee participation of both women and men as it was done during the design process of the project.
Principle 7: Core Labour Rights (Principle that always applies)		Potential risk identified: Insufficient alignment with core labour rights, especially related to implementation of concrete infrastructure works and climate monitoring under Component 1, Outcome 2 and Outcome 3

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks - further assessment and management required for compliance
		The project mainstream core labour rights in all the actions and at different levels. Ecuador and Chile have mechanisms and laws related with labour rights. (Organic Law for the defense of labour rights - Ecuador. Organic Law for the defense of labour rights – Chile). Both countries have ratified the eight core labour conventions, and in general face similar challenges like child labour and discrimination in respect to employment and occupation. As a management measure to assure the alignment of all the activities of the project with the compliance of core labour rights, the Implementing and Executing entities for the project obey to the ILO labour Standards and national labour laws. All the procurement process will follow the EE - UNDP Financial Regulations and Rules (2012) as well as a sustainable procurement process including core labour rights. UNDP follow four key principles related with procurement practices: 1. Best value for money; 2. Fairness, integrity and transparency; 3. Effective international competition and 4. The interest of UNDP. The constructions mitigation measures will strictly follow the general conditions for contracts of civil works as well as the applicable labour legislation of each country. As the final designs of Cerro Gatazo and Quebrada Bonilla need actualization with climate change scenarios, this Unidentified Sub Project will need to undergo detailed screening, a consultation process, the development of safeguard measures and a strict approval method developed. This is described in Section III.C and Annex 14.
Principle 7: Indigenous Rights		Potential risk identified: Indigenous beneficiary families not being adequately informed and engaged to access the range of project benefits.

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks - further assessment and management required for compliance
		The project is consistent with the rights and responsibilities set forth in the UN Declaration on the Rights of Indigenous Peoples and other applicable international instruments relating to indigenous peoples. In the Region of Antofagasta, there are a small indigenous, group the 2002 Census found that, in Antofagasta and Taltal the indigenous population was, respectively, 1.8% and 1%. 4.7% of Antofagasta region´s populations were indigenous groups (INE, 2005). In Esmeraldas, the 2010 census found that most of the population is afro-ecuadorian (52.1%) with only 0.7% of indigenous population in the Esmeraldas Region (Canton). In Esmeraldas City in the Luis Vargas Torres Island, it is known that about 60 Chachi families live in the island. Chachis are an indigenous group that live in the tropical forests of the Esmeraldas province, where they reside in family-related communities (called centros Chachi). The project intervention will not affect indigenous groups or territories since construction works will be executed outside indigenous territories. In Luis Vargas Torres the early warning system which will be implemented in the island will use megaphone with siren that will be installed in the light posts. Thereby, there is no risk of harming indigenous lifestyle, wealth being, etc. Therefore, it is of great importance for the project take into considerations of this indigenous group. The pilot flood early-warning system in Luis Vargas Torres island and the communication and education strategies must consider the needs of this Chachi group. To elaborate, at the beginning of the project initiation, the Chachi families will be located at the project site and be integrated into the various project activities. It will be dealt with a particular attention on the implementation of the Narrator's Initiative and the use of their language in the communication strategies.

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks - further assessment and management required for compliance
		Furthermore, the evacuation map and its procedures (outputs 4.2 and 4.3), and the communication and education strategies (output 6.1) will consider the needs of this indigenous group.
Principle 8: Involuntary Resettlement		Potential risk identified: Temporary physical relocation for the nearest families leaving informal settlements in the proximity of the intervention in Cerro El Gatazo – Esmeraldas, basically related with the removal of mud and soil to stabilize the hill. This risk may confirm when the USP interventions related with Component 1 Outcome 2 finalized the designs. The project will follow strictly participatory process with "do not harm" methodology approach to find a temporary agreed solution. If some families need to be reinstall temporary or permanent, this action cannot be considering as involuntary resettlement. In Chile, Campamentos in Antofagasta and Taltal would not be relocated because of the construction works executed by the project. The construction works developed in Antofagasta are unpopulated and far away from the campamentos communities and this works will help mitigate the dangers produced by the mudflow. Output 6.1 aims to raise awareness of local people about the danger of setting on high-risk areas in addressing informal occupation of land in slums (campamentos) or informal settlements in the slopes of the maountains. As the final designs of Cerro Gatazo for the grey and green infrastructure are not actualized including climate change scenarios, this Unidentified Sub Project will need to undergo detailed screening, a consultation

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks - further assessment and management required for compliance
		process, the development of safeguard measures and a strict approval method developed. This is described in Section III.C and Annex 14.
Principle 9: Protection of Natural Habitats	The project will not intervene in any Natural Habitat taking into account that is be developed in urban areas. The above is described in the full proposal in paragraphs 46 – 51. There is no risk associated of involving unjustified conversion or degradation of critical natural habitats, including those that are (a) legally protected; (b) officially proposed for protection; (c) recognized by authoritative sources for their high conservation value, including as critical habitat; or (d) recognized as protected by traditional or indigenous local communities. This referred to Component 1. The project will not intervene in protected areas or high value conservation areas. The Project does not involve unjustified conversion or degradation of critical natural habitats, including those that are legally protected; officially proposed for protection; recognized by authoritative sources for their high conservation value, including as critical habitat; or recognized as protected by traditional or indigenous local communities. In Ecuador, Output 2.2. Landslide mitigation works in Esmeraldas will be developed in the urban area of Esmeraldas and Cerro Gatazo is not considered as in protected areas or high value conservation areas. In both countries that Output 3.1. Weather radar in Esmeraldas and a storm detection system in Antofagasta will be developed the installation of them will not involve protected areas or high value conservation areas. Finally Output 3.2. Increased number of meteorological stations in Antofagasta, Taltal and	

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks - further assessment and management required for compliance
	Esmeraldas also will not take place in protected areas or high value conservation areas.	
Principle 10: Conservation of Biological Diversity		Potential risk identified: The introduction of non-endemic species for the stabilization of Cerro Gatazo in Esmeraldas may pose a risk for the project. (such decision will come when USP intervention are completely developed) The project avoids any significant or unjustified reduction or loss of biological diversity or the introduction of known invasive species. The project implementation in Chile does not represent any risk to reduction or loss of biological diversity or the introduction of known invasive species. Though, the project for slope stabilization in Cerro Gataso may have a risk of introduction of non-endemic species, as it can be the use of vetiver[79] as an option of non-native grass widely used worldwide for slope stabilization in Ecuador. As the decision of which species will be used, this Unidentified Sub Project will need to undergo detailed screening, a consultation process, the development of safeguard measures and a strict approval method developed. This is described in Section III.C and Annex 14.
Principle 11: Climate Change		Risk Identified: There is no a risk of significant or unjustified increase in greenhouse gas emissions, considering that the project preliminary will not produce more than 1 MM ton /CO2eq during its lifespan. Activities will be screened for this risk during the project implementation.

[79] One of the plants under consideration is vetiver (*Chrysopogon zizanioides*), a perennial grass from India. This plant is non-invasive (Joy, 2009), and has already been used in Esmeraldas (PNUD, 2005). Vetiver is extensively used for slope stabilizations (Truong et al., 2008).

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks - further assessment and management required for compliance
		and the Carbon Footprint will be performed using a recognize tool. However, for the sake of the project and the compliance of the E&SP this will be attended with a Carbon Footprint recognized tool. As being a project which includes building materials, there is a risk of having unjustified increase in greenhouse gas emissions or other drivers of climate change. Even though there is still no defined design for the infrastructure to be developed in Cerro Gatazo, it is highly recommended for landslide protection works as an adaptation sustainable measure the use of gabion as “nature – engineer measure”, which uses rocks and wire (preferable recycled wire) for an effective minimal environmental impact. In addition, the costs of this type of infrastructure are economic. This type of infrastructure is sustainable, whereas concrete structures can have a high carbon footprint. They are typically used to form flexible, permeable and monolithic structures and are aesthetically pleasing therefore can be used where concrete is not mandatory. Carbon footprint analyses show that the use of a gabion solution can reduce CO2 emissions by up to 80% compared to a concrete retaining wall of the same height. If allowed to grow, vegetation can establish within a gabion wall, which can further contribute to carbon sequestration of the solution. The project will also be combining with green naturalistic engineering. However, for Antofagasta mudflow protection works the use of concrete is inevitable since it does not exist until know other different type of design for this type of infrastructure in the deserts. There is no possibility to use natural or ecosystem based system because of the characteristics of the desert of Antofagasta.

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks - further assessment and management required for compliance
		Nonetheless, the project actions , considering all its components, do not involve a large emission of greenhouse gases. As the final designs of Cerro Gatazo and Quebrada Bonilla need actualization in their designs with climate change scenarios, this Unidentified Sub Project will need to undergo detailed screening, a consultation process, the development of safeguard measures and a strict approval method developed. This is described in Section III.C and Annex 14. USPs will be screened in a complete manner during implementation project.
Principle 12 Pollution Prevention and Resource Efficiency		Potential risk identified: The project may be implemented in a way that does not meet applicable standards for minimizing material resource use, the production of wastes, and the release of pollutants. Project interventions, specially related with Component 1, Outcome 2, may cause pollution related with soil removal and dust. The project does not imply major use of energy or the production of wastes and pollutants. The project is designed and implemented in a way that does meets applicable international standards for maximizing energy efficiency and minimizing material resource use, the production of wastes, and the release of pollutants. The project will apply measures to reduce the generation of non-dangerous waste to a maximum. The waste that is generated will be recovered, reused, and recycled in a safe manner for human health and the environment, as far as possible. Final waste, which cannot be used in any way, will be

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks - further assessment and management required for compliance
		treated, destroyed, or disposed in a manner that is safe and innocuous for the environment, including adequate control of emissions, effluents, and residues resulting from the manipulation and procession of waste material. The manipulation and final disposal of waste will comply with the regulatory dispositions of the country. In the absence of specific regulatory regulations, the manipulation and disposition of waste will be carried out applying international best practices. Waste that may negatively affect people and biodiversity cannot be disposed in the environment The project will generate mostly noise, particulate matter, and probably garbage. However, the project will not affect, to the extent of undermining well-being of the families in Antofagasta and in Esmeraldas as the impact of this type of operation is considered minor. The risk will be managed through the environmental management system complying with the requirements of ISO 14.001 and ISO 14064. However, as Output 2.1. Mudflow control infrastructure in Antofagasta and Output 2.2. Landslide mitigation works in Esmeralda's activities are not fully developed because of the absence of designs actualized with climate change scenarios, this Unidentified Sub Project will need to undergo detailed screening, a consultation process, the development of safeguard measures and a strict approval method developed. This is described in Section III.C and Annex 14. USPs will be screened in a complete manner during implementation project.
Principle 13: Public Health		Potential risk identified: The project designed and implemented in a way that produces potentially significant negative impacts on public health. Like any common infrastructure work, there is a low probability risk of

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks - further assessment and management required for compliance
		collapse, especially during the period of construction and if a hazard materialized during this period, hazards such as: heavy rains, earthquake. As any project which includes infrastructure construction works, it must exist an Occupational Health and Safety Management Protocol, which will provide employers, workers, and worker representatives with a sound, flexible framework for addressing safety and health issues in diverse workplaces. They will be intended for medium-sized workplaces such as the project activities developing the construction works. The Protocol shall use a proactive approach to managing workplace safety and health. It shall recognize that finding and fixing hazards before they cause injury or illness is a far more effective approach. The protocol shall be articulated with the OSHA Safety and Health Program Management Guidelines recognized internationally. About the population at risk related with the possible collapse during the implementation, there shall be a Safety Management Protocol in accordance with the technical national and local requirements. In Output 2.1. Mudflow control infrastructure in Antofagasta and Output 2.2. Landslide mitigation works in Esmeralda's activities are not fully developed because of the absence of designs actualized with climate change scenarios, this Unidentified Sub Project will need to undergo detailed screening, a consultation process, the development of safeguard measures and a strict approval method developed. This is described in Section III.C and Annex 14. USPs will be screened in a complete manner during implementation project.

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks - further assessment and management required for compliance
Principle 14: Physical and Cultural Heritage	There is no finding that the project could cause any alteration, damage, or removal of physical cultural resources, cultural sites, and sites with unique natural values recognized as such at the community, national or international level. Projects will not interfere with existing access and use of such physical and cultural resources. The Project will not be implemented in areas with unique natural values recognized at the community, national or international level, heritage recognized by 1972 UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage. Both countries have ratified and entered into force of the Convention Concerning the Protection of the World Cultural and Natural Heritage? The project in annex 18 “Applicable domestic and international laws that apply” presents the local legal and regulatory framework for recognition and protection of physical and cultural heritage • Ministry of Culture, Arts and Heritage. www.cultura.gob.cl/ • Ministry of culture and heritage. www.culturaypatrimonio.gob.ec The Project will not result in interventions that would potentially adversely affect sites, structures, or objects with historical, cultural, artistic, traditional or religious values or intangible forms of culture. On the contrary the narrators’ initiative will build on traditions (e.g., marimba, tales) to potentiate cultural memory of climate-related disasters	

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks - further assessment and management required for compliance
Principle 15: Lands and Soil Conservation	The project is designed and shall be implemented in a way that promotes soil conservation and avoids degradation or conversion of productive lands or land that provides valuable ecosystem services. The areas where the project will be implemented are no productive lands nor high value conservation sites. The objective of the project is to avoid the increment of land erosion causing landslides in Esmeraldas and mudflows in Antofagasta.	

PART III: IMPLEMENTATION ARRANGEMENTS

A. Arrangements for project management at the regional and national level

266. CAF will be the **implementing entity**. The project will be implemented following CAF's administrative and financial regulations as agreed with the Adaptation Fund. CAF will designate an officer from the Environment and Climate Change Directorate to be the focal point for project coordination (i.e., **CAF´s focal point**).

267. The Republic of Chile and the Republic of Ecuador will be the beneficiaries of the project. The **responsible entities** in Chile an Ecuador will be, respectively, MMA and MAE. The responsible entities will be accountable for the implementation of agreed national activities. This includes the monitoring and evaluation of project interventions, achieving project outcomes, and for the effective use of AF resources.

268. The United Nations Development Programme (UNDP) will be the **executing entity**. UNDP will be responsible for project execution, while ensuring collaborative and coherent regional action. Project execution includes, among other tasks, financial management, personnel contract and management, and procurement of goods and services. UNDP will execute the project in accordance with the purpose and activities agreed with the implementing agency.

269. In Chile, the **project partners** are DMC, MOP, MMA, ONEMI, the Municipality of Antofagasta, and the Municipality of Taltal. In Ecuador, the project partners are INAMHI, MAE, the Municipality of Esmeraldas and the Provincial Government of Esmeraldas. The project partners will contribute to project execution and will ensure post-project sustainability (Figure 22).

270. The project organisation structure has a **Project Board** and a Project Unit (PU) (Figure 22). The Project Board is responsible for making by consensus, management decisions when guidance is required by the Project Manager, including recommendation for approval of project plans and revisions. In order to ensure CAF's ultimate accountability, Project Board decisions should be made in accordance with standards that shall ensure management for development results, best value money, fairness, integrity, transparency and effective international competition. In case a consensus cannot be reached within the Board, final decision shall rest with CAF´s Climate Change Coordinator. The terms of reference for the Project Board are contained in Annex 5. The Project Board is comprised of the following individuals: Undersecretary of Environment (MMA, Chile), Undersecretary of Climate Change (MAE, Ecuador), CAF´s Climate Change Coordinator and UNDP Project Coordinator.

271. The **project assurance** role will be provided by CAF´s Principal Environment Executives in Chile and Ecuador. Project assurance will provide objective and independent oversight of the project and monitoring. The project assurance team will review and analyse project reports and the draft annual work plan and budget before they are submitted to the Project Board and will make recommendations to optimize project performance.

272. Strategic guidance will be provided by an **Advisory Committee** integrated by the Chilean Agency for International Cooperation for Development (AGCID) and the Technical Secretariat of International Cooperation of Ecuador (SETECI).

273. On each country, there will be a **National Coordinator**. These will be high ranking officers designated by MMA and MAE (the responsible entities). National coordinators will monitor the execution of national activities of the project and will sustain close coordination among the project partners, the Project Manager, UNDP and CAF. To ensure regional coordination,

National Coordinators will maintain permanent communication and will have quarterly virtual meetings. These meetings will include the Project Manager and CAF´s focal point.

274. The **Project Unit** is headed by a Project Manager and includes eight specialists (Figure 23). These personnel will be contracted by UNDP. The Project Manager will run the project on a day-to-day basis on behalf of the Project Board within the constraints laid down in the annual workplan. The Project Manager function will end when the terminal evaluation report, and other documentation required by the Adaptation Fund and CAF, has been completed and submitted to CAF (including operational closure of the project). The Project Manager will promote coordination among project partners.

275. There will be three thematic coordinators:

    a. An Electronic Media Specialist, who will be responsible to develop and maintain the project´s electronic platform and the development of communication and education on project activities (Figure 21).

    b. A Lead Engineer Specialist, who will be responsible for the implementation of the project´s adaptation measures.

    c. A Monitoring and Evaluation Specialist, who will be responsible for monitoring the progress of the project and to document and systematize project experience and learning.

276. Local Specialists situated in Antofagasta and Esmeraldas:

    a. One Engineer Specialist responsible for the implementation of the adaptation measures in Antofagasta and Esmeraldas.

    b. One Social Specialist responsible for implementation of the public communication and education strategies and the narrators' initiative in Antofagasta, Taltal, and Esmeraldas.

277. Finally, two Accounting and Administration Assistants will provide on-site administrative and accounting support.

278. The Project Manager, Electronic Media Specialist, Lead Engineer Specialist, and Monitoring and Evaluation Specialist will be based in office space arranged by UNDP. Their precise location will be decided at project start. The local engineer specialists will be based in the municipalities and will maintain close collaboration and coordination with the local offices of MMA and MAE (i.e., responsible entities) as well as with the corresponding project partners (Figure 22 and Figure 23). One Accounting and Administration Assistant will be based in the Municipality of Antofagasta and will provide support to the work in both Chilean cities. The other Accounting and Administration Assistant will be based in the Municipality of Esmeraldas.

Audit

279. The project will be audited according to CAF's as implementing entity and UNDP as executing entity regulations and rules and applicable audit policies.

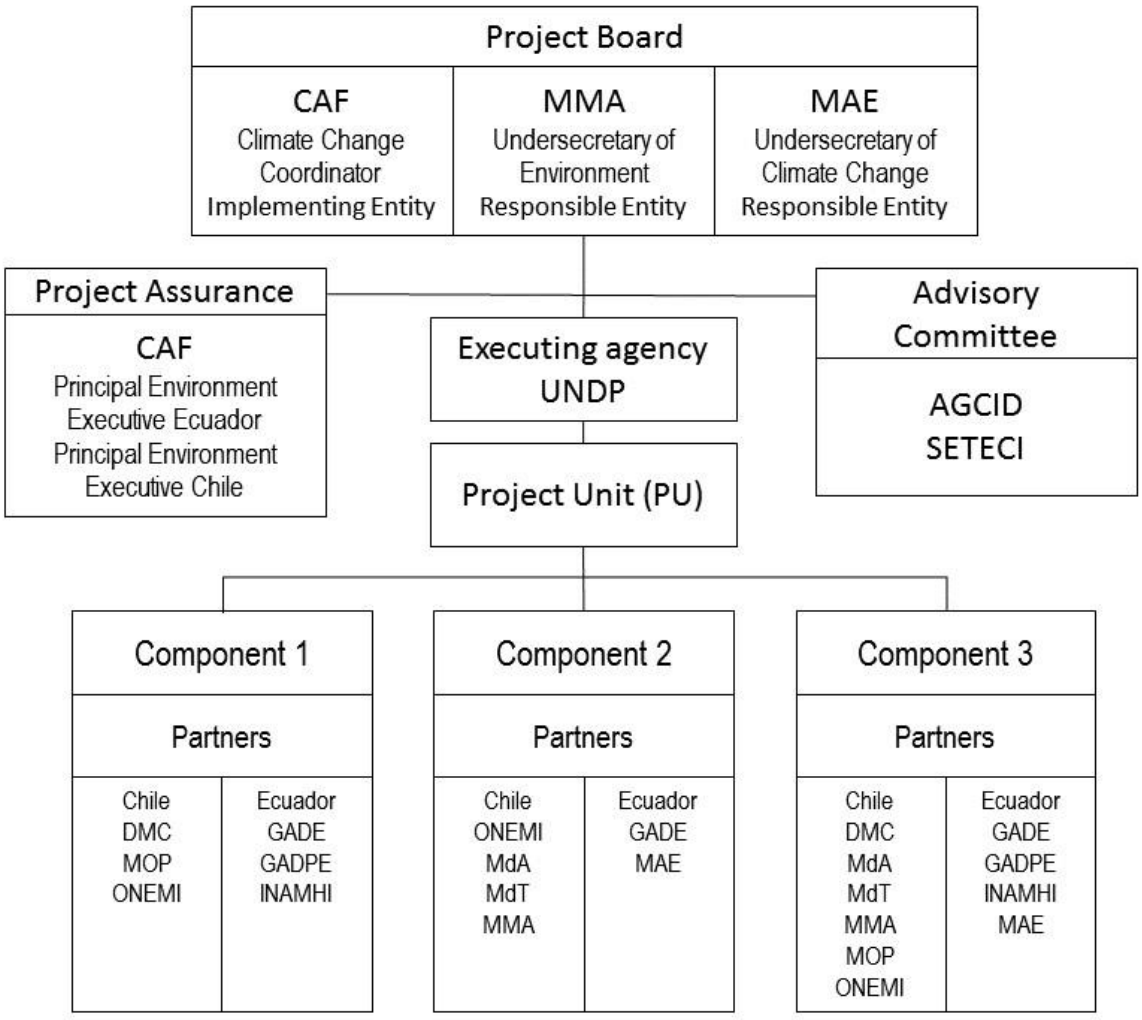

Figure 22. Project organization structure.

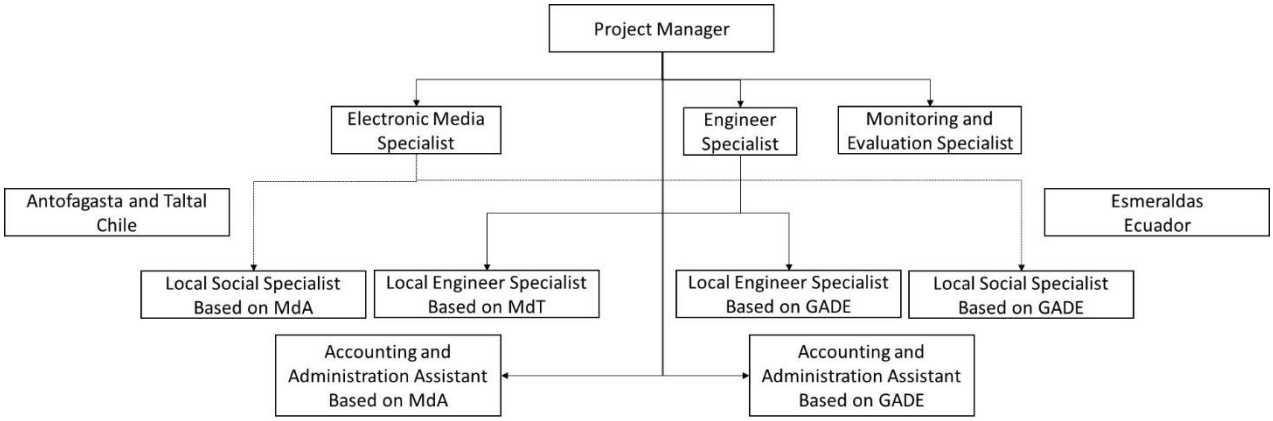

Figure 23. Project Unit.

Agreement on intellectual property rights and use of logo on the project's deliverables

280. In order to accord proper acknowledgement to the Adaptation Fund for providing funding, the AF logo will appear together with the CAF logo on all promotional materials, other written materials like publications developed by the project, and project hardware. Any citation on publications regarding projects funded by the Adaptation Fund will also accord proper acknowledgement to the AF.

B. Describe the measures for financial and project risk management.

281. CAF's risks management consists on two structures: internal (CAF) and external (clients). A robust strategy for internal risks identification and mitigation is in place since 2015 and is executed by the Risks Management Direction. The external strategy is implemented in operations financed by CAF, both in the public and in the private sector. For this project, the structure that applies in terms of risks analysis is the external one. In this case, CAF studies projects from a holistic perspective: political, institutional, financial, operational, technological, social and environmental risks are assessed and addressed with mitigation measures. The status of these risks will be monitored quarterly by the Project Manager. The former will report on the status of the risks to CAF office in Quito, who will record progress in a risk log. Risks will be reported as critical when the impact and probability are high (i.e., 5). Management responses to critical risks will be reported to the Adaptation Fund in the annual project implementation report.
282. In terms of financial risks, CAF's assessment methodology focuses on financial statements, shareholders' information, bonds records, and currency performance, among others. In this project, CAF will regard as financial risks those related to the possibility of the grant not being delivered and/or not being delivered on time; to a possible increase in the budget due to inaccuracies in costs calculations, or due to overprices during project implementation.
283. CAF's social and environmental policies require that every operation in which the organisation participates include an in-depth analysis of the social and environmental risks. The environmental and social risk classifies operations in terms of high, medium, low or no risk. During evaluation phase, the review process seeks to identify vulnerable areas, critic aspects, necessary measures for the prevention, control, mitigation and compensation of identified impacts, so they can be included in the cost structure in order to ensure their viability. The results of the evaluation and the definition of the environmental and social conditions and

recommendations to which the operation is subject, are recorded in an Environmental and Social Report, which is part of the documentation that must be presented to the different internal committees.

284. The project will be audited as per CAF's financial policies, and applicable audit guidelines. The audit would be performed under the CAF's financial regulations and rules applicable to audit policies on AF projects.

285. Potential risks for the development of the proposed project are limited, and mitigation measures have been identified in the following matrix:

Project Risks			
Type	**Description**	**Mitigation measure**	**Impact & Probability Level[80]**
Political	Change of central government in Chile. New president and congress will take office in 2018[81]	Present the project to new authorities in MMA	P = 5 I = 3
	Change of municipal governments in Antofagasta and Taltal. The new authorities will take office in December 2020[82].	Present the project to new municipal authorities in Antofagasta and Taltal	P = 5 I = 3
	Change of municipal and provincial governments in Esmeraldas. The new authorities will take office in 2019[83].	Present the project to new municipal authorities in Esmeraldas. Bailment agreement between CAF and GADPE[84]	P = 5 I = 3
Institutional	Support withdrawal from local counter-parts, taking into account the change of Governments.	Letters of endorsements by national authorities.	P = 3 I = 3
	The change of Governments could eventually lead to staff re-structuration, meaning that there could possibly be a knowledge gap between the newcomers.	Online training course on risk-based adaptation measures for municipal officers and technical staff of coastal cities.	P = 5 I = 3
Financial	Lower economic activity in both countries and impact of April´s earthquake in Ecuador[85].	Support project partners to incorporate and assign required resources in their institutional plans and budgets.	P = 5 I = 3
	Grant not being delivered and/or not being delivered on time.	CAF's cash flow would allow to respond to disbursements in case of delays.	P = 2 I = 3
	Increase in budget due to costs miscalculations, and/or due to overprices during project implementation.	Agreement signed with local counterparts to guarantee the project execution.	P = 2 I = 4

[80] 1 = low / 5 = high

[81] During the second year of project implementation.

[82] Before project closure.

[83] In the mid-term of Project execution.

[84] CAF will sign a bailment agreement with GADPE for the use and maintenance of the radar and meteorological stations. It is foreseen that the equipment will be transferred to GADPE on year 4, after the new provincial government ratifies the commitment to maintain and operate on the long-term the radar and meteorological stations.

[85] The economies of both countries have been affected by international commodities prices decline. The reduced public resources may limit the intended contributions from central al local governments.

Project Risks			
Type	**Description**	**Mitigation measure**	**Impact & Probability Level[80]**
Operational	GADPE has no experience with meteorological monitoring.	Agreement between GADPE and INAMHI[86]	P = 5 I = 3
	Baseline studies are not up to date	Adjustment of existing designs, incorporating the climate change factor.	P = 5 I = 4
	Inaccuracy in radar and storm detection system implementation	An agreement will be signed between MOP, DMC and ONEMI (Chile), and GADPE and INAMHI (Ecuador) to ensure technical and geographical accuracy.	P = 3 I = 3
Technological	Misuse of the online platform created to share best practices between coastal cities.	In-person meetings between project partners of both countries. Four thematic visits are forecasted.	P = 3 I = 2
Social	Lack of understanding of the project, and hence opposition from the local inhabitants.	The communication strategy contemplates socialisation of the project with the local communities.	P = 3 I = 3
Environmental	Effect of El Niño / La Niña in precipitation and local weather conditions.	Monitor information and alerts in national meteorological entities, NOAA, and World Meteorological Organization.	P = 4 I = 1

286. The status of this risks will be monitored quarterly by the Project Manager. The Project Manager will report on the status of the risks to CAF office in Quito, who will record progress in a risk log. Risks will be reported as critical when the impact and probability are high (i.e., 5). Management responses to critical risks will be reported to the Adaptation Fund in the annual project implementation report.

C. Measures for environmental and social risk management, in line with the Adaptation Fund´s Environmental and Social Policy.

287. To ensure that risks are well managed the project management and governance (Section III.A), Monitoring and Evaluation (Section III.D) fully take the management of environmental and social risks into account. In addition, an Environmental and Social Management System will be put in place to ensure fully compliance with the Adaptation Fund's ESP.

288. The entire project has been screened and assessed against the 15 environmental and social principles as presented in Table 11. Risks screening of the project at design stage using the 15 principles of the AF's ESP. in Section II.L.

289. Based on the risk identification and impact assessment in compliance with the environmental and social principles AF (Annex 14), different mitigation measures were defined and integrated into the project´s environmental and management plan (Annex 15).

[86] A pre-condition for the purchase of the radar and meteorological stations will be to have a signed agreement between GADPE and INAMHI to establish operational procedures. INAMHI will provide technical assistance and oversight of the operation.

290. The project identified USP in Component 1, are basically partially designed activities and developed the Environmental and Social Risk Identification Mechanism for Unidentified sub-projects (Annex 15). Any action without ESP screening, mitigation measures and approval by the project board could not be implemented.

291. Before the implementation of any activity or USP, the IE and the EE will assess the compliance of the activity with the ESMP in line with the Adaptation Funds ESP.

292. The following is a summary of the measures identified during design phase. All of them would be implemented to prevent, correct and/or mitigate adverse environmental and social impacts and risks. More mitigation measures shall be implemented for USP activities during full implementation phase of the project.

- A comprehensive information strategy in place to involve the whole community in the evacuation maps. The Local Social Specialist for Chile will prepare a "Communication and Participatory Strategy" that will contain all the activities and how the local community should be involved in all the activities' referred to the project as the socialization of the final designs.
- A study will be undertaken prior to the selection of which species will be used on the implications of introducing different species.
- Interventions in Chile have to comply with technical standards, environmental permits and construction code regulations. Related with the Chile the project will follow the rules to obtain the Environmental Impact Declaration (DIA) in accordance with the Environmental Law (Law 19,300) amended by Law 20,417 of 2010 , and Supreme Decree 40/2012 of 2012 (regulation for the environmental impact assessment system). Article 10 of Law 19,300.
- Ensure that employment procedures/ policy of the operational contractor is communicated to local stakeholders. The intention of giving preferential employment to locals is clearly communicated, to discourage an influx of job-seekers from other areas.
- A construction plan with a specific monitoring procedure to control Water consumption, Fuel consumption, Type of fuel consumption, Raw material consumption, Energy consumption, Solid waste generation, Wastewater / generation (quality of wastewater), Construction waste / debris generation shall be presented by the operational contractor and approved by the Project Board.
- The Carbon Footprint of the gray and green infrastructure works shall be presented
- A monitoring system of the GHG emissions shall be presented
- A Health Impact Assessment and an Occupational Health and Safety Management Protocol shall be presented to the Project Board.
- The community need to be informed clearly, a campaign would be implemented by the Media Specialist to reach different target of population.
- The study to identify the location must analyze different places based on a criteria matrix, such as: accessibility, security, no disturb landscape or other telecom instruments among others.
- An Installation Plan with its Monitoring Procedure for the Early Warning System (radar, meteorological stations, storm detection system and sirens) shall be presented to the Project Board. This should be based in a study for to localization of the system elements.
- Prepare a comprehensive Course Plan with the best technician on eco-engineering, with experience in tropical areas and with native vegetable species for Esmeraldas.

- The technical courses should be approved by the Project Board socialized with all the technical staff of Antofagasta and Taltal – Chile and Esmeraldas – Ecuador.

D. Describe the monitoring and evaluation arrangements and provide a budgeted M&E plan.

293. The project results as outlined in the project results framework (Part III, section E) will be monitored annually and evaluated periodically during project implementation to ensure the project effectively achieves these results. Supported by component three (i.e., includes knowledge Management and monitoring and evaluation), the project monitoring and evaluation plan (Table 12) will also facilitate learning and ensure knowledge is shared and widely disseminated to support the scaling up and replication of project results.

294. Project-level monitoring and evaluation will be undertaken in compliance with standard CAF requirements as agreed with the Adaptation Fund. Though these CAF requirements are not detailed in this section of the project document, CAF´ Ecuador country office will ensure that the monitoring and evaluation (M&E) requirements are met in a timely fashion and to high quality standards. The additional and mandatory monitoring and evaluation requirements as outlined in this section will be undertaken in accordance with the agreement with the Adaptation Fund. In addition to these mandatory CAF and AF monitoring and evaluation requirements, other M&E activities deemed necessary to support project-level adaptive management, and the exact role of project target groups and other stakeholders in project M&E activities, will be finalized during the Inception Workshop and will be detailed in the Inception Report.

Oversight and monitoring responsibilities

295. The primary responsibility for day-to-day project implementation and regular monitoring rests with the Project Manager. The Project Manager will develop annual work plans based on the multi-year work plan included in the present project document, including annual targets at the output level to ensure the efficient implementation of the project. The Project Manager will ensure that the standard CAF and Adaptation Fund M&E requirements are fulfilled to the highest quality. This includes, but is not limited to, ensuring the results framework indicators are monitored annually in time for reporting, and reporting to the Project Board at least once a year on project progress. The Project Manager will inform the Project Board and CAF Country Office in Ecuador of any delays or difficulties as they arise during implementation, including the implementation of the M&E plan, so that the appropriate support and corrective measures can be adopted. The Project Manager will also ensure that all project staff maintain a high level of transparency, responsibility and accountability in monitoring and reporting project results.

296. CAF Country Office in Ecuador will support the Project Manager as needed, including through annual supervision missions. This Country Office is responsible for complying with all CAF project-level M&E requirements. This includes ensuring (i) that quality assurance assessment during implementation is undertaken annually, and (ii) that annual targets at the output level are developed, and monitored and reported using CAF corporate systems. Any quality concerns flagged by the process must be addressed by project management. Additional M&E and implementation quality assurance and troubleshooting support will be provided by the CAF Country Office in Ecuador. The project target groups and stakeholders will be involved as much as possible in project-level M&E.

Monitoring and reporting requirements

297. Inception Workshop and Report A project inception workshop will be held after the project document has been signed by all relevant parties to: a) re-orient project stakeholders to the project strategy and discuss any changes in the overall context that influence project implementation; b) discuss the roles and responsibilities of the project team, including reporting and communication lines and conflict resolution mechanisms; c) review the results framework and discuss reporting, monitoring and evaluation roles and responsibilities and finalize the M&E plan; d) review financial reporting procedures and mandatory requirements, and agree on the arrangements for the audit; e) plan and schedule Project Board meetings and finalize the first year annual work plan. The Project Manager will prepare the inception report no later than one month after the inception workshop. The final inception report will be cleared by CAF Country Office in Ecuador and will be approved by the Project Board.

298. Adaptation Fund Project Performance Report (PPR). The Project Manager and CAF Country Office in Ecuador will provide objective input to the annual PPR as outlined in Document AFB/EFC.9/.4/Rev.1 approved at the 18th meeting of the Adaptation Fund Board. The Project Manager will ensure that the indicators included in the project results framework are monitored annually well in advance of the PPR submission deadline and are reported on accordingly in the PPR. The PPR that is submitted to the Adaptation Fund each year must also be submitted in English and shared with the Project Board. The CAF Country Office in Ecuador will coordinate the input of project partner and stakeholders to the PPR. The quality rating of the previous year's PPR will be used to inform the preparation of the subsequent report. The first PPR should be submitted one year after the start of project implementation (date of inception workshop). The project's terminal PPR along with the terminal evaluation report and corresponding management response will serve as the final project report package or project completion report. The final project report package shall be discussed with the Project Board during an end-of-project review meeting (i.e., Project Board closure meeting) to discuss lesson learned and opportunities for scaling up.

299. Adaptation Fund Results Tracker. This instrument is used by the Adaptation Fund to track specific indicator across its portfolio. The results tracker is an integral part of the PPR and will be completed based on the guidance and requirements of the Adaptation Fund.

300. Mid-term Review (MTR). An independent mid-term review process will begin after the second PPR has been submitted to the AF, and the final MTR report will be submitted to the Adaptation in the same year as the third PPR. The MTR findings and responses outlined in the management response will be incorporated as recommendations for enhanced implementation during the final half of the project's duration. The terms of reference, the review process and the final MTR report will follow the standard templates and guidance established by the Adaptation Fund. The final MTR report will be available in English and will be cleared by the CAF Country Office in Ecuador, the Principal Environment Executives in Ecuador and Chile, and approved by the Project Board.

301. Terminal Evaluation (TE). An independent terminal evaluation (TE) will take place before operational closure of the project. The Project Manager will remain on contract until the TE report and management response have been finalized. The terms of reference, the evaluation process and the final TE report will follow the standard templates and guidance established by the Adaptation Fund. The final TE report will be cleared by the CAF Country Office in Ecuador, the Principal Environment Executives in Ecuador and Chile, and approved by the Project Board.

302. The CAF Country Office in Ecuador will retain all M&E records for this project for up to seven years after project financial closure in order to support ex-post evaluations that might be undertaken.

Table 12. Budgeted monitoring and evaluation plan.

Monitoring and Evaluation action	Primary responsibility	Indicative cost [87] (USD)	Time frame
1. Inception Workshop	CAF	20,000	Within two months of project document signature
2. Inception Report	Project Manager	None	Within two weeks of inception workshop
3. Monitoring progress of project indicators	Monitoring and Evaluation specialist	None	Measured biannually
4. Quarterly and annual reports (PPR)	Project Manager Responsible Entities CAF	None	PPR submitted every year (no later than two months after the end of the reporting year). First PPR must be submitted one year after the start of project implementation (date of inception workshop). The last PPR shall be submitted no later than two months after the end of the reporting year.
5. Oversight missions	CAF	None[88]	Annually
6. Audit	CAF	50,000	Annually
7. Independent mid-term review	CAF Project team	30,000	Year 3
8. Independent terminal evaluation	CAF Project team	40,000	Year 5. Three months before project closure
9. Translation of mid-term review and terminal evaluation reports into English	CAF	6,000	
10. Final project report	Project team CAF	None	One month before project closure
11. Project Board closure meeting	CAF	20,000	Last month of project execution
Total indicative cost		166,000	

[87] Does not include personnel.

[88] Charged to the project cycle management fee.

E. Include a results framework for the project proposal, including milestones, targets and indicators.

	Objective and Outcome Indicators	Baseline	Mid-term and end of project targets	Means of verification	Assumptions
Project Objective: To reduce vulnerability to climate-related floods, mudflows and landslides in three coastal cities by mainstreaming a risk-based approach to adaptation, building collaboration and networking, and developing a culture of adaptation	Number of men and women protected by improved risk-reduction measures in Antofagasta, Taltal and Esmeraldas.	Antofagasta = 0 Taltal = 0 Esmeraldas = 0	End of project Antofagasta = 380,000 (ca., 50% women) Taltal = 10,000 (ca., 50% women) Esmeraldas = 161,000 (ca., 50% women)	▪ Project Performance Report	▪ Political support from local and national authorities. ▪ Entities responsible for building relevant infrastructure and early warning systems are willing to mainstream adaptation measures in their plans and actions. ▪ Interest and collaboration from local population and stakeholders.
Component 1. Priority Actions to increase resilience.					
Outcome 1. Enhanced plans and green infrastructure reduces vulnerability to floods, landslides and mudflows in two coastal cities	Number of plans that incorporate provisions for adaptation to climate change with gender perspective.	Stormwater management plan[89] Antofagasta = 0 Green infrastructure plan[90] Esmeraldas = 0	Mid-term: 1 End of project: 2	▪ Antofagasta´s stormwater management plan ▪ Esmeraldas´ green infrastructure plan ▪ Legal instruments adopting the plans	▪ Interest and support from local authorities. ▪ Local and national authorities committed to fund and implement the plans.

[89] Antofagasta has a stormwater management plan, prepared in 2004, which does not consider the climate change factor. In Chile, stormwater management plans are compulsory for cities >50,000 people.

[90] The adaptation and mitigation strategy (ONU-HABITAT, 2011) and the risks and disasters management strategy (GAD Esmeraldas, 2012) include elements for mangrove enhancement and reforestation of hillsides. However, there is no comprehensive plan to operationalise a grid of green spaces that contribute to flood and landslide protection and generate additional benefits (i.e., a green infrastructure plan).

	Objective and Outcome Indicators	Baseline	Mid-term and end of project targets	Means of verification	Assumptions
Outcome 2. Reduced vulnerability to floods, landslides and mudflows in two coastal cities.	Number of physical assets constructed to withstand conditions resulting from climate variability and change.	Antofagasta = 0 Esmeraldas = 0	Mid-term: 1 End of project: 2	▪ Designs and construction report of mudflow control infrastructure for Bonilla gorge (Antofagasta) ▪ Designs and construction report of landslide control infrastructure in Cerro Gatazo (Esmeraldas)	▪ Local and national authorities warrant quality assurance of designs and construction works. ▪ Pertinent local and national authorities incorporate in their financial plans the resources for future maintenance of the new infrastructure.
	Number of men and women protected by improved infrastructure to withstand climate change and variability-induced stress.	Antofagasta = 0 Esmeraldas = 0	End of project: 12,840 Antofagasta = (ca., 50% women) Esmeraldas = 500 (ca., 50% women)	▪ Survey report of people living in areas protected by improved infrastructure (Bonilla gorge and Cerro Gatazo) ▪ Percentage of women in Antofagasta and Esmeraldas from national statistics.	
Outcome 3. Improved climate monitoring and means to alert the local population	Number of weather radar in Esmeraldas and Storm detection system in Antofagasta to monitor precipitation, linked to gender-sensitive early warning systems.	Antofagasta = 0 Esmeraldas = 0	Mid-term Antofagasta = 1 Esmeraldas = 1	▪ Radar/storm system siting analysis reports. ▪ Radar/storm system installation reports. ▪ Quarterly radar/storm system operation reports. ▪ Agreements to ensure flow of radar/storm	▪ Responsible Entities promptly execute complementary works to house and operate the equipment (e.g., radar tower, radio link). ▪ Pertinent entities incorporate in their financial

	Objective and Outcome Indicators	Baseline	Mid-term and end of project targets	Means of verification	Assumptions
				system information to early warning systems[91]. ▪ Long-term agreements for operation and maintenance[92]. ▪ Bailment agreements[93]	plans the resources for future operation and maintenance of the new meteorological equipment. ▪ Risk management authorities incorporate the new information into their early warning systems to alert the local population.
	Number of meteorological stations to monitor precipitation which affect the cities, linked to gender-sensitive early warning systems.	Antofagasta[94] = 4 Taltal = 1 Esmeraldas[95] = 5	Mid-term Antofagasta = 6 Taltal = 2 Esmeraldas = 7[96]	▪ Installation reports. ▪ Quarterly operation reports. ▪ Agreements to ensure flow of information to early warning systems. ▪ Long-term agreements for operation and maintenance. ▪ Bailment agreements	
Outcome 4. Improved means to respond to floods, landslides and mudflows	Number of men and women covered by alert and evacuation route signs to respond to floods	Number of people Antofagasta = 0	End of project:	▪ Reports on installation of sirens and evacuation route signs.	▪ Risk management authorities integrate the new tools into their early

[91] In Chile, agreement among MOP, DMC and ONEMI. In Ecuador, agreement between GADPE and INAMHI. These agreements will establish operational procedures, information flow, and guarantee that the information from the storm detection system and meteorological stations is expedited to the national weather forecast and early warning systems.

[92] In Chile, DMC and MOP, and in Ecuador, GADPE will be responsible for installation, operation and maintenance of the radar/ storm detection system and meteorological stations.

[93] CAF will sign bailment agreements with DMC, MOP and GADPE for the use and maintenance of the radar/ storm detection system and the meteorological stations.

[94] MOP has three automatic stations in Antofagasta (Liceo Científico Humanista La Chimba, Escuela Fundación Minera Escondida, and Universidad de Antofagasta) and one in Taltal.

[95] INAMHI has three meteorological stations that are relevant for the present project: La Concordia (M0025), Sague (San Mateo) (M0441), and Teaone - Tabiazo (M0444). Two additional stations are located in the city of Esmeraldas (operated by INOCAR) and at Tachina´s airport.

[96] The project will provide two meteorological stations and one hydrological station. These stations will be managed by GADPE under the supervision of INAMHI.

	Objective and Outcome Indicators	Baseline	Mid-term and end of project targets	Means of verification	Assumptions
	(Esmeraldas), landslides (Esmeraldas) and mudflows (Antofagasta and Taltal) The early warning systems in Antofagasta, Taltal, Cerro Gatazo and Isla Luis Vargas Torres are gender and culturally sensitive and consider the special needs of persons with disabilities.	Taltal = 0 Esmeraldas (floods) = 0 Esmeraldas (landslides) = 0 Number of early warning systems Antofagasta = 0 Taltal = 0 Cerro Gatazo = 0 Isla Luis Vargas Torres = 0	Antofagasta = 380,000 people (ca., 50% women) Taltal = 10,000 people (ca., 50% women) Esmeraldas (floods) = 161,000 people (ca., 50% women) Esmeraldas (landslides) = 161,000 people (ca., 50% women) Four early warning systems are gender and culturally sensitive and consider the special needs of persons with disabilities.	▪ Evacuation maps are easily accessible. ▪ Evacuation route signs installed. ▪ Citizen evacuation procedures and guides are easily accessible. ▪ Early warning system designs (four)	warning systems to alert the local population. ▪ Pertinent entities incorporate in their financial plans the resources for future operation and maintenance of sirens and evacuation route signs.
Component 2. Strengthen capacities for adaptation.					
Outcome 5. Local governments with improved capacity to design and implement adaptation measures	Number of staff (men and women) of local governments and pertinent entities trained on risk-based adaptation with a gender perspective in coastal cities.	Antofagasta = 0 Taltal = 0 Esmeraldas = 0 Other coastal cities Chile = 0	End of project: Antofagasta = $\geq$50 Taltal = $\geq$10 Esmeraldas = $\geq$20	▪ Course plan and training materials on risk-based adaptation in coastal cities.	▪ Officers from local governments and pertinent entities are willing to participate in training and to mainstream risk-based adaptation into their work.

	Objective and Outcome Indicators	Baseline	Mid-term and end of project targets	Means of verification	Assumptions
		Other coastal cities Ecuador = 0	Other coastal cities Chile = ≥10 Other coastal cities Ecuador = ≥10 About 40% will be women	▪ Report of training of trainers. ▪ Report of each training event (including list of participants).	
Outcome 6. Local population and government personnel with increased awareness of climate-related risks (floods, landslides, mudflows)	Number of men and women who have participated in awareness activities and events.	Antofagasta = 0 Taltal = 0 Esmeraldas = 0	End of project: Antofagasta = ≥30,000 (ca., 50% women) Taltal = ≥1,000 (ca., 50% women) Esmeraldas = ≥16,000 (ca., 50% women)	▪ Public communication and education strategies for Antofagasta, Taltal and Esmeraldas. ▪ Report of each awareness activity and event (including list of participants). ▪ Quarterly progress reports of implementation of each communication and education strategy.	▪ Local population is sensible to messages about climate-related risks and adaptation to climate change. ▪ Pertinent entities are willing to sustain long-term public awareness strategies and the narrators´ initiative.
	Number of narrators (men and women) trained to maintain cultural memory of climate-related disaster and risks.	Antofagasta = 0 Taltal = 0 Esmeraldas = 0	End of project: Antofagasta = 10 (ca., 50% women) Taltal = 5 (ca., 50% women) Esmeraldas = 10 (ca., 50% women)	▪ Training materials. ▪ Long-term signed agreements to sustain narrators' initiative in the three cities. ▪ Quarterly progress reports of implementation of the narrators´ initiative	
Component 3. ICTs and partnership between coastal cities in Latin America.					

	Objective and Outcome Indicators	Baseline	Mid-term and end of project targets	Means of verification	Assumptions
Outcome 7. Lessons and best practice on reducing vulnerability to climate related flooding, landslides and mudflows in coastal cities have been shared in the region.	Number of men and women (by nationality) who have participated in events for dissemination of lessons and best practice (e.g., workshops, exchange visits, seminars)	0	Mid-term >100 people ≥ 50% women End of project: >200 people ≥ 40% women	▪ Memoirs / reports of virtual and in-person events (including list of participants)	▪ The information is attractive, useful and accessible to key stakeholders and interest groups
	Number of visitors per month (annual average) recorded in the network of electronic channels of the regional on-line platform used to disseminate project´ learnings and best practice	Visits 0 Unique visits 0	Mid-term Visits ≥2000 Unique visits ≥1600 End of project: Visits ≥4000 Unique visits ≥3200	▪ Monthly reports from electronic platform administrator	▪ Coastal communities have adequate internet access

F. Demonstrate how the project aligns with the Results Framework of the Adaptation Fund

303. The project is comprehensive and aligns with four of the seven outcomes of the Adaptation Fund´s results framework.

Project Objective(s)[97]	Project Objective Indicator(s)	Fund Outcome	Fund Outcome Indicator	Grant Amount[98] (USD)
To reduce vulnerability to climate-related flooding in three coastal cities by mainstreaming a risk-based approach to adaptation, building collaboration and networking, and developing a culture of adaptation.	Number of people (men and women) protected by improved risk-reduction measures in Antofagasta, Taltal and Esmeraldas.	Outcome 1: Reduced exposure to climate-related hazards and threats	1. Relevant threat and hazard information generated and disseminated to stakeholders on a timely basis	1,812,195[99]
		Outcome 2: Strengthened institutional capacity to reduce risks associated with climate-induced socioeconomic and environmental losses	2. Capacity of staff to respond to, and mitigate impacts of, climate-related events from targeted institutions increased	229,937[100]
		Outcome 3: Strengthened awareness and ownership of adaptation and climate risk reduction processes at local level	3.1. Percentage of targeted population aware of predicted adverse impacts of climate change, and of appropriate responses	1,022,074[101]
		Outcome 4: Increased adaptive capacity within relevant development sector services and infrastructure assets	4.2. Physical infrastructure improved to withstand climate change and variability-induced stress	7,819,848[102]
Project Outcome(s)	**Project Outcome Indicator(s)**	**Fund Output**	**Fund Output Indicator**	**Grant Amount (USD)**

[97] The AF utilized OECD/DAC terminology for its results framework. Project proponents may use different terminology but the overall principle should still apply

[98] The allocations listed below do not sum the total project Budget. Component 3 (i.e., outputs 7.1 and 7.2) deal with knowledge management and dissemination of lessons and best practice. The AF´s results framework does not have a specific outcome or output dealing with knowledge management.

[99] Correspond to project outputs 3.1, 3.2, 4.1, 4.2 and 4.3. See project budget.

[100] Correspond to project output 5.1. See project budget.

[101] Correspond to project outputs 6.1 and 6.2. See project budget.

[102] Correspond to project outputs 1.1, 1.2, 2.1, and 2.2. See project budget.

Outcome 1. Enhanced plans and green infrastructure reduces vulnerability to floods, landslides and mudflows in three coastal cities	Number of plans that incorporate provisions for adaptation to climate change.	Output 4: Vulnerable development sector services and infrastructure assets strengthened in response to climate change impacts, including variability	4.1.2. Number of physical assets strengthened or constructed to withstand conditions resulting from climate variability and change (by sector and scale)	7,819,848
Outcome 2. Reduced vulnerability to floods, landslides and mudflows in two coastal cities	Number of physical assets constructed to withstand conditions resulting from climate variability and change. Number of people (men and women) protected by improved infrastructure to withstand climate change and variability-induced stress.			
Outcome 3. Improved climate monitoring and means to alert the local population	Number of weather radar/storm system to monitor precipitation, linked to early warning systems. Number of meteorological stations to monitor precipitation which affect the cities, linked to early warning systems.	Output 1.2: Targeted population groups covered by adequate risk reduction systems	1.2.1. Percentage of target population covered by adequate risk-reduction systems	1,812,195
Outcome 4. Improved means to respond to floods, landslides and mudflows	Number of people (men and women) covered by alert and evacuation route signs to respond to floods (Esmeraldas), landslides (Esmeraldas) and mudflows (Antofagasta and Taltal)			
Outcome 5. Local governments with improved capacity to design and implement	Number of staff (men and women) of local governments and pertinent entities	Output 2: Strengthened capacity of national and subnational centres and networks to	2.1.1. Number of staff trained to respond to, and mitigate impacts of,	229,937

adaptation measures	trained on risk-based adaptation in coastal cities.	respond rapidly to extreme weather events	climate-related events (by gender)	
Outcome 6. Local population and government personnel with increased awareness of climate-related risks (floods, landslides, mudflows)	Number of people (men and women) who have participated in awareness activities and events. Number of narrators (men and women) trained to maintain cultural memory of climate-related disaster and risks.	Output 3: Targeted population groups participating in adaptation and risk reduction awareness activities	3.1 Number of news outlets in the local press and media that have covered the topic	1,022,074

G. Include a detailed budget with budget notes, broken down by country as applicable, a budget on the Implementing Entity management fee use, and an explanation and a breakdown of the execution costs.

Budget

Output	Responsible entity	Country	Budget description	Year 1	Year 2	Year 3	Year 4	Year 5	Total	Budget note
1.1. Stormwater management plan for Antofagasta	MOP	CHI	Contractual services company	350.000					350.000	1
	MOP	CHI	Travel	10.000	5.080				15.080	2
	MOP	CHI	Contractual services individual		10.000				10.000	3
	MOP	CHI	Meetings		20.000				20.000	4
	MOP	CHI	Audiovisual & print production costs		3.000				3.000	5
	UNDP	Regional	Local consultants	2.769	2.769	2.769	2.769	2.769	13.846	6
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	7
			Subtotal	364.078	42.158	4.078	4.078	4.078	418.472	
1.2. Green infrastructure plan for Esmeraldas	GADE	ECU	Contractual services company	18.000					18.000	8
	GADE	ECU	Contractual services company	60.000					60.000	9
	GADE	ECU	Contractual services company		50.000				50.000	10
	GADE	ECU	Meetings		20.000				20.000	11
	GADE	ECU	Audiovisual & print production costs		5.000				5.000	12

Output	Responsible entity	Country	Budget description	Year 1	Year 2	Year 3	Year 4	Year 5	Total	Budget note
	GADE	ECU	Contractual services company		70.000	50.000	30.000		150.000	13
	UNDP	Regional	Local consultants	2.769	2.769	2.769	2.769	2.769	13.846	6
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	14
			Subtotal	82.078	149.078	54.078	34.078	4.078	323.392	
2.1. Mudflow control infrastructure in Antofagasta	MOP	CHI	Contractual services company		200.000				200.000	15
	MOP	CHI	Contractual services company			4.333.200			4.333.200	16
	MOP	CHI	Contractual services company		30.000				30.000	17
	MOP	CHI	Miscellaneous expenses		10.000	30.000			40.000	18
	MOP	CHI	Equipment and furniture	14.000					14.000	19
	UNDP	Regional	Local consultants	2.769	2.769	2.769	2.769	2.769	13.846	6
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	7
			Subtotal	18.078	244.078	4.367.278	4.078	4.078	4.637.592	
2.2. Landslide mitigation works in Esmeraldas	GADE	ECU	Contractual services company		50.000	150.000			200.000	20
	GADE	ECU	Contractual services company			2.200.000			2.200.000	21
	GADE	ECU	Miscellaneous expenses			20.000			20.000	22
	UNDP	Regional	Local consultants	2.769	2.769	2.769	2.769	2.769	13.846	6
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	14
			Subtotal	4.078	54.078	2.374.078	4.078	4.078	2.440.392	

Output	Responsible entity	Country	Budget description	Year 1	Year 2	Year 3	Year 4	Year 5	Total	Budget note
3.1. Weather radar in Esmeraldas / acquire a storm detection system with 4 sensors and contract storm detection services for 5 years.	DMC	CHI	Contractual services company	25.000	25.000	25.000	25.000	25.000	125.000	23
	DMC	CHI	Equipment and furniture	405.000					405.000	24
	INAMHI	ECU	Contractual services company	30.000					30.000	25
	GADPE	ECU	Equipment and furniture		500.000				500.000	26
	INAMHI	ECU	Miscellaneous expenses		20.000	10.000	10.000	10.000	50.000	27
	UNDP	Regional	Local consultants	2.769	2.769	2.769	2.769	2.769	13.846	6
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	14
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	7
			Subtotal	65.387	1.025.387	15.387	15.387	15.387	1.136.937	
3.2. Increased number of meteorological stations in Antofagasta, Taltal and Esmeraldas	MOP	CHI	Equipment and furniture	70.000					70.000	28
	GADPE	ECU	Equipment and furniture	70.000					70.000	29
	UNDP	Regional	Local consultants	2.769	2.769	2.769	2.769	2.769	13.846	6
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	14
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	7
			Subtotal	145.387	5.387	5.387	5.387	5.387	166.937	
4.1. Enhanced public warning system in Antofagasta and Taltal	ONEMI	CHI	Equipment and furniture		230.000				230.000	30
	UNDP	Regional	Local consultants	2.769	2.769	2.769	2.769	2.769	13.846	6
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	7
			Subtotal	4.078	234.078	4.078	4.078	4.078	250.392	

Output	Responsible entity	Country	Budget description	Year 1	Year 2	Year 3	Year 4	Year 5	Total	Budget note
4.2. Pilot flood warning system in Esmeraldas	GADE	ECU	Contractual services company	10.000					10.000	31
	GADE	ECU	Equipment and furniture	10.000	50.000				60.000	32
	GADE	ECU	Meetings	2.000	6.600	2.000			10.600	33
	GADE	ECU	Miscellaneous expenses		5.000	5.000	5.000	5.000	20.000	34
	UNDP	Regional	Local consultants	2.769	2.769	2.769	2.769	2.769	13.846	6
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	14
			Subtotal	26.078	65.678	11.078	9.078	9.078	120.992	
4.3. Evacuation route maps and signals in Antofagasta, Taltal and Esmeraldas	ONEMI	CHI	Contractual services company	10.000					10.000	35
	ONEMI	CHI	Audiovisual & print production costs		3.000				3.000	36
	ONEMI	CHI	Audiovisual & print production costs		40.000				40.000	37
	ONEMI	CHI	Miscellaneous expenses		6.000	6.000	6.000	6.000	24.000	38
	GADE	ECU	Contractual services company	10.000					10.000	39
	GADE	ECU	Audiovisual & print production costs		3.000				3.000	40
	GADE	ECU	Audiovisual & print production costs		20.000				20.000	41
	UNDP	Regional	Local consultants	2.769	2.769	2.769	2.769	2.769	13.846	6
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	14
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	7

Output	Responsible entity	Country	Budget description	Year 1	Year 2	Year 3	Year 4	Year 5	Total	Budget note
			Subtotal	25.387	77.387	11.387	11.387	11.387	136.937	
5.1. Course on risk-based adaptation in coastal cities	APC	Regional	Local consultants	25.000	50.000	25.000			100.000	42
	APC	Regional	Meetings	8.000					8.000	43
	APC	Regional	Grant		30.000				30.000	44
	APC	Regional	Meetings		20.000				20.000	45
	APC	Regional	Grant			15.000	15.000	15.000	45.000	46
	UNDP	Regional	Local consultants	2.769	2.769	2.769	2.769	2.769	13.846	6
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	14
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	7
			Subtotal	38.387	105.387	45.387	20.387	20.387	229.937	
6.1. Public communication and education strategies for Antofagasta, Taltal and Esmeraldas.	MdA	CHI	Contractual services company	15.000					15.000	47
	UNDP	CHI	Local consultants	12.000	12.000	12.000	12.000	12.000	60.000	48
	MdA	CHI	Miscellaneous expenses		40.000	30.000	20.000		90.000	49
	MdA	CHI	Equipment and furniture		3.400				3.400	50
	MdT	CHI	Contractual services company	15.000					15.000	51
	UNDP	CHI	Local consultants	10.800	10.800	10.800	10.800	10.800	54.000	52
	MdT	CHI	Miscellaneous expenses		20.000	15.000	10.000		45.000	53
	MdT	CHI	Equipment and furniture		3.400				3.400	54
	GADE	ECU	Contractual services company	15.000					15.000	55
	UNDP	ECU	Local consultants	12.000	12.000	12.000	12.000	12.000	60.000	56

Output	Responsible entity	Country	Budget description	Year 1	Year 2	Year 3	Year 4	Year 5	Total	Budget note
	GADE	ECU	Miscellaneous expenses		20.000	15.000	10.000		45.000	57
	GADE	ECU	Equipment and furniture		3.400				3.400	58
	UNDP	Regional	Local consultants	2.769	2.769	2.769	2.769	2.769	13.846	6
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	14
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	7
			Subtotal	85.187	130.387	100.187	80.187	40.187	436.137	
6.2. Narrators´ initiative initiated	UNDP	CHI	Local consultants	12.000	12.000	12.000	12.000	12.000	60.000	59
	UNDP	CHI	Local consultants	10.800	10.800	10.800	10.800	10.800	54.000	60
	MMA	CHI	Meetings	8.000					8.000	61
	MMA	CHI	Contractual services company		25.000	15.000	10.000		50.000	62
	MMA	CHI	Grant		50.000	60.000	50.000	40.000	200.000	63
	MMA	CHI	Local consultants			6.000			6.000	64
	UNDP	ECU	Local consultants	10.800	21.600	21.600	21.600	10.800	86.400	65
	MAE	ECU	Contractual services company		10.000	10.000	5.000		25.000	66
	MAE	ECU	Grant		15.000	25.000	15.000	10.000	65.000	67
	MAE	ECU	Local consultants			4.600			4.600	68
	UNDP	Regional	Local consultants	2.769	2.769	2.769	2.769	2.769	13.846	6
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	14
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	7
			Subtotal	46.987	149.787	170.387	129.787	88.987	585.937	
7.1. Electronic platform to facilitate	UNDP	Regional	Equipment and furniture	28.000					28.000	69

Output	Responsible entity	Country	Budget description	Year 1	Year 2	Year 3	Year 4	Year 5	Total	Budget note
communication among stakeholders and dissemination of lessons and best practice	UNDP	Regional	Contractual services company	8.600	8.600	8.600	8.600	8.600	43.000	70
	UNDP	Regional	Local consultants	22.800	22.800	22.800	22.800	22.800	114.000	71
	UNDP	Regional	Local consultants	24.000	24.000	24.000	24.000	24.000	120.000	72
	UNDP	Regional	Supplies	1.800	1.800	1.800	1.800	1.800	9.000	73
	UNDP	Regional	Audiovisual & print production costs	10.000	10.000	10.000	10.000	10.000	50.000	74
	UNDP	Regional	Travel	10.000	10.000	10.000	10.000	10.000	50.000	75
	UNDP	Regional	Local consultants	2.769	2.769	2.769	2.769	2.769	13.846	6
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	14
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	7
			Subtotal	110.587	82.587	82.587	82.587	82.587	440.937	
7.2. Lessons and best practice documented and disseminated	UNDP	Regional	Local consultants	24.000	24.000	24.000	24.000	24.000	120.000	76
	UNDP	Regional	Miscellaneous expenses	13.000	15.000	15.000	15.000	15.000	73.000	77
	UNDP	Regional	Meetings	20.000					20.000	78
	UNDP	Regional	Meetings	5.000					5.000	79
	UNDP	Regional	Meetings	5.000					5.000	80
	UNDP	Regional	Travel		20.000	20.000	20.000	20.000	80.000	81
	UNDP	Regional	Travel			10.000	10.000	10.000	30.000	82
	UNDP	Regional	International consultants			30.000		40.000	70.000	83
	UNDP	Regional	Audiovisual & print production costs					30.000	30.000	84
	UNDP	Regional	Audiovisual & print production costs					50.000	50.000	85
	UNDP	Regional	Meetings					20.000	20.000	86

Output	Responsible entity	Country	Budget description	Year 1	Year 2	Year 3	Year 4	Year 5	Total	Budget note
	UNDP	Regional	Meetings					25.000	25.000	87
	UNDP	Regional	Meetings					10.000	10.000	88
	UNDP	Regional	Meetings					25.000	25.000	89
	UNDP	Regional	Local consultants	2.769	2.769	2.769	2.769	2.769	13.846	6
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	14
	UNDP	Regional	Local consultants	1.309	1.309	1.309	1.309	1.309	6.545	7
			Subtotal	72.387	64.387	104.387	74.387	274.387	589.937	
Project execution cost	UNDP	Regional	Equipment and furniture	4.500					4.500	90
	UNDP	Regional	Miscellaneous expenses	1.300	1.300	1.300	1.300	1.300	6.500	91
	UNDP	Regional	Administration fee	87.518	194.492	588.086	38.422	45.558	954.074	92
			Subtotal	93.318	195.792	589.386	39.722	46.858	965.074	

Total project cost	**1.181.487**	**2.625.641**	**7.939.155**	**518.691**	**615.027**	**12.880.000**

Budget notes

1 Engineer company contract to update stormwater management plan for Antofagasta.

2 Travel (including airplane tickets, board and lodging) of MOP personnel for contract supervision

3 Consultant to prepare guidelines to update stormwater management plans to cope with climate-related mudflows in coastal cities

4	Two-day workshop (ca., 20 people) in Antofagasta to validate guidelines. Cost includes materials, locale, board and lodging.
5	Prepare publication of guidelines. Digital document (PDF format) for distribution through websites.
6	Project Manager. USD3,000/month. Allocation of time to this output. Annex 5 has the terms of reference for this post.
7	Accounting and administration assistant, USD1200/month. Time allocation to this output. To be based in Antofagasta.
8	Prepare and implement a training event on green infrastructure planning in coastal cities. Three-day workshop (ca., 30 people) in Esmeraldas. Participants will be technical staff from GADM and relevant entities. Cost includes course development, training materials, locale, and board.
9	Situation analysis of climate-related risks and options to enhance green infrastructure in the city of Esmeraldas. Consultant team must include a botanist, a zoologist, a geographer, a lawyer and a coastal management specialist. The work will include a characterization of the urban area, identify local needs and deficiencies in existing green infrastructure and detailed recommendations of priorities to enhance green infrastructure.
10	Prepare green infrastructure plan for the city, with emphasis on protection from flooding and landslides. The plan will be prepared through a highly participatory process with local stakeholders. A detailed regulation framework must be developed to anchor green infrastructure development into municipal planning. The cost includes personnel, workshops, materials, and travel. The consultant team must include a botanist, a geographer, a lawyer, an urban planner and a coastal management specialist.
11	Cost of meetings and events to socialise the green infrastructure plan to the community and stakeholders
12	Prepare publication of green infrastructure plan. Digital document (PDF format) for distribution through websites, and a communication brief for wider distribution.
13	Design and implement intervention to vegetate Cerro Gatazo hillside to reduce the risk of rainfall-induced erosion and landslides. Cost includes the design of the intervention (in close coordination with the team that will develop landslide mitigation infrastructure in Cerro Gatazo), obtaining the pertinent environmental permits, nursery production of plants, planting and care for two years (i.e., watering,

	weeding, fertilization, pest and disease control). Reference cost USD1,200 ha-1 to establish the plantation, USD400 ha-1 year-1 for maintenance of the plantation.
14	Accounting and administration assistant, USD1200/month. Time allocation to this output. To be based in Esmeraldas.
15	Engineer company to update the designs of mudflow control infrastructure in Quebrada Bonilla (Antofagasta) incorporating future climate scenarios.
16	Construction company to build mudflow control infrastructure in Quebrada Bonilla (Antofagasta).
17	Prepare Environmental Impact Declaration and obtain pertinent environmental permits
18	Various expenses (e.g., airplane tickets, lodging, consumables) for MOP´s supervision of construction works.
19	Purchase of AQUAVEO WMS software and network server to model and analyse watersheds. About USD 7000 to purchase WMS premium edition for five network users. About USD 7000 to purchase a high capacity server to run the software and two computer terminals.
20	Engineer company to update the designs of landslide mitigation infrastructure in Cerro Gatazo incorporating future climate scenarios. This work will closely collaborate with the team which design the intervention to vegetate Cerro Gatazo hillside.
21	Construction company to build landslide mitigation infrastructure in Cerro Gatazo. The cost includes obtaining the pertinent environmental permits.
22	Various expenses for supervision of construction works.
23	Study to identify best location for storm sensors and design supporting infrastructure and facilities. DMC will prepare terms of reference and oversee the study. UNDP will contract the study.
24	Purchase of Storm Detection System of the DMC, including 4 sensors, installation and training of personnel in operation and maintenance. The equipment will be purchased by UNDP. DMC will be responsible for installation, operation and maintenance. For this purpose, a bailment agreement will be signed between DMC and CAF. The equipment will be transferred to DMC during year 4 of the project. A pre-condition for the purchase of the equipment will be to have a signed agreement between MOP, DMC and ONEMI to establish operational procedures,

	information flow, and to guarantee that the information from the Storm Detection System and meteorological stations is expedited to the national weather forecast and early warning systems.
25	Study to identify best location for weather radar and design supporting infrastructure and facilities. INAMHI will prepare terms of reference and oversee the study. UNDP will contract the study.
26	Purchase of weather radar, including installation and training of personnel in operation and maintenance. Rough distribution of investment: radar USD300,000, spare parts USD100,000, training USD20,000, and installation USD80,000 (e.g., power plant, lighting protection). INAMHI will provide technical specifications. UNDP will purchase the equipment. GADPE will be responsible for installation, operation and maintenance. INAMHI will oversee the installation, operation and maintenance of the radar. A pre-condition for the purchase of the equipment will be to have a signed agreement between GADPE and INAMHI to establish operational procedures, information flow and to guarantee that the information from the radar and meteorological stations is expedited to the national weather forecast and early warning systems. CAF will sign a bailment agreement with GADPE for the use and maintenance of the radar and meteorological stations. It is foreseen to transfer the equipment to GADPE during year 4 of the project. However, if GADPE cannot guarantee its long-term operation, the equipment will be transferred to INAMHI.
27	Various expenses to cover INAMHI´s (i) training of GADPE personnel, and (ii) supervision of installation, operation and maintenance of radar and meteorological stations.
28	Purchase of meteorological stations, including installation. MOP will be responsible for installation, operation and maintenance. For this purpose, a bailment agreement will be signed between MOP and CAF. The equipment will be transferred to MOP during year 4 of the project. A pre-condition for the purchase of the equipment will be to have a signed agreement between MOP, DMC and ONEMI.
29	Purchase of two meteorological stations and one hydrological station (including installation). INAMHI will provide technical specifications and will oversee the installation, operation and maintenance of the equipment. UNDP will purchase the equipment. GADPE will be responsible for installation, operation and maintenance. CAF will sign a bailment agreement with GADPE.
30	Purchase and install mudflows public warning equipment (e.g., sirens, communication network, control centre). It is foreseen to use omni-directional outdoor warning sirens with one kilometre radius coverage. Nine sirens will be needed in Antofagasta and one in Taltal. ONEMI will provide technical specifications and will be responsible for the installation, operation and maintenance. UNDP will buy the equipment and transfer it to ONEMI.

31	Design flooding early warning system for trial testing. Design will combine community-based actions coordinated with municipal and national authorities. The pilot will be implemented in Isla Luis Vargas Torres. The system will be designed with the participation of key organisations of island´s residents. The organizations that have agreed to contribute are 12 de mayo, Cordero Crespo, 20 de noviembre, Pianguapi, 29 de agosto, and Habana.
32	Purchase and installation of equipment for pilot flood early warning system. It is foreseen to use two omni-directional outdoor warning sirens with one kilometre radius coverage. GADE will be responsible for the installation, operation and maintenance. UNDP will buy the equipment and transfer it to GADE.
33	Meetings and workshops socialize and train local groups on flooding alert and emergency procedures. The cost includes production of handouts and communication material.
34	Flood emergency drills with local groups of the pilot area.
35	Update mudflows evacuation maps for Antofagasta and Taltal. Digital files (PDF format) will be posted in local websites and social media to facilitate public access.
36	Print evacuation maps in large format and locate in high-transit areas for public display in both cities.
37	Production and placing of mudflow evacuation route signs in Antofagasta and Taltal
38	Various expenses to hold annual mudflow evacuation drills in Antofagasta and Taltal
39	Prepare flooding evacuation map and landslide risk evacuation map for Esmeraldas. Digital files (PDF format) will be posted in local websites and social media to facilitate public access.
40	Print flooding evacuation map and landslide risk evacuation map in large format and locate in high-transit areas for public display.
41	Production and placing of signals for flooding evacuation routes and landslide risk areas
42	Two consultants to coordinate and prepare course on risk-based adaptation in coastal cities. Lead consultant will be based in Chile; the other consultant will be in Ecuador. They will prepare the analysis of existing experience, prepare the joint workshop to delineate the training

	course, identify and take contact with key partners, contribute and oversee the preparation of the course, organize the training of trainers and oversee the delivery of the first training course. Lead consultant USD 60,000, local consultant USD 40,000.
43	Joint workshop to delineate training contents and structure, and agree working procedures. Three-day workshop. Travel cost for three persons USD6000 (airplane tickets, food and lodging, terminal expenses) and USD2000 for locale, materials and board. Travel cost includes one of the consultants.
44	Grant to partner organization (e.g., university with on-line training capabilities) to develop course and training materials, including training of trainers.
45	One-week workshop to train trainers. Cost includes travel.
46	Grant to partner organization to offer three training courses.
47	Prepare needs assessment and communication and public education strategy for Antofagasta
48	Local engineer specialist to coordinate and catalyse implementation of the project´s adaptation actions and the communication and public education strategy in Antofagasta. This person will also oversee the specialist responsible for activities in Taltal. Monthly salary USD2,000, 50% time dedicated to coordinate implementation of project´s adaptation actions and public education strategy. This person will be based within the Municipality of Antofagasta, under the supervision of the project´s Lead Engineer Specialist. With respect to the public education strategy, this person together with municipal staff will assess the progress in reaching the goals, adjust the strategy and prepare the workplan for the following year. Annex 5 has the terms of reference for this post.
49	Production of communication materials and events to implement the communication and public education strategy in Antofagasta. This also includes office materials and consumables for the work of the consultant.
50	Purchase of computer, printer, furniture and office supplies for the consultant to be based within the municipality
51	Prepare needs assessment and communication and public education strategy for Taltal
52	Local engineer specialist to coordinate and catalyse implementation of the project´s adaptation actions and the communication and public education strategy in Taltal. Monthly salary USD1,800, 50% time dedicated to coordinate implementation of project´s adaptation actions

	and public education strategy. This person will be based within the Municipality of Taltal. With respect to the public education strategy, this person together with municipal staff will assess the progress in reaching the goals, adjust the strategy and prepare the workplan for the following year. Annex 5has the terms of reference for this post.
53	Production of communication materials and events to implement the communication and public education strategy in Antofagasta. This also includes office materials and consumables for the work of the consultant.
54	Purchase of computer, printer, furniture and office supplies for the consultant to be based within the municipality
55	Prepare needs assessment and communication and public education strategy for Esmeraldas
56	Local engineer specialist to coordinate and catalyse implementation of the project´s adaptation actions and the communication and public education strategy in Esmeraldas. Monthly salary USD1,800, 50% time dedicated to coordinate implementation of project´s adaptation actions and public education strategy. This person will be based within the Municipality of Esmeraldas, under the supervision of the project´s Lead Engineer Specialist. With respect to the public education strategy, this person together with municipal staff will assess the progress in reaching the goals, adjust the strategy and prepare the workplan for the following year. Annex 5has the terms of reference for this post.
57	Production of communication materials and events to implement the communication and public education strategy in Esmeraldas. This also includes office materials and consumables for the work of the consultant.
58	Purchase of computer, printer, furniture and office supplies for the consultant to be based within the municipality
59	Local engineer specialist based in Antofagasta, will lead the narrators´ initiative in the two countries, under the supervision of the project´s Lead Engineer Specialist. This person will coordinate and catalyse implementation of the initiative in Antofagasta and Taltal, and will supervise the adaptation specialist based in Esmeraldas. Monthly salary USD2,000, 50% of time dedicated to the narrators´ initiative. This person will be based within the Municipality of Antofagasta, but will have close coordination with MMA office in Antofagasta for the narrators´ initiative. Together with the Taltal´s adaptation specialist, this person will compile stories, anecdotes, and factual information to be used by narrators. This person will oversee the development of activities executed by local partners sponsored by the project. Jointly with project partners and the project´s Lead Engineer Specialist, every year, this person will assess the progress in reaching the goals, adjust the strategy and prepare the workplan for the following year. Annex 5has the terms of reference for this post.

60 Local engineer specialist based in Taltal, under the supervision of Antofagasta´s adaptation specialist and the project´s Lead Engineer Specialist. This person will coordinate and catalyse implementation of the initiative in Taltal. Monthly salary USD1,800, 50% of time dedicated to the narrators´ initiative. This person will be based within the Municipality of Taltal, but will have close coordination with MMA office in Antofagasta for the narrators´ initiative. Together with the Antofagasta´s adaptation specialist, this person will compile stories, anecdotes, and factual information to be used by the narrators. This person will oversee the development of activities executed by local partners sponsored by the project. Jointly with project partners and the project´s Lead Engineer Specialist, every year this person will assess the progress in reaching the goals, adjust the strategy and prepare the workplan for the following year. Annex 5has the terms of reference for this post.

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61 Joint workshop to share national and international experience and convene work strategy. Three-day workshop. Travel cost for three persons USD6,000 (airplane tickets, food and lodging, terminal expenses) and USD2,000 for locale, materials and board. Travel cost includes one of the consultants. International experts and potential partners will be invited to present their experience (e.g., JICA, EDUCEN) through web-based link.

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62 Technical assistance to local groups in Antofagasta and Taltal which are interested in developing narrators´ activities. In year 2 training to develop skills and messages. In years 3 and 4 mentoring.

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63 Small grants to sponsor local groups in Antofagasta and Taltal. The allocations will sponsor local partners / groups to execute activities (e.g., children shows, street theatre, puppetry, music displays) to enhance / develop local collective memory about climate-related risks and adaptation to climate change.

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64 Independent assessment of narrators´ initiative in Antofagasta and Taltal. The report will contribute to the mid-term review of the project.

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65 Local engineer specialist based in Esmeraldas to implement the narrators´ initiative. This person will coordinate and catalyse implementation of the initiative in Esmeraldas, under the supervision of the adaptation specialist to be based in Antofagasta. Monthly salary USD1,800 for 48 months. This person will be based within the Municipality of Esmeraldas, but will have close coordination with MAE´s office in Esmeraldas for the narrators´ initiative. This person will compile stories, anecdotes, and factual information to be used by the narrators. Also, this person will oversee the actions executed by the local partner sponsored by the project. Jointly with project partners and the project´s Lead Engineer Specialist, every year this person will assess the progress in reaching the goals, adjust the strategy and prepare the workplan for the following year. Annex 5has the terms of reference for this post.

66	Technical assistance to local groups interested in developing narrators´ activities. In year 2 training to develop skills and messages. In years 3 and 4 mentoring.
67	Small grant to sponsor local groups in Esmeraldas. The allocations will sponsor local partners / groups to execute activities (e.g., children shows, street theatre, puppetry, music displays) to enhance / develop local collective memory about climate-related risks and adaptation to climate change.
68	Independent assessment of narrators´ initiative in Esmeraldas. The report will contribute to the mid-term review of the project.
69	Equipment for web-based communication platform. One server + five teleconference sets (Antofagasta, Taltal, Esmeraldas, Santiago, Quito) + software. USD15,000. Equipment and software for project website and social media platforms. Three servers (USD6,000) + three multi-function printers (USD2,100) + three video cameras (USD1,500) + three audio recorders (USD300) + video, audio and image editing software (USD1,000) + website management software (USD1,000) + sundries 1,900. Total USD28,000.
70	Web-based communication service (e.g., WebEx, SKYPE for business) - USD200/month, plus high-speed internet access in three locations (Antofagasta, Taltal and Esmeraldas) - USD100/month per location, plus webhosting USD200/year.
71	Electronic media specialist, to administer and maintain the electronic platform for communication and hosting. USD1,900/month. This person will be based in CAF. Annex 5has the terms of reference for this post.
72	Lead Engineer Specialist, USD2,000/month. Based in CAF. Supervises the adaptation specialists based in Antofagasta, Taltal and Esmeraldas. This person coordinate the implementation of the project´s adaptation actions. In collaboration with the Electronic Media Specialits, maintains the project website, the social networking platforms, and the mailing list server to disseminate information to stakeholders and interest groups. Annex 5has the terms of reference for this post.
73	Office supplies for electronic platform (e.g., paper, toner, pens)
74	Production videos, images and other communication media for the project´s web platform and news.
75	National and international travel of Lead Engineer Specialist.

76	Monitoring and evaluation specialist, USD2,000/month. Responsible to document the project experience, including providing support to blogs. Annex 5has the terms of reference for this post. This person will prepare learning experience documents. Nine learning experience documents are planned: 1. incorporating the climate change factor into stormwater management plans in Chile, 2. preparation of green infrastructure plan in Esmeraldas, 3. incorporating the climate change factor into mudflow control infrastructure in Antofagasta, 4. incorporating the climate change factor into landslide control in Cerro Gatazo (Esmeraldas), 5. Use of weather radar/ storm system to enhance early warning systems, 6. mudflows warning system in Antofagasta and Taltal, 7. pilot flood warning system in Esmeraldas, 8. communication and education strategies to increase public awareness of climate-related disaster risk, and 9. contribution of narrators to sustain cultural memory on climate-related risks and disasters.
77	Allocation for monitoring of project development. The value includes international and local travel of Monitoring and Evaluation specialist, consumables, meetings and other various expenses.
78	Project inception workshop. Participate members of the Project Board, responsible entities, and the project team. The allocation includes international travel, locale, board and materials. Two-day workshop to update project strategy, update first year workplan and budget, and fine-tune administration procedures and agreements.
79	National workshop to launch the project in Chile. Event to be held in Antofagasta. Cost includes locale, board and local travel costs.
80	National workshop to launch the project in Ecuador. Event to be held in Esmeraldas. Cost includes locale, board and local travel costs.
81	Travel cost for exchange visits. The allocation includes international and local travel, accommodation, materials and consumables. Four exchange visits are planned, one per year: 1. pilot stabilization of Cerro Gatazo to control landslides (in Ecuador), 2. early warning and response systems to climate-related events (in Chile), 3. public awareness strategies (in Chile), 4. narrators' initiative (in Ecuador).
82	Travel cost to present project results in national or international events and fora. The use of these resources will be decided by the Project Board.
83	Mid-term review and terminal evaluation of the project. Lump sum to cover contract of international consultant and national consultants (one on each country), airplane tickets (international and national), accommodation, board and lodging.

84	Prepare and edit technical documents with results and lessons of the project. The documents will include executive summaries in Spanish, English, French and Portuguese. The documents will be in high-quality PDF format for download.
85	Prepare and disseminate project´s memoirs. Prepare and edit document in format for general public with executive summary in Spanish, English, French and Portuguese. 5,000 printed copies and high-quality PDF for download.
86	Project Board closure meeting. Participate members of the Project Board, responsible entities, and the project team. The allocation includes international travel, locale, board and materials. Two-day meeting to review project outcomes and analyse terminal evaluation and final project report.
87	Public event in Antofagasta to close the project. It will include technical talks and informal activities to present results and learnings to stakeholders and general public. It will be desirable to have video link with the other project sites or pre-recorded video to have summaries of their results and lessons. The cost includes locale, consumables, catering, travel, rental of equipment (e.g., sound amplification).
88	Public event in Taltal to close the project. It will include technical talks and informal activities to present results and learnings to stakeholders and general public. It will be desirable to have video link with the other project sites or pre-recorded video to have summaries of their results and lessons. The cost includes locale, consumables, catering, travel, rental of equipment (e.g., sound amplification).
89	Public event in Esmeraldas to close the project. It will include technical talks and informal activities to present results and learnings to stakeholders and general public. It will be desirable to have video link with the other project sites or pre-recorded video to have summaries of their results and lessons. The cost includes locale, consumables, catering, travel, rental of equipment (e.g., sound amplification).
90	Three computers and printers for project manager and accounting and administration assistants.
91	Office supplies and consumables (e.g., paper, toner, folders)
92	UNDP project administration and services

Budget on the Implementing Entity management fee use

304. The project cycle management fee will be used by CAF to cover the indirect costs of administering and supporting project implementation and to provide project assurance. This table contain indicative costs of the main categories of project services.

Category	Indicative cost (USD)
Technical support and backstopping by personnel from headquarters and the offices in Quito and Montevideo[103].	300,000
Financial administration of project funds and accounting services.	150,000
Procurement of goods, works and services and contract administration. Including management of project personnel and consultants.	230,400
Project oversight. Including visits to project sites to verify quality of deliverables, and overseeing independent evaluations.	150,000
Reporting. Including technical, administrative and financial reports to the Adaptation Fund. Preparation of annual Project Performance Report (PPR)	100,000
Provide office space and support services to the project´s management unit within CAF	100,000
Total	1,030,400

H. Include a disbursement schedule with time-bound milestones.

Description	First disbursment (at signature of agreement)	Year 1	Year 2	Year 3	Year 4	Total
Project funds	1.181.487	2.625.641	7.939.155	518.691	615.027	12.880.000
Implementing Entity management fee	206.080	206.080	206.080	206.080	206.080	1.030.400
Total	1.387.567	2.831.721	8.145.235	724.771	821.107	13.910.400
Estimated date	15 June 2017	15 June	}	15 June	15 June	

[103] There is no country office in Chile. The Montevideo office manage Chile´s projects and matters.

List of annexes

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PART IV: ENDORSEMENT BY GOVERNMENTS AND CERTIFICATION BY THE IMPLEMENTING ENTITY

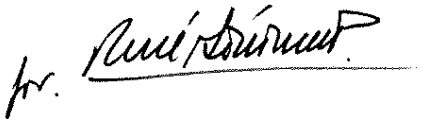
A. Record of endorsement on behalf of the government[104]

Provide the name and position of the government official and indicate date of endorsement for each country participating in the proposed project / programme. Add more lines as necessary. The endorsement letters should be attached as an annex to the project/programme proposal. Please attach the endorsement letters with this template; add as many participating governments if a regional project/programme:

6. Each Party shall designate and communicate to the secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

B. Implementing Entity Certification

Provide the name and signature of the Implementing Entity Coordinator and the date of signature. Provide also the project/programme contact person's name, telephone number and email address

I certify that the "***Regional Project Reducing climate vulnerability and flood risk in coastal urban and semi urban areas in cities in Latin America (Chile – Ecuador)***" proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans of Chile and Ecuador and subject to the approval by the Adaptation Fund Board, commit to implementing the project/programme in compliance with the Environmental and Social Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.	
 *Ligia Castro de Doens* Implementing Entity Coordinator	
Date: *April 16 2018*	Tel. and email: +5717449444 lcastro@caf.com
Project Contact Person: Carolina Cortés	
Tel. And Email: +59323988437 – acortes@caf.com	