

Volcanic Hazard – Centered Disaster Risk Reduction Action Plan for Agoncillo, Batangas: Integrating Preparedness for Volcano, Landslide, Flood and Seismic Risk

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Abstract:

This summary presents the highlights of the Volcanic Hazard–Centered Disaster Risk Reduction Action Plan for Agoncillo, Batangas: Integrating Preparedness for Volcano, Landslide, Flood, and Seismic Risks. It was developed to strengthen the disaster resilience and preparedness capacity of the Municipality of Agoncillo, Batangas. Due to its proximity to Taal Volcano and exposure to multiple hazards, including volcanic eruption, earthquakes, flooding, landslides, and typhoons, the municipality remains highly vulnerable to disasters that threaten lives, livelihoods, infrastructure, and essential services.

The action plan was formulated to provide a comprehensive and localized framework that addresses these interconnected hazards through proactive disaster risk reduction and management strategies. It also aims to enhance institutional coordination, community participation, and long- term resilience by integrating risk-informed planning and science-based approaches.

The study utilized descriptive and exploratory research approaches to assess the level of disaster awareness, preparedness, response capacity, and recovery mechanisms within the municipality. Data were gathered from residents, barangay officials, MDRRMO personnel, and emergency responders through a survey. Community assessment was conducted in selected high-risk barangays. Findings revealed that the respondents generally demonstrated a high level of awareness regarding volcanic hazards, early warning systems, evacuation procedures, and disaster preparedness measures.

Anchored on the four thematic areas of Disaster Risk Reduction and Management—Prevention and Mitigation, Preparedness, Response, and Rehabilitation and Recovery—the action plan proposes programs, projects, and activities aimed at strengthening early warning systems, improving evacuation and response operations, enhancing community-based training, and promoting resilient infrastructure and livelihood recovery. Overall, this action plan serves as a strategic roadmap for reducing disaster risks, improving community resilience, and supporting the sustainable development of the Municipality of Agoncillo.

Keywords —Volcanic Hazard,Landslide, seismic risk, Agoncillo, Batangas,Flood

1.1 Introduction

The Philippines is widely recognized as one of the most hazard-prone countries in the world due to its geographic location along the Pacific Ring of Fire and the Western Pacific typhoon belt. Globally, countries situated along tectonic boundaries and tropical cyclone pathways experience compounded disaster risks, and the Philippines exemplifies this

condition. It hosts hundreds of volcanoes, with several classified as active, and experiences frequent seismic activity due to the interaction of the Philippine Sea Plate and the Eurasian Plate. In addition, the country is visited by an average of more than 20 tropical cyclones annually, many of which bring intense rainfall, flooding, landslides, and storm surges.

The increasing frequency and intensity of disasters in the Philippines, particularly in hazard-prone areas such as Agoncillo, Batangas, highlights the urgent need for a harmonized and integrated disaster risk governance system. Situated near Taal Volcano, Agoncillo is highly exposed to volcanic eruptions, ashfall, earthquakes, and other secondary hazards, which are further intensified by climate change impacts and variability such as extreme rainfall and temperature variability. In response to these challenges, disaster risk reduction and management must move beyond isolated interventions and toward a coordinated, multi-level, and policy-aligned approach. The municipality established national frameworks and policies, particularly Republic Act No. 10121

The necessity of this action plan arises from the increasing complexity and interconnected nature of disaster risks faced by the municipality. Past events, particularly the 2020 Taal Volcano eruption and recurring typhoon-induced flooding, demonstrate that hazards in Agoncillo do not occur in isolation but instead trigger cascading effects across physical, economic, and social systems. Existing disaster management approaches, while functional, require further strengthening through an integrated, risk-informed, and multi-hazard framework that emphasizes preparedness, coordination, and long-term resilience.

The municipality of Agoncillo, Batangas is situated within one of the most active and high-risk volcanic environments in the Philippines due to its proximity to Taal Volcano. Being a lakeshore municipality located along Taal Lake. Agoncillo is directly exposed to multiple volcanic hazards such as ashfall, base surges, ground shaking, landslide, flood, and seismic hazard maps allow for the identification of vulnerable barangays and support risk- and decision-making. These spatial datasets help illustrate the extent and severity of potential hazards and provide a valuable foundation for disaster preparedness, mitigation, response, and recovery activities.

The Municipality of Agoncillo is a second-class municipality composed of 21 barangays and situated along the lakeshore of Taal Lake,

approximately 10 kilometers from Taal Volcano. Its geographic location places the municipality within a highly vulnerable zone exposed to multiple hazards, including volcanic eruptions, earthquakes, flooding, landslides, and typhoons. The municipality's terrain ranges from low-lying lakeshore communities to steep and mountainous upland areas, resulting in varying levels of hazard susceptibility across barangays. These physical characteristics, combined with its location within the Taal caldera system, make Agoncillo highly susceptible to both geologic and hydrometeorological hazards

Agoncillo it is bounded by the municipality of Laurel in the North, Taal Lake, and Volcano in the East, municipality of Lemery in the West, and municipalities of San Nicolas and Taal in the South. It is located 120 kilometers south of Manila. Agoncillo has a total population of 40,662 based on 2024 census population and total household 8,580. Agoncillo has a total land area of 4,941.47 hectares. Wherein 57.03 hectares are utilized under urban areas while the remaining areas are considered rural. The municipality is politically subdivided into twenty-one barangays at present. The land areas under rural barangays are mostly agricultural in nature. In terms of climate, Agoncillo experiences a Type I climate, characterized by two distinct seasons dry and wet. This climate condition further contributes to the municipality multi-hazard environment.

The Municipality of Agoncillo, Batangas, located within the high-risk zone of Taal Volcano, is highly exposed to interconnected hazards, including volcanic activity, seismic risks, flooding, and rain-induced landslides. The multi-hazard scenario has been further reviewed and enhance to ensure that it remain realistic, comprehensive. Municipality of Agoncillo response to the recommendation, additional details regarding the Incident Command System (ICS) activation procedures, inter- agency and communication protocols. Taal Volcano serves as the primary triggering event, preceded by intense volcanic earthquakes, ground deformation, and increased gas emissions. As the eruption intensifies, it generates ashfall, base surge, and ballistic

a dry season and a wet season. This climate pattern adds to Agoncillo's multi-hazard profile, particularly in relation to flooding, landslides, and drought-related pressures on agriculture (CLUP 2020-2030)

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Figure 2 highlights the red-colored areas represent zones with high landslide susceptibility. Statistically, these zones are concentrated within the upland areas and steep slope segments of Agoncillo, particularly in barangays situated away from the lakeshore. The green-colored areas indicate moderate landslide susceptibility, which are transitional zones between upland and lowland areas. The yellow zones represent low landslide susceptibility areas, mainly located in the lowland and lakeshore parts of Agoncillo, including flatter barangays near Taal Lake. All 21 barangays within the municipality are exposed to landslide hazards, varying only in their specific level of susceptibility.

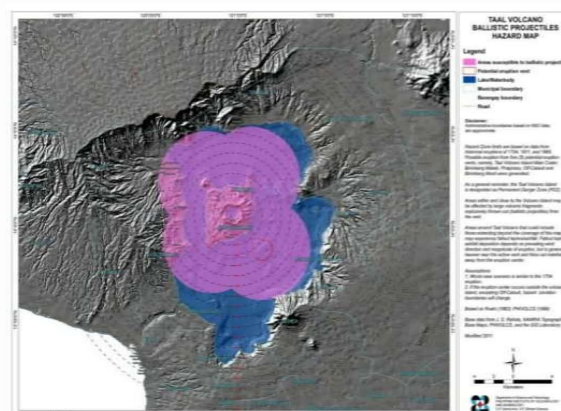


Figure 1 . Map of Agoncillo, Batangas (Agoncillo CLUP 2020-2030)

The municipality covers 4,941.47 hectares, of which 57.03 hectares are classified as urban, while the rest are rural and largely agricultural. It falls under Type I climate classification, characterized by two distinct seasons:

Results of the Conducted Survey

The survey was conducted through face-to-face interviews with the support and approval of the Barangay Captains and barangay officials.

Part I. Demographic Profile

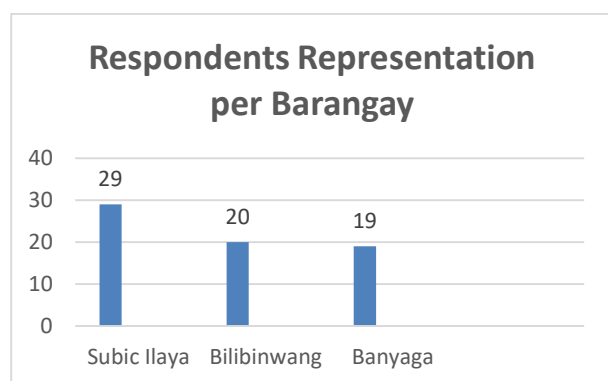


Figure 4: Respondent's Representation of Barangay

Figure 4 illustrates the distribution of respondents per barangay involved in the action plan, showing varying levels of participation across Subic Ilaya, Bilibinwang, and Banyaga. Among the three barangays, Subic Ilaya recorded the highest number of respondents at 29, while Bilibinwang and Banyaga had 20 and 19, respectively. This indicates that while all barangays were represented, Subic Ilaya demonstrated the strongest level of participation in the planning process. The data suggests that community engagement was present across all barangays, reflecting inclusivity in gathering inputs for disaster risk reduction initiatives. However, the noticeable difference in the number of respondents implies varying levels of participation, which may influence the extent of representation of local perspectives and needs in the action plan.

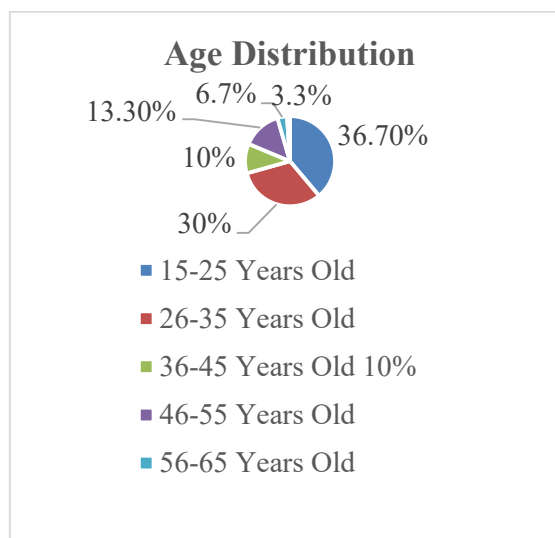


Figure 5: Age Distribution

Figure 5 shows the age distribution of respondents included in the action plan, which reflected a diverse range of age groups, with the 15-25 years age category having the highest representation at 36.70%. This suggested that the active participation of youth and young adults in disaster preparedness—often via community-based programs—highlights their important role in local initiatives. This pattern suggests that awareness and involvement in disaster risk reduction are being successfully encouraged among younger generations.

Respondents aged 26–35 comprised 30% of the sample, representing a major group of working-age adults likely involved in decision-making, emergency response, and community leadership. While the 36-45 years old group comprised 10% of the total respondents, indicating a moderate level of participation from mid-career professionals and community leaders.

The 46-55-year-old group made up 13.3% of the respondents, reflecting some engagement from middle-aged individuals who might have contributed experience and leadership in disaster preparedness initiatives. The 56-65 years old category had minimal representation of 6.7%, and the 66 years old and above category had the least participation of 3.3%, suggesting that older individuals were less involved in disaster risk reduction efforts, potentially due to mobility or accessibility challenges.

This reflects that middle age group (25-35) is the most engaged in local governance and disaster management. In the data set, both young and middle-aged people add to the diversity, ensuring result represents the general state of disaster management in the subject barangays.

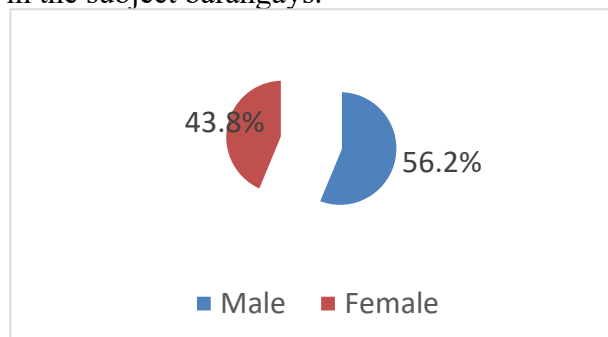


Figure 6. Gender Distribution

Figure 6 shows the gender breakdown of respondents for the disaster risk reduction and management action plan, showing a higher representation of males (56.2%) compared to females (43.8%). This indicated that men had a slightly greater participation in disaster preparedness and response activities, which might have been influenced by traditional gender roles where men were often more involved in emergency response, rescue operations, and technical aspects of disaster management. Despite having a lower percentage, female participation was still significant at 43.8%, suggesting that women played an active role in disaster preparedness initiatives, community engagement, and planning efforts. Their involvement reflected the increasing recognition of the importance of integrating gender considerations into disaster risk reduction strategies, ensuring that both men and women contributed to building community resilience.

Part II. Results and Community Assessment

The community assessment indicates a generally strong level of disaster awareness and preparedness, while also revealing specific operational weaknesses. Respondents came from different age groups, with the 15–25 category comprising 36.7%, followed by 26–35 at 30%. Older groups were less represented, with respondents aged 66 and above comprising 3.3%. Gender distribution

was 56.2% male and 43.8% female. The results suggest meaningful youth and working-age participation, but also point to the need for greater inclusion of older residents.

For disaster prevention and mitigation, the overall weighted mean was 3.60, interpreted as Strongly Agree. Respondents reported particularly high awareness of volcanic eruptions and sulfuric-fume health effects, with a weighted mean of 3.82. They also strongly agreed that ashfall mixed with rain can contribute to landslides and flooding, with a weighted mean of 3.76. Awareness of wider effects of ashfall and sulfuric fumes was also high. Respondents recognized the role of drainage maintenance and hazard maps, although the findings also indicate a need for more frequent drills and exercises.

Disaster preparedness obtained an overall weighted mean of 3.65. The highest concern involved volcano alert levels and warnings, followed by the clarity of information from the MDRRMO to barangay level. Respondents also expressed confidence that the LGU and barangays could provide food, water, shelter, and medical kits. Knowledge of preparedness before and after disasters was rated highly. Awareness of early warning systems and go bags was also positive.

Disaster response obtained an overall weighted mean of 3.45. Respondents expressed confidence in BDRRMC capacity, relationships among the MDRRMO, barangay officials, and responders, evacuation procedures, and relief distribution. However, communication and staffing received comparatively lower ratings, indicating that response confidence exists alongside recognized operational constraints.

For rehabilitation and recovery, the highest-rated concern was infrastructure rehabilitation, particularly roads, bridges, and drainage, with a weighted mean of 3.70. Psychosocial support, health monitoring, long-term livelihood planning, and assistance for farmers and fishermen were also rated positively. RDANA and assistance to affected households were recognized, although long-term

restoration of properties received the lowest item rating at 3.26.

Overall, the results show a community that is aware and generally confident but still requires stronger systems, equipment, communications, inclusive participation, and sustained recovery programs.

PESTEL ANALYSIS

Political Factors

The local government of Agoncillo implements disaster risk reduction and management programs in line with the Philippines' disaster management framework, particularly Republic Act No. 10121. Coordination among the Municipal Disaster Risk Reduction and Management Office (MDRRMO), barangay officials, national agencies, and emergency response organizations help strengthen preparedness and response capacities. Government support through policies, contingency planning, and evacuation protocols plays an important role in reducing disaster impacts, though issues related to resource allocation, policy execution, and inter-agency coordination can limit overall effectiveness.

Economic Factors

Volcanic eruptions and related hazards can significantly affect the local economy of Agoncillo. Agriculture, fisheries, tourism, and small businesses are vulnerable to ashfall, ground deformation, earthquakes, and evacuation measures. Damage to infrastructure, roads, and public facilities can lead to substantial economic losses and higher recovery expenditures for the municipality. Access to adequate funding through the municipality's disaster risk reduction and management fund complemented by support from national government agencies, is vital to sustain preparedness, response, rehabilitation, and recovery initiatives in high-risk areas.

Barangay resources, such as stockpiles of relief goods and emergency supplies, demonstrate a clear financial commitment to disaster preparedness. This economic capacity strengthens resilience by allowing households and local authorities to respond quickly and more effectively during emergencies. The heavy reliance on vulnerable economic sectors

underscores the need for focused measures to protect livelihoods during volcanic events. Enhancing local economic resilience through diversified income sources and appropriate disaster insurance mechanisms can help reduce financial risk and support faster, more sustainable community.

Social Factors

The population of Agoncillo is exposed to multiple volcanic and secondary hazards because of its proximity to Taal Volcano. Levels of community awareness, risk perception, public education, and participation in preparedness programs strongly influence the municipality's overall resilience. Vulnerable groups—such as children, older persons, persons with disabilities, and low-income households—tend to experience more severe impacts during disasters.

Strengthening community-based disaster risk reduction initiatives and conducting regular evacuation drills can enhance preparedness and adaptive capacity. In high-risk barangays, many families are familiar with the effects of sulfuric fumes, ashfall, and related health problems during volcanic activity, underscoring the community's exposure and vulnerability. Social cohesion and community participation are reinforced through active involvement in trainings and preparedness activities, and these local networks can play a crucial role in supporting evacuation operations and relief distribution, thereby improving overall community resilience.

Technological Factors

Technological advancements play a major role in hazard monitoring and early warning. Monitoring conducted by the Philippine Institute of Volcanology and Seismology provides essential information on volcanic activity, seismic events, and ground deformation. Communication technologies such as mobile alerts, social media, radio, and dedicated emergency communication systems help ensure that warnings and advisories reach communities in a timely manner.

The use of Geographic Information Systems (GIS), hazard maps, and remote sensing tools improves risk assessment and supports more effective emergency planning. Public address

systems, mobile phones, and limited internet connectivity are increasingly used for coordination and information sharing at the local level. However, the adoption of more advanced technologies and digital governance tools remains modest in many areas, which can constrain the full potential of technology-enabled disaster risk management.

Environmental Factors

Agoncillo faces multiple environmental risks associated with volcanic activity, including ashfall, ballistic projectiles, volcanic earthquakes, ground cracking, landslides, flooding, and lake-related hazards. Environmental degradation, deforestation, and improper land use practices may increase community vulnerability to disaster. Climate Change can further intensify the impact of heavy rainfall, flooding, and landslides, especially in hazard-prone areas. Sustainable environmental management and ecosystem protection are essential for reducing disaster risks and promoting long-term resilience. Integrated environmental management is vital for sustainable disaster preparedness. Barangays must align hazard monitoring, environmental protection, and community education to more effectively address both human and ecological vulnerabilities.

Legal Factors

Disaster risk management in Agoncillo is anchored in national laws, policies, and regulations, including Republic Act No. 10121, the National Disaster Risk Reduction and Management Plan, land-use regulations, the National Building Code of the Philippines, and local ordinances on disaster preparedness and environmental protection. These legal frameworks guide risk-informed development planning, promote safe construction practices, and support hazard-based land-use planning, thereby enabling more effective emergency management operations.

Ongoing review and revision of policies are necessary to keep pace with emerging and evolving hazards. Legal mechanisms must enforce compliance with safety standards, clearly define roles and responsibilities, and encourage public-private collaboration to strengthen DRRM implementation in high-risk areas.

SWOC ANALYSIS

Strengths

Disaster Prevention and Mitigation

1. Establishment DRRM structure - All surveyed barangays have officially designated DRRM focal persons, ensuring accountability and coordination for disaster prevention and mitigation.
2. Preparedness Plans – Barangays have a clear evacuation plan, designated emergency assembly areas, and a communication system for volcanic hazards, demonstrating well-organized local planning.
3. Community Awareness – Residents are well-informed about volcanic risk and warning signs, reflecting active dissemination of information and community engagement.

Disaster Preparedness

1. Active Participation - Residents have participated in community trainings, drills, and preparedness programs, indicating a proactive approach to individual and household readiness.
2. Household Preparedness – Families maintain emergency kits and communication plans, ensuring immediate response capabilities.
3. Accessible Evacuation Resources – Evacuation Centers are present and reachable, supporting timely evacuation during volcanic events.

Disaster Response

1. Use of Protective Measures – Respondents consistently use masks, goggles, and other equipment during volcanic hazards, demonstrating awareness and adherence to safety protocols.
2. Community Confidence – High trust in barangay and Municipality of Agoncillo (MDRRMO) response capacity strengthens coordinated efforts during emergencies.

Disaster Rehabilitation and Recovery

1. Government and Community Support – Respondents confirmed receiving assistance from local authorities and organizations, suggesting existing frameworks for recovery efforts.

Weaknesses

Disaster Prevention and Mitigation

1. Telecommunication system – Early Warning System (EWS) communication remains inadequate due to weak

signal connectivity, while siren audibility is perceived as insufficient in effectively reaching the community during emergencies.

2. Hazard map – Although hazard maps are available, these have not been widely distributed or printed, resulting in limited community awareness and understanding of hazard-prone areas.
3. Drainage system – Despite regular maintenance and cleaning, the drainage system occasionally becomes clogged, while some barangays continue to experience inadequate or absent drainage infrastructure.
4. Roads – Road accessibility remains vulnerable to flooding, as even minimal rainfall can result in road inundation and mobility disruptions,

Disaster Preparedness

1. Go bags – The availability of emergency go bags among households in the barangay remains uneven. While some families have prepared and maintained go bags for emergencies, a significant number of households still lack this essential preparedness measure. Households without go bags may face greater challenges during emergencies, including delays in evacuation, limited access to essential supplies, and increased vulnerability to disaster impacts.

2. Rescue equipment – Barangay Disaster Risk Reduction and Management Council (BDRRMC) is insufficient to adequately support emergency response and rescue operations during disasters and other hazard events. The limited quantity and capacity of rescue tools, personal protective equipment, communication devices, and emergency response resources.

Disaster Response

1. Communication system – In several remote barangays remains inadequate and presents a significant gap in disaster preparedness and response operations.
2. Barangay Disaster Risk Reduction and Management Council (BDRRMC) – Faces a significant challenge due to the insufficient number of personnel available to effectively responds to disaster and emergency.
3. Logistics - Municipality Disaster Risk Reduction and Management Office and Barangay Disaster Risk Reduction and Management Committee, has limited availability of transportation vehicles to effectively support large-scale disaster response and emergency operations during large-scale disaster such as volcanic eruption, flood, and landslide.

Disaster Rehabilitation and Recovery

1. No partnership program – The barangay currently has no established partnership programs with private sector organizations, and non-government organizations (NGOs), and other external stakeholders

that could support disaster risk reduction and management initiatives.

2. No livelihood program -The barangay currently has limited or no access to livelihood programs and economic assistance initiatives from the local Government (LGU). This gap presents a significant challenge to the socio-economic development and resilience of the community, particularly for low-income households.

3. Infrastructure and housing – The Local Government Unit (LGU) provides support for infrastructure rehabilitation and housing assistance programs for barangays affected by disasters. The available assistance remains insufficient to fully address the needs of all affected households and communities.

3. GOALS AND OBJECTIVES

A. Disaster Prevention and Mitigation

Goal 1. To minimize disaster risks in vulnerable barangays through climate-resilient infrastructure, proactive environmental management, and strict land-use policy enforcement.

Objectives:

1.1 Produce and validate standardized, GIS-based multi-hazard maps for 100% of barangays. risk assessment tools, approved by the MDRRMC by 2027-2028.

1.2 Rehabilitate and improve drainage systems in at least 80% of all barangays by 2028.

B. Disaster Preparedness

Goal 2: Enhance local disaster preparedness and response capabilities by upgrading early warning systems and community communication channels.

Objectives:

2.1 Establish and operationalize a standardized, multi-hazard Early Warning System (EWS) with functional communication channels for floods, landslides, and volcanic eruptions across all barangays from 2027 to 2028

2.2 Strengthen household disaster preparedness in at least 90% of barangays through community-based training, resulting in increased adoption of emergency plans, go-bag readiness, and awareness of evacuation procedures from 2027 to 2028.

C. Disaster Response

Goal 3: Deliver swift, synchronized emergency response to preserve life, alleviate suffering, and maintain public safety.

Objectives:

3.1 Strengthen the operational response capacity of the MDRRMO and BDRRMCs through multi-hazard response training, resulting in improved readiness in incident command, search and rescue, and mass casualty management from 2027 to 2028.

3.2 Establish and operationalize an effective coordination and communication system between MDRRMO and all barangays, ensuring timely information sharing and coordinated disaster response actions from 2027 to 2028.

D. Disaster Rehabilitation and Recovery

Goal 4 Upgrade the disaster recovery framework to rebuild, revitalize, and future-proof community infrastructure and livelihoods systems, promoting resilient and sustainable long-term development.

Objectives:

4.1 Implement a post-disaster rehabilitation program to restore critical infrastructure, protect lives, and improve basic services in affected barangays. functional, and disaster-resilient conditions within six (6) months after disaster events.

4.2 Restore and strengthen the livelihoods of Deliver coordinated recovery support from

government, NGO, and private partners to ensure at least 70% of disaster-affected households regain income within six months.

Monitoring and Evaluation

The Monitoring and Evaluation framework provides a mechanism for tracking whether the action plan is implemented as intended and whether PPAs produce their expected outcomes. The M&E system uses measurable indicators, documented data sources, responsible offices, monitoring frequency, required resources, time frames, and funding sources.

For prevention and mitigation, M&E includes

GIS-based hazard mapping training and outputs, early warning system testing and maintenance, and drainage cleaning and desilting. Evidence includes attendance sheets, training reports, GIS outputs, inventory reports, monitoring reports, cleaning reports, and photo documentation. Site inspections and field validation are important because they verify whether planned outputs are actually functional.

For preparedness, M&E monitors early warning equipment, communication systems, search-and-rescue training, community drills, go-bag distribution, and evacuation-center improvement. The plan uses equipment inventories, testing logs, inspection records, training certificates, attendance sheets, drill reports, beneficiary lists, and accomplishment reports. The community-drill target includes at least four drills or simulation exercises yearly and 90% household participation.

For response, M&E examines the establishment and readiness of trained emergency response teams and the functioning of coordination mechanisms. Indicators include training completion, equipment availability, coordination meetings, communication logs, and documented protocols. The plan identifies at least four coordination meetings yearly as a monitoring target for the inter-agency and inter-barangay mechanism.

For recovery, M&E tracks livelihood assistance, skills training, and partnerships. Beneficiary lists, accomplishment reports, photos, training records, certificates, MOAs, partnership agreements, and meeting reports are used to verify progress. The plan recognizes risks such as delayed fund release, insufficient assistance, limited livelihood opportunities, low participation, and weak partner engagement.

The M&E framework is therefore not simply a reporting requirement. It is intended to support adaptive management. Quarterly monitoring, field inspection, annual review, and continuous updating allow the LGU to identify implementation problems and adjust activities. The approach is consistent with the plan's characterization as a living document that must respond to changing hazards, resources, institutional conditions, and community needs.

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