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Strengthening Public-Private Collaboration for Resilience: A Multi-Hazard Action Plan Addressing Human-Induced Chemical Fire and Environmental Contamination in Barangay Canlubang, Calamba City, Laguna

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Abstract:

This study provides a detailed Disaster Risk Management Action Plan aimed at enhancing public-private partnership to mitigate human-induced multi-hazards in Barangay Canlubang, Calamba City, Laguna. It looks closely at a situation with a lot at stake, like a labor dispute, that could lead to arson and cause huge chemical fires and pollution of local rivers. Using a mixed-methods research approach, the study finds important gaps in institutions, such as the lack of required information-sharing systems and not enough specialized early warning systems for toxic smoke plumes. The Action Plan suggests four integrated goals for the many parts of the Philippine DRRM system to fix these problems. These goals span everything from prevention and preparation to response and recovery. Some of these tactics are making it an local ordinance for security intelligence sharing, using specialist multi-hazard warning systems, and making formal agreements for mutual aid to get resources. The research ultimately offers an evidence-based framework intended to reconcile operational disparities and ensure both public safety and economic stability at a critical industrial-residential nexus.

Keywords — **Public-Private Partnership, Chemical Fire, Environmental Contamination, Resilience**

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I. INTRODUCTION

As the second-largest contributor to the Philippines' Gross Domestic Product (GDP), the CALABARZON region is a primary industrial catalyst. Within this region, Calamba City, Laguna, has emerged as a prominent industrial hub, attracting significant national investments. However, rapid industrialization introduces severe human-induced hazards—including social conflicts, industrial activity, and deliberate acts of arson—that can surpass natural disasters in complexity and impact. The inherent interconnectedness of these risks, where social instability precipitates technological failure, necessitates a specialized, multi-faceted preparedness strategy. This research emphasizes that the effectiveness of a city's disaster management relies heavily on the legal compliance and operational strength of its constituent barangays.

Barangay Canlubang, the most economically and demographically developed barangay in Calamba City, serves as a critical industrial-residential interface. This unique proximity between dense residential populations and high-risk manufacturing

facilities, such as those PEZA Economic Zones, necessitates proactive measures to mitigate multi-hazard events. Current local Disaster Risk Reduction and Management (DRRM) plans often lack a specific focus on these human-induced risks, creating a critical policy gap that this Action Plan seeks to address through strengthened public-private collaboration [1].

TABLE I
INVENTORY OF PEZA MANUFACTURING ECONOMIC ZONES AS OF FEBRUARY 2023

Inventory of PEZA Manufacturing Economic Zones as of February 2023

Name of Ecozone	Location	Developer/Operator	Nationality	Total Area (sqm)
Calamba Premiere International Park	Batino, Parian and Barandal	Allegis Realty Holdings Corporation	100% Filipino	57,052.00
Carmelray Industrial Park	Canlubang	NYK-Transnational Land Corporation	60% Filipino and 40% Japanese	20,000.00
Carmelray Industrial Park II	Punta & Milagrosa	Starworld Corporation	60% Filipino and 40% Korean	656,349.00
Carmelray International Business Park	Canlubang	Carmelray Industrial Corporation	100% Filipino	1,026,984.00
Filinvest Technology Park – Calamba	Punta, Burol, Bubuyan	Filinvest Corporation - JTCI	100% Filipino	1,430,252.00
Light Industry & Science Park II	Real, La Mesa	Carmelray Industrial Corporation	100% Filipino	400,000.00
SMPIC Special Economic Zone	Paciano Rizal	Filinvest Land Inc.	100% Filipino	510,733.71
YTMI Realty Special Economic Zone	Makiling	LISP-II Locators' Association, Inc.	65.6% Filipino; 24.4% American; 10% Japanese	704,292.00

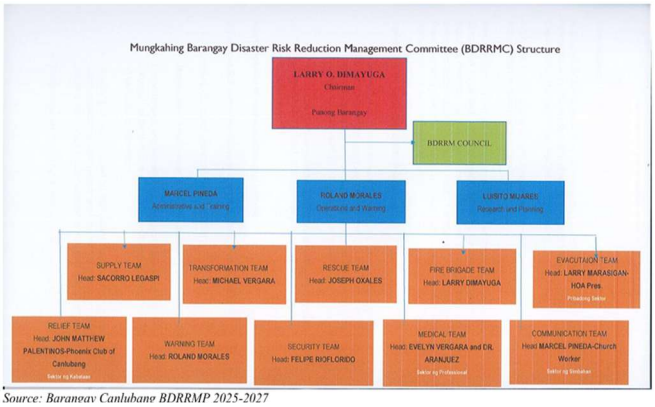
Source: Philippine Economic Zone Authority

A. BACKGROUND OF THE PLAN

A robust Barangay Disaster Risk Reduction and Management (BDRRM) plan is fundamental to a city's overall resilience, serving as the first line of defense due to its localized knowledge and immediate presence. This customized approach ensures that the specific industrial complexities of the area are translated into actionable safety and security protocols for the community [2].

Them Imperative of a strong BDRMRM Plan:

- **Localized Knowledge and First Response:** Barangay officials act as primary responders, leveraging their understanding of local topography and demography for swifter actions.
- **Risk Identification:** Customized plans address specific natural and human-induced threats unique to an area, such as the chemical spill risks inherent to Canlubang's industrial landscape.
- **Community Empowerment:** Grassroots involvement fosters a culture of resilience and working together.
- **City-Level Integration:** Strong barangay DRRM operations serve as the "five senses" of a city's crisis response.



Source: Baranagay Canlubang BDRRMP 2025-2027

***Figure 1**. Barangay Canlubang BDRRMC Structure*

B. Institutional and Resource Analysis

PNP and BFP Manpower: Calamba City faces significant personnel shortages. The police-to-population ratio is approximately 1:3,800, well below the national standard of 1:1,000. Similarly, the firefighter ratio is one per 8,849 residents, compared to the 1:2,000 standard. These gaps necessitate heavy reliance on private sector partnerships and auxiliary forces [3].

TABLE III
CANLUBANG INSTITUTIONAL AND HUMAN RESOURCE

Canlubang Institutional and Human Resource

Human Resource	Bilang
Health Facilities and Professionals (Doctor, Midwives or Nurse)	50
Trained Barangay Health Workers	85
Trained Barangay Nutrition Scholars	8
Trained Barangay Emergency Response Teams	10
Trained Community Volunteer Organizations	10
Pool of Community Volunteers	290
BDRRM Operations Center and Trained Personnel	18
YTMI Realty Special Economic Zone	10

Source: Barangay Canlubang BDRRMP 2025-2027

Hazard Coverage Gaps: While the existing Canlubang BDRRM Plan identifies natural hazards like typhoons (ranked 1st) and earthquakes (ranked 2nd), it does not specifically address human-induced threats. Grassfires currently hold the lowest priority, highlighting a critical need to integrate complex risks like industrial arson and chemical fires into the risk register.

C. Multi-Hazard Scenario

This research investigates a high-stakes, cascading threat where a societal crisis triggers a technological and environmental disaster, as shown in Table III.

TABLE IIIII
MULTI-HAZARD SCENARIO

Phase	Scenario
The Trigger (Phase 1)	Volatile labor disputes or civil unrest escalate into a violent disturbance.
The Deliberate Act of Arson (Phase 2):	A deliberate act of arson breaches a facility, targeting hazardous material (HazMat) storage.
The Consequence – Chemical Fire and Mass Casualty Incident (Phase 3):	An extraordinary incident
Compound Crisis – Delated Response and Overwhelmed Systems (Phase 4)	Incidents that overwhelm standard response systems.
Environmental Contamination (Phase 5)	Contaminated firefighting runoff enters the Cauang-Cauang Creek, causing widespread environmental contamination downstream.

D. Scope, Limitations, and Significance

Scope: The study focused on Barangay Canlubang to formulate an efficient, localized response strategy for chemical fires and environmental contamination brought by human interventions.

Limitations: While context-specific, the framework is adaptable for various industrial zones. Challenges encompass the lack of empirical data on protests escalating specifically into chemical spills and the voluntary nature of private sector resource investment.

Significance: This plan provides practical ideas to enable local stakeholders, protect the general public through protocols like "shelter-in-place," and ensure business continuity for industrial parks.

II. SITUATIONAL ANALYSIS

A. Overview of the Study Area

Barangay Canlubang is the largest barangay in Calamba City, Laguna, covering 3,192 hectares of land that serves as a primary industrial-residential interface. It hosts approximately 11.17% of the city's total population, with 60,292 residents distributed across various sitios and high-density residential areas. The presence of Carmelray Industrial Park 1 (CIP1) within its jurisdiction makes it a strategic economic hub, yet this proximity creates significant vulnerability to human-induced hazards.

B. PESTEL Analysis

A PESTEL analysis was conducted to evaluate the external factors influencing the disaster resilience of the area.

- **Political:** Calamba City maintains a stable political environment, but the transition of local leadership every three years poses a risk to the continuity of specialized disaster programs.
- **Economic:** The barangay's high annual revenue (estimated at Php 125.8M) provides a strong financial base for DRRM investments, though a major industrial disaster could lead to severe economic impact and job losses.
- **Social:** The high population density and the presence of "transient" workers in boarding houses or apartments complicate mass evacuation protocols and resource distribution during emergencies.
- **Technological:** While industrial parks utilize advanced safety and security technologies, the barangay's local emergency

communication systems require modernization to ensure real-time alerts and notifications for residential areas.

- **Environmental:** The natural topography slopes toward the San Cristobal River and Laguna de Bay, making these water bodies highly susceptible to contamination from firefighting foam and chemical runoff.
- **Legal:** Compliance with RA 10121 is evident, but Data Privacy Law often prevent the sharing of private security intelligence and proprietary chemical list and the Safety Data Sheets (SDS) with public responders.

C. Institutional Capacity and Risk Perception

Data gathered from 68 respondents composed of local residents and stakeholders.The survey findings for Barangay Canlubang indicate a community that is highly cognizant of industrial risks yet harbors skepticism towards existing institutional and collaborative structures. This narrative presents a detailed summary of the findings and the weighted mean (WM) ratings.

D. Key Survey Findings:

Risk Perception and Awareness

With an overall weighted mean of 3.59 (Agree), respondents demonstrate a solid understanding of the hazards associated with their industrial environment. The highest-ranked awareness pertains to the fact that industrial fires can lead to chemical spills or toxic gas releases (WM 3.88). While there is general agreement that labor disputes in the industrial park could escalate into arson (WM 3.60), the community remains Neutral (WM 3.40) on whether these human-induced threats are more severe than natural hazards like earthquakes or floods. This indicates that although the risks are acknowledged, they may not yet be prioritized above prevalent natural threats.

Institutional Preparedness and Capacity

The assessment of institutional capacity yielded an overall rating of 2.96 (Neutral), reflecting significant public doubt. Although the BDRRMC is generally seen as having sufficient resources (WM 3.49), the community maintains a Neutral stance regarding the adequacy of PNP personnel to manage civil unrest (WM 2.79) and the BFP's equipment for hazardous material fires (WM 2.78). Furthermore, there is a Neutral perception (WM 2.79) regarding the existence of clear operational plans for inter-agency coordination, highlighting a critical preparedness gap.

Public-Private Partnership and Collaboration

Public-private collaboration received an overall Neutral assessment of 3.26, yet specific items show a strong mandate for formal action. There is Strong Agreement (WM 4.21) on the necessity of a formal Memorandum of Agreement (MOA) between the LGU and CIP1, as well as the active participation of the private sector in joint emergency drills. However, lower scores regarding the willingness of companies to share internal security plans (WM 3.91) and provide timely resources during a crisis (WM 3.78) suggest a lack of public confidence in private sector transparency and immediate mobilization.

Policy, Planning, and Regulation

The policy framework was rated at 3.71 (Agree), with a clear call for more rigorous oversight. The highest-ranked item in this section (WM 3.99) underscores a robust agreement on the need for stricter policies mandating that corporations disclose their Risk Identification and Assessment studies to local authorities. Respondents remained Neutral (WM 3.32) regarding the adequacy of current city-level disaster plans in addressing human-induced risks, confirming that existing frameworks are seen as deficient in this area.

Community and Environmental Vulnerability

The community and environmental vulnerability section received the highest overall agreement with a rating of 4.07 (Agree). Notably, the survey's highest single rating—a Strong Agreement (WM 4.41)—demands the implementation of a specialized early warning system for chemical or security-related emergencies. While residents express confidence in knowing how to react to a leak (WM 3.92), they remain highly concerned (WM 3.90) about the potential for chemical spills to contaminate vital local waterways like the Cauang-Cauang Creek and San Cristobal River.

E. SWOC Analysis

The SWOC analysis integrates factors critical to the four thematic areas of DRRM in the Philippines:

Disaster Prevention and Mitigation

TABLE IVV
SWOC FOR PREVENTION AND MITIGATION

Strengths	The barangay has a solid legal foundation with an established BDRRMC and a formalized BDRRM Plan (2025-2027) that includes contingency planning for natural hazards.
Weaknesses	Absence of a localized, digitized SDS registry and lack of formalized security intelligence sharing between locators and the PNP.
Opportunities	The presence of industrial companies offers an avenue for public-private collaboration on industrial hazard prevention and the creation of a specialized Peace and Order Committee.
Challenges	Rapid urbanization and land conversion create new environmental risks, while existing policies fail to comprehensively address human-induced threats like civil unrest or arson.

Disaster Preparedness

TABLE V
SWOC FOR DISASTER PREPAREDNESS

Strengths	The BDRRMC is active in training, having completed eight (8) different programs including Basic Life Support and earthquake drills. The area also benefits from two BFP substations, one of which is located inside the industrial park.
Weaknesses	Current training is limited, as members have only attended an "Incident Command System (ICS) orientation," which may lead to uncoordinated responses during complex incidents or events. Early Warning Systems are also predominantly focused on floods rather than anthropogenic hazards.
Opportunities	There is potential to conduct full-scale exercises with the Emergency Response Teams (ERTs) of private companies to test operational and tactical readiness.

Disaster Response

TABLE VI
SWOC FOR DISASTER RESPONSE

Strengths	The barangay utilizes an operational 24/7 "Radio Room" as its Disaster Operations Center and maintains essential response assets, including a fire truck and two ambulances.
Weaknesses	There is a critical shortage of manpower to address simultaneous civil unrest and chemical fires, compounded by a lack of specialized training for hazardous materials (HazMat) incidents and Civil Disturbance Management.
Opportunities	Formalizing MOA/MOU agreements with industrial locators would grant the barangay access to private-sector rescue equipment and emergency vehicles during crises.
Challenges	Navigating civil unrest while managing a chemical leak is extremely complex and currently lacks a pre-established, unified command structure for public-private coordination.

Disaster Rehabilitation and Recovery

TABLE VII
SWOC FOR DISASTER REHABILITATION AND RECOVERY

Strengths	The barangay's Quick Response Fund (QRF) is legally restricted to its own constituents, creating a support gap for non-resident workers.
Weaknesses	The plan identifies the chance to tap into Corporate Social Responsibility (CSR) projects and national programs like DOLE's TUPAD to facilitate a faster "Build Back Better" process.
Opportunities	A major incident could lead to extensive business closures and job losses, creating a long-term financial burden on the LGU and damaging companies' reputation.

III. GOALS AND OBJECTIVES

The strategic framework of the Action Plan, organized into four thematic areas with specific goals and objectives designed to achieve verifiable resilience by 2028.

A. Disaster Prevention and Mitigation

TABLE VIII
GOAL 1 AND OBJECTIVES – PREVENTION AND MITIGATION

GOAL 1	Reduce the vulnerability of the barangay-industrial interface (the interface refers to the critical boundaries of the two stakeholders) by establishing mandatory legal mechanisms for shared security intelligence and enforcing rigorous chemical fire prevention standards, thereby reducing the probability of Civil Unrest escalating into an Arson/HazMat event by 50% by December 2027.
OBJECTIVES	1.1 To institutionalize a legal mandate (e.g., Barangay Ordinance/MOA) for Public Private Security Information Sharing, requiring CIP1 locators to disclose non-proprietary security threat assessments (especially regarding labor disputes) to the PNP and/or BDRRMC by Q4 2027.

	1.2 The annual Vulnerability and Chemical Fire Risk Audits will be mandated and enforced as a dual prevention and mitigation mechanism for all companies handling hazardous materials. This initiative aims to achieve 100% audit compliance by Q4 2028. A key requirement of the audit process is the submission of a copy of the Safety Data Sheet (SDS) to the Barangay Disaster Risk Reduction and Management Committee (BDRRMC). 1.3 To develop and adopt Environmental Runoff Containment (Secondary Containment) and Diversion Protocol for firefighting activities in CIP1, ensuring contaminated water is prevented from entering the Cauang-Caung Creek by Q2 2028.

Outcome:

PPA Matrix: Goal 1 - Objective 1.1

Outcome: Formalized, legally-backed mechanisms for public-private security information sharing were established, which enhanced the BDRRMC's predictive capacity for civil unrest and arson risk.

This PPA Matrix for Goal 1, Objective 1, details a strategic initiative to institutionalize a legal mandate for public-private security information sharing to reduce the vulnerability of the barangay-industrial interface. The primary program involves conducting a multi-sectoral consultative workshop and drafting a formal Memorandum of Agreement (MOA) or Barangay Ordinance. Targeted stakeholders include the BDRRMC, the Punong Barangay, PNP Calamba, and various industrial park management entities. The plan outlines key outputs such as legal policy gap analysis reports and multi-stakeholder consultations scheduled to take place between Q1 and Q4 of 2027. With a total budget of ₱80,000, the project is funded through a combination of Barangay MOOE, LDRRM funds, and contributions from industrial partners.

PPA Matrix: Goal 1 - Objective 1.2

Outcome: The project achieved 100% compliance in annual Chemical Fire Risk Audits and necessitated the mandatory creation of a digitized, centralized SDS registry, which was made accessible to the BFP, BDRRMC, and CIP1 Fire Substation.

A strategic plan to enhance chemical safety and security at the boundary between industrial areas and the local barangay. The primary goal is to reduce the risk of civil unrest escalating into hazardous material incidents by 50% through improved legal mechanisms and fire prevention standards by late 2028. To achieve this, the plan mandates 100% compliance with annual chemical fire risk audits and the submission of Safety Data Sheets (SDS) to a centralized registry. Implementation involves a joint collaboration between the BDRRMC and BFP Calamba to digitize these records and conduct formal audits starting in 2027. The project is supported by a total budget of ₱100,000.00, sourced from various local government funds and industry contributions.

PPA Matrix: Goal 1 - Objective 1.3

Outcome: A formal, legally enforceable protocol was established, which ensured that firefighting water and chemical runoff was contained and diverted away from the Cauang-Cauang Creek, thereby mitigating Widespread Environmental Contamination.

The last objective for the goal represents a core infrastructure based mitigation strategy aimed at addressing the scenario's primary environmental impacts. Objective 1.3 requires the formal execution and establishment and legal implementation of a firefighting runoff containment protocol aimed at preventing chemically tainted water from entering the Cauang-Cauang Creek. This step alleviates the most significant long-term impact on the community as it addresses the risk of widespread environmental contamination stated in Phase 5 of the Multi-Hazard Scenario. The institutionalization of the protocol via Barangay Resolution guarantees enduring and enforceable environmental protection measures in the industrial-barangay interface.

B. ***Disaster Preparedness***

TABLE IX
GOAL 2 AND OBJECTIVES – PREPAREDNESS

GOAL 2	Establish a specialized, multi-sectoral capacity and resources needed for a unified response to civil unrest and chemical fire, achieving a 90% proficiency rating in joint public-private simulation exercises by December 2027.
OBJECTIVES	1.1 Conduct Train the Trainers (ToT) with the representatives of BFP, BQRT, CIP1 ERT and Locator's ERT in order to capacitate all stakeholders for cascading the Joint Industrial HazMat Response and Containment Protocols by Q4 2028. 1.2 Conduct DRRM capacity and knowledge building to clarify command and control for all stakeholders by Q3 2027. 1.3 Design and deploy a Barangay-Level Multi-Hazard Early Warning System (EWS) specialized for Toxic Smoke Plumes and Security Threats, ensuring 90% of residential areas adjacent to CIP1 receive immediate alerts by Q3 2028.

Outcome:

PPA Matrix: Goal 2 - Objective 2.1

Outcome: A certified corps of multi-sectoral trainers was created and equipped to implement and enforce the Joint Industrial HazMat Response and Containment Protocols (JIHRCP), which shifted institutional preparedness from Neutral (2.96) towards Agree (≥3.41).

The capacity-building program aims to improve the "Neutral" rating in the Institutional Preparedness by cultivating a multidisciplinary workforce of professionals and certified trainers. The PPA emphasizes the integration of specialized expertise in Civil Disturbance Management (CDM), HazMat Containment Protocol, and Emergency Medical Response into a unified Industrial HazMat Response and Containment Protocol. This PPA's objective guarantees that all stakeholders function within a unified operational framework by training members from PNP, BFP, and ERTs. The group of qualified trainers is essential for imparting consistent, advanced technical knowledge that is cascaded to all frontline responders, hence attaining the required 90% proficiency rating.

PPA Matrix: Goal 2 - Objective 2.2

Outcome: Conduct DRRM capacity and knowledge building to clarify command and control for all stakeholders by Q3 2027.

This objective establishes the essential command and control framework to oversee the complex and simultaneous requirements of human-induced hazard and chemical leak situations. The objective aims to clarify the authority, coordination channels, and command transfer protocols between public and private sector leaders via a Unified ICS and EOC standards. Implementing these protocols guarantees efficient and effective task assignment and cluster response approaches and mitigates possible friction that may impede a swift and timely response. The resulting clear, validated and tested ICS and EOC structures are essential during the early stages of a chaotic multi hazard scenario.

PPA Matrix: Goal 2 - Objective 2.3

Outcome: An active, targeted, and multi-platform EWS was operationalized, which enhanced the community's ability to respond to a chemical release (Toxic Smoke Plume) and addressed the "Strongly Agree" (4.41) urgency for EWS expressed in the survey.

PPA aims to establish and implement an advanced Early Warning System (EWS) specifically for chemical related leak or smoke. The technology will deliver a specific, multi-platform notification (SMS, Social Media Platforms, Siren, Public Announce System) more quickly than traditional communication channels, thereby addressing the community's elevated risk perception.

C. *Disaster Response*

TABLE X
GOAL 3 AND OBJECTIVES – RESPONSE

GOAL 3	Facilitate a swift, coordinated, and resource-abundant operational deployment to the incident location, reducing casualties and environmental contamination from human-induced civil-unrest to chemical fire by attaining an average BFP/ERT safe site access time of less than 10 minutes by December 2028.
OBJECTIVES	1.1 Establish a Mutual Aid and Resource Prepositioning Agreement with CIP1 locators to instantly deploy specialized HazMat equipment (e.g., firefighting foam, SCBA, containment materials) to the BDRRMC and BFP during emergencies by Q3 2027. 1.2 Achieve operational readiness for multi-hazard response by successfully conducting at least two (2) full-scale simulation exercises (Civil Unrest with Chemical Fire) before Q4 2028. The exercises will be used to demonstrate the functionality of ICS activation, EOC activation, and emergency access protocols in a high stress, complex scenario. 1.3 Secure and formalize the support of additional trained personnel to serve as emergency responders for multi hazard scenarios, such as civil unrest and chemical fires. This initiative aims to increase the number of available responders and establish a clear protocol for their rapid deployment by Q4 2028.

Outcome:

PPA Matrix: Goal 3 - Objective 3.1

Outcome: A formal, legally-backed Public-Private Mutual Aid Agreement was approved, which guaranteed immediate access to privately-owned specialized HazMat and rescue resources and ensured prepositioned BFP assets were locally maintained.

This PPA Disaster Response addresses the significant resource deficiency and centralized dependence that slow down emergency response. The objective formalizes a Public-Private Mutual Aid Agreement with industrial park locators, ensuring the immediate mobilization of privately owned HazMat response resources, including firefighting foam, self-contained breathing apparatus (SCBA), and specialized containment materials. By having this agreement, rapid access to critical equipment, the BFP and first responders will be able to bypass the bureaucratic approval process, thereby achieving the tough safe site access of less than 10 minutes. The signed agreement formalizes a resource partnership that is crucial for the management of high-severity chemical related fire incidents.

PPA Matrix: Goal 3 - Objective 3.2

Outcome: Verification confirmed that the Joint Industrial HazMat Response and Containment Protocols and the ICS and EOC Protocol (from Goal 2) enabled a BFP/ERT Safe Site Access time of less than minutes during a highly volatile scenario.

The presented PPA is the ultimate evaluation of the overall action plan, surpassing the fundamental preparedness drills. To evaluate the resilience of the command structure and coordination protocols in an emergency or crisis. The objective requires two (2) full-scale exercises (FSE) that utilize the actual Civil Unrest and Chemical Fire Scenario. Full-scale exercises are large-scale, complex, and require a lot of resources. They test how well a company or organization can handle emergencies in a real-life setting. It includes a lot of different agencies, groups, and areas of government, and it combines "boots on the ground" field reaction with the functions of an emergency operations center. FSEs will rigorously measure the quantifiable metric of Safe Site Access Time for BFP and ERTs, ensuring the < 10-minute target is achievable in a dynamic, high-volatility situation. After-Action Reviews (AARs) from these simulations will provide the verifiable indicators needed to justify the overall 50% vulnerability reduction goal.

PPA Matrix: Goal 3 - Objective 3.3

Outcome: An expanded, multi-sectoral pool of trained personnel was formalized via a registry, which overcame the existing weakness of low

PNP/BFP personnel-to-population ratio and the BDRRMC's lack of manpower.

The PPA mitigates the significant deficiency of inadequate on-site personnel during a multi-hazard disaster by establishing auxiliary or force multiplier personnel and certified volunteers. These personnel will undergo cross-training in fundamental support functions. Therefore, the PNP and BFP personnel will focus on high-risk HazMat and public peace and order operations. Institutionalizing the group formalizes a vital surge in the capability of the BDRRMC.

D. ***Disaster Rehabilitation and Recovery***

TABLE XI
GOAL 3 AND OBJECTIVES – REHABILITATION AND RECOVERY

GOAL 4	Implement a sustainable, legally supported, and inclusive recovery program that ensures long-term economic stability and comprehensive environmental remediation, achieving 80% site remediation and economic aid to affected families within one-year post-incident.
OBJECTIVES	1.1 Mandate and institutionalize a policy requiring CIP1 locators to acquire All-Risk Industrial Insurance (or Environmental Impairment Liability insurance) that includes a legally designated portion of proceeds for immediate community environmental remediation and non-resident employee financial support by Q4 2029. 1.2 Partner with the CLDD, DOLE and CIP1 locators to establish a support or similar TUPAD program ensuring affected workers receive aid within 3 months post-incident by Q4 2029. 1.3 Develop a Long-Term Environmental and Health Surveillance Program for the Cauang-Cauang Creek and residential zones for five years post-incident to monitor for chronic chemical contamination by Q2 2028 – Q2 2033.

Outcome:

PPA Matrix: Goal 4 - Objective 4.1

Outcome: A formal, legally-backed Public-Private Mutual Aid Agreement was approved, which guaranteed immediate access to privately-owned specialized HazMat and rescue resources and ensured prepositioned BFP assets were locally maintained.

This discusses the essential financial mechanisms by transforming the risk into fiscal capacity for recovery. This pivotal project institutionalizes a legally supported mechanism for financial risk transfer, fundamentally addressing the systemic challenge of inadequate disaster rehabilitation funding (SWOC/PESTEL Economic Factors). The objective is to secure the adoption of the LGU's Mandatory Environmental Impairment Liability Ordinance, leveraging the local government's legislative authority for public welfare (RA 7160) to enforce industry fiscal accountability. The allocated ₱150,000 specifically targets the procurement of expert legal and fiscal consultancy, ensuring thepolicy is rigorously drafted, fiscally defensible, and successfully compels industrial park locators to dedicate insurance proceeds for environmental remediation and non-resident employee financial support. This formal financial engineering action is critical to achieving the goal of distributing economic aid within the five-year post-incident timeline.

PPA Matrix: Goal 4 - Objective 4.2

Outcome: A formal Public-Private-National Government Agreement was established, which provided immediate employment or financial support to workers displaced by the facility closure or damage.

This PPA ensures an inclusive and sustainable recovery approach by proactively mitigating the socio-economic disruption caused by work displacement following a facility's temporary shutdown or damage. This initiative directly addresses Goal 4, which seeks a legally supported, comprehensive recovery program, and Objective 2, which targets aid distribution within three months post-incident.

PPA Matrix: Goal 4 - Objective 4.3

Outcome: The project institutionalized a five-year, post-incident surveillance program, which ensured early detection and mitigation of chronic health and environmental contamination issues.

This addresses the analysis in the PESTEL Environmental Factors. This commitment to multi-year, science-based surveillance guarantees the detection and mitigation of chronic contamination, confirming adherence to restoration standards and validating the overall achievement of the 80% target.

The 80% target represents a high-efficiency threshold for humanitarian and government aid delivery. This target ensures the program is judged successful not just by its existence, but by its reach, guaranteeing that the vast majority of documented affected 107 families receive support (e.g., LSCWP/TUPAD aid) within the critical first year (12 months) of recovery. The resulting percentage must be ≥ 80% within 12 months post incident. As the baseline, the total number of affected workers and residents will be verified and registered by the social workers.

TABLE XII
TOTAL BUDGET FORECAST

Programs, Projects, and Activities	
PPA Budget Summary	
Goal 1	305,000.00
Goal 2	4,269,000.00
Goal 3	995,000.00
Goal 4	455,000.00
	6,024,000.00

The total budget forecast for the Programs, Projects, and Activities (PPAs) is P6,024,000, as shown in Table XII. This figure is contextualized by the Barangay Canlubang Annual Budget for Fiscal Year 2026, estimated by the Barangay Secretary at P175,000,000. Furthermore, this figure is projected to increase progressively over the subsequent years.

TABLE XIII
BARANGAY CANLUBANG BUDGET FOR FY 2026

Barangay Canlubang Budget for FY 2026		
Annual Budget of Barangay Canlubang for Fiscal Year 2026 - P175,000,000.00		
Fund	**Percentage**	**Amount**
Barangay Disaster Risk Reduction and Management Fund	5% of the Total Budget	P8,750,000.00
Preparedness, Prevention, and Rehabilitation	70% of BLDRRMF	P6,125,000.00

The foundation of the Action Plan's funding is the Local Disaster Risk Reduction and Management Fund (LDRRMF). A significant portion of the estimated budget, specifically ₱8,750,000, is allocated to this fund, representing the mandated five percent (5%) of the Annual Barangay Budget. Crucially, ₱6,125,000. Seventy percent (70%) of the LDRRMF is explicitly designated for preparedness, prevention, and rehabilitation programs.

The funding strategy further anticipates substantial industry contributions, leveraging the Park Management Fund (including Safety Committee and Security Budget allocations) and dedicated Corporate Social Responsibility (CSR) initiatives or direct donations. This layered financial approach ensures robust, multi-sectoral resourcing beyond the mandated LDRRMF.

Consequently, the total forecasted budget required for the Programs, Projects, and Activities (PPAs) of this Action Plan is strategically positioned to be reasonably within the cumulative budgetary capacity. The implementation of these key PPAs will be managed incrementally, phased across Fiscal Year 2026 and subsequent years, ensuring fiscal sustainability and continuous program development.

IV. MONITORING AND EVALUATION

The suggested strategic measures aimed at safeguarding the barangay-industrial interface in Calamba City. The assessment verifies that the plan's principal objective is to diminish the likelihood of civil disturbance escalating into arson or hazardous material incidents by 50% by December 2028.

The plan outlines the "Dual-Focus Chemical Safety and SDS Submission" initiative, aimed at attaining 100% audit compliance for all industrial locators. A key element of this assessment is the effective establishment of a digitized, centralized Safety Data Sheet (SDS) registry available to emergency responders. The publication evaluates the "Firefighting Runoff Protocol," designed to safeguard the Cauang-Cauang Creek from chemical pollution. This environmental goal is assessed by the implementation of legally mandated secondary containment measures for all firefighting operations in the CIP1 area.

The assessment underscores the imperative of collaborative efforts among the BDRRMC, Bureau of Fire Protection (BFP), and CENRO to guarantee operational efficacy. Stakeholder engagement is monitored by official Memorandums of Agreement (MOA) and the establishment of standardized standards. The chapter assesses the distribution of ₱225,000.00 between these two particular objectives. Funding is confirmed to consist of a combination of local government LDRRM funds and obligatory industry payments. The timeline evaluation verifies that essential milestones, including the SDS inventory, are scheduled for completion by the fourth quarter of 2027.

Additionally, the concept encompasses collaborative modelling exercises to evaluate the efficacy of the improved runoff techniques. The assessment underscores that these legislative and technical frameworks are crucial for closing the safety intelligence gap between the community and the industrial park. In conclusion, the chapter asserts that these linked PPAs (Programs, Projects, and Activities) offer a systematic framework for enduring multi-hazard risk mitigation. By 2028, the efficacy of the intervention will be evaluated based on its capacity to uphold environmental integrity and industrial safety and security concurrently.

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