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Introduction

The Philippines ranked second in the list of the 2014 World Risk Index as one of the countries that have high risks of suffering from disasters. Country risk was evaluated by the level of exposure to natural hazards and the vulnerability of a society.

Situated within the Pacific Ring of Fire, the country is vulnerable to various types of environmental disasters. These situations, plus other human and developmental factors, compound the communities' incapacity to cope with such disasters. Recording an annual average of 18 to 20 typhoons, the country's most frequently occurring hazards are floods and storms.

With its natural topography and landscape, watershed areas, including cities and municipalities within the catchment areas of major river basins and natural drainage systems, are characterized as considerably high in level of exposure to flooding.

^{*} Five (5) partner institutions prepared a detailed assessment of their respective topics; the assessments were used as references for the preparation of this policy paper. The institutions from the different colleges and an office from the University of the Philippines Diliman led by the School of Urban and Regional Planning (SURP) are the following: the National College of Public Administration and Governance (NCPAG), College of Social Work and Community Development (CSWCD), College of Social Science and Philosophy-Department of Political Science (CSSP-DPS), and the Office of the Chancellor (OC).

TABLE 1. World risk index 20	14
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	WorldRiskIndex		
Rank	Country	Risk (%)	
1.	Vanuatu	36.50	
2.	Philippines	28.25	
3.	Tonga	28.23	
4.	Guatemala	20.68	
5.	Bangladesh	19.37	
6.	Solomon Islands	19.18	
7.	Costa Rica	17.33	
8.	El Salvador	17.12	
9.	Cambodia	17.12	
10.	Papua New Guinea	16.74	
11.	Timor-Leste	16.41	
12.	Brunei Darussalam	16.23	
13.	Nicaragua	14.87	
14.	Mauritius	14.78	
15.	Guinea-Bissau	13.75	

Source: www.worldriskindex.org

Flood-related hazards constitute a major portion of the damages caused by natural disasters in the country. Climate change further aggravates the impacts of these disasters, attributed to anthropogenic (human-induced) factors and unsustainable human practices—such as illegal cutting of trees, water pollution, improper waste disposal, and the like. In most urban growth centers, the encroachment of informal settlements in environmentally critical habitats contributes to increased vulnerability to disaster risks and climate change impacts.

Considering the number of rivers traversing Metro Manila, the cities and towns in the metropolis that serve as national and regional economic growth centers are usually the areas hardest hit by typhoons. Exacerbated by urban congestion and clogged drainage systems, extensive and prolonged floods have caused widespread damage to infrastructure, houses, and schools resulting to the disruption of economic and social activities, and evacuation of many low-income families living in shanty-

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Figure 1: World risk index showing the ranking of the Philippines in terms of disasters 2014 Source: <u>http://worldriskreport.entwicklung-hilft.de</u>

type houses located in low-lying, flood-prone danger zones along the shores of Manila Bay, Laguna Lake, river banks, esteros, creeks, and other waterways.

Urban centers do not just serve as sites for major economic drivers but also provide a rich and diverse places with cultural and tourism potential. Overexploitation of resources and degradation of habitats continue to contribute to the urban environmental decay. While the level of hazard exposure is a significant risk factor, the socio-economic condition and inherent capacity of a community to cope with disasters are also major determinants of vulnerability. The increasing levels of vulnerability, especially in areas affected by land tenure issues, internal disputes, and land use conflicts need to be addressed in order to reduce climate change and disaster risks impacts.

The increasing frequency and intensity of hydro-meteorological hazards have heightened the compelling need for the Philippines to undertake disaster risk reduction and management (DRRM), and climate change adaptation (CCA) measures and policies. These are cascaded to subnational and local government units through mainstreaming CCA and DRRM in land use and local development planning, thereby formulating localized DRRM measures and CCA options that are applicable and realistic to the needs and current situation of each community.

To examine the hazards and vulnerability to natural disasters, a collaborative research project was undertaken by the University of the Philippines-Center for Integrative and Development Studies (UP-CIDS) led by the School of Urban and Regional Planning (SURP). This paper discusses the results of the study entitled, "Building Sustainable and Disaster Resilient Informal Settlement Communities" under the program on "Environmental Planning and Governance Towards Sustainable and Resilient Communities at Selected Priority Areas in Metro Manila and Laguna De Bay Regions."

The study aimed to translate the technical and scientific data and communityrelated initiatives into a policy and plan of action for disaster risk reduction and management. As a research strategy, the study is multi-disciplinary for components that highlight science, technology, and social science. Disaster risk management and community resilience were examined from the perspective of land use planning and environmental governance. Barangay Tumana in Marikina City served as case study sample site.

Framework for Sustainable and Resilient Informal Settlements Communities

Urban resilience is the ability to tolerate and recover from unexpected and unfortunate events associated with natural hazards and impacts of climate change. Building resilience to these disaster risks can be achieved by reducing the vulnerability and increasing the adaptive capacity of institutions and communities, but can be done most effectively through strengthened urban planning and management; considering and responding to these risks are an essential part of active and practical urban management strategies and infrastructure development plans.¹ The Hyogo Framework for Action (HFA) is the key instrument for implementing disaster risk reduction, adopted by the Member States of the United Nations. Its primary goal is to build resilience of nations and communities to disaster risks by achieving



Figure 2: Components of building sustainable and resilient settlements

substantive reduction of disaster losses in the lives and in the social, economic, and environmental assets of communities.

The HFA offers five areas of priorities for action, guiding principles, and practical means for achieving disaster resilience for vulnerable and marginalized communities in the context of inclusive growth and sustainable development.² In building the resilience of informal settlement communities, this paper has anchored its community-based disaster risk management approach to the HFA.

In examining Barangay Tumana as the pilot site, the study focused on five components, namely: urban planning, environmental governance, capacity development of local government (barangay level) and societal organizations, community development and livelihood program, and financial and economic development.

Methodology and Approaches

Primary data gathering was conducted in December 2013 through a questionnaire survey of 384 households in the selected pilot area. A household survey was conducted to generate empirical data and baseline information on the

socio-economic conditions in the targeted communities. Data collection using a questionnaire survey instrument was done in December 2013. The sample size of 384 out of 8,455 total households in Tumana was surveyed using the Slovin's Formula with 95 percent confidence level and 5 percent margin of error. Various frequency and cross-tabulations were produced. The 22-page survey instrument was divided into three parts: (a) the socio economics; (b) LGU assessment; and (c) characterization of democratic processes.

Survey results were supplemented by the review of related literature and secondary data, documents, reports, and conduct of key informant interviews. National government agencies (NGAs)—including the Housing and Urban Development Coordinating Council (HUDCC), Department of Environment and Natural Resources (DENR)-River Basin Coordination Office (RBCO), Department of the Interior and Local Government (DILG), National Disaster Risk Reduction and Management Council-Office of the Civil Defense were consulted to identify potential relevant sources of literature and other unpublished information. A multi-stakeholder validation was also conducted in order to validate the research findings and analysis of results of each project component.

The Climate Change (CC) Act or RA 9729 and the Disaster Risk Reduction and Management (DDRM) Act or RA 10121

Republic Act (RA) 9729 of 2009 and RA 10121 of 2010 state that the LGUs shall be the frontline agencies in the formulation, planning, and implementation of climate change and disaster risk reduction action plans in their respective areas, consistent with the provisions of the Local Government Code, the CCA and DRRM Frameworks, and the National Climate Change and Disaster Risk Action Plans. Barangays shall be directly involved with municipal and city governments in prioritizing climate change and disaster-related issues, and in identifying and implementing best practices and other solutions. Municipal and city governments shall consider climate change adaptation (CCA) and disaster risk reduction (DRR) as their regular functions. Provincial governments shall provide technical assistance, enforcement, and information management in support of municipal and city climate

change action and disaster risk reduction management plans. Inter-local government unit collaboration shall be maximized in the conduct of climate and disaster-related activities. Non-governmental organizations (NGOs) and people's organizations (POs), as well as representatives from vulnerable sectors, shall also be consulted.

According to these laws, LGUs shall regularly update their respective action plans to reflect changing social, economic, and environmental conditions, and emerging issues. The LGUs shall furnish the CC and DRRM Commissions copies of their action plans and all subsequent amendments, modifications, and revisions thereof within one month of their adoption. The LGUs shall mobilize and allocate necessary personnel, resources, and logistics to effectively implement their respective action plans.

The local chief executive shall appoint the person responsible for the formulation and implementation of the local action plan, preferably with training and knowledge on climate change or disaster risk related subjects. It shall be the responsibility of the national government to extend technical and financial assistance to LGUs for the accomplishment of their Local Climate Change and Disaster Risk Reduction Action Plans. The LGU is authorized to appropriate and use the amount from its internal revenue allotment (IRA) necessary to implement the said local plan effectively, any provision in the Local Government Code to the contrary notwithstanding (RA 9729 and RA 10121). The law seeks to develop resiliency in the face of natural and man-made disasters, and to lessen the vulnerability of the grassroots by establishing a full range of programs in disaster preparedness, including education, training, and organizing. From disaster response and recovery, the law now focuses on disaster risk reduction, preparedness, and mitigation.

Informal Settlements in a Disaster Prone Area: The Case of Barangay Tumana, Marikina City

Marikina City, bounded by mountain ranges and sliced by a river, is one of the 17 cities and municipalities comprising the Metro Manila area or the National Capital Region (NCR). The total land area of Marikina is approximately 2,150 hectares or 21.50 km.² Marikina City is composed of 16 barangays and represents about 3.42 percent of the total land area of Metro Manila.³



Figure 3: Vicinity map of Marikina City

The population of Marikina City was recorded at 424,150, representing an increase of 32,980 over its May 2000 level. The increase in the population translates to an average annual population growth rate (PGR) of 0.81 percent. Meanwhile, the City of Marikina contributed 3.58 percent to the total population of the National Capital Region (NCR) of 11,855,975 in 2010.⁴

Marikina City serves as a catch basin of rainwater coming from the municipalities of San Mateo and Montalban, and the cities of Antipolo and Quezon, comprising 543 square km of land draining into the Marikina River. During typhoons and heavy monsoon rains, the Marikina River overflows, inundating low-lying areas near its banks, which had affected 10,000 residents for two weeks at its worst in 1988 before the institution of mitigation programs.



Figure 4: Map showing flood risk assessment of Marikina City for Typhoon Ondoy, 2009 Source: Project DOST-NOAH, 2014

In 2009 flashfloods induced by tropical storm Ondoy (international name: Ketsana) inundated 75 percent of Marikina's land area. It recorded the highest flood level in the city's history at 22.8 meters. There are seven barangays that are at high susceptibility for flooding. These are Malanday, Industrial Valley Complex (IVC), Tañong, Jesus Dela Peña, Sto. Niño, Nangka and Tumana. The said barangays are mostly on the riverside. Almost 90 percent of Marikina City will be affected in the worst case scenario of flooding.⁵ The figure below shows the level and extent of exposure of Tumana to flooding hazard.

Tumana is the fourth largest barangay in terms of land area at 181.87 km.² Despite its relatively small land area, Tumana is the second most populous barangay in the city with 41,809 residents as of the 2010 census conducted by the National Statistics Office (NSO). Tumana also recorded the highest number of informal settler families with makeshift houses (328 HHs) in Marikina City for the past years.

Families residing in dwelling units made of light materials and makeshift houses are most vulnerable during typhoon and flash floods. Table 2 below shows the number of households living in makeshift houses in the seven barangays of Marikina City that are previously identified by the local government with highest susceptibility to flooding.

Barangay	Population	HHs with Makeshift Houses
Tumana	36,054	328
Malanday	43,863	157
Nangka	32,299	151
Sto. Niño	21,668	97
Jesus Dela Peña	6,277	46
IVC	11,562	31
Tañong	5,309	15

Barangay Tumana, formerly a medium density residential area, was converted into a socialized housing zone. *Socialized housing* refers to housing programs and projects covering houses and lots or home lots only undertaken by the government or the private sector for the underprivileged and homeless citizens (informal settlements), which shall include sites and services development, long-term financing, and liberalized terms on interest payments.⁶ However, Marikina City is hampered by land tenure issues in Barangay Tumana. Figure 5 shows that Tumana is highly populated by informal settlement families living in makeshift houses.

With its location close to the Marikina River and aggravated by the community's poor socio-economic condition, disaster risks are undoubtedly high in Tumana. Based on survey results, the socio-economic profile of the 384 informal settlements families in Tumana was analyzed according to income level, educational attainment, employment status, and land ownership to analyze the degree to which Tumana can be affected by hazards and natural disasters.



Figure 5: Map showing the location of makeshift houses in Marikina City Source: Google Maps

The flooding map (figure 6) shows that both riverbanks for the whole stretch of the Marikina River traversing the city are flood-prone areas, frequently flooded during heavy rains and typhoons. While the normal depth of the river is 3 m, it can go as high as 18 m during heavy downpours.⁷

The increasing rate of rural-urban migration in the country is expected to continue and will exacerbate this housing problem, particularly in highly urbanizing cities. Considering the rate of urbanization and the level of hazard exposure, there are very limited safe areas left for settlements expansion in the city. Hence increasing





the resilience and capacity of this marginalized and vulnerable group of urban populations residing in slum areas and squatter settlements is necessary in order to cope with disasters and sustainably adapt to the adverse impacts of climate change. The proliferation of informal settlements in the danger areas of Tumana indicates its high vulnerability to flooding.

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Sustainability Issues and Urban Development Challenges in Brgy. Tumana, Marikina City

More Frequent Typhoons and Intense Monsoon Rains, Increased Risks to Flooding, and Imminent Threat of Earthquake

Based on the climate projections of the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), Metro Manila will be facing an increased level of hazard exposure for the coming years as climate change impacts continue to intensify due to unsustainable human activities that result in environmental degradation. The National Capital Region (NCR) is threatened by the adverse impacts of the steady increase in temperature, changes in seasonal rainfall causing heavy rains or drought, and projected increase in occurrence of extreme weather disturbances.



Figure 7: Photo showing rescue teams from several government agencies helping to evacuate residents from their flooded homes in Brgy. Tumana at the height of Typhoon Mario on September 19, 2013. *Source: GMA News Online, "Marikina Inundated as Tumana River Overflows."*

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The City of Marikina is considered the second most flood-prone city in the National Capital Region (NCR). Approximately one-half of Tumana (the eastern portion which is about 100 hectares in size) is intermittently flooded. Flood heights reach a maximum of 40 feet. Marikina is projected to have fewer but stronger typhoons and sporadic monsoon rains (*habagat*). Projections for a hotter summer season—particularly during the months of March, April, and May—and heavier rains during the rainy season—particularly the months of June, July, and August. It is also noted that the socialized settlement zone is situated in an environmentally critical area.

Moreover, the Philippine Institute of Volcanology and Seismology (PHILVOLCS) discovered that an active fault system stretches at least 31 kilometers across Metro Manila. PHILVOLCS has warned the local government that Tumana is facing an imminent threat of a magnitude 7.2 earthquake.

Disaster risks are high when vulnerable communities are not able to withstand the adverse effects of hazards, and their capacities are not sufficient. With this increasing level of hazard exposure in Marikina City, the most vulnerable sector is the marginalized group of urban dwellers residing in slum areas and informal settlements, with Tumana being a case in point.

Vulnerable and Marginalized Informal Settlement Families (ISF) Living in High-Risk Disaster Prone Areas

The informal residents of Marikina City, despite their relatively poor condition in the slums, do not want to leave Tumana even in the face of disaster risks and the prospect of frequent evacuations. Most of the informal settlement families, currently occupying the open spaces and environmentally critical areas, express interest in relocation to safer resettlement sites.

Flooding has become the imminent threat in the center of the city, endangering settlements and disrupting basic social services. The informal settlement families (ISF) sprawling in danger zones pose great risks to environmental and living conditions. The City of Marikina's determination to abolish informal settlements is a demanding task; yet it is a curative means to achieve sustainable development through one of its promising Marikina Squatter-Free Programs, which asserts a safe in-city resettlement and the allotment of 24 sqm lot for every ISF beneficiary.



Figure 8: Photo showing the residents in Brgy. Tumana as they return to houses damaged by Typhoon Ondoy.

Source: Philstar.com, "Remembering Ondoy."

Insecurity of Tenure in Land Ownership and Housing

Another key contributing factor to the community's vulnerability is the insecurity of tenure in land ownership and the emergent challenge of providing adequate shelter. Only 15 percent of the residents of Tumana own their plots of land, while the rest are either ISFs or renters. Majority of the residents (89.3 percent) are yet to receive housing assistance from any agency or organization. As of 2012, there are 729 informal settlement households in Marikina City. The city's shelter needs assessment showed the need for 515 new dwelling units annually from 2013 to 2020 to erase the housing backlog. The Marikina Settlements Office (MSO) has been proactive in providing safety nets for those that may be considered ISFs to fortify development plans. The pending legal battle between two claimants to the title of the resettlement site, was cited by some key informants as the reason for the delay in shelter (resettlement) plan implementation for Tumana. It seems that there will be an impending conflict between Tumana barangay officials and the Marikina Settlements Office with regard to implementing a relocation plan until the legal ownership of the resettlement site is settled.

The threat to property and person is very high during the typhoon season that there is a need for relocation. However, there are mixed responses among the respondents with 44.1 percent willing to be relocated outside Marikina and only 12 percent still willing to stay in their current location. Even the participants of the focus group discussions (FGDs) were unanimous in their intention to stay in Tumana because they believed in the Marikina Settlements Office's plan of rebuilding once the tenure issue is resolved. This shows a lack of awareness since only a few know about the status of their tenure. At some point, Tumana residents have become the target of fake real estate agents, in exchange for promising people tenure, either in their present location or in another municipality.

Issues on tenure and land conflicts are significant factors that structure the everyday lives of communities and the way they assess and respond to disaster risk. Land tenure is something that is often not addressed by the government because of its political and contentious character.

Instability of Local Economy and Lack of Sustainable Livelihood Alternatives

The challenge in the informal economy is that jobs that result from it are lowpaying and unstable, with working conditions that are often dismal and unsafe. Survey results show that 42.51 percent of the respondents source their income from the informal economy, with laborers and skilled workers sharing the distinction of being in the top group. Approximately 50 percent of the survey respondents earn PHP 5,000 to PHP 10,000 monthly. Their lack of stable jobs can also be attributed to their stunted educational attainment. It is noted that approximately 50 percent

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are high school graduates, or had reached high school but did not graduate. Given the fact that the informal economy hardly provides stability in employment, gaining a regular source of income is a challenge for them. The FGDs held in Tumana validated these results as the participants identified disaster events, unemployment, and demolition as their top three major concerns.

Need to Improve Localization of National Policies and Inter-Agency Coordination towards Implementing DRRM and CCA Measures

The limited knowledge of existing policies and laws in addressing DRRM encumbers good local planning and effective implementation. Local Government Units need to reorient themselves, study the existing policies and laws, and strategically map out feasible interventions. Policies and laws need to be revisited to ensure agreements are still applicable.

Duplication of roles, which impedes the efficiency and effectiveness of a supposedly lead agency, also exists. Moreover, failure to implement laws on DRRM and CCA related sectors, such as watershed governance and the absence of institutional mechanisms, weakens the implementation of DRRM and CCA in the country. Due to the country's need to counteract large-scale disasters, the NDRRMC's overall efforts will require the integration of capacity development needs.

Based on the experiences of lead agencies, such as DILG, OCD, DENR and NHA, command and control is at times complex due to a structure in which authority is shared, responsibility is dispersed, and resources are spread out. This affects operations that are supposed to be executed in an expedient manner. The supportive and collaborative link between the lead agencies and implementing partners, from national to local levels, will need to be aligned with the strategies and operations wherever possible to adopt innovative solutions to disaster-related concerns, whether natural or man-made calamities.

The collaborative governance in the city of Marikina has its strength in implementing DRRM due to its demonstrated resiliency amidst the environmental adversities that have confronted the city over the past few years. Moreover, almost all barangays in Marikina City have their own Barangay Disaster Risk Reduction and Management (DRRM) Plan. Due to climate change, environmental adaptation is necessary to be integrated in Marikina's Local Shelter Plan for ISFs. Thus, the relocation of over nine thousand informal settlements poses a critical challenge.

Analysis and Policy Recommendations

The study raises three major areas for policy recommendation: slum upgrading, vulnerability reduction, and urban resilience.

Undertake Slum Upgrading/On-Site Development and Adaptation

On-site development refers to the process of upgrading blighted and slum urban areas with a view of minimizing the displacement of dwellers in said areas, and with provisions for basic services.^{\$}</sup>

Prioritize Resolution of the Land Dispute through Appropriate Legal Measures

Barangay Tumana has a population of less than nine thousand households, based on the 2010 census data. The resettlement program has been put on hold due to the land rights dispute. In the 1990s, Tumana was regarded as a resettlement site of those identified as in-city ISFs. However, with the current conflicting land claims and legal battle, the residents in the barangay, totaling some 8,000 families, are considered ISFs. The rest are residents in private lands. It is common knowledge in the community that there is uncertainty in identifying the real owner or owners of the lands in Tumana. Various names of claimants surface here and there, so confusion among the residents is high. Even barangay officials have difficulty in determining ownership of land parcels in the area. Residents argue that, before considering resettlement and relocation, the identity of the owners of the lands they are occupying must be established first. This might not be an easy task, but a simple first step is to go to the city assessor's office and secure copies of real estate tax payments for the area based on cadastral maps.

The land ownership issue in the barangay has to be resolved since it affects how people perceive issues related to DRRM. The programs of DRRM especially catering to ISFs living in danger zones should ascertain continuity and sustainability to meet the objectives, and whether the objectives are suited to Marikina's development plan. Due to the pending case on land ownership, the present condition of the ISFs needs to be addressed through multi-stakeholders participation, alliances, and co-management of programs.

Undertake Human Settlements Planning and Affordable Shelter Development

Future population growth and expansion of human settlements will present increasing challenges for conserving species-rich regions and maximizing the benefits humans gain from nature. In addition to its direct impact on the housing market, rising population density creates wider welfare issues and consequences for living standards. To make a more adaptable housing program for ISFs, there is a need to improve affordability through a subsidy program; this will consider the income of ISFs in rationalizing the prescribed amortization rates for housing. There is also the potential of rental housing, which addresses the problem of identifying a relocation site. Developing the rental housing market as a possible solution to increase the access of ISFs to low-cost decent housing is a way to ease the pressure of giving up productive land to develop low-cost housing.

Policies to access and manage land resources for the purpose of affordable housing should be explored. Incentives to unlock land for affordable housing can also be provided.

Several strategies to increase the supply of land for housing can be done such as: (a) direct allocation of land exclusively for socialized or other affordable housing development; (b) constructing or improving access to unutilized and other potential affordable housing sites in Marikina City; and (c) establishment of a stronger guarantee system for the funding of low-cost housing projects.⁹

Review the Implementation of City Ordinance No. 48 Series of 2014 on the Construction of Houses on Stilts

Marikina City has been implementing Local Ordinance No. 48 series of 2014 allowing the construction of houses on stilts. Considering that relocation is the least desirable option of both the residents and the local government, this ordinance espouses the concept of constructing new houses and renovating existing houses be done in such a way that the first floor becomes vacant and the second floor will be the living quarters. However, this may be considered a temporary coping mechanism since the historical accounts in Tumana show that the lowest indicated flood level is already 2 m. Furthermore, strict sewage policy must also be followed to prevent the community from directing their wastes to the river.

Transform the Relief Mentality and Dependency

The distribution of goods donated by different humanitarian organizations should be organized and systematic to ensure equity and fairness. The barangay has to take charge of distribution and implement such a system. There is a proposal to coordinate with donors by holding a conference with them in order for the barangay officials to express to them what the residents actually need, such as medicines, food that is ready to eat, etc. A change of perspective is also necessary for the barangay residents. Some of the people of Tumana generally expect that the help from the government and other groups will be sustained even during the post-disaster period. Some barangay officials recognized the need to eradicate the so-called *relief mentality* (i.e., being dependent on donations from government and other groups) on the part of some residents.

Intensify Campaign for Proper Waste Disposal and Segregation

Some respondents see improper disposal of waste as a major contributing factor to flooding. Hence, enforcing strict policies in waste disposal will reduce flooding. At the national level, policies are already set up with regards to waste disposal, like RA 9003 (Ecological Solid Waste Management) and RA 9275 (Clean Water Act). In addition to this, Marikina City is known for being among the cities with good waste management programs, with at least eight city ordinances pertaining specifically to waste management and disposal. A study must be made to determine the actual

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contribution that improper waste disposal has to flooding in Tumana to help the residents in coming up with an informed choice. Documented best practices on solid waste management could be a good source of lessons for LGUs and communities.¹⁰

Reduce Vulnerability

This strategy aims to geographically separate, regulate, or control the extent of interaction between the general population and areas that need to be protected (e.g., National Integrated Protected Areas System (NIPAS), Strategic Agricultural and Fisheries Development Zone (SAFDZ), Network of Protected Areas for Agricultural Development (NPAAD), critical watersheds), and areas that are disasterprone (e.g., fault lines, and areas that are prone to floods, landslides, and liquefaction).

Prioritize the In-Filling/Densification of Existing Safe Residential Areas

As population increases, the risk of disasters likewise increases because the number of people at risk in the same location increases, and also because the number of locations occupied by people increases. Risks further arise as areas that are inherently prone to earthquakes, floods, or landslides are built up. Thus, the effects of climate change, such as the increase in tropical cyclones resulting to flooding, increase vulnerability.

Promote Legislative Measures to Protect the Environmentally Critical Areas Including the High-Risk Flood-Prone Areas

Legislative measures need to be enforced to protect areas that have been identified as environmentally critical, which should include the high-risk, flood-prone areas of the barangay. The barangay should take care to maintain the parks, open spaces, and recreation land use designated in Tumana. The easement policy, a distance of 96 m on both sides of the Marikina River centerline and authorizing the relocation of all residents found within the easement to safer ground, should be effectively enforced and monitored (Ordinance 10 of 1994).

Identify Disaster-Prone and Other Environmentally Critical Areas and Define Appropriate Residential Development Limits and Specifications in Physical Plans to Reduce Safety Risks

Safety cannot be compromised. Thus, danger zones have to be cleared of population and activities that are at risk, or necessary disaster mitigation measures have to be in place. With this, structural and technological interventions that are based on standards for decent housing, and a rights-based approach in safe locations may be employed.

The land use and the activity pattern of the flood prone area are extremely crucial in the effectiveness of the flood mitigation measures. Some of the main measures to be undertaken during land use planning include: (a) prohibition of any industrial and manufacturing activities in the flood plain; and (b) strict enforcement of the zoning policy along the Marikina River and strong regulatory measures to prevent any encroachments. Only recreational activities like parks, gardens, and play areas may be allowed within the buffer zone.

Promote Urban Risk Resilience through Community Empowerment and Institutional Capacity Building

The capacity of Barangay Tumana and its residents for environmental governance, particularly for disaster risk reduction and management (DRRM), have to be developed. The barangay has to maximize the resources and assistance it receives to improve its capacity to address the community's environmental issues and concerns. Furthermore, increasing adaptive capacity through community empowerment may be achieved by promoting participatory and community-based DRRM methods. Provision of trainings and seminars, not only on DRRM but also on sustainable livelihood programs, will help increase their capacity to cope with disasters. It is also necessary to improve the community's access to safety nets, basic services, and lifeline utilities.

The engagements between the barangay and external groups are largely limited to provision of goods for those affected by an emergency or disaster situation. Very few external organizations have been tapped to undertake activities that would enhance the capacity of the barangay or empower the residents.

The barangay has to come up with a concrete plan regarding the management of evacuation centers. It has to coordinate with school officials and the city government. Resources (both human and material) for capacity development of both barangay and societal organizations have to be either developed or provided. Specifically, there is a need for the barangay to mobilize the community-based organizations in order to disseminate information, advocate awareness on DRRM, in particular, and environmental governance, in general.

Establish Social Enterprises

Initial results show that the two most active groups in the community in terms of participation in community activities are women and the youth. In fact, specific programs are already being implemented for the development and capacity building of these sectors. In developing social enterprises, the involvement of the youth and women will be crucial to sustainability.

Strengthen Community Organizations

Societal associations are perceived as advantageous for DRRM and CCA. Capacity building programs should be undertaken to enhance their skills in livelihood activities and increase their awareness of DRRM and CCA. Livelihood activities can strengthen and make community associations self-reliant. Community organizations should be empowered by allowing them to participate and contribute to the planning and implementation of development programs, as well as DRRM and CCA measures.

Institutionalize River Basin Organization (RBO)

Continuous capacity building, especially on the part of the LGUs and other lead agencies and frontliners, is needed since disasters are inevitably caused by natural and human-made hazards. The establishment of Marikina's River Basin Office, as strongly recommended by the Department of the Environment and Natural Resources (DENR), is envisioned to lessen environmental vulnerabilities that may worsen living conditions. Such a management or governance structure

would also prevent office operations from being hampered should there be a change of administration. As part of the NDRRM goal to manage the consequences of disasters, the Department of the Interior and Local Government (DILG) has already included Barangay Tumana in the 2015 priority LGU areas that will be assisted on resettlement, especially of ISFs.

Strengthen Institutional Coordination Mechanisms and Inter-LGU Linkages

The City of Marikina and Barangay Tumana need to strengthen their collaboration and coordination to identify concrete ways to implement resettlement programs while waiting an agreeable resolution on the pending case of land ownership.

There should be interagency coordination to improve vertical linkages among levels of administration (national, regional, provincial, and city) and inter-local government unit coordination. This can be reinforced by providing real incentives to inter-local cooperation, and harmonizing legal and service management mechanisms among metropolitan LGUs.

Acknowledgements

This policy paper is a synthesis and summary, and was prepared as part of the program entitled "Environmental Planning and Governance Towards Sustainable and Resilient Communities at Selected Pilot Priority Areas in Metro Manila and Laguna de Bay Regions" that was financially supported by the University of the Philippines-Center for Integrative and Development Studies (UP-CIDS). The authors would like to acknowledge the partners from both the partner colleges and the office. Special thanks to the program adviser, Dr. Maria Lourdes Rebullida of the College of Social Science and Philosophy-Department of Political Science (CSSP-DPS), and the project team leaders—Dr. Faina Diola of the National College of Social Work and Community Development (CSWCD), Dr. Ruth Lusterio-Rico of the College of Social Science and Philosophy-Department of Political Science (CSSP-DPS), Ms. Paulyn Tusi of the Office of the Chancellor (OC)—for the many

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insightful discussions during the workshops and meetings. We would also like to thank the research specialists and assistants of each project team for their hard work, from the start until the finalization of the report. The program team would also like to thank Dr. Marilou G. Nicolas and Dr. Edna E. A. Co, the former and the present UP-CIDS Executive Directors, respectively, for their untiring support of the program. Lastly, thanks to Honorable Mayor Del De Guzman of Marikina City, and the heads of departments and staff of the city government, and Barangay Captain Zifred Ancheta of Tumana and barangay council members and staff, for unselfishly sharing information and data for the study.

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