



ENHANCED LOCAL
**CLIMATE
CHANGE
ACTION PLAN**

2023-2032
CITY OF MALOLOS



Republika ng Pilipinas
Lalawigan ng Bulakan
Lungsod ng Malolos

TANGGAPAN NG SANGGUNIANG PANLUNGSOD

HANGO SA KATITIKAN NG IKA-23 KARANIWANG PULONG NG SANGGUNIANG PANLUNGSOD NG MALOLOS NA GINANAP SA BULWAGANG PULUNGAN NG SANGGUNIANG (ANNEX), IKA-LIMANG PALAPAG NG BAGONG GUSALI NG PAMAHALAANG LUNGSOD NG MALOLOS NOONG IKA-05 NG DISYEMBRE, 2022.

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KAPASITYAHANG PANLUNGSOD BLG. 335-2022

ISANG KAPASITYAHANG PANLUNGSOD NA PINAGTITIBAY AT INA-ADOPT ANG LOCAL CLIMATE CHANGE ACTION PLAN (LCCAP) 2023-2032 NG LUNGSOD NG MALOLOS PARA SA DISEMINASYON AT IMPLEMENTASYON BILANG PAGHAHANDA SA MGA POSIBLENG BANTA AT PANGANIB NA DULOT NG PAGPAPANIBAGO NG KLIMA (CLIMATE CHANGE).

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SAPAGKAT, ang City of Malolos Local Climate Change Action Plan (LCCAP) 2023-2032 ay nabuo ng LCCAP Technical Working Worp at LCCAP Core Team;

SAPAGKAT, ang LCCAP Technical Working Worp at LCCAP Core Team, kasama ang ilang piling kawani ay dumaan sa mga pagsasanay at pakikipag-ugnayan sa Department of Interior and Local Government (DILG), City Disaster Risk Reduction and Management Council (CDRRMC) at mga Pamahalaang Barangay upang makabuo ng plano bilang paghahanda sa mga posibleng banta ng panganib na maaaring idulot ng pagpapanibago ng klima (climate change) sa mga mamamayan;

SAPAGKAT, ang nasabing plano ay titiyak sa kahandaan ng Pamahalaang Lungsod sa anumang sakuna na maaring harapin sa mga darating na panahon;

SAPAGKAT, sang-ayon sa itinatadhana ng RA 7160, kilala sa taguring Local Government Code of 1991 partikular sa Seksyon nito na naghahayag na tungkulin ng Pamahalaang Lokal na isulong ang kagalingang panlahat, kaya

Sa pamamagitan ng kahilingan ni Kgg. Emmanuel R. Sacay na sinang-ayunan ng lahat, ay

IPINASIYA, gaya ng dito ay ginagawang pagpapasiya na pagtibayin at i-adopt ang Local Climate Change Action Plan (LCCAP) 2023-2032 ng Lungsod ng Malolos para sa diseminasyon at implementasyon bilang paghahanda sa mga posibleng banta at panganib na dulot ng pagpapanibago ng klima (climate change).

PINAGTIBAY.

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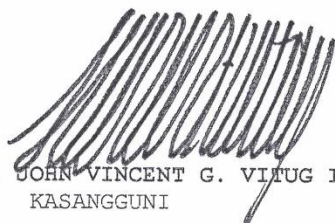
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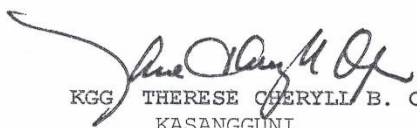

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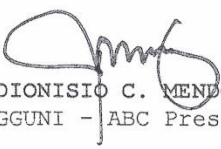

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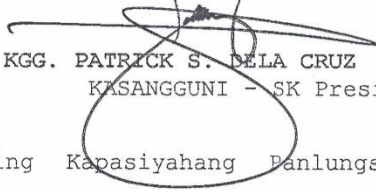

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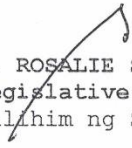

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PINATUTUNAYAN ko, na ang nasabing Kapasiyahang Panlungsod ay pinagtibay ng Sanggunian.


MA. ROSALIE SP. CRUZ
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Pansamantalang Kalihim ng Sangguniang Panlungsod

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KGG. MIGUEL ALBERTO T. BAUTISTA
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FOREWORD

Climate Change refers to change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods. Climate change is caused by both natural events and human activity.

Pursuant to Republic Act No. 9729 or Climate Change Act of 2009, the City Government of Malolos along with other Local Government Units (LGUs) consistent with the provisions of Local Government Code, the Framework, and the National Climate Change Action Plan (NCCAP) was mandated to formulate, plan and implement Climate Change Action Plan (CCAP) in their respective areas.

The City Government of Malolos recognizes that our climate is changing and that there is a need for the City to adapt to the changes that is occurring, and the changes that is likely to follow in the decades to come.

The City also understands that some climate change impacts will develop slowly, while others will be in the form of big events and will need to adapt and be ready for these events.

Adaptation is about taking action to avoid, manage or reduce the consequences that will be brought about from climate events. Adapting to climate change must be integrated into day-to-day planning and risk management activities of Local Government and this discipline must be transferred within local communities.

The City Government of Malolos, in partnership with the Department of Interior and Local Government (DILG), the League of Local Planning Development Coordinator-Bulacan Chapter, Provincial Government of Bulacan and Climate Change Commission, has developed this Local Climate Change Action Plan (LCCAP) to address impacts of climate change that will create various challenges for Local Government, impacting not only on the environment but the City's business operations and its communities.

The LCCAP provides a strategic framework for actions that target a number of key environmental areas and environmental threats.

The City's implementation of actions to assist in adapting to our changing climate will help further its aim to sustain communities, protect and enhance the environment, as well as open up opportunities to foster economic prosperity within the Region and the country as well.

The City acknowledges that this Action Plan is one of the first steps in the adaptation process and that climate change needs to be addressed in an ongoing and sustained manner. As such, the LCCAP will need to be regularly reviewed over time, in light of new events or knowledge that comes to hand in relation to the impacts of climate change, in order to develop and expand on local government adaptation actions.

Adoption and implementation of the LCCAP will enable the city to establish local government leadership in the area of climate change adaptation and mitigation.



ACKNOWLEDGEMENT

The preparation of this report required considerable effort, resources and coordination between the City's relevant officers and staff, Non-Government Organizations (NGOs), Civil Society Organizations (CSOs), Barangay Officials, Government Agencies and the LCCAP Core Team. The City Government of Malolos would like to thank its staff members for their contribution and support in this process. The City would especially like to thank all personnel, offices, agencies especially the LCCAP Core Team who provided input into the development of formulated Local Climate Change Action Plans during two workshops, discussions, consultations and other key related activities.

The actions included in the LCCAP were identified by the above group during the workshops and other related activities.

Many individuals participated in a large number of consultations including at the county level. This reflects the dedication invested by the people of the City of Malolos in the process of making the city more climate-resilient and means the Action Plan responds to the most pressing climate change issues affecting the city.

Reaching this significant milestone in City of Malolos response to climate change would not have been possible without the generous support provided by Government Officials headed by Honorable Mayor Christian D. Natividad and Honorable Vice Mayor Miguel Alberto T. Bautista in providing all the needed support including financial resources.

The City Government of Malolos is committed to the implementation of the Local Climate Change Action Plan (LCCAP) and invites all partners and stakeholders to join in delivering the prioritized actions for the benefit of the city. We must look forward to seeing the fruits of all the efforts in a more climate resilient and low carbon Malolos.



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ACRONYMS AND ABBREVIATIONS

AIP	Annual Investment Plan
BDRRMC	Barangay Disaster Risk Reduction Management Council/Committee
BFAR	Bureau of Fisheries and Aquatic Resources
BFP	Bureau of Fire Protection
BMC	Bulacan Medical Center
BNS	Barangay Nutrition Scholars
CAgO	City Agriculture Office
CC	Climate Change
CCA	Climate Change Adaptation
CDP	City Development Plan
CDRRMO	City Disaster Risk Reduction and Management Office
CENRO	City Environment and Natural Resources Office
CEO	City Engineering Office
CFARMC	City Fisheries, Aquatic Resource Management Council
CGM	City Government of Malolos
CGSO	City General Services Office
CHED	Commission on Higher Education
CHO	City Health Office
CLUP	Comprehensive Land Use Plan
CMO	City Mayor's Office
CPDO	City Planning and Development Office
CSOs	Civil Society Organizations
CSWDO	City Social Welfare and Development Office
CTECO	City Training, Employment and Cooperative Office
DA	Department of Agriculture
DBM	Department of Budget and Management
DENR	Department of Environment and Natural Resources
DepEd	Department of Education
DILG	Department of the Interior and Local Government
DOH	Department of Health
DPWH	Department of Public Works and Highways
DR	Disaster Risk
EWSs	Early Warning Systems
HLURB	Housing and Land Use Regulatory Board
HOAs	Home Owners Association
HUDCC	Housing for Urban Development and Coordinating Council
IEC	Information and Education Campaign
IT	Information Technology
LCCAP	Local Climate Change Action Plan
LCE	Local Chief Executive



LGUs	Local Government Units
LSB	Local School Board
LSP	Local Shelter Plan
MWD	Malolos Water District
MWSS	Metropolitan Waterworks and Sewerage System
NCCAP	National Climate Change Action Plan
NFSCC	National Framework Strategy on Climate Change
NGOs	Non-Government Organization
NHA	National Housing Authority
NIA	National Irrigation Administration
OCA	Office of the City Administrator
OCD	Office of Civil Defense
P/R/NDRRMC	Provincial/Regional/National Disaster Risk Reduction Management Council
PAO	Provincial Agriculture Office
PDP	Philippine Development Plan
PENRO	Provincial Environment and Natural Resources Office
PNP	Philippine National Police
PPAs	Programs, Projects and Activities
PRC	Philippine Red Cross
RDSWD	Regional Department of Social Welfare and Development
RHUs	Rural Health Units
SAR	Search and Rescue
SP	Sangguniang Panlungsod
TWG	Technical Working Group
VGs	Volunteer Groups
VMO	Vice mayor's Office
WITF	Waterways and Irrigation Task Force



DEFINITION OF TERMS

Adaptation	the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.
Adaptation	refers to the adjustment in natural or human system in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities; refers to the ability of ecological, social or economic systems to adjust to climate change, variability and extremes, as well as moderate or offset potential damages, and take advantage of associated opportunities (IPCC 2007). It also implies the ability to anticipate hazard or perturbation (UNDP 2010). It determines whether the system absorbs changes without damage or whether these changes will lead to negative consequences.
Adaptive Capacity	is the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.
Adaptive Capacity	the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with consequences; a function of wealth, technology, institutions, information, infrastructures, “social capital”;
Anthropogenic causes	refers to causes resulting from human activities or produced by human beings
Anthropogenic Climate Change	the component of climate change that is caused by humans. Scientist are certain that Global Warming has started and that the warming of the planet will be faster than at any time in the last several hundred thousand years which will cause major disturbances in ocean currents, weather and ecosystems.
Autonomous Adaptation	refers to reactive, incremental or spontaneous adaptation, geared towards meeting present climate conditions or challenges
Brainstorming	free flowing lists/diagrams of all ideas and options
Capacity	a combination of all strengths and resources available within a community, society or organization that can reduce the level of risk, or effects of a disaster. Capacity may include infrastructure and physical means, institutions, societal coping abilities, as well as human knowledge, skills and collective attributes such as social relationships, leadership and management. Capacity may also be described as capability.



Civil Society Organizations	non-state actors whose aims are neither to generate profits nor to seek governing power. CSOs unite people to advance shared goals and interests. They have a presence in public life, expressing the interests and values of their members or others, and are based on ethical, cultural, scientific, religious or philanthropic considerations. CSOs include nongovernment organizations (NGOs), professional associations, foundations, independent research institutes, community-based organizations (CBOs), faith-based organizations, people's organizations, social movements and labor unions.
Climate	refers to average weather over long periods of time, typically at a 30year average
Climate Change	refers to a statistically significant variation in the average condition of climate or in its variability that persists for decades, or longer, caused by both natural processes and human impacts, such as greenhouse gas emissions (World Bank 2010)
Climate Change	a change in climate that can be identified by changes in the mean and/or variability of its properties and that persists for an extended period typically decades or longer, whether due to natural variability or as a result of human activity,
Climate Change Adaptation	refers to policies, actions, and other initiatives designed to limit the potential adverse impacts arising from climate variability and change (including extreme events), and exploit any positive consequences” (ADB 2005). Adaptation is geared towards reducing climate change adverse impacts and risks in order to reduce vulnerability
Climate Change Impact	refers to a change in natural and human systems, whether harmful or beneficial resulting from climate change (IPCC 2007). Climate change can impact on the agricultural system by introducing new stressors into the system, and/or exacerbating existing stressors. To illustrate, it has been projected that up to 30% of plant and animal species could go extinct if the global temperature increase exceeds 1.5-2.5°C, and crop yields in tropical zones could significantly decrease with even a modest temperature increase of 1-2°C (IUCN).
Climate Change is...	... attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods.
Climate Change Mitigation	refers to policies, actions and other initiatives that reduce the net emissions of greenhouse gases, such as CO ₂ , CH ₄ , N ₂ O, and ozone that cause climate change through global warming. Examples of activities that mitigate or prevent greenhouse gases emissions are: a) use of renewable energy; b) clean fuel; c) reduction of emission through avoided deforestation and forest degradation; d) sustainable forest management; and e) conservation and enhancement of carbon stocks. Examples of activities that remove greenhouse gases from the atmosphere are reforestation and geo-engineering (ADB 2005).



Climate Extremes	refers to climate and weather events that occur rarely at a particular place and time of the year, with peaks and lows outside the range of expected distribution, such as extremely hot temperature or unseasonal rainfall.
Climate Hazards	refers to potentially damaging physical manifestations of climatic variability or change, such as droughts, floods, storms, episodes of heavy rainfall, long-term changes in the mean values of climatic variables, and potential future shifts in climatic regimes, among others (Brooks 2003).
Climate Mainstreaming	refers to integrating climate concerns and adaptation responses into relevant policies, plans, programs and projects at the national, sub-national and local scales. The long-term goal is to integrate CCA into public policy across sectors, weave it into organizational missions and routinely consider it in decisions about development. As climate change and its impacts are cross-cutting issues, adaptation measures are seldom undertaken solely in response to climate change, but superimposed into other ongoing initiatives and governance frameworks within the scope of development goals, such as CC adaptation in agriculture interwoven with initiatives of other sectors, namely: poverty alleviation, water supplies, public health, disaster risk reduction and management and biodiversity conservation (USAID 2009, IPCC 2007).
Climate Proofing	this involves: a) identifying risks to a development project, natural or human asset, as a consequence of current and future climate variability and change; b) ensuring that identified risks are reduced to acceptable levels through long-lasting and environmentally sound, economically viable, and socially acceptable changes; c) implementing changes at one or more of the following stages in the project cycle: planning, design, construction, operation, and decommissioning (ADB 2005).
Climate Resilience	refers to the ability of a system, community or society exposed to hazards to resist, absorb, accommodate, and recover from the effects of a hazard in a timely and efficient manner, including the preservation and restoration of its essential basic structures and functions (UNISDR 2009). Improved adaptation can help develop resiliency.
Climate Risk	refers to the product of climate and related hazards working over the vulnerability of human and natural ecosystems.
Climate Variability	refers to variations in climatic conditions (average, extreme events, among others) on time and space scales beyond individual weather events, but not persisting for extended periods (shorter term than climate change) (ADB 2005)
Demographic Disaster	population, concentration, mobility, density, growth occurs when adverse impacts produce widespread damage and cause severe alterations in the normal functioning of communities or societies (IPCC 2011)



Disaster	a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope causing its own resources. Disasters are often described as a result of the combination of: the exposure to a hazard; the conditions of vulnerability that are present; and insufficient capacity or measures to reduce or cope with the potential negative consequences, Disaster impacts may include loss of life, injury, disease and other negative effects on human, physical, mental and social well-being, together with damage to property, destruction of assets, loss of services, social and economic disruption and environmental degradation.
Disaster Mitigation	refers to a policy development, policy on geo-strategic interventions, short-term policy on setting of curfew, prohibition of human activities in the danger zones, disposition of relief and donations, integration of disaster risk reduction to CLUP, community training and public awareness on structural, non-structural disaster mitigation requirements.
Disaster Preparedness	refers to hazard assessment, documentation of risk areas and mapping, research and planning for crisis administration, education and training / drills in LGUs, road safety and technical assistance to cities, municipalities and barangay disaster coordinating councils as well as the various schools and universities and the business sectors. Developed warning criteria on floods, landslides and mudflows.
Disaster Response Operations	refers to overall administration and coordination of disaster response activities such as execution of emergency plans, communication and information management, monitoring of disaster situation, stabilizing the crisis situation, provide ambulant services to the distress victims, command post and the likes.
Disaster Risk Index (DRI)	refers to the model developed to assess what countries are most at risk from hazards, such as droughts, floods, cyclones and earthquakes, based on observed past losses and their relation to population exposure and vulnerability. The DRI is used for the annual ranking of countries in terms of human vulnerability linked mostly with country development level and environmental quality.
Disaster Risk Index (DRI)	which aims at monitoring the evolution of risk, assessing what countries are most at risk requires considering various types of hazards, such as. Before assessing risk, these four hazards were modeled using GIS and overlaid with a model of population distribution in order to extract human exposure. Human vulnerability was measured by crossing exposure with selected socio-economic parameters. The model evaluates to what extent observed past losses are related to population exposure and vulnerability. Results reveal that human vulnerability is mostly linked with country development level and environmental quality.



Early Warning System	the set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss. A people-centered early warning system necessarily comprises four (4) key elements: knowledge of the risks; monitoring, analysis and forecasting of the hazards; communication or dissemination of alerts and warnings; and local capabilities to respond to the warnings are received. The expression "end-to-end warning system" is also used to emphasize that warning systems need to span all steps from hazard detection to community response.
Emergency	Unforeseen or sudden occurrence, especially danger, demanding immediate action.
(Strategic) environmental impact assessments	mental impacts taken into account before deciding on development
Exposure	refers to the nature and degree to which a system is exposed to Significant climatic variations (IPCC). It depends on frequency, magnitude, intensity and duration of climate stressor, such as El Niño, La Niña, temperature rise, sea level rise, tropical cyclone and other extreme events. For example, an intensifying cyclone may lead to the increased risks of climate-induced hazards such as floods and landslides, and their impacts.
Exposure	what is at risk from climate change (e.g. population, resources, property) and the change in climate itself (e.g. sea level rise, temperature, perception, extreme events).
Extreme Events	
Flood	is defined as a rise, usually brief, in the water level in a stream to a peak from which the water level recedes at a slower rate (Excess Water)
Flooding	a great flow of water that rises and spreads over the land. may result when a volume of water from lakes/streams/ rivers exceeds its carrying capacity and escapes from its usual boundaries
Focus groups	groups of stakeholders that discuss their opinions on certain topics
Framework	Structure, organization
Geographic	location, contour, features, etc.
Global warming	refers to the increase in the average temperature of the Earth's near-surface air and oceans that is associated with the increased concentration of greenhouse gases in the atmosphere.
Greenhouse Effect	– refers to the process by which the absorption of infrared radiation by the atmosphere warms the Earth.
Greenhouse Gases	refers to constituents of the atmosphere that contribute to the greenhouse effect including, but not limited to, carbon dioxide, methane, nitrous oxide, hydroflourocarbons, perflourocarbons and sulfur hexaflouride.
Greenhouse Gases (GHG)	those gaseous constituents of the atmosphere, either natural or anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere and clouds.



Hazard	danger, risk, calamity/ it is defined as the intrinsic property, characteristics, or condition of a material or system that has the potential to cause harm. (PANGANIB)
Human Development Index (HDI)	refers to a composite statistic of life expectancy, education, and income indices to rank countries into four tiers of human development. It was created by economist MahbubulHaq, followed by economist AmartyaSen in 1990, and published by the United Nations Development Programme.
Mainstreaming	refers to the integration of policies and measures that address climate change into development and sectoral decision making.
Mitigation	within the context of climate change, refers to human intervention to address anthropogenic emissions by sources and removal by sinks of all GHG, including ozone-depleting substances and their substitutes.
Mitigation	structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation, and technological hazards and to ensure the ability of at-risk communities to address vulnerabilities aimed at minimizing the impact of disasters. Such measures include, but are not limited to, hazard-resistant construction and engineering works, the formulation and implementation of plans, programs, projects and activities, awareness raising, knowledge management, policies on land-use and resource management, as well as the enforcement of comprehensive land-use planning, building and safety standards, and legislation.
Mitigation potential	refers to the scale of GHG reductions that could be made, relative to emission baselines, for a given level of carbon price
Planned adaptation	refers to anticipatory, pro-active and transformative adaptation based on awareness of long-term future changes in climate conditions.
Preparedness	pre-disaster actions and measures being undertaken within the context of disaster risk reduction and management and are based on sound risk analysis as well as pre-disaster activities to avert or minimize loss of life and property such as, but not limited to, community organizing, training, planning, equipping, stockpiling, hazard mapping, insuring of assets, and public information and education initiatives.
Private Sector	the key actor of the economy where the central social concern and process are the mutually beneficial production and distribution of goods and services to meet the physical needs of human beings. The private sector comprises private corporations, households and nonprofit institutions serving households.
Recovery	refers to damage assessment, rehabilitation planning and secure funding. Organizing of disaster recovery and development team through cluster approach.
Rehabilitation	measures that ensure the ability of affected communities/ areas to restore their normal level of functioning by rebuilding livelihood and damaged infrastructures and increasing the community's organizational capacity.
Resilience	the ability of a system, community or society exposed to hazards to resist, absorb, accommodate and recover from the effects of a hazard in a timely



and efficient manner, including through the preservation and restoration of its essential basic structures and functions.

Response	any concerted effort by two (2) or more agencies, public or private, to provide assistance or intervention during or immediately after a disaster to meet the life preservation and basic subsistence needs of those people affected and in the restoration of essential public activities and facilities.
Risk	is defined as the likelihood of an adverse effect, direct or indirect, on human health and welfare. Risk is mathematically expressed as the product of hazard, exposure and vulnerability
Risk	refers to a measure of the likelihood of exposure to a hazard and the consequence/impact of that hazard such as the probability of being struck by flood and the magnitude of the impact of the flood measured in terms of cost of crop damage; the higher the probability of the occurrence of a hazard and the higher its impact, the higher the risk.
Risk Assessment	a methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihood and the environment on which they depend. Risk assessments with associated risk mapping include: a review of the technical characteristics of hazards such as their location, intensity, frequency and probability; the analysis of exposure and vulnerability including the physical, social, health, economic and environmental dimensions; and the evaluation of the effectiveness of prevailing and alternative coping capacities in respect to likely risk scenarios.
Risk Reduction	the concept and practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposures to hazards, lessened vulnerability of people and property, wise management of land and the environment and improved preparedness for adverse events.
Risk Reduction and Management	systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster. Prospective disaster risk reduction and management refers to risk reduction and management activities that address and seek to avoid the development of new or increased disaster risks, especially if risk reduction policies are not put in place.
Sea level Rise	refers to increase in sea level which may be influenced by factors like global warming through the expansion of sea water as the oceans warm and melting of ice over land, as well as other local factors such as land subsidence.
Sensitivity	is the degree of biophysical effects of climate change which also considers the socioeconomic context of the system being assessed
Sensitivity	the biophysical effect (e.g. flooding, strong winds, land inundation, etc) of climate change which also considers the socioeconomic context of the system being assessed.



Sensitivity	refers to the degree to which a system is affected, either adversely or beneficially, by climate-induced hazards such as landslides, flashfloods or drought. More sensitive areas are likely to sustain more serious damage or impact.
Stakeholder consultation	consultation with individuals and/or groups affected by future processes
State of Calamity	a condition involving mass casualty and/or major damages to property, disruption of means of livelihoods, roads and normal way of life of people in the affected areas as a result of the occurrence of natural or human-induced hazard.
Susceptible	at risk, prone, having a tendency, subject
Sustainable Development	development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two (2) key concepts: (1) the concept of "needs", in particular, the essential needs of the world's poor, to which overriding priority should be given; and (2) the idea of limitations imposed by the state of technology and social organizations on the environment's ability to meet present and future needs. It is the harmonious integration of a sound and viable economy, responsible governance, social cohesion and harmony, and ecological integrity to ensure that human development now and through future generations is a life-enhancing process.
Vulnerability	the degree to which the exposed elements will suffer a loss from the impact of a hazard. "Vulnerability" ~ the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard. Vulnerability may arise from various physical, social, economic, and environmental factors such as poor design and construction of buildings, inadequate protection of assets, lack of public information and awareness, limited official recognition of risks and preparedness measures, and disregard for wise environmental management.
Vulnerability	the degree to which a system is susceptible to, or unable to cope with adverse effects of climate change, including climate variability and extremes. Is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its capacity.
Vulnerability	refers to the extent to which a natural or human system is susceptible to sustaining damage resulting from climate variability and change, despite human actions to moderate or offset such damage, as a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity and its adaptive capacity (ADB 2005).
Vulnerable	helpless, in danger, in a weak position, defenseless
Vulnerable and Marginalized Groups	those that face higher exposure to disaster risk and poverty including, but not limited to, women, children, elderly, differently-abled people, and ethnic minorities.
Vulnerable and marginalized groups	refers to groups or communities who face higher exposure to disaster risk and aggravated poverty including, but not limited to, children, elderly, differently-abled people and indigenous peoples



Weather

refers to conditions of the atmosphere over a short period of time, the temperature, wind, humidity (rainfall) and cloudiness, among others experienced day to day.



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**SECTION 1:
BACKGROUND**

SECTION I. BACKGROUND

A. INTRODUCTION

As the country is situated in the Pacific Ring of Fire, the Philippines is prone to the impacts of natural hazards. In the latest Global Assessment Report (GAR), the International Strategy for Disaster Reduction (ISDR) placed the Philippines third among the most disaster-prone countries in the world by virtue of its exposure to natural hazards and the vulnerability of its exposed population. This situation is aggravated by new external threats like climate change which was induced more intense meteorological and meteorologically triggered hazard events within the last decade, resulting in increased deaths and devastation, especially in areas unprepared for such phenomena. Examples are the rain-induced landslides in Quezon province in 2004 and Leyte in 2005, extreme flooding in Metro Manila and its environs in 2009, and recently the flash floods and landslides that hit Cagayan de Oro City and Iligan City in late 2011 are manifestations of heightened disaster risks to the Philippines from a rapidly changing climate.

Climate change is the most serious global challenge of our time. Seeing the need for legislation, Republic Act No. 9729 was enacted in 2009. It is also known as Climate Change Act of 2009. The law aims to mainstream climate change adaptation into government policy and establish a framework strategy. RA No. 9729 created the Climate Change Commission. Government agencies and LGUs are to allocate from their annual appropriations enough funds for formulation, development and implementation of projects under this Act. Amending the Climate Change Act, Republic Act No. 10174 established the People's Survival Fund in 2012 to provide long-term financing to projects to address the problem of climate change. The Climate Change Act of 2009 recognized the importance of climate change impacts for Philippine development.

The formulated National Climate Change Action Plan developed is the logical next step to enable the Philippines to reduce vulnerability to climate change and to improve our country's ability to take advantage of the opportunities that climate change offers.

Scientific modelling indicates that the Philippines, including the City of Malolos and Bulacan Province will continue to be hard hit by forecast reductions in rainfall, increased temperatures, increased extreme weather events and further reductions in surface and groundwater resources.

The forecasted changes to the climate will create challenges for all levels of government, including the Local Government sector. Some of the key challenges for the City are likely to be the impacts on infrastructure, land use planning, human health, biodiversity, environmental health, fire and emergency services. Other broader key risks include the potential for changing economic viability of local industries and social dislocation.

Adaptation is about taking action to avoid, manage or reduce the consequences that will be brought about from our changing climate. Effective adaptation also requires recognizing and taking advantage of the opportunities that new markets and new skills may present.



City Government of Malolos in response to RA 9729 will allocate from its annual appropriations enough funds for formulation of Local Climate Change Action Plan (LCCAP), development and implementation of projects under this Act. The LCCAP provides a suite of actions that the City can implement to adapt to the anticipated impacts of climate change. Formulation of the (LCCAP) will help ensure that the City has the capacity and knowledge to adapt to these changing circumstances and can continue to provide a safe and peaceful environment promoting a harmonious high-quality lifestyle to our community.

A.1 Brief Profile of the City of Malolos

A.1.1 Location, Land Area, and Political Subdivisions

The City of Malolos lies in the southern portion of the Province of Bulacan approximately within the longitudinal coordinates $120^{\circ} 46' 48.50''$ E and $120^{\circ} 51' 53.00''$ E and within the latitudinal coordinates $14^{\circ} 45' 26.00''$ N and $14^{\circ} 53' 29.86''$ N. It belongs to the five (5) coastal towns of Bulacan with a coastline reaching to more than 4 kilometers. It is accessible by land through the Manila North Road, which is about 40 kilometers north of Manila.

There are five (5) municipalities surrounding the City of Malolos. Two (2) of which also belongs to the coastal towns of Bulacan, the Municipalities of Paombong and Bulakan located on the western and eastern part respectively. The rest of the municipalities surrounding the city are part of the lowland towns of Bulacan comprising the Municipality of Plaridel on the north, the Municipality of Guiguinto on the east and the Municipality of Calumpit on the west. The southernmost part of the city is bounded by the Manila Bay.

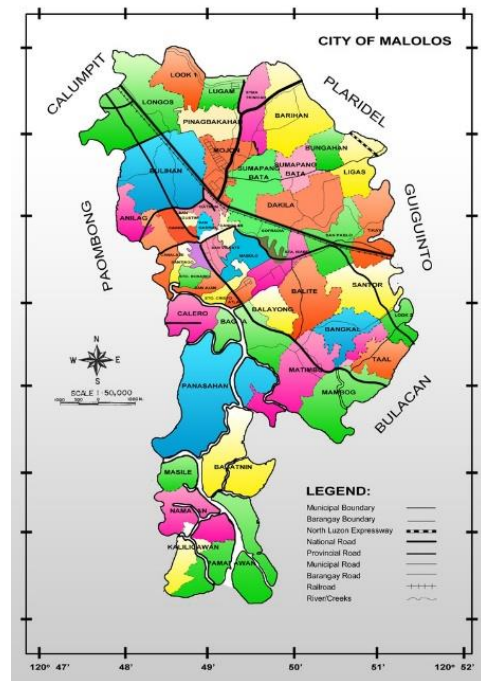


Figure 1: City of Malolos map

The City of Malolos has a total land area of 7,105.16 hectares based on the Barangay Boundary Index Mapping (BBIM) survey done by the Department of Environment and Natural Resources-Land Management Bureau (DENR-LMB) in year 2014-2015.

A.1.2 Population and Settlements

The 2015 Census of Population of the City of Malolos resulted to a total of 252,074 inhabitants which is 7.66 percent of the total population of Bulacan. With these figures, the city ranks third among other cities and municipalities in terms of 2015 Census of population. The City of Malolos grows at a slower rate than that of the province and the country at Annual Growth Rate (AGR) of 1.41 percent based on the Census of population in 2010. The records of population show that the growth is faster from 1970 onwards and with the current rate, the City of Malolos will double its population in almost 52 years. The table below shows the historical Censuses of Population including that of the province, which population growth is usually faster than that of City of Malolos except in 1970, 2000, and 2010.



Table 1: Ranking of Population among other Towns in the Province

RANK	MUNICIPALITY/CITY	2015 POPULATION	% TO TOTAL BULACAN POPULATION
BULACAN		3,292,071	100.00
DISTRICT I		717,820	21.80
1	City of San Jose Del Monte	574,089	17.44
2	Santa Maria	256,454	7.79
3	MALOLOS (CAPITAL)	252,074	7.66
4	Marilao	221,965	6.74
5	Meycauayan City	209,083	6.35

The housing facilities are being provided by the 81 residential subdivisions situated across the city aside from the housing facilities along the barangay and the city roads. There are also two (2) government housing projects in the area with more than 3,300 housing units situated in Barangays Bangkal and Mabolo. The Northville 8 in Barangay Bangkal is a resettlement site to more than 3,200 families being managed by the National Housing Authority (*NHA*). The Bagong Tuklas Resettlement in barangay Mabolo is administered by the city government.

The informal settlers in the city as of 2015 were around 550 families. They are scattered in 6 barangays of the city. Barangays Tikay, Look 2nd, and Atlag have the most number of informal settlers recorded at 162, 141, and 103, respectively.

Table 2: Population Density

BARANGAY	LAND AREA IN HAS.	% TO TOTAL LAND AREA	2015 POPULATION	POPULATION DISTRIBUTION	DENSITY (POP. /HA.)
1. Anilao	132.30	1.86	3,078	1.22	23.27
2. Atlag	37.88	0.53	5,294	2.10	139.74
3. Babatnin	440.24	6.20	958	0.38	2.18
4. Bagna	89.44	1.26	5,321	2.11	59.49
5. Bagong Bayan	68.12	0.96	3,688	1.46	54.14
6. Balayong	134.47	1.89	3,338	1.32	24.82
7. Balite	178.68	2.51	2,813	1.12	15.74
8. Bangkal	122.92	1.73	12,437	4.93	101.18
9. Barihan	222.45	3.13	5,833	2.31	26.22
10. Bulihan	413.75	5.82	13,510	5.36	32.65
11. Bungahan	93.41	1.31	2,965	1.18	31.74
12. Caingin	55.67	0.78	6,899	2.74	123.93
13. Calero	150.16	2.11	1,281	0.51	8.53
14. Calligawan	95.98	1.35	302	0.12	3.15
15. Canalate	30.70	0.43	4,124	1.64	134.31
16. Caniogan	42.15	0.59	5,132	2.04	121.74
17. Catmon	25.83	0.36	2,382	0.94	92.21
18. Cofradia	50.83	0.72	3,937	1.56	77.46
19. Dakila	249.85	3.52	5,352	2.12	21.42
20. Guinhawa	42.20	0.59	4,086	1.62	96.83
21. Liang	9.45	0.13	1,661	0.66	175.73
22. Ligas	183.92	2.59	6,624	2.63	36.01
23. Longos	405.14	5.70	14,864	5.90	36.69
24. Look 1st	140.48	1.98	6,808	2.70	48.46
25. Look 2nd	71.91	1.01	3,108	1.23	43.22



26. Lugam	77.52	1.09	4,711	1.87	60.77
27. Mabolo	141.08	1.99	6,435	2.55	45.61
28. Mambog	217.72	3.06	2,673	1.06	12.28
29. Masile	92.68	1.30	832	0.33	8.98
30. Matimbo	288.36	4.06	6,516	2.58	22.60
31. Mojon	130.19	1.83	18,239	7.24	140.10
32. Namayan	193.26	2.72	771	0.31	3.99
33. Niugan	72.12	1.02	828	0.33	11.48
34. Pamarawan	231.99	3.27	3,336	1.32	14.38
35. Panasahan	704.65	9.92	8,818	3.50	12.51
36. Pinagbakahan	144.09	2.03	6,087	2.41	42.25
37. San Agustin	13.02	0.18	2,262	0.90	173.73
38. San Gabriel	13.02	0.18	2,467	0.98	189.47
39. San Juan	76.92	1.08	4,388	1.74	57.05
40. San Pablo	128.03	1.80	5,240	2.08	40.93
41. San Vicente	25.44	0.36	2,790	1.11	109.65
42. Santiago	40.04	0.56	1,973	0.78	49.27
43. Santisima Trinidad	134.41	1.89	6,524	2.59	48.54
44. Santor	215.26	3.03	8,646	3.43	40.17
45. Sto. Cristo	42.68	0.60	2,025	0.80	47.45
46. Sto. Niño	10.11	0.14	561	0.22	55.48
47. Sto. Rosario	67.28	0.95	7,633	3.03	113.45
48. Sumapang Bata	114.81	1.62	2,645	1.05	23.04
49. Sumapang Matanda	169.02	2.38	7,554	3.00	44.69
50. Taal	92.68	1.30	2,231	0.89	24.07
51. Tikay	180.87	2.55	10,094	4.00	55.81
TOTAL	7,105.16	100.00	252,074	7.66	35.48

A.2 Physical Resources

A.2.1 Topography

The City of Malolos is characterized by flat terrain extending from its narrow coastline at the south to the agricultural plains in the north. This is evident by the largely spaced contour lines in the northern part of the city and spot elevations on the south. Having the Manila Bay at its coastal boundary, major rivers, and tributaries traverses the town and drains all the way to the sea including the rivers of Pamarawan, Galas, Malaway, Pangagtan, and Bugwan. These rivers and many other tributaries interweaving the City of Malolos cover 4.00 % of its total land area.

A.2.2 Climate

The City of Malolos has two (2) pronounced seasons; the wet season which is usually from the month of May to November and the dry season which is usually from December to April. The climate appears to be almost equally distributed among the land of the city which is basically a flat terrain from south to the north.

A.2.3 Slope

Bulacan is categorized into three (3) thematic areas: the coastal area, lowland area, and upland or highland area. Lowland areas are characterized by slopes having 0 to 3% or level to gently sloping. These areas have the greatest portion in Bulacan totaling to about 41% of the whole area of the province.



The City of Malolos belongs to coastal area of Bulacan. The whole territory of the city is characterized by a slope ranging from 0 to 3% or having a land with generally flat terrain.

A.2.4 Soil Classification

Quingua soil series comprises majority of the soil types found in the territory of the City of Malolos representing about 37% of its entire territory. This soil series is where the rich soil of the city can be found. This is evident by the areas' suitability for rice paddy farming in many parts of the city. Land

A.2.5 Classification

Land Classification in Bulacan is divided into two (2) major types, Alienable and Disposable (*A & D*) and Forest Lands. *A & D* refers to lands of public domain which have not been the subject of the present system of classification and declared not needed for forest purposes. This is further classified into settlements, built-up, and production areas. It is estimated that about 66% (*1,851 sq.km.*) of the total land area in Bulacan is *A & D* (*source, LMB*). Forest Lands are further categorized into three (3), protected forest land (*NIPAS*), *NON-NIPAS* Protection Forests, and the production forests. The whole area of City of Malolos falls within the *A & D* classification of public domains.

A.2.6 Geology

The whole territory of the City of Malolos has a geologic composition of alluvium formation which indicates suitability for urban development. Alluvial rock formation is the result of the deposition of weathered rock materials by rivers, creeks, and streams of low-level areas. It is a term used when the generally characterized with soils that are loose at the surface, well-drained and permeable, with good water-holding capacity.

Alluvial rock formation characterizes the majority of the geologic structure of the Province of Bulacan which are commonly found in its western section and estimated to cover about 40% to 50% of its landmass.

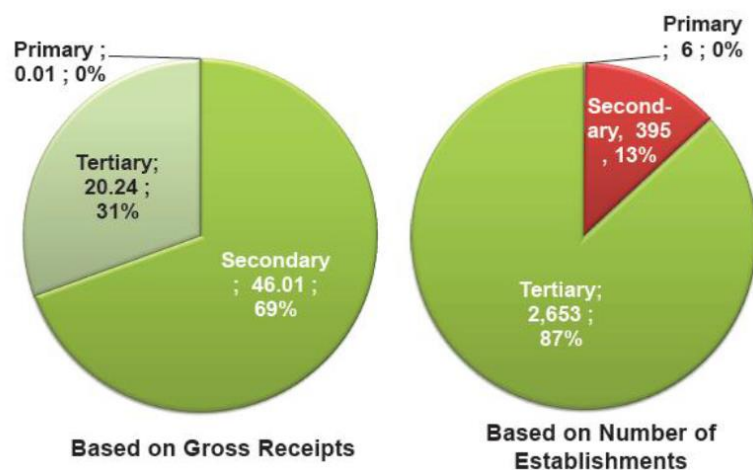
A.3 Local Economy

The economy of City of Malolos is driven by the secondary (*industry*) and the tertiary (*service*) sectors. The tertiary sector dominates in terms of number at 87 percent, but the secondary sector has the biggest slice of the economy based on annual gross receipts at 69 percent. It suggests that the businesses under the industry group are larger with huge capitalization. Specifically, the biggest sub sectors are manufacturing for the industry group while trading for the service sector.

Given that the urbanization level in the City of Malolos is advancing, the contribution of the primary sector to its economy is not as substantial as that of the other sectors. It only constitutes less than 1 percent of the annual gross receipts, and the same percentage holds true with the number of registered businesses.



Figure 2: Structure of the Local Economy: Indicative Number of Businesses and Total Gross Receipts (In Billion PhP), 2015



Source: City of Malolos Ecological Profile

The primary sector includes agriculture, fishery, livestock, and forestry. Meanwhile, the secondary sector is also referred as the industry group. It relates to the production of goods production such as mining and quarrying of minerals; manufacturing; generation of electric power; production of gas and steam; development of waterworks systems; and construction. And finally, the tertiary or the service sector are the businesses of wholesale and retail trading; transportation, storage, and communication; finance, insurance, real estate, and business services; and community, social, and personal services.

A. 4 Infrastructures, Facilities, Utilities

A.4.1 Transportation

The City of Malolos is traversed by MacArthur Highway. The said highway connects the city to adjacent Municipalities of Calumpit and Guiguinto. Three (3) other national roads, A. Mabini, F. Estrella, and Paseo del Congreso act as main arteries of the city’s road network.

The local roads, on the other hand, serve as the lifelines that link the different barangays. These roads provide access to different markets, basic services, both social and economic, and employment opportunities.

The segment of North Luzon Expressway (*NLEx*) traversing the city serves as a gateway to nearby provinces and cities. *NLEx* makes the City of Malolos more accessible for social and economic activities.

A.4.1.1 Roads and Bridges

The City of Malolos has a total road network of 136.95 km. The city’s national roads account for 21.30 km, all of which are asphalted. The total length of provincial roads and city roads are 25.38 km and 30.79, respectively. Barangay roads account for the largest part of the road network with the total



length of 59.48 km. 79% of the length is either paved with concrete or asphalted, indicating good mobility.

The information on inventory of roads is referenced to year 2009. The survey to update the information is scheduled and will be spearheaded by the Road Board.

The City of Malolos has a total of 31 bridges that connects the different barangays within the city. All of the bridges are of concrete type except the Malolos Flyover in Guinhawa which is asphalt-laid prefabricated steel. The width of the bridges ranges from 3.00 to 8.85 meters with usual capacity of 14 tons.

A.4.1.2 Ancillary Road Facilities

There are 13 pedestrian crossings and 4 footbridges situated along MacArthur Highway.

A.4.1.3 Transport and Terminals

Modes of transportation within the urban centers and nearby barangays are cars, jeepneys, buses, tricycles, motorcycles, bikes, and pedicabs (e-bikes/tricycles). While in the coastal barangays and settlements along fishpond area strips, only boat and pedicabs are available. There are 85 terminals with 93 different routes.

There are also 10 ports in the city where local transport is the usual activity.

A.4.2 Power Utilities

MERALCO served the City of Malolos for its power needs on a 24-hour basis. Electricity is available in all barangays, reaching 60,777 of the total households. At the end of 2016, the electrification level is already at 99.17%.

Power supply is secured for the city through the presence of two substations in Pinagbakahan and Tikay. The electric power distribution system provides current of 220 volts and 440 volts, which assures sufficiency for future developments in the city.

A.4.3. Water

Water is supplied mainly by the City of Malolos Water District (CMWD). CMWD provides Level III of water supply to 41,405 service connections; 40,133 are of domestic type and 1,272 are of commercial type. CMWD sources out water through 68 operational pumps with capacity ranging 3-40 hp.

Water is also being supplied by the three rural waterworks systems in Babatnin, Bulihan, and Pamarawan. There are also other publicly and privately owned artesian wells to meet the water need of the populace. “*Listahang Tubig*”, a project led by National Water Resources Board (*NWRB*) with the support of the World Water and Sanitation Program (*WB-WSP*) and the US Agency for International Development (*USAID*)’s Water for Resilient Economic Growth and Stability (*Be Secure*) Project, has identified the other water sources: LGU-Run Utility, Home Owner’s Association, Real Estate Developer, Peddler, and other Private Operators.



A.4.4. Information and Communication Technology

A.4.4.1 Postal Services

The City of Malolos has postal services located at the Provincial Capitol Compound (Main) and has extension offices in Sto. Rosario and at Robinson's Place, MacArthur Highway, Sumapang Matanda. There are private courier services to complement these postal services.

A.4.4.2 Telephone Service Provider

There is one office of Philippine Long Distance Telephone (*PLDT*), Co. located at Sikatuna St., Catmon and the other is Globe lines at Graceland Mall, Guinhawa.

A.4.4.3 Mobile Communication Service

For mobile communication, Globe Telecom, Sun Cellular, and SMART Communications, Inc. offer their services to the populace. Their coverage continues to improve as they strategically build communication facilities to serve the growing needs of the city.

A.5 Social Services

A.5.1 Health and Nutrition

A.5.1.1 Health Facilities and Manpower

The City of the Malolos has seven (7) Rural Health Units (RHUs) and thirty-nine (39) Barangay Health Stations (BHSs). Barangay Health Stations are located in every barangay except in San Agustin, Santiago, San Gabriel, San Juan, Canalate, and Sto. Niño. Health services in the said barangays are being provided in the barangay hall. The BHSs are used for the delivery of primary health care services such as basic consultation, health education, and referral to RHU and core referral hospital. Each RHU on the other hand, has its catchment barangays for referral facility of the BHSs or barangays and for other primary health care services such as consultation, basic treatment, and referral facilities of complicated cases to the next level hospital. Further, maternal and child health care, dental health, nutrition, family planning, and environmental health are being provided in the RHUs. The medical services are being complimented by a number of privately owned facilities like 14 hospitals, 124 clinics (*EENT, dental, maternity, medical/surgical, pediatric*), and 17 laboratory clinics. The Bulacan Medical Center (*BMC*) operated and owned by the provincial government is also situated in the City of Malolos to provide tertiary hospital services.

Health Service Workers deliver services to the people in the community to promote preventive health care as mandated to the Local Government Unit (*LGU*) through its City Health Office (*CHO*). The *CHO* focuses on maternal and child health care, which includes family planning, nutrition and dental care, diarrhea disease control, and tuberculosis control program. There are eight (8) doctors leading the delivery of health services, 25 nurses, 7 dentists, 35 midwives, 7 sanitary inspectors, 5 nursing aide, and 10 dental aides. The status of employment of health workers varied from permanent plantilla positions and casual. The delivery of health services are being assisted by the volunteer work of 280



Barangay Health Workers (*BHWs*) dispersed across barangays. They were assisting the assigned midwife in barangay health station in the delivery of primary health care. Meanwhile, the doctors, nurses, and other health workers are stationed at the RHUs. However, the required number of RHU personnel is guided by the standards stipulated in the revised Implementing Rules and Regulations on the Magna Carta of Public Health Workers or R.A. 7305.

A.5.2 Education

The national government thru the Department of Education (*DepEd*) provide kindergarten, elementary, and secondary education across the country. Kindergarten education is a mandatory entry stage to basic education. Other privately-owned schools on the other hand, provide up to tertiary level education. The city has 86 pre-elementary school facilities, 83 elementary, 36 secondary/high school, 6 technical/vocational, and 6 college or tertiary facilities.

The constituents of the City of Malolos have options where to enroll for education from various institutions. The registered 107 public schools are complemented by 110 private schools from pre-elementary to college education.

Percentage of children who are not attending elementary school increased from 7.97 in SY 2014-2015 to 12.07 in SY 2015-2016. In secondary level, it was registered for more than 21 percent. Consequently, the net enrolment ratio of elementary decreased from 92 percent in SY 2014-2015 to nearly 88 percent in the following school year. The percent of children that are not attending elementary school in SY 2015-2016 was higher than that of the Bulacan Schools Division and Meycauayan City Division. Survival rate on the other hand, which defined as the percentage of enrollees at the beginning grade or year in a given school year that reached the final grade or year of the elementary/secondary level also shows decreasing rate from 96 in SY 2014-2015 to 85 percent in SY 2015-2016. The City of Malolos Division's survival rates for SY 2015-2016 in elementary level was the lowest among the school's divisions of the province. In the secondary level, the registered survival rate of little more than 91 percent is the same as that of Bulacan Division (91.67) but higher than Meycauayan City Division and San Jose Del Monte City Division at 81.60 and 80.20, respectively.

A.5.3 Housing

The housing facilities are being provided by the 81 residential subdivisions situated across the city aside from the housing facilities along the barangay and the city roads. There are also two (2) government housing projects in the area with more than 3,300 housing units situated in Barangays Bangkal and Mabolo. The Northville 8 in Barangay Bangkal is a resettlement site to more than 3,200 families being managed by the National Housing Authority (*NHA*). The Bagong Tuklas Resettlement in barangay Mabolo is administered by the city government.

The informal settlers in the city as of 2015 were around 550 families. They are scattered in 6 barangays of the city. Barangays Tikay, Look 2nd, and Atlag have the most number of informal settlers recorded at 162, 141, and 103, respectively.



A.5.4 Social Welfare Services

As of SY 2015-2016, there were 53 Day Care Workers for the 61 Day Care Centers situated across barangays in the city. The presence of Day Care Centers and Senior Citizens Centers in the city is compliant with the related laws on social welfare services for the total development and protection of children and senior citizens mandated in the Republic Act 6972, RA 7876, and RA 8980.

Senior citizens on the other hand, were more than 15,800 as of 2015. They are being provided social services such as issuance of SC IDs and booklets for availment of privileges and benefits, incentives for centenarians, referrals for nebulizer, cane, wheelchair, and the like at the senior citizens' center.

Social and livelihood assistance are being provided by the city government to children in conflict with the law, persons with disability, solo parents, and poor families.

The recorded persons with disabilities (*PWDs*) were increasing from the past five (5) years (2011-2015). As of 2015, there were more than 1,300 *PWDs* in the city. The accessibility of *PWDs* to the public and private facilities is a social concern mandated by BP 344.

As of 2016, there were 27 children in conflict with the law (*CICL*). Thirteen (13) barangays have this concern and the highest number is in Barangay Bangkal.

As of 2016, there were almost 2,000 solo parents in the city and almost 85 percent are female. Of the total number of solo parents, more than 46 percent are separated, almost 20 percent are single, and almost 34 percent are widow/widower. There were also 17 solo parents recorded at their early age of 15-20 years old.

The “*Pantawid Pamilyang Pilipino Program*” (*4Ps*) of the national government through the Department of Social Welfare and Development Office (*DSWDO*) has more 3,100 beneficiaries in the City of Malolos. There were family-beneficiaries across all the barangays of the city. Ten (10) barangays have more than 100 *4Ps* beneficiaries. The highest number of family beneficiaries is in Barangay Bangkal with 532. Barangays Santor, Look 1st, Mojon, and Pamarawan are included in the top five barangays with highest number of *4Ps* beneficiaries.

A.5.5. Peace and Order

The city government has one (1) Police Station, one (1) Fire Protection Unit, and Peace Keeping Barangay Patrol/Tanod. The minimum standard ratio of police to population is 1:1,000 and 1:2,000 for firemen. As of 2015, the policemen and firemen to population ratios are 1:1,909 and 1:14,828, respectively.

Crime statistics of the city shows that there was a significant decrease in the number of index crimes in 2015 with 377 from the past four years (2011-2014). Non-index crimes on the other hand, have an increasing trend for the past five years (2011-2015). Crime volume fluctuates over the years. Crime solution efficiency on the other hand, is increasing and registered for almost 69 percent in 2015.

A.5.6. Water and Sanitation



In 2015, the average of households in the city with access to safe water was a little more than 98 percent. It is higher than the provincial average of 88 percent. Forty-three (43) barangays (84.3%) have 100 percent of households with access to safe water. Barangay Barihan on the other hand, has the lowest percent of households with access to safe water at only 61.76 percent. Barangays Tikay and Pamarawan have 86.7 and 88.6 percent of households with access, respectively.

In the same year, the access of the households to sanitary toilet facilities had an average of a little more than 83 percent. It is lower than the provincial average of 89 percent. Eleven (11) barangays (21.6%) have 100 percent access while five barangays (*Barihan, Canalate, Look 1st, Lugam, and Mabolo*) have less than 50 percent of its households with access to sanitary toilet. Barangay Look 1st had the least percent of households with access to sanitary toilet at 17.14 percent.

A.6. Waste Management

At present, households' solid wastes are being collected and disposed to the Material Recovery and Composting Facility (*MRCF*) located in Barangays Matimbo and Mambog with more than 5 hectares of land area. Recyclable materials are being sorted by the "eco boys" for marketing to end-user manufacturers.

The city government is strengthening the barangays to participate in the collection of segregated wastes from the households to common collection points like Material Recovery Facility (*MRF*) with designated Residual Containment Box (*RCB*). As of 2015, 27 out of the 51 barangays in the city have existing MRF for the recyclable and residual wastes.

The sewage or wastewater on the other hand, is being disposed to the sewage pipes of the households to the drainage canals along the roads. It is essential that waste disposal system is intensified for the control of generation, collection, transport, processing, and disposal of solid waste materials in a way that best adopt the scope of public health and other environmental considerations. In line with the Clean Water Act, the City of Malolos Water District in Joint Venture Agreement with Primewater Infrastructure Corp. is planning to establish a Water Treatment Plant (Septage and Sewage) within the vicinity of Material Recovery and Composting Facility.





**SECTION 2:
CLIMATE INFORMATION &
SITUATIONAL ANALYSIS**

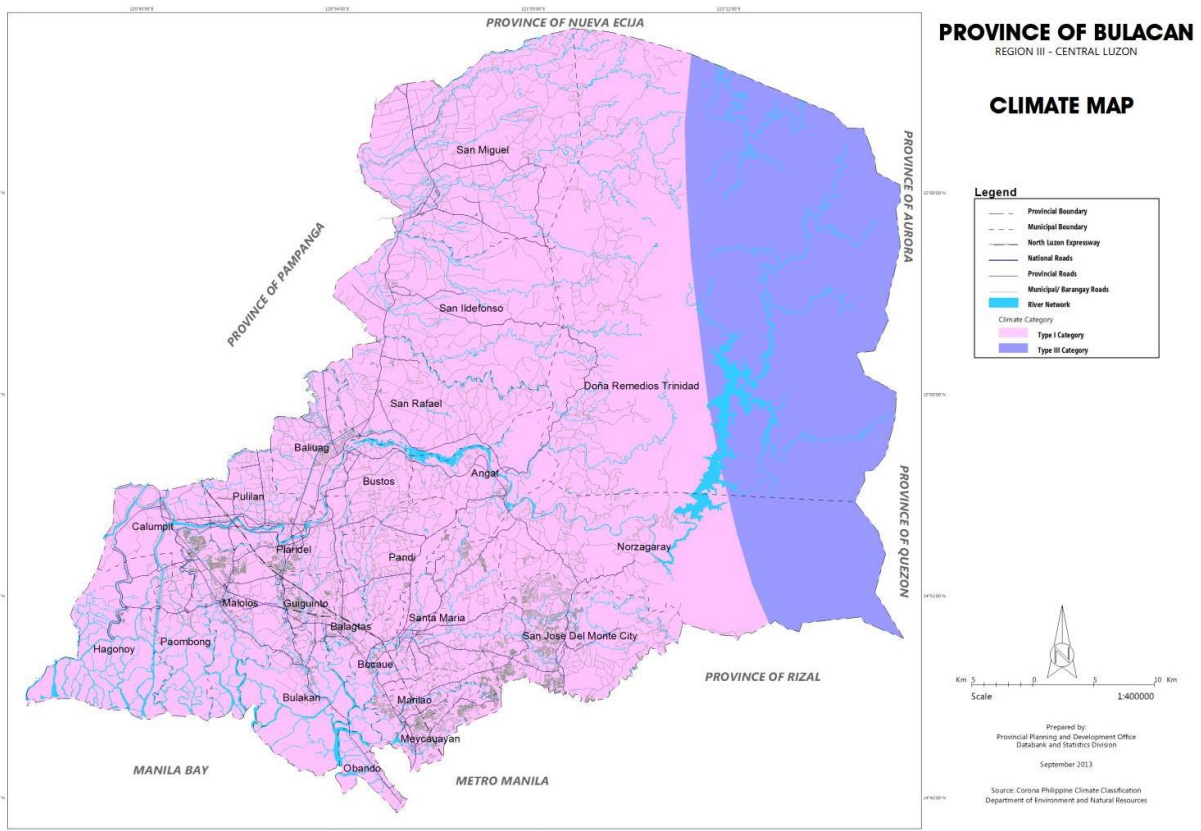
SECTION II. CLIMATE INFORMATION AND SITUATIONAL ANALYSIS

A. CLIMATE PROFILE

The Province of Bulacan generally falls under Type I category based on the modified Corona's Philippine Climate Classification (1951-2010). Areas with this type of climate have distinct pronounce wet and dry seasons. The months of June to November are considered rainy season period with rainfalls ranging from 1,000mm to more than 5,000mm.

The rainy season in Bulacan coincides with the onset of the southwest monsoon, which brings moisture-laded cloud formation from the Southwest Asia.

Figure 3: Climate Map of the Province of Bulacan



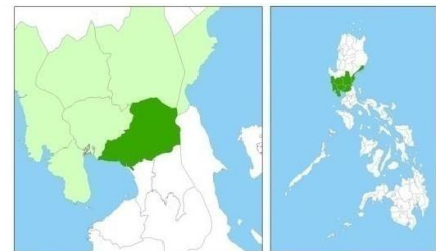
Technical Notes:

SPHERIOD..... CLARKE 1866
PROJECTION..... UNIVERSAL TRANSVERSE MERCATOR
VERTICAL DATUM..... MEAN SEA LEVEL
HORIZONTAL DATUM..... LUZON DATUM

This map is indicative and is intended for Provincial level Risk Assessment. For Municipal and site level hazard microzonation, further consultation to mandated government agencies is recommended.



Prepared by the Provincial Government of Bulacan for Integrating Disaster Risk Reduction and Climate Change Adaptation in Local Development and Decision-making Processes.



B. HAZARD PROFILES

B.1. Hydro-meteorologic Hazards

The following section will discuss the consequence analysis results for hydro-meteorologic hazards identified in the City of Malolos such as flooding and storm surge. The discussion will focus on the exposure of the population to these hazards.

Flooding

Flooding is the primary hazard that the City of Malolos commonly experience. This is specifically true in the low-lying areas and coastal barangays of the city. It is usually caused by heavy rains from typhoons and monsoon rains that has a regular occurrence in the whole province aggravated by coastal tide. Aside from the principal causes of flooding in the city, such as heavy rains and tidal sea-level rise, there are other factors that contribute to this hazard that worsens its effect. The general topography of the affected areas can be described as low-lying as the slope of the City of Malolos is relatively flat that makes the water current flow slowly towards drainage and streams.

Silted river systems and clogged water ways contribute to the rapid flood water rise during heavy rains. Likewise, continuous urbanization with reclassification of agricultural lands and transformation into concrete spaces decreases agricultural land that helps capture rainwater.

Similar to flooding, the population most at risk from typhoons (strong winds) and Southwest Monsoon (Habagat) are those settlements affected by flooding, particularly the informal settler families whose dwelling units are made of makeshift materials. Specifically, livelihood, education, health, infrastructure and land use are also likely to be affected.

Flooding in other build up areas in the City of Malolos has been preventing the smooth flow of products and services and has caused suspension of businesses that is causing huge loss in the revenues of the large and small-scale industries.

Based on the updated flooding hazard prepared by MGB, the City of Malolos is prone to three levels of flooding susceptibility. The coastal municipalities along Manila Bay and topographically low-lying areas of the city are highly susceptible to more than one (1) up to two (2) meter of flood waters. These areas are usually flooded for several hours during heavy rains aggravated by high tide. Other barangays are likewise moderately to low susceptible flooding. These areas are usually inundated during prolonged and extensive heavy rainfall of extreme weather conditions.

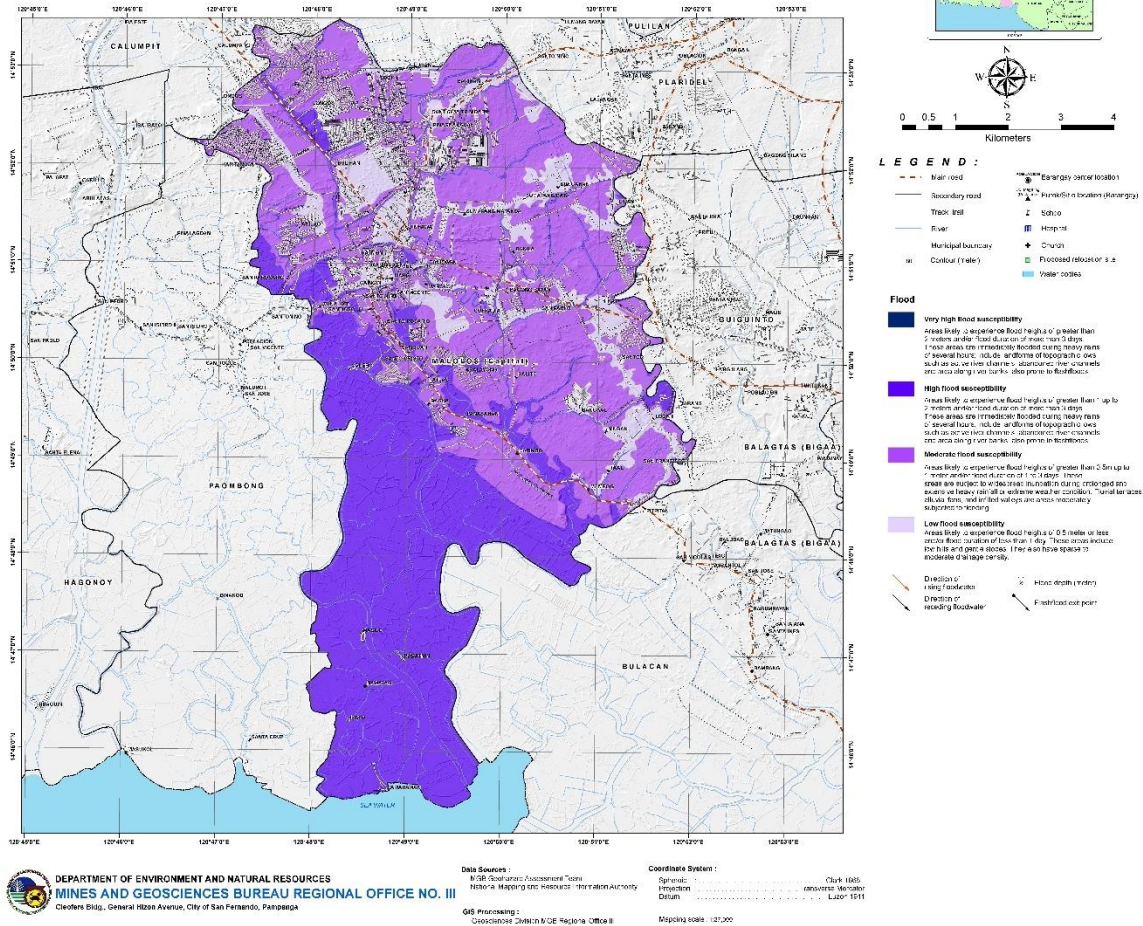
Identifying Potentially Affected Population

The following are the population exposure tables and its map representation for flooding hazard.



Figure 4: Flood Hazard Map of the City of Malolos

DETAILED FLOOD HAZARD MAP OF MALOLOS CITY,
BULACAN, PHILIPPINES



According to the data generated from GeoAnalyticsPh from the Department of Science and Technology, the barangays of Namayan, Pamarawan and Masile registered to have the highest population exposed to high flooding at 93%, 88%, 86% and 77% respectively. These barangays with the highest proportion of population exposed to flooding hazard deserves to have the most attention in terms of capability to cope with the impacts of flooding.



Table 3. Population Exposed to Flooding

	Barangay	Total Population	Assesment (No. of Population Affected)		
			Low	Moderate	High
1	Anilao	3,078	0	802	2,276
2	Atlag	5,294	0	3,730	1,564
3	Babatnin	958	0	0	958
4	Bagna	5,321	0	1,141	4,180
5	Bagong Bayan	3,688	786	2,623	279
6	Balayong	3,337	112	2,387	838
7	Balite	2,813	16	2,387	410
8	Bangkal	12,436	1,120	8,423	2,893
9	Barihan	5,833	723	4,678	432
10	Bulihan	13,510	4,047	8,212	1,251
11	Bungahan	2,966	1,192	1,561	213
12	Caingin	6,899	3,028	1,699	2,172
13	Calero	1,281	0	0	1,281
14	Caliligawan	302	0	0	302
15	Canalate	4,124	0	752	3,372
16	Caniogan	5,132	1,185	2,746	1,201
17	Catmon	2,382	1,622	418	342
18	Cofradia	3,938	774	2,854	310
19	Dakila	5,352	569	4,377	406
20	Guinhawa	4,086	3,682	119	285
21	Ligas	6,623	1,622	4,660	341
22	Liyang	1,661	1,334	107	220
23	Longos	14,864	2,408	10,215	2,241
24	Look 1st	6,808	863	5,499	446
25	Look 2nd	3,108	1,256	926	926
26	Lugam	4,711	1,247	3,000	464
27	Mabolo	6,435	2,742	3,312	381
28	Mambog	2,673	59	923	1,691
29	Masile	932	0	0	832
30	Matimbo	6,516	0	2,826	3,690
31	Mojon	18,239	10,633	6,576	1,030
32	Namayan	771	0	0	771
33	Niugan	828	234	565	29
34	Pamarawan	3,334	0	0	3,334
35	Panasahan	8,818	0	807	8,011
36	Pinagbakahan	6,086	1,308	4,172	606
37	San Agustin	2,262	799	1,194	269
38	San Gabriel	2,467	1,766	701	0
39	San Juan	4,388	19	1,813	2,556
40	San Pablo	5,240	768	4,122	350
41	San Vicente	2,790	34	2,055	701
42	Santiago	1,973	0	224	1,749
43	Santisima Trinidad	6,524	1,545	4,410	569
44	Santo Cristo	2,025	0	1,759	266
45	Santo Niño	561	5	477	79
46	Santo Rosario	7,633	0	6,625	1,008
47	Santol	8,646	1,584	6,846	216
48	Sumapang Bata	2,644	590	1,938	116
49	Sumapang Matanda	7,554	1,944	5,160	450
50	Taal	2,232	407	1,728	97
51	Tikay	10,093	2,569	6,856	668

* Data based on PSA 2015



Table 4. Disaggregated Population Exposed to Flooding

	Barangay	Total Population	Assesment (No. of Population Affected)																	
			Male									Female								
			0 - 10	11 - 20	21 - 30	31 - 40	41 - 50	51 - 60	61 - 70	71 - 80	80 and Over	0 - 10	11 - 20	21 - 30	31 - 40	41 - 50	51 - 60	61 - 70	71 - 80	80 and Over
1	Anilao	3,078	335	319	264	239	171	122	70	18	4	317	277	264	249	189	129	71	26	14
2	Atlag	5,294	505	477	414	417	325	248	160	46	11	449	491	443	410	339	253	195	76	35
3	Babatin	958	99	74	86	85	58	42	34	6	3	94	60	74	82	59	56	24	18	4
4	Bagna	5,321	548	524	499	410	310	214	102	32	12	536	523	466	360	349	221	137	59	19
5	Bagong Bayan	3,688	275	360	330	219	228	193	97	27	13	303	385	320	263	275	206	112	52	30
6	Balayong	3,337	382	320	295	242	196	146	73	23	6	305	318	284	264	203	148	87	37	9
7	Balite	2,813	295	225	254	199	181	130	74	29	3	249	244	239	206	181	140	92	48	24
8	Bangkal	12,436	1,694	1,520	1,041	837	721	381	152	43	4	1,602	1,417	885	881	659	351	171	66	12
9	Barihan	5,833	599	563	478	460	332	236	138	51	13	538	542	504	460	334	303	181	73	28
10	Bulihan	13,510	1,140	1,324	1,082	1,091	753	555	386	115	13	1,218	1,303	1,187	1,211	846	631	435	160	60
11	Bungahan	2,966	333	288	265	238	170	127	76	19	2	272	239	237	252	166	130	92	45	14
12	Caingin	6,899	680	643	679	476	393	334	155	43	4	614	634	617	512	472	320	203	83	37
13	Calero	1,281	180	126	123	88	78	41	25	2	152	119	108	102	60	44	24	7	2	0
14	Caliligawan	302	31	35	23	17	21	12	9	5		42	27	14	21	23	9	9	2	2
15	Canalate	4,124	384	378	350	320	245	182	105	41	9	386	353	368	309	272	186	132	67	37
16	Caniogan	5,132	573	512	506	354	280	205	102	40	6	498	445	485	359	302	225	145	63	32
17	Catmon	2,382	209	235	178	205	137	109	68	24	5	189	226	208	182	165	100	91	36	15
18	Cofradia	3,938	386	416	330	298	220	186	81	24	7	373	356	377	293	231	193	106	39	21
19	Dakila	5,352	548	511	456	459	330	188	122	31	12	491	484	481	449	343	217	150	58	22
20	Guinhawa	4,086	72	275	1,000	983	612	213	75	20	6	67	88	181	195	140	93	34	15	17
21	Ligas	6,623	725	657	599	537	392	265	141	50	10	660	536	583	522	403	276	174	66	28
22	Liyang	1,661	174	185	135	123	99	58	34	14	3	130	169	146	142	110	59	48	23	9
23	Longos	14,864	1,398	1,525	1,256	1,016	978	652	335	114	23	1,278	1,450	1,346	1,155	1,026	697	406	159	50
24	Look 1st	6,808	739	694	577	549	392	290	134	47	6	709	653	548	526	406	278	175	65	20
25	Look 2nd	3,108	338	299	289	242	182	122	73	21	7	320	274	279	232	190	120	73	36	11
26	Lugam	4,711	538	452	421	371	251	208	79	29	18	442	435	415	364	256	217	137	54	24
27	Mabolo	6,435	665	608	546	476	382	255	164	34	18	593	603	583	538	380	301	182	67	40
28	Mambog	2,673	290	273	219	210	179	111	57	24	7	230	237	231	212	176	128	55	26	8
29	Masile	932	99	87	70	58	51	36	16	8	1	87	80	52	69	59	34	13	11	1
30	Matimbo	6,516	659	633	544	487	391	300	176	51	13	570	599	540	520	389	332	200	81	31
31	Mojon	18,239	1,714	1,810	1,708	1,282	1,051	857	452	127	40	1,535	1,733	1,640	1,336	1,159	938	524	243	90
32	Namayan	771	95	87	51	57	53	37	20	7	2	75	79	57	49	37	26	25	9	5
33	Niugan	828	113	77	78	63	48	35	12	5	1	92	74	61	63	44	37	16	6	3
34	Pamarawan	3,334	388	329	322	245	205	150	70	19	5	388	304	269	207	192	146	58	25	14
35	Panasahan	8,818	859	836	810	667	548	423	182	58	12	803	811	762	684	600	425	207	87	44
36	Pinagbakahan	6,086	574	582	463	489	366	222	133	48	12	617	554	541	529	385	279	192	76	25
37	San Agustin	2,262	203	213	208	190	134	92	61	28	8	198	187	196	181	127	119	64	36	17
38	San Gabriel	2,467	251	259	215	178	160	100	53	21	3	239	237	195	187	173	90	66	22	18
39	San Juan	4,388	389	440	378	319	279	181	115	37	12	373	429	352	320	301	221	149	70	23
40	San Pablo	5,240	483	456	499	392	358	207	145	36	17	417	499	448	436	364	241	150	66	26
41	San Vicente	2,790	303	344	218	211	164	83	50	16	6	353	281	236	218	133	85	60	25	4
42	Santiago	1,973	201	185	178	137	123	79	48	18	5	170	180	182	146	123	89	74	27	8
43	Santisima Trinidad	6,524	766	663	555	503	433	240	115	39	8	660	632	525	486	402	240	163	63	31
44	Santo Cristo	2,025	208	180	168	162	115	94	55	21	9	173	162	159	148	135	92	79	47	18
45	Santo Niño	561	39	56	70	63	52	21	12	4	0	36	33	57	46	23	27	14	5	3
46	Santo Rosario	7,633	748	773	668	568	461	314	212	60	19	697	741	616	591	449	349	225	90	52
47	Santol	8,646	1,078	893	762	656	496	308	171	50	9	981	806	707	652	491	314	175	71	26
48	Sumapang Bata	2,644	265	255	240	224	167	101	55	23	8	231	232	242	200	175	107	69	39	12
49	Sumapang Matanda	7,554	680	738	613	560	495	340	195	88	19	578	744	616	595	516	367	246	121	43
50	Taal	2,232	226	230	222	149	134	93	52	22	4	226	213	195	158	124	94	60	21	8
51	Tikay	10,093	965	991	941	779	653	405	187	54	14	914	976	936	786	704	397	257	100	0

*Data based on PSA 2015



There are eight (8) barangays at present with moderate to high susceptibility to flooding depending on the location. Flooding is usually confined to the low-lying and coastal portion controlled by topography. Residential structures located near the creek/river are usually affected by the overflow from the silted river/creek and high tide.

Storm Surge

Storm surge is the abnormal rise in sea level that occurs during tropical cyclones or “bagyo”. It is caused by strong winds and low atmospheric pressures produced by tropical cyclones. As the tropical cyclone approaches the coast, strong winds push the ocean water over the low-lying coastal areas, which can lead to flooding.

The Philippines located along the typhoon belt experience annual torrential rains and thunderstorms from July to October and the Province of Bulacan is included among those areas suffering from severely heavy rainfall with strong gusty winds that is causing storm surges in the coastal municipalities of Hagonoy, Paombong, Bulakan, Obando and Malolos. During typhoon season, around 19 enters the Philippine area of responsibility. About 8-9 typhoons makes landfall and most of these affect Bulacan passing directly over its area. This makes the coastal barangays of Bulacan susceptible to storm surges with other contributing factors such as astronomical tidal conditions and general topography of lowlands. The following figure is the Storm Surge Hazard Map of the Province of Bulacan.

Tropical cyclones are tracked, and their paths predicted with days advance notice to those expected to be affected by the storm. Very often wind speeds, location and time are forecasted quite well, but this does not necessarily apply to the accompanying rain or the occurrence and height as well as extend of storm surges. The deadliest disaster of 2013, the typhoon Haiyan (local Philippine name Yolanda) crossed the Philippines on 8 November 2013.

Based on our characterization of the storm surge hazard in the Province of Bulacan, the coastal barangays in the City of Malolos are prone to this type of specific hazard. Wave surges from Manila Bay affects these areas during thunderstorms and typhoons bearing strong winds.

Identifying Potentially Affected Population

The storm surge hazard map from the GMMA Project of the Department of Science and Technology shows potential damage of water inundation to the coastal barangays of the city. Data generated from the DOST website, GeoAnalyticsPh, illustrates population portion that are exposed to this type of hazard.

Table 5: Population Exposure from Storm Surge Hazard

	Barangay	Total Population	Assesment (No. of Population Affected)	
			Safe	Inundation of >1 meters to 4 meters surge
1	Anilao	3,078	3,078	0
2	Atlag	5,294	4,879	415
3	Babatnin	958	17	941
4	Bagna	5,321	1,747	3,574
5	Bagong Bayan	3,688	3,688	0
6	Balayong	3,337	3,337	0
7	Balite	2,813	2,813	0
8	Bangkal	12,436	12,436	0
9	Barihan	5,833	5,833	0
10	Bulihan	13,510	13,510	0
11	Bungahan	2,966	2,966	0
12	Caingin	6,899	6,899	0
13	Calero	1,281	95	1,186
14	Caliligawan	302	6	296
15	Canalate	4,124	3,659	465
16	Caniogan	5,132	5,132	0
17	Catmon	2,382	2,382	0
18	Cofradia	3,938	3,938	0
19	Dakila	5,352	5,352	0
20	Guinhawa	4,086	4,086	0
21	Ligas	6,623	6,623	0
22	Liyang	1,661	1,661	0
23	Longos	14,864	14,864	0
24	Look 1st	6,808	6,808	0
25	Look 2nd	3,108	3,108	0
26	Lugam	4,711	4,711	0
27	Mabolo	6,435	6,435	0
28	Mambog	2,673	2,463	210
29	Masile	832	0	832
30	Matimbo	6,516	5,724	792
31	Mojon	18,239	18,239	0
32	Namayan	771	0	771
33	Niugan	828	828	0
34	Pamarawan	3,334	806	2,530
35	Panasahan	8,818	2,716	6,102
36	Pinagbakahan	6,086	6,086	0
37	San Agustin	2,262	2,262	0
38	San Gabriel	2,467	2,467	0
39	San Juan	4,388	4,160	228
40	San Pablo	5,240	5,240	0
41	San Vicente	2,790	2,790	0
42	Santiago	1,973	1,662	311
43	Santisima Trinidad	6,524	6,524	0
44	Santo Cristo	2,025	1,443	582
45	Santo Niño	561	561	0
46	Santo Rosario	7,633	7,633	0
47	Santol	8,646	8,646	0
48	Sumapang Bata	2,644	2,644	0
49	Sumapang Matanda	7,554	7,554	0
50	Taal	2,232	2,232	0
51	Tikay	10,093	10,093	0

* Data based on PSA 2015

Among the barangays of the City of Malolos, the coastal barangays, by percentage, have the highest population exposure to storm surge hazard occurrences at very high and high category respectively.

The government will have to consider development of adaptive measures aside from alternative livelihood for fishing families in the aforementioned areas such as building of infrastructures that may lessen the impact of storm surges to the settlement along the coastlines.

B.2 Geologic Hazards

The following section will discuss the consequence analysis results for geologic hazards identified in the City of Malolos such as ground shaking, soil liquefaction and tsunami. The discussion will focus on the exposure of the population to these hazards.

Earthquake – Ground Shaking

Based on the characterization of ground shaking hazard, the entire City of Malolos is prone to a strong Intensity VIII ground shaking level (PHIVOLCS Earthquake Intensity Scale - PEIS -8). The simulation was made form Rapid Earthquake Damage Assessment System (REDAS) of Philippine Institute of Volcanology and Seismology (PHILVOLCS).

The ground shaking hazard map was further processed to determine level of susceptibility. Since this is a single event hazard, a hazard code of susceptible will be used for the entire area.

Hazard Occurrence	Ground Shaking (Hazard Code)	Description
Intensity VIII	SUSCEPTIBLE	Prone to PEIS Intensity VIII ground shaking level

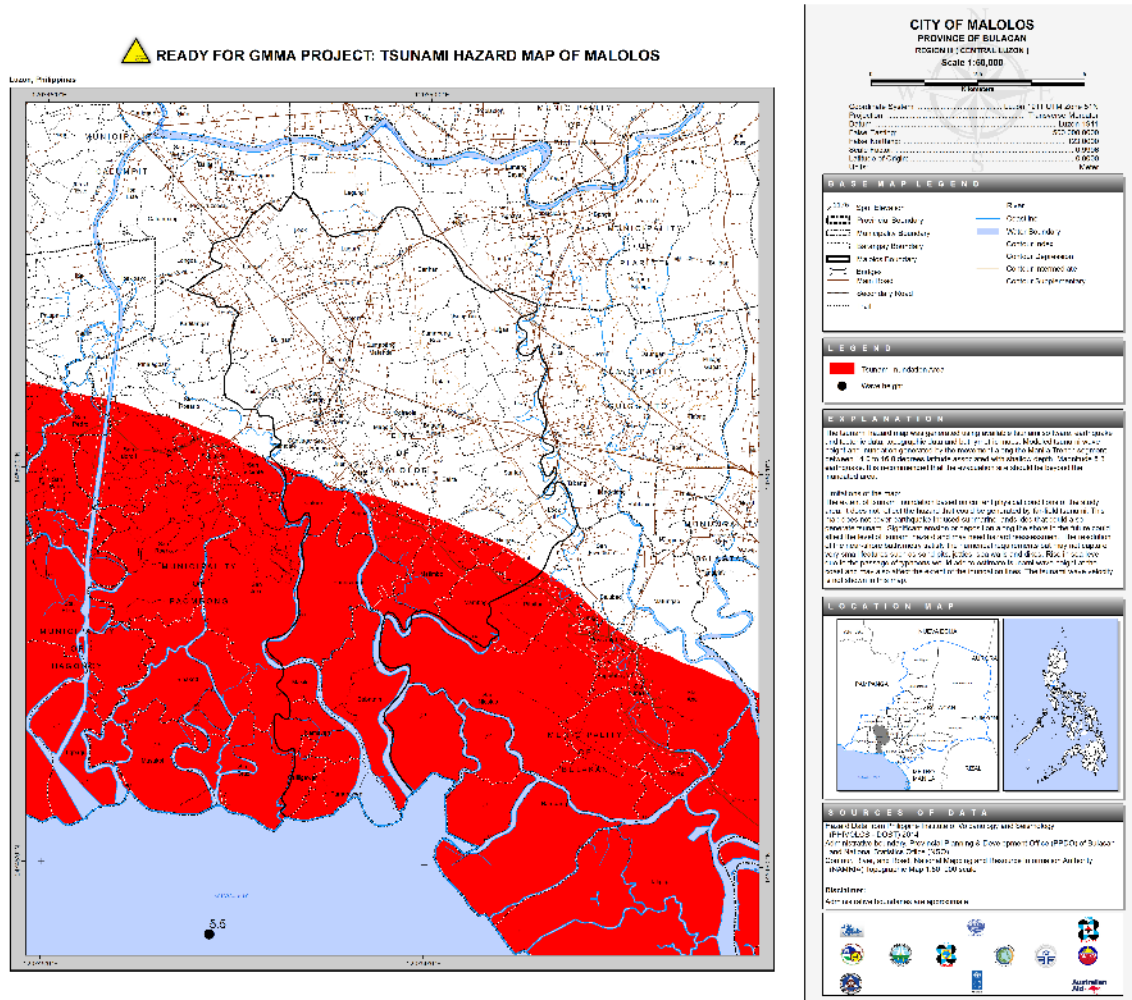
Identifying Potentially Affected Population

Since this single event hazard covers the entire city, every member of the population of the City of Malolos is exposed and included in the potentially affected population.

Tsunami

With its coastline facing Manila Bay, some of the areas in the City of Malolos are highly susceptible to tsunami. A Tsunami is a series of sea waves commonly generated by under-the-sea earthquakes and whose heights could be greater than 5 meters. It is erroneously called tidal waves and sometimes mistakenly associated with storm surges. Tsunamis can occur when the earthquake is shallow-seated and strong enough to displace parts of the seabed and disturb the mass of water over it.

Figure 5: Tsunami Hazard Map of the City of Malolos



Identifying Potentially Affected Population

The tsunami hazard map from the GMMA Project of the Department of Science and Technology shows potential damage of water inundation to the coastal barangays of the city. Data generated from the DOST website, GeoAnalyticsPh, illustrates population portion that are exposed to this type of hazard.



Table 7: Population Exposed to Tsunami Hazard

	Barangay	Total Population	Assesment (No. of Population Affected)	
			Safe	Inundation of >1 meters to 4 meters surge
1	Anilao	3,078	3,078	0
2	Atlag	5,294	4,879	415
3	Babatnin	958	17	941
4	Bagna	5,321	617	4,704
5	Bagong Bayan	3,688	3,688	0
6	Balayong	3,337	2,991	347
7	Balite	2,813	2,679	134
8	Bangkal	12,436	8,105	4,332
9	Barihan	5,833	5,833	0
10	Bulihan	13,510	13,510	0
11	Bungahan	2,966	2,966	0
12	Caingin	6,899	6,899	0
13	Calero	1,281	137	1,144
14	Caliligawan	302	0	302
15	Canalate	4,124	3,478	646
16	Caniogan	5,132	5,132	0
17	Catmon	2,382	2,382	0
18	Cofradia	3,938	3,938	0
19	Dakila	5,352	5,352	0
20	Guinhawa	4,086	4,086	0
21	Ligas	6,623	6,623	0
22	Liyang	1,661	1,661	0
23	Longos	14,864	14,864	0
24	Look 1st	6,808	6,808	0
25	Look 2nd	3,108	3,108	0
26	Lugam	4,711	4,711	0
27	Mabolo	6,435	6,435	0
28	Mambog	2,673	0	2,673
29	Masile	932	0	932
30	Matimbo	6,516	0	6,516
31	Mojon	18,239	18,239	0
32	Namayan	771	0	771
33	Niugan	828	743	85
34	Pamarawan	3,334	2	3,332
35	Panasahan	8,818	11	8,807
36	Pinagbakahan	6,086	6,086	0
37	San Agustin	2,262	2,262	0
38	San Gabriel	2,467	2,467	0
39	San Juan	4,388	4,324	64
40	San Pablo	5,240	5,240	0
41	San Vicente	2,790	2,790	0
42	Santiago	1,973	1,851	122
43	Santisima Trinidad	6,524	6,524	0
44	Santo Cristo	2,025	1,968	57
45	Santo Niño	561	561	0
46	Santo Rosario	7,633	7,633	0
47	Santol	8,646	8,646	0
48	Sumapang Bata	2,644	2,644	0
49	Sumapang Matanda	7,554	7,554	0
50	Taal	2,232	1,270	961
51	Tikay	10,093	10,093	0

* Data based on PSA 2015



B.3 Drought

From 2000 to 2005, City of Malolos experienced slight to severe drought that affected 1,427 farmers of 25 barangays (see Figure 15). The Food and Agriculture Organization reports that among all-natural disasters, drought affects the largest number of people. The outcome of a drought related disaster could be wide spread and devastating as it produces a complex web of impacts, which span many sectors of the economy, especially the agriculture sector. This complexity leads to a lowering of food grain production due to poor crop performance and depends upon the intensity and duration of drought stress.

With the trend in temperature increase for the past decades and projected rise of 1.0 to 1.3 degree centigrade in 2020, the agricultural production in the city may decline and displace farming communities—intensifying migration to the city. Sensitive to this hazard are farmer families engaged in crop production and/or aquaculture, children 0 to 9 years of age, the elderly, and individuals with pre-existing cardio-vascular conditions. The direct impact on small-scale farmers in is the reduction in yield of crops, depending on the growth stage and access to irrigation. This readily translates to diminishing disposable income for basic needs.

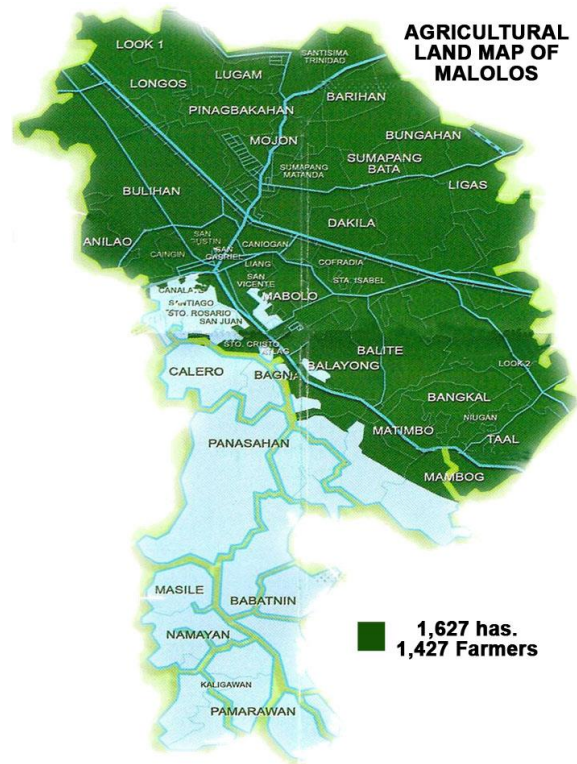


Figure 7: Map showing barangays and farmers affected by drought

C. CLIMATE CHANGE PROJECTION

C.1 Temperature

It is to be noted that all the projected changes are relative to the baseline (1971-2000) climate. For example, a projected 1.0°C-increase in 2020 means that 1.0°C is added to the baseline mean temperature value of the province as indicated in the table to arrive at the value of projected mean temperature. In a similar manner, for say, a +25%-rainfall change, it means that 25% of the seasonal mean rainfall value in the said province (from table of baseline climate) is added to the mean value.

Table 9: Climate Information Risk Analysis Matrix (CLIRAM) of the projected seasonal change in mean temperature (in degrees Celsius) in the mid-21st century (2036-2065) for the Province of Bulacan

OBSERVED BASELINE (1971-2000)	PROJECTED (2036-2065)			
	Scenario	Range	Change	Projected Value
25.6	Moderate Emission (RCP4.5)	Lower Bound	1.0	26.6
		Median	1.2	26.8
		Upper Bound	1.6	27.2
	High Emission (RCP8.5)	Lower Bound	1.2	26.8
		Median	1.6	27.2
		Upper Bound	1.9	27.5
Mar-Apr-May (MAM)	Scenario	Range	Change	Projected Value
27.9	Moderate Emission (RCP4.5)	Lower Bound	1.0	28.9
		Median	1.2	29.1
		Upper Bound	1.7	29.6
	High Emission (RCP8.5)	Lower Bound	1.3	29.2
		Median	1.7	29.6
		Upper Bound	2.3	30.2
Jun-Jul-Aug (JJA)	Scenario	Range	Change	Projected Value
27.1	Moderate Emission (RCP4.5)	Lower Bound	1.0	28.1
		Median	1.3	28.4
		Upper Bound	1.8	28.9
	High Emission (RCP8.5)	Lower Bound	1.3	28.4
		Median	1.6	28.7
		Upper Bound	2.3	29.4
Sep-Oct-Nov (SON)	Scenario	Range	Change	Projected Value
26.7	Moderate Emission (RCP4.5)	Lower Bound	1.0	27.7
		Median	1.1	27.8
		Upper Bound	1.9	28.6
	High Emission (RCP8.5)	Lower Bound	1.4	28.1
		Median	1.6	28.3
		Upper Bound	2.3	29.0

Source: Observed Climate Trends and Projected Climate Change in the Philippines (DOST-PAGASA, 2018)

Based on the observed baseline and temperature projections, the province will experience a high seasonal mean temperature of 30.2°C in the dry months of March-April-May in 2050, in the Upper Bound of the High Emission Scenario. The lowest seasonal mean temperature on the other hand will be experienced in the months of December-January-February at 26.6°C (Lower Bound of Moderate Emission Scenario).



C.2 Rainfall

Table 10. Climate Information Risk Analysis Matrix (CLIRAM) of the projected seasonal change in total rainfall (millimeters) in the mid-21st century (2036-2065) for the Province of Bulacan

OBSERVED BASELINE (1971-2000)	PROJECTED (2036-2065)			
Dec-Jan-Feb (DJF)	Scenario	Range	Percent Change	Projected Value
212.4	Moderate Emission (RCP4.5)	Lower Bound	4.4	221.7
		Median	18.0	250.6
		Upper Bound	61.5	343.1
	High Emission (RCP8.5)	Lower Bound	-2.0	208.2
		Median	15.4	245.1
		Upper Bound	48.1	314.5
Mar-Apr-May (MAM)	Scenario	Range	Percent Change	Projected Value
288.9	Moderate Emission (RCP4.5)	Lower Bound	0.0	289.0
		Median	12.5	325.1
		Upper Bound	23.8	357.8
	High Emission (RCP8.5)	Lower Bound	-6.8	269.1
		Median	3.3	298.4
		Upper Bound	22.9	355.1
Jun-Jul-Aug (JJA)	Scenario	Range	Percent Change	Projected Value
1041.4	Moderate Emission (RCP4.5)	Lower Bound	-23.2	799.4
		Median	-10.7	929.7
		Upper Bound	1.4	1056.4
	High Emission (RCP8.5)	Lower Bound	-18.3	850.7
		Median	-5.0	989.2
		Upper Bound	9.6	1141.7
Sep-Oct-Nov (SON)	Scenario	Range	Percent Change	Projected Value
842.1	Moderate Emission (RCP4.5)	Lower Bound	-8.6	769.6
		Median	-5.8	793.5
		Upper Bound	11.6	939.5
	High Emission (RCP8.5)	Lower Bound	-9.2	764.5
		Median	1.2	852.4
		Upper Bound	18.3	995.9

Source: Observed Climate Trends and Projected Climate Change in the Philippines (DOST-PAGASA, 2018)

In 2050, Bulacan will receive the highest amount of rainfall in the months of June-July-August at 1141.7 mm, which is 100.3 mm (9.6%) higher than the baseline (Upper Bound of High Emission Scenario). The driest months of December-January-February however will be drier in 2050, with a projected 208.2 mm of rainfall, which is 4.2 mm (2.0%) lower than the baseline.

C.3 Extreme Events and Tropical Cyclones

Table 11: Frequency of extreme events in 2020 and 2050 under medium-range emission scenario in the Province of Bulacan

No. of Days w/ Tmax > 35°C			No. of Dry Days			No. of Days w/ Rainfall > 200 mm		
OBS (1971-2000)	2006-2035	2036-2065	OBS (1971-2000)	2006-2035	2036-2065	OBS (1971-2000)	2006-2035	2036-2065
1095	1984	3126	7476	6302	6220	9	13	17

Source: Disaster Risk and Climate Change Vulnerability Assessment (DRCCVA) Report 2013 (From PAGASA Report on Climate Change in Philippines 2011)

From 1951-2015, a slight decrease in the number of tropical cyclones and a minimal increase in the frequency of very strong tropical cyclones (with >170 kph winds) were observed over the Philippine Area of Responsibility (PAR), according to DOST-PAGASA. The number of hot days (max. temp > 35°C) in the 2036-2065 period will almost triple the amount compared to the baseline and will increase almost 1000 days compared to 2006-2035. Despite this, the number of dry days will significantly decrease and the number of days with > 200 mm rainfall will increase, exhibiting the intensification of extreme weather due to climate change.

4. Sea Level Rise

According to DOST-PAGASA, the sea level over certain parts of the Philippines has risen by 5.7-7.0 mm per year from 1993 to 2015, which is nearly double the global average rate of 2.8-3.6 mm/yr (1993-2010). This difference could be attributed to the occurrence of natural climate-related phenomena, e.g. El Niño Southern Oscillation (ENSO), which directly affects the tropical Pacific region. Noticeable changes were also observed at specific locations. A rapid increase in sea level was observed in Manila from 1955 to 2015, as indicated by tide gauge observations from the National Mapping and Resource Information Authority (NAMRIA). However, this is attributed to long-term land subsidence from excessive groundwater extraction.

Sea level rise in the Philippines will continue to be slightly larger than the global average. The trend for RCP4.5 will continue to be linear up to the end of the 21st century, while the trend for RCP8.5 will follow a rather exponential increase. Under the RCP8.5 scenario projections, it is expected that the sea level in the country will increase by approximately 20 cm by the end of the 21st century.

D. CLIMATE CHANGE VULNERABILITY ASSESSMENT

D.1 Sectoral Vulnerability to Climate Change

The following table is sourced from PAGASA report on Climate Change in the Philippines showing the impacts of climate changes presented per vulnerable sector.



Table 12: Potential Impacts of Climate Change to Vulnerable Sector

SECTOR	IMPACTS OF CLIMATE CHANGE
Water	<ul style="list-style-type: none"> <input type="checkbox"/> Water quality problems (e.g. presence of metallic substance, algal blooms, contaminations) <input type="checkbox"/> Reduction in rainfall during the summer season will result in water shortage. <input type="checkbox"/> Irrigation water for farms will be less affecting food production. <input type="checkbox"/> Water level in dams will be low affecting energy production. <input type="checkbox"/> Heavy rains in many areas will create flooding affecting economic activities, damages to physical assets and even fatalities, injuries and illnesses. Decrease fresh water availability due to salt water intrusion
Forestry	<ul style="list-style-type: none"> <input type="checkbox"/> Increase in temperature and variability in rainfall will affect the growth and development of plants and animals in the forest. <input type="checkbox"/> Some forest plants and wildlife animal species may not survive. <input type="checkbox"/> Invasive species may override the natural habitats of fruit-bearing plants. <input type="checkbox"/> Forest fires may become frequent in forest and grassland areas during El Nino episodes.
Agriculture	<ul style="list-style-type: none"> <input type="checkbox"/> Land degradation resulting to crop failures <input type="checkbox"/> Changes in temperature and rainfall intensity, frequency and distribution will affect the growth and yield of climate sensitive crops and fruit trees. Floods and strong winds brought by typhoons will damage crops and affect their production. Prolonged drought may dry up inland fish ponds resulting to decrease in yields. Drought will seriously affect crop production while heat stress will increase mortality of poultry and livestock. Changes in temperature and rainfall will trigger the spread of pests and diseases of both plants and animals. Sea surface temperature will affect fishery. Fish will move out to cooler and deeper waters making it difficult to reach and catch them by artisanal fishermen. Aquaculture and marine culture are damaged by typhoons and coastal flooding aside from storm surges. Insects/ pest outbreaks
Coastal	<ul style="list-style-type: none"> <input type="checkbox"/> Storm surge and sea level rise will inundate coastal settlements and tourism industry. <input type="checkbox"/> Small islands will significantly be affected by sea level rise inundating large portions of the lands and contaminating the ground water with saline. <input type="checkbox"/> Damages to coral reefs/ sea grass
Health	<ul style="list-style-type: none"> <input type="checkbox"/> Flooding will cause the outbreak and spread of water-based and vector-borne diseases leading to higher morbidity and mortality. The incidence of malaria, dengue, leptospirosis, schistosomiasis, cholera and dysentery will increase in flooded and unsanitary areas. <input type="checkbox"/> Heat waves will increase heat stroke among the elderly. <input type="checkbox"/> The demand for energy will increase and may exceed the available supply. <input type="checkbox"/> Typhoons and monsoon rains can flood hospitals and health centers disrupting services and access by the residents. Declining air quality in cities and reduction in quality of life for people in warm areas <input type="checkbox"/> Risk of food and water shortage and malnutrition



Sectoral assessments provide more details and targets for strategic development plans, while at the local or community level, vulnerable groups can be identified and coping strategies implemented, often employing participatory methods. Thus, vulnerability and capacity assessment will include analysis of exposure, sensitivity and adaptive capacity of households, community and institutions. It will take into consideration the physical and outcome risks, the socio-economic condition of the population, and their resilience as well as the various climatic events that could affect the locality.

Based on historical experiences of the City of Malolos, current climate and observed trends and projection of climate change, elements, sectors and institutions assessed mostly affected, on the other hand, referred to the traditional sectors that make up local development and land use plans, namely:

- Social – Population and demographic characteristics and basic social services that include health, education, housing, and protective services.
- Economic – Major economic systems, such as agriculture, industry/manufacturing, service-based economic activities, and tourism, including the enabling services that facilitate the functions of these systems.
- Infrastructure – Accessibility and utility support infrastructure, such as transport, water and power supply, telecommunications, waste management facilities, and other strategic infrastructure supporting all sector functions resulting from government mandates.
- Environment – The natural environment, including ecosystems, critical habitats, and protected areas. Environment also includes natural resource management practices and initiatives of the public sector.
- Land use – Land use refers to the spatial spread of sector activities and resources within a city’s territorial boundaries as a result of local and national policies.

Based on the identified impacts of climate change related hazards; the following table indicates the elements, sectors and institutions at risk:

Table 13: Elements, Sectors and Institutions Exposed to CC Hazards, Impacts and Stressors

Climate Change Hazards/Impacts	Elements, Sectors and Institutions Exposed to Hazards	Sensitivity Drivers/ Stressors
Flooding, Coastal Land Inundation, Typhoon-TC-Strong Wind	<p><u>SOCIAL SECTOR</u></p> <p><i>Population:</i></p> <p>As shown in Figure 12 and Table 58, there were 77,984 populace or 15,435 HHs (settlements) with high and moderate susceptibility to flooding excluding those 2,920 displaced family considered informal settlers living in danger areas such as nearby creeks and waterways. As shown in Figure 13 and 14 and Table 59.b. almost all the populace and households including those in the coastal barangays are susceptible to typhoons and Southwest Monsoon (Habagat) or increased in rainfall also resulted to flooding.</p> <p><i>Education:</i></p> <p>Based on statistics, the following are the number of enrollees in DCC, Pre-Elem., Elem., High School, Vocational and College by which their school</p>	<ul style="list-style-type: none"> ▪ Uncontrolled residential developments, illegal structures and settlements along waterways and coastal areas (Weak housing materials, especially for informal settlers) ▪ Awareness on Climate Change impacts confined within a few officials of the City government and community leaders. The level of awareness is not enough in order for them to be motivated to plan ahead ▪ Political will is always an obstacle in implementing bigger adaptive measures



	<p>activities will be hampered resulting to decreased in educational performance due to existence of prolonged flooding due to typhoons, TC, SW Monsoon and extreme weather events in the city:</p> <p>DCC – 3,583, Pre-Elem – 5,433, Elem – 31,045, High School – 19,515, Technical/Vocational – 3,878, and College – 53,064 or 116,518 ISYs</p> <p><i>Public Health, Health Services, Nutrition and Sanitation:</i></p> <p>At present, one of the major tasks of the city government is to promote preventive health care, which is also the national thrust in the country's health program. Prolongation of flooding due to climate change hazards resulted in increase of incidence of vector borne diseases (e.g. dengue, malaria, leptospirosis, pneumonia etc.).</p> <p>Aside from private health service, services of city government through its six (6) rural health units (RHU) and thirty nine (39) barangay health stations (BHS) with eight (8) doctors, including the City Health Officer who is assigned at CHO, twenty five (25) nurses, seven (7) dentists, three (3) medical technologists, thirty five (35) midwives, five (5) nursing aides and ten (10) dental aides and additional manpower rendering help for public health services with two hundred eighty (280) Barangay Health Workers (BHWs) will be slowed down and delayed upon occurrence of flooding, typhoons, tropical cyclone and other extreme events. Hazards may also caused cemeteries, memorial parks and garbage disposal facilities submerged which resulted to contamination to safe water used by city's populace.</p> <p>With regards to drought hazard, mostly affected are the farmer families engaged in crop production and/or aquaculture, children 0 to 9 years of age, the elderly, and individuals with pre-existing cardio-vascular conditions. The direct impact on 548 small-scale farmers in 26 barangays is the reduction in yield of crops, depending on the growth stage and access to irrigation. This readily translates to diminishing disposable income for basic needs.</p> <p>City-wide, shortages in potable water supply can be expected in highly-dense barangays as well as increased health risks, especially for populations of vulnerable ages (children and the elderly). The factors contributing to the risks are inadequate or poor irrigation facilities and the limited reach of the present water supply system, particularly in the urban fringe.</p> <p>Population and Households:</p> <p>2016 Population projection - 255,686</p> <p>No. of households - 55,584</p> <p><i>Public Health, Health Services and Nutrition:</i></p> <p>Occurrence of drought will affect the health services, nutrition and sanitation in the city of Malolos. Other related impacts of drought are the increase of incidence of dengue, malaria, pneumonia etc.) and emotional trauma, poor health condition and loss of lives.</p> <p><i>Protective Services:</i></p>	<ul style="list-style-type: none"> ▪ The mandated Calamity Fund (5%) allocated annually is not adequate ▪ Increasing demand for utilities ▪ Incomplete education facility/ies ▪ Increasing malnutrition rate ▪ Passive participation of the vulnerable/marginalized sectors ▪ Increasing crime rate ▪ Sluggish advocacy for public interest issue ▪ Lack of technological capabilities ▪ Increasing unemployment rate ▪ Lack of access to livelihood ▪ Inexperienced officials, leaders and service providers ▪ Sluggish governance of some barangay leaders ▪ Weak and unreceptive organizational structure and systems
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<p>Increased In Temperature (Drought and Heat Stress)</p>	<p>Effect to Peace and Order situation of the city. One of the consequence of a prolonged flooding and other related climate change hazards is the disruption of livelihoods and source of income which may resulted to increased of theft, robbery and other related cases.</p> <p><i>Other Vulnerable Sectors:</i> Children and youth, PWDs – 1,319, Elderly, Women, Pregnant Women, Solo Parents etc.</p> <p><u>ECONOMIC SECTOR</u></p> <p>At 101.5 to 163.8 mm quantity of rainfall within a span of 4 days, a City-wide flooding would occur and the following major economic activities will be affected. With reference to typhoons, fish ports, fishponds, rice fields, and livestock production are the most susceptible.</p> <p>The city's rice and crop lands, aquaculture areas, and livestock are likewise sensitive to increasing temperatures. Commercial fish ports located in Panasahan and Atlag, while fishponds are spread out in the barangays. The following are at risk and exposed in the effects of CC hazards including increased in temperature which resulted to drought:</p> <p><i>Agriculture and Fisheries:</i></p> <p><i>Agriculture</i></p> <p><u>Total agricultural land – 1,678 ha.</u></p> <p>Rice Production in 25 barangays</p> <p>No. of farmers – 1,427</p> <p>Area planted in ha. (irrigated) - 1,074.35 with 3,192.91 tons/yr production in wet lands & 1,723.55 with 7,702.17 tons/yr production in dry land</p> <p>Fruit production in 44 barangays</p> <ul style="list-style-type: none"> ○ 11,118 mango trees planted in 286.58 ha. with 4,257,450 kg. harvest/yr.; ○ 1,063 Guyabano trees planted in 10.99 ha. with 10,248 kg. harvest/yr.; ○ 583 jackfruit trees planted in 7.09 ha. with 43,590 kg. harvest/yr., and ○ 2,665 guava trees planted in 10,225 ha. with 45,389 kg. harvest/yr. <p>Vegetables Production in 7 barangays</p> <ul style="list-style-type: none"> ○ String Beans planted in 1.410 ha. with 410 kg. harvest/yr.; ○ Eggplant planted in 0,370 ha. with 405 kg. harvest/yr.; ○ Bitter Ground (Ampalaya) planted in 0.720 ha. with 300 kg. harvest/yr.; ○ Okra planted in 0.220 ha. with 550 kg. harvest/yr. <p>Livestock in 50 barangays (Cattle, Carabao, Hogs, Goat, Swine) – 1,473</p> <p>Poultry Production in 51 barangays (Broiler chicken, Native Chicken, Ducks, Geese, Turkeys, Pigeons) – 29,530</p> <p>No. of farmers/raisers – 3,274</p>	<ul style="list-style-type: none"> ▪ Crop variety (low resistance level to hazards) ▪ Low functionality of irrigation support ▪ Economic activities located below sea level ▪ Almost 10% of city's population dependent on agriculture and fisheries ▪ Insufficient number of skilled workers ▪ Minimal revenue of the income generating facilities of the city. ▪ Some business establishments did not file permits (Commercial/Industrial)
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<p><i>Typhoons, TC, Flooding and Drought</i></p>	<p>No. of farm/poultry for swine and chicken - 1</p> <p><i>Fishery</i></p> <p>Bodies of water - 191.66 has</p> <p>No. of barangays - 11 barangay</p> <p>No. of fisherman - 1,305 fisherman</p> <p>Fishponds area - 1,900.48 has</p> <p>Fish catch – 957.7 metric tons/yr</p> <p><i>Manufacturing</i></p> <p>Commerce and Trade:</p> <p>Commercial establishment will also be likely affected by CC hazards. Flooding, precipitation, typhoons resulted in low productivity of 164,483 labor force/employees which committed frequent absences due to CC hazards. Increased in temperature demand more electricity consumption that may resulted to shortfall in economic production, lesser economic growth and disruptions of economic activities.</p> <p>No. of establishments – 3,431 (5-yr average 2009 to 2014)</p> <p>Industrial Estate – FBIC with 25 industries</p> <p>Slaughterhouse – Malolos Public Market</p> <p>Ice Plant and Cold Storage</p> <p>Recreational and Amusement Center – 13</p> <p>Hotels, Motels and Lodging Houses – 11</p> <p>Banking Institutions – 32</p> <p>Markets, Supermarkets, Malls, Department Stores, Flea Market – 14</p> <p><i>Tourism</i></p> <p>Historical, Cultural, Religious Attractions and Museums - 12</p> <p>The city's water supply is perceived to be the most susceptible to drought and would likely have pervasive effects on the sector as water shortages will directly impinge on commercial and industrial operations.</p> <p><u>WATER</u></p> <p>No. of Concessionaries – Residential (40,133), Commercial (1,272)</p> <p>Consumption - 9,233,564.75 cu. m. and 2,260,344.00 cu. m. respectively</p>	
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<p><i>Drought, Flooding, Typhoons with Strong Winds and Southwest Monsoon</i></p>	<p>Pumping station with a maximum of 30 hp – 66</p> <p><u>Rural Waterworks Systems</u></p> <p>Water is also being supplied by the three (3) rural waterworks systems in Babatnin, Bulihan and Pamarawan. There are also public and privately-owned artesian wells to meet the water need of the populace and 66 pumping stations owned and maintained by the City of Malolos Water District that will be most like affected by CC hazards.</p> <p><u>INFRASTRUCTURES:</u></p> <p>As the city’s backbone of the economic sector and critical support for the social sector, stakeholders identified that shortage in water supply will affect drainage system and shallow wells in some settlements and major roads/ and facilities are almost equally susceptible to drought, flooding, to typhoons with strong winds and Southwest Monsoon. Public and privately-owned artesian wells to meet the water need of the populace must be properly maintained including the 66 pumping stations are owned and maintained by the City of Malolos Water District.</p> <p><u>Roads in km. (Concrete, Asphalt, Gravel, Earth) – 136.9467 km.</u></p> <p><u>Ports – 10 with a total area of 2,335.65 sq. m.</u></p> <p>Modes of transportation within the urban centers and nearby barangays are cars, jeepneys, buses, tricycles, motorcycles/bikes and pedicabs. While in the so-called “coastal” barangays, settlements along fishpond area strips, boat and pedicabs are likely affected by flooding, to typhoons with strong winds and Southwest Monsoon. Occurrence of typhoons may cause damage to ports and terminals resulted to discontinue of operation of such transportation with chain effect to social sectors.</p> <p><u>Concrete Bridges w/ capacity of 14 tons – 31</u></p> <p>There are 31 bridges in the City of Malolos, with length of more than 510.64 meters. All are concrete except the Malolos Fly-over which is made of prefabricated steel (asphalt overlaid) under the Mabey Fly-over System. Its widths range from 3.0 meters to 8.85 meters and mostly have capacities of 14 tons each.</p> <p><u>Terminals – 103 transport association, 85 terminals with 93 routes (FX, Jeepney, Pedicab, Tricycle, Boat)</u></p> <p>As stated above, there are 87 terminals for all modes of transports even for motorized boats; Atlag Bridge (Babatnin/Kaliligawan/Masile/Namayan) and Panasahan Fish Market (Pamarawan) except for buses.</p> <p><u>POWER</u></p> <p>The City of Malolos is served by MERALCO for its power needs on a 24-hour basis. Electricity is available in all barangays, giving a rate of 98.06% households with electricity. Power supply is assured in the City of Malolos</p>	<ul style="list-style-type: none"> ▪ Uncontrolled residential developments, illegal structures and settlements along waterways and coastal areas (Weak housing materials, especially for informal settlers) ▪ Poor drainage systems, clogged drainage ▪ Defective and out-dated water supply pipes and pumping stations ▪ Old and weak infrastructures ▪ Flood resilient infrastructures
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	<p>with the presence of two (2) sub-stations in Pinagbakahan and Tikay. The electrical power distribution system provides current of 220 volts and 440 volts.</p> <p>Electric Consumption</p> <p>A total of 220,974 MWh power was consumed in 2015, with about 45.07% accounted for residential use, 34.80% for commercial use, 18.97% for industrial uses and for others about 1.16%.</p> <p>Residential, 60,055</p> <p>Commercial, 56,950</p> <p><u>WATER</u></p> <p>No. of Concessionaries – Residential (40,133), Commercial (1,272)</p> <p>Consumption - 9,233,564.75 cu. m. And 2,260,344.00 cu. m. respectively</p> <p>Pumping station with a maximum of 30 hp – 66</p> <p><u>Rural Waterworks Systems</u></p> <p>Water is being supplied by the three (3) rural waterworks systems in Babatnin, Bulihan and Pamarawan. There are also public and privately-owned artesian wells to meet the water need of the populace.</p> <p><u>Other Infrastructures</u></p> <p>Postal and Courier Service</p> <p>Telephone Service</p> <p>Internet Service provider</p> <p>Cable Network Service</p> <p>Government Buildings and facilities including Barangay Halls and Health Centers</p> <p>Tourism facilities and tourist spots</p> <p>Business establishments</p> <p>Schools</p> <p>Churches</p> <p>Recreational facilities</p> <p><u>ENVIRONMENT</u></p> <p>1,074.35-hectare wetland in the city, the bard sanctuaire, costal écosystèmes, 100 percent of mangrove areas, and fish sanctuaries face risk including</p>	<ul style="list-style-type: none"> ▪ Absence of waste water treatment facility ▪ Lack of appropriate sanitary landfill ▪ Absence of regular local agency/office with strengthen
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<p>Drought, Flooding, Typhoons with Strong Winds, SLR, SS</p>	<p>species migration and the invasion of pests and diseases brought upon by all identified climate change hazards including drought and prolonged dry spells. Siltation, waste, and encroachment of urban uses in buffer zones reportedly have increased the threat to these resources.</p> <p><u>Mangroves Nursery and Areas</u></p> <p>Mangrove culturing involves sprout collection on existing mangroves and maintenance of nursery in Calero. Reforestation in existing mangrove areas will stabilize river banks and increase fish population. Mangrove areas can be found along tributaries strips covering 41.02 ha. or 0.61%.</p> <p><u>Drainage and Sewerage</u></p> <p>Drainage systems are insufficient and not yet fully interconnected. Surface run-offs are usually collected through public storm drainage systems on major road networks. Other run-offs rely on natural drainage through sloping surfaces. NIA canal system serves as a collecting basin for surface run-off making water build-up during heavy rains to recede easily.</p> <p><i>Need for higher demand/wastewater treatment</i></p> <p>Since there is no centralized waste water treatment facility/plant in the city, domestic and commercial waste waters are discharged through the tributaries even it is untreated. Majority of the households and commercial establishments have individual specific tanks, effluent will traverse through tributaries till it reaches the Manila Bay. However, there are still households that do not have sanitary toilet facilities. Out of the 50,552, 83.25% or 42,083 households have accessed to sanitary toilets.</p> <p>The environment sector of City of Malolos primarily concern is the management of urban environment quality, which focuses on waste management, pollution control, and the conservation of protected areas, environmentally critical or constrained areas, and resources. CC hazards such as flooding, typhoons, sea level rise, storm surge and drought mostly affect coastal ecosystems, specifically the mangroves located in 6 barangays. These mangroves serve as breeding grounds for marine life and help filter sediment from upland developments. However, encroachment and destruction from waste have destroyed significant mangrove populations, affecting livelihoods.</p> <p><u>Garbage/Waste Management</u></p> <p>Climate Change hazards will affect the solid wastes generated by the populace processed by the existing MRCF, occupying about 5 ha. located in Matimbo and Mambog. Only trucks with segregated wastes are being allowed to enter the facility to encourage waste segregation at the household level. Vermiculture or worm composting now being introduced in waste reduction/processing will slow down the production of compost materials.</p> <p><i>Marine Resources on water bodies - 191.66 ha.</i></p>	<p>capabilities and specialization on local weather and ecology management</p> <ul style="list-style-type: none"> ▪ Level of pollution from settlements and sedimentation from uplands ▪ Volume of solid wastes improperly disposed ▪ Full Compliance to Ecological Solid Waste Management Act (RA 9003) ▪ Full Compliance to Clean Air Act (RA 8749) ▪ Full Compliance to Clean Water Act (RA 9275)
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<p>Drought and Flooding</p>	<p><u><i>Inhabitants</i></u></p> <p>Birds are the noticeable inhabitants within the area. As to population, the most common species of birds are the Sparrow (Maya), Whiskered Tern (Kalangay to locals) which can be observed mostly in fish ponds and fish corrals (baklad) in the morning between 6AM to 9AM all year round, Chinese Egret (Tagak) which can be seen in the afternoon between 4PM to 6 PM during November to February, Striated Heron (Bakaw Itim) and Yellow Bittern (Bakaw) which inhabited mangrove (Bakawan) areas. Other bird species such as Common and White Collared Kingfishers (Kasay-kasay), Pied Fantail (Maria Kapra), Crake (Kulok/Kilayan) and Common Sandpiper (Kanduro) are discernible anytime except the last, during low tides. Rarely can be seen in the fishponds and rivers are the Little Grebe (Kanisid). “Pipit”, “Batu-bato” and “Tarat” are also common as to with other areas.</p> <p><u>LAND USE</u></p> <p>The lands most susceptible to climate change related hazards including drought are:</p> <ul style="list-style-type: none"> ○ Agricultural land ○ Open spaces ○ Critical habitats and mangrove areas <p>Owing to their direct exposure to rising temperature, the location of these land uses, declining quality of natural resources, and unregulated adjacent developments are among the stressors that magnify the susceptibility of these land resources.</p> <p>Coastal developments (residential, commercial, tourism), in 6 barangays are directly threatened when it comes to flooding and typhoons. Industrial sites are also affected with the interruption of services contingent with these hazards. The most vulnerable elements along these areas are structures that are built of less sturdy materials. Across sectors, the impacts of climate change manifest spatially, indicating a strong interdependence of elements and resources at risk. More importantly, the pattern of impacts across space emphasize a policy environment that has long directed growth to areas that are now constrained, requiring major shifts in land use allocation and development controls.</p> <p><u>LAND AREA/USE</u></p> <p>Barangays Sto. Niño, Sto. Rosario and San Vicente comprise the city proper “Poblacion”, which is one of the growth centers or business districts in the City of Malolos. Malolos Public Market initializes business activities in the Poblacion area. The City Hall is located at Sto.Niño, fronting the Immaculate Concepcion Cathedral Basilica Minore (Malolos Church) and its patio. The Provincial Capitol (Provincial Government of Bulacan) is in Guinhawa, where another growth center “Malolos Crossing” can be found. Potential growth center sprouts along the strips of Blas Ople Diversion Road.</p> <p>CLASIFICACION AREA (has.) Percent To Total (%)</p>	<ul style="list-style-type: none"> ▪ Rate of conversion of land areas for urban uses based on service demand ▪ Access to land tenure ▪ Conflicting/ competing land uses ▪ Sedimentation and nutrient loading from agricultural lands
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	<table border="1"> <tr> <td>Built-up Areas</td> <td>1,621.40</td> <td>24.11</td> </tr> <tr> <td>Water Bodies</td> <td>191.66</td> <td>2.85</td> </tr> <tr> <td>Other Plantation</td> <td>338.94</td> <td>5.04</td> </tr> <tr> <td>Agricultural Areas</td> <td>2,157.38</td> <td>32.08</td> </tr> <tr> <td>Fishponds</td> <td>1,900.48</td> <td>28.26</td> </tr> <tr> <td>Grassland</td> <td>351.72</td> <td>5.23</td> </tr> <tr> <td>Bare/Rocky Land</td> <td>122.40</td> <td>1.82</td> </tr> <tr> <td>Mangrove Forest</td> <td>41.02</td> <td>0.61</td> </tr> <tr> <td>TOTAL</td> <td>6,725.00</td> <td>100.00</td> </tr> <tr> <td colspan="3">Land Reclassified, 1997-2015 – 2,788,902.50 (sq.m.)</td> </tr> </table>	Built-up Areas	1,621.40	24.11	Water Bodies	191.66	2.85	Other Plantation	338.94	5.04	Agricultural Areas	2,157.38	32.08	Fishponds	1,900.48	28.26	Grassland	351.72	5.23	Bare/Rocky Land	122.40	1.82	Mangrove Forest	41.02	0.61	TOTAL	6,725.00	100.00	Land Reclassified, 1997-2015 – 2,788,902.50 (sq.m.)			
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Sea Level Rise Storm Surge	<p>Due to Tropical Cyclone there is a possibility that “Storm Surge” may occur and “Sea Level Rise” brought by intense rainfall, storms etc., will mostly affect the coastal barangays of the city. SOCIAL, ECONOMIC, ENVIRONMENT, INFRASTRUCTURE and LAND USE are at very high risk due to the above-mentioned climate change impacts.</p> <p>Fish ports, fishponds and livestock production are the most susceptible. Commercial fish ports are located in Panasahan and Atlag while fishponds are spread out in the other barangays.</p> <p>Over 190 hectares of bodies of water and 1,294 fishermen in 6 coastal barangays are at risk.</p> <p>The rise in sea level is likely to affect small business owners in the coastal barangays.</p> <p><i>Fisheries:</i></p> <p>Marine Resources on water bodies - 191.66 has</p> <p>Fish Catch - 626.5 tons/yr</p> <p>Fisherman - 1,294</p> <p>Fishponds - 1,900.48 has</p> <p>Mangrove Forest - 41 has</p> <p>Similar to flooding, the population most at risk from sea level rise and storm surges (wave surges) are those settlements in coastal areas, particularly the informal settler families whose dwelling units are located beside the river and are made of makeshift materials. Specifically, ports, sea vessels and fishing boats and commercial establishments are also likely to be affected.</p>	<ul style="list-style-type: none"> ▪ Destruction of mangroves, conversion of mangroves to urban uses ▪ Weak coastal defenses ▪ Intensity of coastal developments 																														



	<p><i>Education</i></p> <p><i>Public Health, Health Services, Sanitation and Nutrition</i></p> <p><i>Other Sectors at Risk:</i> <i>Other Vulnerable Sectors:</i> Children and youth, PWDs – 1,319, Elderly, Women, Pregnant Women, Solo Parents etc.</p> <p><i>Population, Households, Infrastructures at Risk:</i></p> <p>6 barangays in coastal community w/ total pop. of 7,792, w/ 1,694 HHs living in 1,045 built houses 6 elem. Sch.</p> <p>6 brgy. Halls, Health Centers, recreation facilities, <u>ports – 10 with a total area of 2,335.65 sq. m., rural waterworks system</u></p> <p>Barangay roads, facilities, roads and drainage system along the coastal area are most exposed and equally susceptible to SLR and storm surges including shallow wells in some settlements.</p> <p>Storm surges and Sea Level Rise mostly affect coastal ecosystems, specifically the mangroves located in 6 barangays (Pamarawan, Babatnin, Calligawan, Namayan, Masile and Calero). These mangroves serve as breeding grounds for marine life and help filter sediment from upland developments. However, encroachment and destruction from waste have destroyed significant mangrove populations, affecting livelihoods.</p> <p>Protected areas and critical habitats including ground water sources, surface water, and watershed are likely to be affected by the rising sea level. This could threaten future water supply for domestic and industrial uses, and irrigation. Stakeholders cite deforestation, nutrient loading, and uncontrolled groundwater extraction as factors that heighten the sensitivity of these resources.</p> <p>Among the contributing factors to this susceptibility are:</p> <ul style="list-style-type: none"> ○ An influx of informal settlers dwelling on natural waterways; ○ Siltation and waste in rivers and estuaries hampering the ingress and egress of water and increasing the cost of maintenance; ○ An outdated drainage system. <p>Coastal developments (residential, commercial, coastal tourism), in the city are directly threatened when it comes to storm surges and SLR. The most vulnerable elements along these areas are structures that are built of less sturdy materials.</p> <p>The lands most susceptible to sea level rises are the fishponds, open spaces, critical habitats and mangrove areas.</p>	
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	<p>Owing to their direct exposure to sea level, the location of these land uses, declining quality of natural resources, and unregulated adjacent developments are among the stressors that magnify the susceptibility of these land resources.</p> <p>Despite the rather long history of sea level rise and storm surge in the city, the same land uses are evident and intensifying in the same areas over time. The threat of SLR and SS in residential areas can induce displacements and migration. However, with the economic and infrastructure systems equally affected, these movements are constrained due to losses incurred.</p> <p>Across sectors, the impacts of climate change manifest spatially, indicating a strong interdependence of elements and resources at risk. More importantly, the pattern of impacts across space emphasize a policy environment that has long directed growth to areas that are now constrained, requiring major shifts in land use allocation and development controls.</p> <p><i>LAND AREA/USE</i> - 2,133.16 has. (Water Bodies, Fishponds and Mangrove Forest)</p>	
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Given the observed impacts of climate change, underlying causes, identified elements, places, people & sectors exposed to the climate related and geo-physical hazards, City of Malolos shows a variable level of threat per hazard. Overall, City of Malolos determined that the degree to which people, places, institutions and sectors are impacted by climate change hazards today and in the future faces **Medium** threat. As evidence, base on historical events, city’s populace experienced small number of injuries, significant general reduction in livelihoods, isolated but significant instances of environmental and infrastructure damage that might be reversed with intensive efforts. Of those identified hazards, drought posted the highest threat with a score of 4.16 out of 5, followed by flooding and typhoon/tropical cyclone with 4.13 and 4, respectively and Sea Level Rise with 2.67. Storm surge appears to be the least threatening with a threat level of 2.5.

The high level of drought may be due to the nature of resources at risk, which are potable water, agriculture, natural resources and the subsequent impacts on health and livelihoods. Threat from flooding and typhoon can be attributed to the physical scale of such an event, both historically and by scientific analysis from the Philippine Atmospheric, Geophysical and Astronomical Services Administration. Among the sectors assessed, environment, land use and economics posted the highest threat level from multi-hazards with 3.86, 3.6 and 3.51 respectively. Infrastructure follows and social with 3.26 and 3.24, respectively. For environment and land use, the result can be traced to magnitude of elements affected. The threat to the environment sector can be ascribed to the fragile nature of resources, their location, and uncontrolled pressure from surrounding developments.



Table 14: Observed Threat Level (TL)

Sector	Drought	Flooding	Typhoon/TC	SLR	Storm Surge	Average
Environment	4	4	4.33	3.33	3.66	3.86
Land Use	4.66	4.33	4	2.66	2.33	3.6
Economics	4	4.14	3.85	2.85	2.71	3.51
Infrastructure	4.33	4	3.66	2.33	2	3.26
Social	3.8	4.2	4.2	2.2	1.8	3.24
Level of Threat	4.16	4.13	4	2.67	2.5	3.01
	High	High	High	Medium-High	Medium-High	Medium

Climate Related Hazards City-wide Level of Threat (Medium-High); 5-High, 1-Low

E. ADAPTIVE CAPACITY

Adaptive capacity assessment is required in order to come up with successful local climate change action plan that is responsive to the needs of the community. Adaptive capacity assessment is to evaluate the propensity of human and ecological systems to suffer harm and their ability to respond to stresses brought about by climate change and variability. This will also include identification of sectors that may be affected by climate change events (e.g. typhoon, flood, sea level rise, drought, etc.) based on past and present climate variability. It discussed various factors affecting vulnerability of households, communities, and other sectors under climate change related events.

City of Malolos adaptive capacity relies on its regular services, programs, national policies, and civil society organization networks for support. Current measures addressing climate risks are mandate-driven and concentrate on social services disaster responses directed towards addressing the impacts of climate-related events. This is evident in the structural measures pursued by the city (e.g. flood control). Private sector participation is minimal, except for the infrastructure sector, implying heavy dependence on local drawn resources and aid from other agencies. As impacts are context-specific, adaptive measures should likewise be so.

The resilience of a city depends on the fragility of the urban system and the capacity of social agents to anticipate and take action to adjust to changes and stresses considering constraints on resource access and supporting systems. Urban resilience describes the ability of a city to withstand or accommodate stress and shocks such as climate change impacts and natural hazards, while still maintaining its function. At the urban scale, resilience will depend on the ability to maintain essential assets as well as to ensure access to services and functions that support the well-being of citizens. This is particularly prevalent for populations lacking access to financial, material, and social capital that can be used to buffer the stresses and enable long-term adjustments. Urban populations depend on interrelated and interdependent urban systems (e.g. infrastructure, ecosystems, institutions, and knowledge networks) that support and are supported by social agents – both private and public. The Overseas Development Institute elaborates this capacity at the local level as:

Table 15: Adaptive Capacity at the Local Level

ADAPTIVE CAPACITY AT THE LOCAL LEVEL	
Characteristics	Features that reflect a high adaptive capacity
Asset Base	Availability of key assets that allow the system to respond to evolving circumstances



Institutions and Entitlements	Existence of an appropriate and evolving institutional environment that allows fair access and entitlement to key assets and capitals
Knowledge and Information	The system has the ability to collect, analyze and disseminate knowledge and information in support of adaption activities
Innovations	The system creates an enabling environment to foster innovation, experimentation and the ability to explore niche solutions in order to take advantage of new opportunities
Flexible, Forward Looking, Decision Making and Governance	The system is able to anticipate, incorporate and respond to changes with regards to its governance, structures and future planning

Building knowledge to inform decisions of both the public and private sector is also limited to information, education campaigns activities. Recently, there has been a deliberate effort to improve decision parameters through the use of risk data generated by national agencies and some development organizations. As for governance, typical processes seem to apply like usual planning tasks and regulation. In terms of hazard, the city is most keen on averting the impacts of flooding, drought and typhoons. Storm surge and sea level rise, on the other hand, are remote events to the city, and are not perceived to be as pressing as floods or typhoons and drought. This explains the minimal actions and investments on these hazards. The city's lessons from past typhoons and flooding events have improved risk reduction responses, as seen in the foregoing measures that it has been pursuing.

E.1 Adaptive Capacity and Measures

Table 16: Adaptation/Mitigation Measures + Adaptive Capacity

HAZARDS	MAJOR IMPACTS	ADAPTIVE CAPACITY	MEASURES	
			ADAPTIVE	MITIGATION
Flooding due to extreme weather events (<i>increased rainfall</i>), Typhoons/TCs	<ul style="list-style-type: none"> ▪ Destruction of properties, shelter, infrastructures, embankment and other facilities ▪ Loss of lives, displacement of families, disaster trauma - emotional breakdown and suicidal tendencies syndrome incidence ▪ Increased maintenance, repair and replacement of residential, commercial and industrial buildings resulting to increase in preventive expenditures and higher maintenance costs, thus, reduction in capacity of businesses to operate due to property damage leading to increased poverty, increase in demand for basic needs, higher incidence of malnutrition and increase in crime rates 	<ul style="list-style-type: none"> ▪ Efforts to address the Climate Change related drivers and impacts is on the context of Disaster Risk Reduction ▪ The enacted Climate Change Act and other related laws can be a startup process to address Climate Change ▪ City of Malolos is one of the Philippines' having a best practice in emergency response and an awardee of Climate-Resilient City of CCC; ▪ Updated DRRM Plan ▪ Strengthened Local/City Disaster Risk Reduction and Management Office (DRRMO), emergency responders area organized down to barangay level 	<ul style="list-style-type: none"> ▪ Improve infrastructure design such as the use of climate change resilient materials, stronger roof fixing connections, installation of essential vulnerable equipment on higher elevations and designing aerodynamically efficient structures ▪ Adopt formal asset management approach that can effectively consider climate inputs to maintain buildings (least cost adaptation strategy e.g. retrofitting) ▪ Locating major infrastructures away from areas considered 	<ul style="list-style-type: none"> ▪ Promotion of green buildings such as buildings with energy efficient designs (natural lighting and ventilation) ▪ Use of locally sourced energy (e.g. solar) to minimize transmission infrastructure ▪ Encourage use of green materials in construction ▪ Adopt alternative and more efficient construction methods e.g. prefabrication and off-site construction ▪ Promotion of electric vehicles ▪ Anti-smoke belching campaign ▪ Encourage fuel switching e.g. conversion to



<p>Coastal Land Inundation due to Increased Rainfall, Sea Level Rise (SLR), Storm Surge due to Typhoons/TCs</p>	<ul style="list-style-type: none"> ▪ Hampered economic activities leading to disruption of livelihood resources (crops, livestock, poultry, etc.) ▪ Uncoordinated and poor delivery of health services/poor health system ▪ Hampered school activities, decreased educational performance ▪ Reduction in available water for consumptive use-potable, commercial and industrial and increased run-off and pollution of freshwater sources, thus affecting the quality of drinking water and impact to public health, water contamination and water pollution leading to increase incidence of diarrhea and food poisoning, occurrence of incidence of vector borne and communicable diseases (e.g. dengue, malaria, leptospirosis etc.) ▪ Increased occurrence of waste slide/wastewater flows especially in ill-designed and operated landfill garbage dump sites due to increased rainfall intensities ▪ Accelerated deterioration and depreciation of assets due to highly variable climate ▪ Destruction of production areas, mangrove areas resulting to loss of tourism, recreation, and coastal habitats ▪ Increased rainfall could also wash more agricultural fertilizer and municipal sewage into coastal waters, creating more low-oxygen “dead zones” in major coastal waters ▪ Sea level rise is highly likely in a changing climate, and 	<ul style="list-style-type: none"> ▪ Presence of basic communication channels and infrastructures ▪ Adequate manpower and time to plan and implement adaptation actions (technical people, trained responders, health and education facilities etc.) ▪ As a form of adaptation, Zoning Ordinance, CLUP is on-going revision and development to include the regulation of building constructions in flood prone areas (min. 1-meter height elevation, Green Building etc.) ▪ Diligent and strict implementation of a Climate Change compliant land use and risk reduction policies ▪ Upland Community Organizing Program ▪ Urban Greening Program ▪ Intensified campaigns on waste segregation ▪ Solid Waste Action Plan ▪ Early warning systems for severe weather, including advisories on storm surge probabilities, as well as planning for and developing resilient livelihoods where traditional fishing/ agriculture are no longer viable ▪ Proactive planning (short- and long-term adaptation measures) in attaining poverty eradication, sufficient nutrition and secure livelihoods goals ▪ River desiltation Project ▪ Presence of Waterways and Irrigation Task Force (WITF) ▪ Mangrove Nursery 	<p>most vulnerable to climate stress</p> <ul style="list-style-type: none"> ▪ Maintain livelihood opportunities and diversify options ▪ Reduce risks to human health and safety ▪ Mobilize and unite all stakeholders, lead in planning and management ▪ Develop and implement flood plain zones ▪ Promote best practices in solid waste mgmt e.g. reduction, reuse, recycling. ▪ Locating and improve major wastewater infrastructure away from vulnerable areas/ design to account for climate change e.g. increase design flows ▪ Strictly enforce environmental laws ▪ Implementation of proper solid waste management program in order to minimize waste dumping and have properly constructed and operated landfill facilities ▪ Reserve local sites to accommodate waste sorting, recycling and reuse, away from climate change vulnerable areas ▪ Improve drainage infrastructure design such as accounting for increased rainfall intensities in design flow calculations ▪ Develop locally specific flood protection programs ▪ Strengthen governance frameworks for coastal adaptation 	<p>compressed natural gas (CNG) and bio-fuels</p> <ul style="list-style-type: none"> ▪ Encourage non-motorized transport i.e. cycling and walking ▪ Promote alternative energy sources that will minimize need for transmission and distribution infrastructure
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	low-lying islands will face permanent inundation in the future		<ul style="list-style-type: none"> Develop watershed management programs to protect catchment areas 	
Drought	<ul style="list-style-type: none"> Water shortage due to drought leading to increase in water cost per unit of production, disrupted maturing processes of crops, unpredictable farming conditions, dwindling fish catch, fish kills in fresh water aquaculture resulted to low income of farmers and fisherman and shortage of food supply Increased levels of heat stress, respiratory illness, chronic disease, human displacement (short-term and long-term), infectious disease, and premature death Changes in soil characteristics and disturbance regimes (e.g., fires, pests, and diseases), which would favor some species over others and thus change species composition Failure of ecological systems to provide the wide range of benefits on which societies rely for their continued existence, adapt and re-establish themselves 	<ul style="list-style-type: none"> Locate new settlements away from vulnerable areas this will require proper land use planning to avoid siting buildings on river flood plains and low-lying coastal areas Rational water management, planning to avoid mismatch between water supply and demand through policies, changes in cropping patterns in agricultural areas Horizontal and vertical diversification of crops, farmer field schools which incorporate use of weather/climate information in agricultural operations, including policy environment for subsidies and climate-friendly agricultural technologies, weather-based insurance, and others Maps of drought prone areas Access to drought forecasting and early warning system 	<ul style="list-style-type: none"> Use of dynamic cropping calendar and breeding of stress-resistant varieties of crops Use of water supply systems with minimal contribution to climate change, e.g. gravity over pumped systems, which does not require power Encourage water use efficiency and conservation (technology, behavioural and pricing solutions and incentives) Develop and implement rainwater harvesting systems Promote water reuse and/or recycling Locating critical water supply infrastructure away from vulnerable areas Adopt formal asset management approach that can effectively consider climate inputs to maintain water supply infrastructures Encourage water use efficiency and conservation (technology, behavioral and pricing solutions and incentives) 	

Following the identification of adaptive capacity measures, the stakeholders scored their present level of response/action on climate risks.

Table 17: Level of Adaptive Capacity

Sector	Flooding	Drought	Typhoon/TC	SLR	Storm Surge	Average
Infrastructure	1.66	2.66	1.66	2.66	3.66	2.46
Environment	1.66	2.33	2.33	2.66	3.66	2.6
Land Use	1	1.66	3	4	5	2.93



Economics	2.28	1.71	2.42	3.42	4.85	2.94
Social	2	3	2.25	3.5	4.5	3.05
Adaptive Capacity	1.72	2.27	2.33	3.24	4.33	2.78
	<i>High</i>	<i>Medium-High</i>	<i>Medium-High</i>	<i>Medium-Low</i>	<i>Low</i>	<i>Medium</i>

1-High, 5-Low

By computing the vulnerability ratings, the summary of the result of the threat level (exposure & sensitivity) vs. the Adaptive Capacity of the different groups and sectors, the relative vulnerability of the City of Malolos by hazard is 1.57. This can be traced to the apparent concentration of present efforts on response to drought, flooding and typhoons and preparedness effort on sea level rise, base on city’s experiences. From among the hazards identified, given all the efforts to address its impacts, the city still appears to be most vulnerable to flooding.

Table 18: Vulnerability by Hazard

Rank	CC Related Hazard	Threat Level	Adaptive Capacity	Vulnerability Rating (5 Most Vulnerable)
1	Flooding	4.13	1.72	2.40 (MH)
2	Drought	4.16	2.27	1.83 (M)
3	Typhoon/TC	4	2.33	1.72 (M)
4	Storm Surge	2.5	2.33	1.07 (ML)
5	SLR	2.67	3.24	0.82 (L)
Ave. Score				1.57 (M)

Of the five sectors, land use is the most vulnerable to multi-hazards. Both economics and environment sectors posted the next sectors with highest threat level followed by social and infrastructure.

Table 18: Vulnerability by Sector

RANK	CC RELATED HAZARD	Threat Level	Adaptive Capacity	Vulnerability Rating (10 Most Vulnerable)
1	Land Use	3.6	2.93	6.53
2	Economics	3.51	2.94	6.45
3	Environment	3.86	2.6	6.46
4	Social	3.24	3.05	6.25
5	Infrastructure	3.26	2.46	5.72
Ave. Score				6.28



F. CLIMATE CHANGE KEY DEVELOPMENT ISSUES

HAZARDS	CLIMATE CHANGE ISSUES & CONCERNS	SECTORS/ AREA	OBJECTIVES
Flooding, TC, SLR, SS, strong wind	1. Existing facilities and infrastructures not at par with the structural standard and adaptive to CC hazards	Infrastructure Social	To adapt green building technology in infrastructure projects
Flooding, Drought, TC, SLR, SS	2. Prevalence of malnutrition cases due to reduction of livelihood activities	Social Economics	To provide sustainable nutrition program
Flooding, TC, SLR, SS	3. Dislocation of settlements/dwellings	Social Infrastructure	To provide the affected populace relocation site and settlement adaptive to CC and DR
Flooding, Drought, TC, SLR, SS	4. Health problems (increase of incidence of vector borne diseases e.g. dengue, malaria, leptospirosis, pneumonia etc., incidence of dengue, malaria, COPD, emphysema, bronchial asthma, emotional trauma and other diseases	Social	To provide prompt accessibility to health services and facilities
ALL	5. Passive participation of the community and the vulnerable sectors in the issues of CC and DRRM	Social	To ensure and enhance active participation of all sectors and the community especially vulnerable groups in LGU governance, planning, implementation, monitoring and evaluation of CC and DRRM issues
ALL	6. Awareness on Climate Change only confined within a few officials of the City government and community leaders	Social	To increase and intensify awareness of the community especially the vulnerable groups in concerns relative to CC and DRRM
ALL	7. Political will is always an obstacle in implementing bigger adaptive measures. Some officials, leaders and service providers stick on to uncertain and inappropriate decisions in resolving issues relative to CC and DRRM	ALL	To promote pro-active and responsive governance in managing DRRM and CCA issues
ALL	8. Increasing demand for services and utilities including facilities	Social Infrastructure	To provide and make available the needed services and facilities to respond and minimize the impacts of disasters and CC related hazards and vulnerability
ALL	9. Source of livelihood impeded	Social Economics Infrastructure	To provide alternative source of income to populace affected by CC hazards
Flooding, Drought	10. Crime rate increases	Social Economic	To ensure employability among Maloleños
ALL	11. Insufficient number of personnel with adaptive and improved technological capabilities in CC and DRRM	Social	To choose capable personnel and provide them with necessary trainings, seminars and other capability enhancement activities to improved adaptive and improved technological capabilities in CCA and DRRM
ALL	12. Insufficient number of capable and trained responders	Social	To conduct trainings to groups, sectors, organizations on rescue and response
Flooding, Drought	13. Filthy and low potable water supply	Social Economics Infrastructure	To provide adequate and improve access to potable/clean water supply



Flooding, Drought	14. Low functionality of irrigation support	Social Infrastructure Environment	To rehabilitate irrigation facilities and improve water system
Flooding	15. Defective and out-dated water supply pipes and pumping stations	Social	To rehabilitate water facilities, improve system and services
ALL	16. Absence of appropriate waste management in the coastal barangay detrimental to the sustainability of the fishing industry and endangered the life of residents due to the presence of toxins that might have already contaminated its water resource	Social Environment	To capacitate the community on relative laws and provision of waste management services and facilities
Flooding, Drought, TCs, SS, SLR	17. 10% of city's population relies and dependent on livestock, agriculture and fisheries	Social Economics	To strengthen the capacity and resiliency of livestock producers, farmers and fishermen and fisheries to the effects of CC hazards
Flooding, Drought	18. Low harvest in farming	Social Economics	To lessen the overhead cost of farm production and generate more profit
ALL	19. Depleting fish catch	Social Economics Environment	To rehabilitate and protect fish sanctuary to increase fish production
Flooding, Drought	20. High cost of maintenance and limited space to raise livestock due to urbanization	Social Economics Land Use	To promote and improve CC adaptive livestock raising/production and responsible pet ownership
Flooding, Drought, TCs	21. Production of Business Establishments (Commercial/Industrial) decreases due the effect of CC hazards	Economics Social	To develop and improve the capabilities of sectors (farmers, fisheries, livestock, manufacturing/ business) to adjust to climate change and continue to increase productivity
Flooding, TCs	22. Vulnerability of dilapidated facilities	Economics Infrastructure	To strictly enforce the Building Code and conduct of regular inspection; To adapt green building technology in infrastructure projects
ALL	23. Identification and preservation of the remaining lands according to use (resistance level to hazards)	ALL	To avoid conflicting/competing land uses
Flooding, Drought	24. Production support and post-harvest, livestock and poultry facilities	Social Economics	To provide support to economic sectors through services, financial assistance and facilities and promote CC adaptive production
ALL	25. Support fund mechanism, financial assistance and skills trainings to farmers and fishermen and livestock producers	Social	To promote coordination among farmers and fishermen for endorsement to different agencies for funding and skills training programs and projects
Flooding, TC, SLR, SS	26. Uncontrolled residential developments, illegal structures and settlements along waterways and coastal areas (Weak housing materials, especially for informal settlers)	Social Infrastructure	To control residential developments, illegal structures and settlements along waterways and coastal areas (weak housing materials, especially for informal settlers)
Flooding, Drought	27. Poor drainage systems due to clogged drainage, creeks and waterways	Environment Infrastructure	To improve waterways and drainage system and implement flood and erosion control projects
Flooding, TC, SLR, SS	28. Destruction of mangroves and coastal habitats	Environment	To identify zone declared of mangrove and fish sanctuary
Flooding, TC, SLR, SS	29. Conversion of mangroves to urban uses	Land Use Environment	To strengthen governance frameworks for coastal adaptation and protection of ecosystems



Flooding, TC, SLR, SS	30. Weak coastal defenses	Environment	To ensure the safety and protection of the populace and habitats in coastal areas/barangays
Flooding, Drought	31. Undisciplined and ignorant public in implementing proper waste management	Environment	To ensure proper waste segregation, collection, reduction and diversion of solid waste
Drought	32. No system for monitoring of air ambient quality	Social Environment	To minimize air pollution
Flooding	33. Insignificant attention on the promotion of clean and green programs and activities	Environment	To achieve a sustainable clean and green environment
Flooding, TC, SLR, SS	34. Some barangays do not have waste management system resulting to residential and commercial waste being dumped everywhere	Social Environment	To increase public awareness on proper waste management and protection of natural environment
Flooding	35. Level of pollution and solid wastes from settlements and sedimentation from uplands improperly disposed	Social Environment	To control and mitigate the negative environmental impacts of pollution and solid waste
Flooding	36. Lenient implementation of DENR requirements for subdivision sewerage treatment facility	Social Infrastructure	To strictly enforce all environmental laws relative to water quality management
Flooding	37. Lack of wastewater treatment facility for highly populated buildings and community	Social Infrastructure Environment	To avoid hazards and risks of wastewater to human health and safety
Drought, Flooding	38. Inefficient services on supply and quality of water to the community	Social	To enhance service efficiency and improve water quality
Flooding	39. Continuing water pollution (e. g. incidence of improper disposal of septage/sewage)	Environment	To adopt a program on water pollution control and management
ALL	40. Insufficient facilities and services on sanitation and hygiene	Social	To provide facilities, services and promotion of hygiene and sanitation
ALL	41. Lack of capable and competent local agency/office/personnel with capacity, competency and specialization on weather and ecology management	ALL	To create a regular local agency with capabilities, capacities and specialization on weather and ecology management
ALL	42. Increasing ratio of land conversion and areas for urban uses as a result of service demand due to absence of Urban Conservation Plan	Land Use	To establish development controls to guide/regulate/ revitalize the built up areas, including public utilities, landscaping, urban design, etc. And to avoid conflicting and competing land uses
ALL	43. Non-performing, less productive and insufficient number of CGM, barangay officials and employees with specializations vis-à-vis the needs on Disaster Risk Reduction and Management and Climate Change Adaptation	ALL	To enhance the capability and competency of appropriate offices, groups, staff and personnel (service providers) on adaptive and technological ability relative to CCA and DRRM
ALL	44. Trainings and seminars attended on DRRM and CC only benefitted the attendees	ALL	To promote and increase awareness of the community in DRRM and CCA
ALL	45. Compliance of barangays, sectors and general public on DRRM and CCA are not properly monitored and assessed	ALL	To ensure and enhance active participation NGOs, CSOs, the community especially the vulnerable groups in LGU initiatives on DRRM and CCA





**SECTION 3:
OBJECTIVES OF THE PLAN**

Section III: OBJECTIVES OF THE PLAN

A. DEVELOPMENT GOALS AND OBJECTIVES

The goals of the City of Malolos Climate Change Action Plan 2017-2022 are anchored on the following goals of the National Climate Change Action Plan 2023-2033:

- a. Building the adaptive capacities of the communities
- b. Increase the resilience of vulnerable sectors and natural ecosystems to climate change
- c. Optimize mitigation opportunities towards gender-responsive and rights-based sustainable development.

A.1 Sectoral Goals:

A.1.1 Social

1. Promotion of health and safety, enhance economic prosperity and social justice and preserve the comfort and convenience of the inhabitants while maintaining quality of natural environment for current and future generations
2. Provide the citizenry with multiple skills and proficiency for livelihood, encourage and support the development of appropriate and self-reliant scientific and technological capabilities with corresponding financial assistance compliant to climate-related impacts
3. Increase accessibility and address the increasing need of the constituents to social (clean and safe water, sustainable nutrition program, population program, livelihood, human settlements, insurance program etc.) services.
4. Well-informed citizenry/community and equip them with knowledge in the context of Climate Change Adaptation to assure that they are assisting to minimize the impacts and reduce the number of high risk sectors in climate-related hazards.
5. Increase the number and ensure active participation of vulnerable sectors in LGU planning, implementation, monitoring, evaluation and actively participating in governance.

A.2. Economic

1. Delineate heritage zones to be protected to the impacts of climate-related hazards.
2. Develop and improve the capabilities (e.g. Entice farmers and fishermen to utilize organic feeds and other farm inputs, modernization program, lessen overhead cause, Organize farmers and fishermen into economic interest groups etc.) of economic sectors in adapting to the effects of climate change leading to high production and maintain quality and increase productivity
3. Enforce all laws and ordinances to protect the welfare of animals, livestock raisers and pet owners
4. Coordinate and links with Government Agencies and NGO on all matters on pertaining the city attain an environment conducive to investment and businesses that promotes full employment among residents.
5. Ensure the participation of Business Sectors in developing and adhering to the mandates of relevant laws, acts, ordinances and policies regarding Disaster Risk and Climate Change adaptation and in responding to adverse impacts of disaster and climate-related hazards.



A.3. Infrastructure

1. Enhance the right of the people to a balanced ecology and build their adaptive capacity to climate change impacts and vulnerabilities
2. Identify vulnerable infrastructures and formulate necessary intervention programs to increase susceptibility and minimized the effects and impacts to any kind of climate-related hazards.
3. Improve services and facilities that will provide production support to economic sector
4. Implement Construction Safety and Health Procedures in infrastructures and rehabilitation projects.
5. Formulate guidelines and policies on green building technology
6. Use alternative sources of energy (solar energy) on certain establishments, public buildings and streetlights and construction/development of resilient infrastructures (disaster and CC infrastructure resilient).

A.4. Environmental Sector

1. Ensure the implementation of RA 9003 and other environmental laws, acts, ordinances, regulations and policies (one (1) MRF in each cluster, industry equipped with waste water facilities, proper waste segregation, collection, groundwater extraction for individual residents and establishments, reduction and diversion of solid waste, use of chemicals on fishponds, resorts and other water facilities that egress to other water tributaries etc.)
2. Encourage citizenry to plant and propagate trees, participate in restoring mangrove areas, rehabilitation of fish sanctuaries and mitigate the negative environmental impacts of solid waste achieve a sustainable clean and green.
3. Promote community's participation in mitigating and responding to adverse impacts of CC and providing full protection and revitalization of natural resources and ecology
4. Integrate climate change and disaster risk reduction system in the local governments (city and barangays) programs and in communities (enactment of ordinance imposing stiffer penalties to those who violate environmental laws, Tree-planting ord. for scholar beneficiaries and other sectors, adoption of scorecard system for every barangay, specifically in their environmental functions that will serve as their eligibility to benefit from LGU programs etc.)
5. Empower, invigorate and institutionalize the Bantay-Ilog/Dagat and equip them with technological capabilities to protect the sea and coastal areas from illegal fishing.
6. Establish, operate and maintain sewerage treatment, septage facilities, water treatment facilities and other related infrastructures.

A.5. Land Use

1. Identify and preserve lands according to suitability and determine urban expansion area adequate to accommodate future growth.
2. Formulate a city open space plan and management guidelines & compliance to open space standards.
3. Delineate and map out environmentally constrained and critical areas
4. Establish density controls to guide developments in areas prone to environmental hazards.
5. Revisit local land use requirements so as not to hamper economic activities without prejudice to the community specifically the marginalized sector (fisher folks/farmers).



To reflect the stated Vision, Missions and Goals, the City of Malolos will implement a range of climate change adaptation and mitigation measures in order to better prepare, protect and inform its residents and rate payers for the anticipated impacts of climate change.

In summary, the Vision will be achieved through the application of a best practice risk management framework that sets strong, clear goals to provide a risk management approach and to clarify and develop local policy and planning actions to enable the City to adapt to the issues of climate change underpinned by the following sustainable principles that drive all actions outlined in this plan to:

The LCCAAP will address key issues by aiming for the city to:

1. Prepare itself and take necessary action so that it can adapt to the expected impacts of climate change with minimal impact to its operations and its community;
2. Promote resilience and support local communities to partner with the City to improve the management of the local environment and community public assets;
3. Encourage transport, planning and building systems that support low emissions and accommodate a changed climate;
4. Support disadvantaged communities to adjust to the cost of a low emissions economy to reduce climate change impacts on these communities

3.2 OBJECTIVES

The specific objectives of the City of Malolos Climate Change Action Plan 2017-2022 emulates the work priorities defined in the National Climate Change Action Plan 2011-2028 which include the following:

1. To ensure availability, stability, accessibility and affordability of safe and healthy food
2. To ensure the resilience of water resources, manage supply and demand, manage water quality and promote conservation
3. To protect and rehabilitate critical ecosystems and restore ecological services
4. To reduce the risks of most vulnerable groups/sectors (elderly, youth, pregnant etc.) to climate change and disasters
5. To create green and eco-jobs and sustainable consumption and production
6. To promote and expand energy efficiency and conservation and develop sustainable and renewable energy, environmentally sustainable transport
7. To enhance community's knowledge on climate change, capacity for climate change adaptation, mitigation and disaster risk reduction


City of Malolos Local Climate Change Action Plan 2017-2022 is anchored on the National Climate Change Framework strategy which has recently been translated into a National Climate Change Action Plan (NCCAP), which adopts the following priorities:

1. Food security
2. Water sufficiency
3. Ecological and environmental stability



4. Human security
5. Climate-smart industries and services
6. Sustainable energy
7. Knowledge and capacity development





SECTION 4: STRATEGIES, POLICIES & PROGRAMS, PROJECTS & ACTIVITIES

A. ADAPTATION AND MITIGATION OPTIONS

The emergence of climate change related hazards such as increased in temperature, flooding, increased precipitation, frequency and intensity of typhoons, sea level rise, storm surge, etc. have impacts on the city's economy, environment, infrastructure, land use and on the city's 255,686 projected population and 55,584 number of households. Having coastal barangays, formation of marine and riverine water bodies around it, and its fast-growing urban population, City of Malolos is greatly vulnerable to the impacts of climate change, and has already experienced noticeable adverse effects in the past years. Without concerted national and local action, the challenges the city will face as a result of climate change are expected to intensify in the medium or long term.

In response to this and in consonance with the Climate Change Act (Republic Act 9729) which provides the policy framework with which to systematically address the growing threats on community life and its impact on the environment, the City Government of Malolos defined its Local Climate Change Action Plan which is based on the preceding analyses of the Vulnerability and Adaptation Assessment Report. The report is the result of the workshops conducted participated by different stakeholders, trainings and seminars attended by the members of the LCCAP Core Team, relative information/data provided by the DILG and other government agencies.

The City of Malolos Local Climate Change Action Plan 2017-2022 is patterned on the national climate change framework strategy which has recently been translated into a National Climate Change Action Plan (NCCAP), which adopts the following priorities:

1. Food security
2. Water sufficiency
3. Ecological and environmental stability
4. Human security
5. Climate-smart industries and services
6. Sustainable energy
7. Knowledge and capacity development

LCCAP Core Team of the City of Malolos conducted an initial identification of climate change mitigation and adaptation options that enable the city to adjust to the impacts of climate change such as the increasing temperature of 1.0°C to 1.3°C throughout the year, the heavier rains causing floods during the wet seasons of June to February, and the typhoons caused by heavy rains alone in addition to typhoons accompanied by strong winds.



Table 20: List of Identified Adaptation and Mitigation Options

Adaptation And Mitigation Options (Proposed Interventions)	Hazards	Sectors	NCCAP Priority Responded
1. Provision of livelihood trainings, assistance funds and other possible source of income to populace affected by CC hazards	Flooding/ Extreme Weather Events (EWE) Drought/ Increased Temperature (IT) Typhoons/ Tropical Cyclone (TC) Storm Surge (SS) Sea Level Rise (SLR)	Social Economic	Food Security
2. Require business establishments to allocate/hire certain number or percentage of their workforce from vulnerable sectors especially the PWDs and Solo Parents	ALL	Social Economic	Food Security
3. Provision of post-harvest facilities like access roads, hauling equipment, storage etc. to provide better price to farmers	Flooding/ EWE Drought/ IT	Social Economic Infrastructure	Food Security
4. Revisit local land use requirements so as not to hamper economic activities without prejudice to the community specifically the marginalized sector (fisher folks/farmers)	ALL	Land Use Economic Social	Food Security Environmental Stability
5. Diversify/intensify organic farming and adopt new cropping/ intercropping pattern consistent with the change in seasonal pattern 6. (Climate-resilient crops)	Drought/IT Flooding/EWE	Economic Social	Food Security
7. Promote and adopt insurance program for sectors	ALL	Economic Social	Food Security
8. Provision of tax incentives	ALL	Economic Social	Food Security
9. Periodic education program for farmers and fishermen in coordination by Dept. of Agriculture, Dept. of Fisheries, Dept. of Trade and Industry to upgrade knowledge from subsistence to profitable farming and funding of projects that are agriculture and fishery related	ALL	Economics Social	Food Security Knowledge and capacity development
10. Provision of budget allocation for price subsidy on feeds for livestock and poultry thereby enabling the sector to compete with the cheap imported stocks flooding the local market	Flooding/EWE Drought/IT	Economic	Food Security
11. Provision of funding for the development of indigenous and cheap sources of farm inputs to those affected by disasters and CC hazards to improve production and make products more competitive	Flooding/EWE Drought/IT	Economic	Food Security
12. Provision of modern inputs & techniques in farming, livestock production and fisheries	Flooding/EWE Drought/IT	Economic	Food Security Knowledge and Capacity Development
13. Acquisition of Land and Land Improvements	Flooding Drought	Land Use	Ecological and Environmental Stability
14. Declaration of mangrove and fish sanctuary	Flooding/EWE Drought/IT SLR SS TCs	Social Economic Land Use Environment	Food Security Ecological and Environmental Stability
15. Promote veterinary health program and animal welfare	Drought/IT	Social	Food Security



Adaptation And Mitigation Options (Proposed Interventions)	Hazards	Sectors	NCCAP Priority Responded
		Economic	
16. Construction/rehabilitation of a communal irrigation or water impounding system and/or purchase of post facilities such as farm or hand tractor with trailer, thresher, mechanical drier	Flooding/EWE Drought/IT	ALL	Water Sufficiency
17. Rehabilitation and maintenance of defective and outdated water supply pipes and pumping stations	Flooding/EWE Drought/IT	Social Infrastructure	Water Sufficiency
18. Establishment of Water Testing Facility	Flooding/EWE Drought/IT	Infrastructure	Water Sufficiency
19. Construction or rehabilitation of local government owned potable water supply system	Flooding/EWE Drought/IT	Infrastructure	Water Sufficiency
20. Encourage water use efficiency and conservation (technology, behavioral and pricing solutions and incentives) and water reuse and/or recycling	Drought/IT	Social Environment	Water Sufficiency
21. Strict implementation of DENR requirements for subdivision sewerage treatment facility	Flooding/EWE Drought/IT	Environment	Water Sufficiency Ecological and Environmental Stability
22. Require wastewater treatment facility for highly populated buildings and for community	Flooding/EWE	Environment Infrastructure	Water Sufficiency Ecological and Environmental Stability
23. Strict adherence to the provisions of the Water Code and Sanitation Code	Flooding/EWE Drought/IT	Environment	Water Sufficiency Ecological and Environmental Stability Human Security
24. Formulation of City Storm Drain and Drawing Sustainable Wastewater Master Plan	Flooding/EWE Drought/IT	Environment	Water Sufficiency Ecological and Environmental Stability
25. Regular water quality surveillance	Flooding/EWE Drought/IT	Environment	Water Sufficiency
26. Construction of water recycling facility and provision of more shallow tube wells	Flooding/EWE Drought/IT	Infrastructure	Water Sufficiency
27. Regulate the use of chemicals on fishponds, resorts and other water facilities that egress to other water tributaries	Flooding/EWE	Environment Economic Social	Water Sufficiency Ecological and Environmental Stability
28. Locating critical water supply infrastructure away from vulnerable areas	Flooding/EWE Drought/IT	Social Infrastructure	Water Sufficiency
29. Adopt formal asset management approach that can effectively consider climate inputs to maintain water supply infrastructures	Drought	Infrastructure	Water Sufficiency
30. Adopt formal asset management approach that can effectively consider climate inputs to maintain buildings (least cost adaptation strategy e.g. retrofitting)	Flooding/EWE	Infrastructure Economic Social	Human Security Climate Smart Industries and Services
31. Adoption of Plan for provision of potable and adequate water supply	Flooding/EWE Drought/IT	Social	Water Sufficiency
32. Establishment of Sewerage Treatment and Septage Management Facilities, requiring establishments/subdivisions to put up water treatment facilities	Flooding/EWE Drought/IT	Infrastructure Social Environment	Water Sufficiency Ecological and Environmental Stability



Adaptation And Mitigation Options (Proposed Interventions)	Hazards	Sectors	NCCAP Priority Responded
33. Full Compliance to Clean Water Act (RA 9275)	Flooding/EWE Drought/IT	ALL	Water Sufficiency Ecological and Environmental Stability
34. Establishment of selected areas as environmentally critical and protected areas (Farm land, Fish sanctuary etc.)	ALL	Environment	Ecological and Environmental Stability
35. Construction/rehabilitation of sanitary landfill/material recovery facilities and purchase of garbage trucks and related equipment	Flooding/EWE Drought/IT	Infrastructure Environment	Ecological and Environmental Stability
36. Construction (material assistance) and fabrication of steel type BMRF for highly urbanized barangay (mobile type)	Flooding/EWE Drought/IT	Infrastructure Environment	Ecological and Environmental Stability
37. Strict implementation of environmental protection laws and ordinances (e.g. anti-litter ordinance, RA 9003, illegal discharge of domestic and industrial wastes to bodies of water etc.)	Flooding/EWE	Social Environment	Ecological and Environmental Stability
38. Adoption of Approved 10-year Solid Waste Management Plan	ALL	ALL	Ecological and Environmental Stability
39. Reserve local sites to accommodate waste sorting, recycling and reuse, away from climate change vulnerable areas	Flooding/EWE Drought/IT	Environment	Ecological and Environmental Stability
40. Promote best practices in solid waste mgmt e.g. reduction, reuse, recycling (IEC campaign, brochures etc.)	Flooding/EWE Drought/IT	Social Environment	Ecological and Environmental Stability
41. Sagip Basura/Sagip Ilog Program	Flooding SLR SS EWE	Environment Social	Ecological and Environmental Stability Food Security
42. Creation/Deputization of Environmental Green Armies/Bantay Basura/Ilog Team)	Flooding	Environment Social	Ecological and Environmental Stability
43. Rehabilitation and reforestation of mangrove areas (collection, potting, planting, monitoring of planted mangrove and illegal cutting activities)	Flooding SLR SS EWE	Environment	Ecological and Environmental Stability Food Security
44. Rehabilitation and maintain fish sanctuaries and marine reserves	Flooding SLR SS EWE	Environment Land Use	Ecological and Environmental Stability Food Security
45. Empower the Bantay Dagat and equip them with technological capabilities to protect the sea and coastal areas from illegal fishing and other illegal activities that endanger the coastal habitats	Flooding SLR SS EWE	Environment Social	Ecological and Environmental Stability Food Security Knowledge and Capacity Development
46. Community participation in Bantay-Ilog/Dagat Project implementation	Flooding SLR SS EWE	Environment Social	Ecological and Environmental Stability



Adaptation And Mitigation Options (Proposed Interventions)	Hazards	Sectors	NCCAP Priority Responded
47. Procurement of one 30-seater motorized banca for monitoring of illegal cutting of mangroves and coastal clean-up, coastal clean-up, and coastal survey	Flooding SLR SS EWE	Social Environment	Ecological and Environmental Stability Food Security
48. Construction of CFARMC/Bantay Dagat Office	Flooding SLR SS EWE	Infrastructure	Ecological and Environmental Stability
49. Plant a Tree Project for scholar beneficiaries and other sectors	ALL	Environment Social	Ecological and Environmental Stability
50. Clean and Green Contest for communities	ALL	Environment Social	Ecological and Environmental Stability
51. Creation of Waterways and Irrigation Task Force	Flooding	Environment	Ecological and Environmental Stability
52. Adoption of scorecard system in environmental functions to be the barangays' eligibility to benefit from LGU programs, banning of plastics/styro	Flooding/EWE Drought	Environment Social	Ecological and Environmental Stability
53. Impose stiffer penalties to those who violate environmental laws	ALL	Environment Social	Ecological and Environmental Stability
54. Promote tree planting and prohibiting cutting of trees.	Flooding Drought	Environment Social	Ecological and Environmental Stability
55. Formulate policies on strict imposition of penalties for illegal use and conversation of lands designated to a specific use	Flooding/EWE Drought	Environment Land Use	Ecological and Environmental Stability
56. Update land inventory to determine access to land tenure and avoid conflicting/ competing land uses	Flooding/EWE Drought	Environment Land Use	Ecological and Environmental Stability
57. Develop and implement flood plain zones	Flooding/EWE	Environment Land Use	Ecological and Environmental Stability
58. Formulate Urban Conservation Plan	ALL	Environment Land Use	Ecological and Environmental Stability
59. Revision of Comprehensive Land Use Plan (CLUP)/Zoning Ordinance	ALL	Environment Land Use Economic	ALL
60. Formulation of Comprehensive Development Plan (CDP)	ALL	ALL	ALL
61. Purchase/acquisition of latest/updated satellite imagery map of City of Malolos including the necessary software and hardware	ALL	ALL	Ecological and Environmental Stability Human Security
62. Reorientation of local government employees on the Zoning laws and Land use plans especially those agencies or departments connected with transactions on land use or in construction like the Engineering Office, Planning Office and Assessor's Office	ALL	Social Economic Land Use	Ecological and Environmental Stability Knowledge and Capacity Development



Adaptation And Mitigation Options (Proposed Interventions)	Hazards	Sectors	NCCAP Priority Responded
63. Strict monitoring of industries and households producing wastewater pollution (e. g. incidence of improper disposal of septage/sewage)	Flooding	Environment Social	Ecological and Environmental Stability Human Security
64. Asphaltting of Provincial Road (Sumapang Bata, Sumapang Matanda, Bungahan, Ligas) with drainage provision	Flooding	Infrastructure	Ecological and Environmental Stability
65. Asphaltting of Mabolo-Sto. Cristo Diversion Road with drainage provision	Flooding	Infrastructure	Ecological and Environmental Stability
66. Construction or rehabilitation of local roads or bridges and purchase of appropriate engineering equipment such as dump truck, graders and pay loader	Flooding	Infrastructure	Ecological and Environmental Stability
67. Establishment of Air Quality Monitoring Station	IT	Environment Infrastructure	Ecological and Environmental Stability Human Security
68. Prohibition of vape smoking in public areas	IT	Environment Social	Ecological and Environmental Stability Human Security
69. Improve drainage infrastructure design such as accounting for increased rainfall intensities in design flow calculations	Flooding/EWE	Infrastructure	Ecological and Environmental Stability
70. Develop locally specific flood protection programs	Flooding	Infrastructure	Ecological and Environmental Stability
71. Dredging and Desilting of Pamarawan and Tangib River Entrance (Part of Manila Bay)	Flooding	Infrastructure Environment	Ecological and Environmental Stability
72. Concreting, upgrading and widening of Caingin-Bulihan-Longos Provincial Roads with drainage provision	Flooding	Infrastructure Environment	Ecological and Environmental Stability
73. Concreting, upgrading and widening of San Pablo-Sta. Isabel-Mabolo-Caniogan-Malolos Proper Provincial Roads with drainage provision	Flooding	Infrastructure Environment	Ecological and Environmental Stability
74. Dredging, desilting of Panasahan, Pamarawan, Canalate and Calero River using backhoe dredging machine or suction excavator	Flooding	Infrastructure Environment	Ecological and Environmental Stability
75. Dredging of creeks along Flash flood-prone areas	Flooding	Infrastructure Environment	Ecological and Environmental Stability
76. Construction of protective structures such as sea wall and other forms of embankments	Flooding/EWE SLR SS	Infrastructure Environment	Ecological and Environmental Stability Human Security
77. Proposed concreting, upgrading and widening of Provincial Road (Sto. Niño-Canalate with drainage provision)	Flooding	Infrastructure Environment	Ecological and Environmental Stability
78. Proposed concreting, upgrading and widening of Bigaa-Plaridel National Road (Bagna-Mambog) with drainage provision	Flooding	Infrastructure Environment	Ecological and Environmental Stability
79. Clear danger zones of settlements and locating major infrastructures away from areas considered most	Flooding/EWE SLR	Infrastructure Social	Human Security



Adaptation And Mitigation Options (Proposed Interventions)	Hazards	Sectors	NCCAP Priority Responded
vulnerable to climate stress (Reduction of settlements along coastline)	SS		
80. Identification and purchase and development of land for socialized housing program, relocation of informal settlers and relocation of victims of calamities	Flooding/EWE TCs SLR SS	Infrastructure Social Land Use	Human Security
81. Formulation of Local Shelter Plan	ALL	ALL	Human Security Ecological and Environmental Stability
82. Construction/ rehabilitation of facilities such as evacuation center, multi-purpose hall intended to cater out -of-school youths, women, senior citizens, minors, displaces families, indigenous people and differently-abled persons	Flooding/EWE TCs SLR SS	Social Infrastructure	Human Security
83. Construction/retrofitting of public schools, DCCs and buildings to withstand climate impacts	Flooding	Infrastructure Social	Human Security
84. Rehabilitation of Fish Port in Pamarawan and Other Coastal Barangays	Flooding/EWE TCs SLR SS	Infrastructure Social Economic	Human Security Food Security
85. Upgrading/Construction/Rehabilitation of health centers, rural health units or hospitals and purchase of medical equipment	Flooding/EWE TCs SLR SS	Infrastructure Social	Human Security
86. Construction of Senior Citizens Building	Flooding/EWE TCs	Infrastructure Social	Human Security
87. Construction of flood gate	Flooding SLR SS	Infrastructure Environment	Human Security
88. Installation of flood warning system	Flooding SLR SS	Social Infrastructure	Human Security
89. IEC for flood warning system	Flooding SLR SS	Social Infrastructure	Human Security Knowledge and Capacity Development
90. Creations of mental health and psycho-social support teams	ALL	Social	Human Security
91. Promote gender and development	ALL	Social	Human Security
92. Regular and mop-up immunization of vulnerable population	ALL	Social	Human Security
93. Hygiene promotion training	ALL	Social	Human Security
94. Control of mosquitoes and breeding grounds	ALL	Social	Human Security
95. Anti-smoke belching campaign	Drought	Social	Human Security
96. Control of Diarrheal Disease Program, 97. Environmental Health and Sanitation Program	Flooding Drought/IT	Social	Human Security
98. Training on Nutrition management in emergencies	Flooding/EWE Drought/IT	Social	Human Security Knowledge and Capacity Development
99. Encourage use of green materials in construction	Flooding/EWE	Infrastructure Social Economic	Human Security Climate Smart Industries and Services



Adaptation And Mitigation Options (Proposed Interventions)	Hazards	Sectors	NCCAP Priority Responded
100. Develop local guidelines on the design, retro-fitting or operational modification of infrastructure and integrate CCA in the local ordinances	Flooding/EWE	Infrastructure Economic Social	Human Security
101. Strict enforcement of the building code and conduct inventory, vulnerability and risk assessments for critical facilities and infrastructure	Flooding/EWE	Infrastructure Economic Social Environment	Human Security
102. Adopt alternative and more efficient construction methods e.g. prefabrication and off-site construction	Flooding/EWE	Infrastructure Economic Social	Human Security
103. Improve infrastructure design such as the use of climate change resilient materials, stronger roof fixing connections, installation of essential vulnerable equipment on higher elevations and designing aerodynamically efficient structures	Flooding/EWE	Infrastructure Economic Social	Human Security
104. Promotion of green buildings such as buildings with energy efficient designs (natural lighting and ventilation)	Flooding/EWE	Infrastructure Economic Social	Climate Smart Industries and Services
105. Shift to renewable energy sources and promote the use of locally sourced energy (e.g. solar) to minimize transmission infrastructure	Flooding/EWE IT	Infrastructure Environment	Sustainable Energy
106. Construction and Installation of LED Solar Street Lights along Blas F. Ople Road	IT	Infrastructure Environment	Sustainable Energy
107. Use of water supply systems with minimal contribution to climate change, e.g. gravity over pumped systems, which does not require power	IT	Environment Infrastructure Social	Sustainable Energy
108. Replacement of existing traffic lights to new traffic lights (with LED lamp and digital seconds signal)	IT	Infrastructure Environment	Sustainable Energy
109. Replacement of existing streetlights from old lamp to new luminaire	IT	Infrastructure Environment	Sustainable Energy
110. Installation of LED Screen (Electronic Information System/Ad Board) in new Market Bldg	IT	Environment Infrastructure Social	Sustainable Energy
111. Promotion of electric vehicles and encourage non-motorized transport i.e. cycling and walking	IT	Environment Infrastructure Social Economic	Sustainable Energy
112. Encourage fuel switching e.g. conversion to compressed natural gas (CNG) and bio-fuels	IT	Social Economic Infrastructure Environment	Sustainable Energy
113. IEC awareness campaign on disaster and Climate Change management, adaptation, hazards, impacts etc.	ALL	Social	Knowledge and Capacity Development
114. Conduct Basic Life Support training for barangay officials and volunteers	ALL	Social	Knowledge and Capacity Development
115. Capability building training to improve epidemic preparedness and response mechanism	Flooding Drought/IT	Social	Knowledge and Capacity Development
116. Extend assistance to accreditation of organized sectors, groups	ALL	Social	Knowledge and Capacity Development



Adaptation And Mitigation Options (Proposed Interventions)	Hazards	Sectors	NCCAP Priority Responded
117. Mobilize and unite all stakeholders and sectors and include them in BUB, CDP, POC, CLUP and other institutional meetings and assemblies	ALL	Social	Knowledge and Capacity Development
118. Provision of needed trainings, seminars and workshops to produce a highly competent leaders, trainers, responders and service providers knowledgeable in DRRM and CCA	ALL	Social	Knowledge and Capacity Development
119. Employ a strong political will in decision making on issues and adaptive measures relative to CC and DRRM	ALL	ALL	ALL
120. Creation of Section under LDRRMO with personnel capable and with specialization on local weather and ecology management	ALL	ALL	ALL
121. Disaster Risk Reduction and Management Program	ALL	ALL	ALL
122. Construction of additional lying-in clinics in Rural Health Units (RHU)	ALL	Social	Human Security
123. Environmental management projects that promote air and water quality, as well as productivity of coastal or fresh water habitat and agricultural land and forest land	Flooding	Environment	Human Security
124. Reforestation and urban greening	Flooding Drought	Environment	Ecological and Environmental Stability
125. Implementation of flood and erosion control projects such as rehabilitation and construction of drainage system de-silting of rivers and de-clogging of canals	Flooding	Environment	Ecological and Environmental Stability Human Security



B. PRIORITIZED PPAS, INDICATORS, IOD/OPR, RESOURCES NEEDED, BUDGET SOURCE, POLICY REQUIREMENTS

Programs/Projects/Activities	Schedule of Implementation (From-To)		Implementing Office/ Department	Resources Needed	Budget Source	Policy Requirements
	2023-2028	2029-2033				
Barangay Material Recovery Facility (BMRF) Construction (material assistance) and fabrication of steel type BMRF for highly urbanized barangay (mobile type)	2023-2028		CMO CEO	18,000,000.00	General Fund	AIP Funding approved by the CDC
Procurement of one 30-seater motorized banca for monitoring of illegal cutting of mangroves and coastal clean-up, coastal clean-up, and coastal survey	2023-2028		CMO CGSO	400,000.00	General Fund	AIP Funding approved by the CDC
Formulation of Comprehensive Development Plan (CDP)	2023-2024		CPDO	300,000.00	General Fund	AIP Funding approved by the CDC
Creation/Deputization of Environmental Green Armies/Bantay Basura/Ilog Team	2023-2024		CENRO	900,000.00	General Fund	Creation through Executive Order
Sagip Basura/Sagip Ilog Program	2023-2028	2020-2022	CENRO	300,000.00	General Fund	AIP Funding approved by the CDC
Water Testing Facility	2017-2018		CEO CMWD	6,000,000.00	General Fund	AIP Funding approved by the CDC
Replacement of existing streetlights from old lamp to new luminaire	2023-2028		CEO	6,000,000.00	General Fund	AIP Funding approved by the CDC
Revision of Comprehensive Land Use Plan (CLUP)/Zoning Ordinance	2017-2018		CPDO	5,000,000.00	General Fund 20% Development Fund	AIP Funding approved by the CDC
Acquisition of Land and Land Improvements	2018-2019		CEO	30,000,000.00	General Fund	AIP Funding approved by the CDC
Provision of livelihood trainings, assistance funds and other possible source of income to populace affected by CC hazards	2023-2028	2020-2022	CMO	15,000,000.00	General Fund	AIP Funding approved by the CDC
Construction or rehabilitation of local government owned potable water supply system	2023-2028		CPDO	27,000,000.00	General Fund 20% Development Fund	AIP Funding approved by the CDC
Senior Citizens Building	2017-2018		CEO	8,000,000.00	General Fund	AIP Funding approved by the CDC
Purchase/acquisition of latest/updated satellite imagery map of City of Malolos including the necessary software and hardware	2017-2018		CPDO	3,000,000.00	General Fund	AIP Funding approved by the CDC
Construction or rehabilitation of health centers, rural health units or hospitals and purchase of medical equipment	2023-2028		CPDO	15,000,000.00	General Fund 20% Development Fund	AIP Funding approved by the CDC
Construction/rehabilitation of a communal irrigation or water impounding system and/or purchase	2023-2028		CPDO	15,000,000.00	General Fund	AIP Funding approved by the CDC



of post facilities such as farm or hand tractor with trailer, thresher, mechanical drier					20% Development Fund	
Construction or rehabilitation of sanitary landfill or material recovery facilities and purchase of garbage truck and related equipment	2023-2028		CPDO	15,000,000.00	General Fund 20% Development Fund	AIP Funding approved by the CDC
Purchase and development of land for relocation of informal settlers and relocation of victims of calamities	2023-2028	2020-2022	CPDO	20,000,000.00	General Fund 20% Development Fund	AIP Funding approved by the CDC
Construction of CFARMC/Bantay Dagat Office	2017		CEO CAgO	1,500,000.00	General Fund	AIP Funding approved by the CDC
Coastal clean-up and rehabilitation of mangrove areas (collection, potting, planting, monitoring of planted mangrove and illegal cutting activities)	2023-2028	2020-2022	CMO PNP CFARMC	900,000.00	General Fund	AIP Funding approved by the CDC
Construction/ rehabilitation of facilities such as evacuation center, multi-purpose hall intended to cater out-of-school youths, women, senior citizens, minors, displaced families, indigenous people and differently-abled persons	2023-2028	2020-2022	CPDO	75,000,000.00	General Fund 20% Development Fund	AIP Funding approved by the CDC
Crops Insurance Program	2023-2028	2020-2022	CMO CAgO	6,000,000.00	General Fund	AIP Funding approved by the CDC
IEC awareness campaign on disaster and Climate Change management, adaptation, hazards, impacts etc.	2023-2028	2020-2022	CDRRMO	1,500,000.00	DRRMF	Utilization of DRRMF upon endorsement of CDRRMC to LCE for approval
Conduct Basic Life Support training for barangay officials and volunteers	2023-2028	2020-2022	CDRRMO	1,500,000.00	DRRMF	Utilization of DRRMF upon endorsement of CDRRMC to LCE for approval
Capability building training to improve epidemic preparedness and response mechanism	2023-2028	2020-2022	CHO	600,000.00	General Fund	Approval of City Health Board
Extend assistance to accreditation of organized sectors, groups	2023-2028	2020-2022	CPDO	300,000.00	General Fund	AIP Funding approved by the CDC
Mobilize and unite all stakeholders and sectors and include them in BUB, CDP, POC, CLUP and other institutional meetings and assemblies	2023-2028	2020-2022	CPDO DILG CAo	300,000.00	General Fund	CPDO initiative
Provision of needed trainings, seminars and workshops to produce a highly competent leaders, trainers, responders and service providers knowledgeable in DRRM and CCA	2023-2028	2020-2022	PAGASA DILG RO III Climate Change Commission	600,000.00	DRRMF	Utilization of DRRMF upon endorsement of CDRRMC to LCE for approval
Creation of Section under LDRRMO with personnel capable and with specialization on local weather and ecology management	2018-2019		CHRMO		General Fund	Enactment of Ordinance for creation
Promotion of electric vehicles Encourage non-motorized transport i.e. cycling and walking	2019		CMO-POSD CAo PNP		General Fund	Enactment of Ordinance on the use of E-vehicles



Encourage fuel switching e.g. conversion to compressed natural gas (CNG) and bio-fuels	2023-2024		CMO-POSD CAo PNP		General Fund	Enactment of Ordinance
Installation of LED Screen (Electronic Information System/Ad Board) in new Market Bldg	2023-2024		CEEDO	300,000	General Fund	AIP funding approved by the City Development Council (CDC)
Promotion of green buildings such as buildings with energy efficient designs (natural lighting and ventilation)	2018-2019		CEO CPDO SP	300,000	General Fund	Enactment of SP Ordinance for adoption
Shift to renewable energy sources and promote the use of locally sourced energy (e.g. solar) to minimize transmission infrastructure	2024-2025		CEO CPDO SP	1,500,000.00	General Fund	Enactment of SP Ordinance for adoption
Use of water supply systems with minimal contribution to climate change, e.g. gravity over pumped systems, which does not require power	2024-2025		CEO CMWD	500,000.00	General Fund	Enactment of Appropriation Ordinance
Construction or rehabilitation of local roads or bridges and purchase of appropriate engineering equipment such as dump truck, graders and pay loader	2023-2028		CPDO	450,000,000.00	General Fund 20% Development Fund	Included in AIP funding approved by the CDC
Establishment of Air Quality Monitoring Station	2023-2024		CENRO	2,000,000.00	General Fund	Included in AIP funding approved by the CDC
Construction/retrofitting of public schools, DCCs and buildings to withstand climate impacts	2023-2028		CEO	15,000,000.00	General Fund	Included in AIP funding approved by the CDC
Construction and Installation of LED Solar Street Lights along Blas F. Ople Road	2023-2024		CEO CGSO	5,000,000.00	General Fund 20% Development Fund	Included in AIP funding approved by the CDC
Encourage use of green materials in construction	2023-2028	2020-2022	CEO CPDO BFP	300,000.00	General Fund	Approval of SP Resolution for adoption
Adopt formal asset management approach that can effectively consider climate inputs to maintain buildings (least cost adaptation strategy e.g. retrofitting)	2023-2028	2020-2022	CEO CPDO BFP			Approval of SP Resolution for adoption
Develop local guidelines on the design, retro-fitting or operational modification of infrastructure and integrate CCA in the local ordinances	2023-2028		CEO CPDO SP BFP			Approval of SP Resolution for adoption
Strict enforcement of the building code and conduct inventory, vulnerability and risk assessments for critical facilities and infrastructure	2023-2028	2020-2022	CEO CPDO BFP			Formulation of policies and guidelines
Adopt alternative and more efficient construction methods e.g. prefabrication and off-site construction	2023-2028		CEO CPDO SP			Approval of SP Resolution for adoption



Improve infrastructure design such as the use of climate change resilient materials, stronger roof fixing connections, installation of essential vulnerable equipment on higher elevations and designing aerodynamically efficient structures	2023-2028	2029-2033	CEO CPDO			Approval of SP Resolution for adoption
Clear danger zones of settlements and locating major infrastructures away from areas considered most vulnerable to climate stress (Reduction of settlements along coastline)	2023-2028		CEO	300,000.00	General Fund	PPA specified in the formulated Local Shelter plan
Formulation/Enhancement of Local Shelter Plan	2023		LSP TWG CPDO DILG	200,000.00	General Fund	SP Resolution for adoption and implementation
Construction of flood gate	2023-2025		CEO DPWH	5,000,000.00	DRRMF	Utilization of DRRMF upon endorsement of CDRRMC to LCE for approval
Installation of flood warning system	2024-2025		CDRRMO CEO CGSO	1,500,000.00	DRRMF	Utilization of DRRMF upon endorsement of CDRRMC to LCE for approval
IEC for flood warning system	2023-2028	2029-2033	CDRRMO	600,000.00	DRRMF	Utilization of DRRMF upon endorsement of CDRRMC to LCE for approval
Creations of mental health and psycho-social support teams	2023-2024		CSWDO CHO	100,000.00	General Fund	Approval of Executive Order
Promote gender and development	2023-2028	2029-2033	CSWDO CPDO SP	300,000.00	General Fund	Regular function and CSWDO initiatives
Regular and mop-up immunization of vulnerable population	2023-2028	2029-2033	CHO-RHUs Barangay Volunteers	1,500,000.00	General Fund	Regular function and CHO initiatives through Memorandum of DOH
Hygiene and sanitation promotion training	2023-2028	2029-2033	CHO	300,000.00	General Fund	Regular function and CHO initiatives
Control of mosquitoes and breeding grounds	2023-2028	2029-2033	CHO- Sanitation	500,000.00	General Fund	Regular function and CHO initiatives
Anti-smoke belching campaign	2023-2028		CENRO CMO-POSD PNP Barangay Officials Force Multipliers	300,000.00	General Fund	Enactment of SP Ordinance for the implementation of Anti-smoke belching campaign
Control of Diarrhea, Disease Program, Environmental Health and Sanitation Program	2023-2028	2029-2033	CHO Barangay Health Volunteers	1,500,000.00	General Fund	Regular function and CHO initiatives
Training on Nutrition management in emergencies	2023-2028	2029-2033	CHO	300,000.00	General Fund	Regular function and CHO initiatives
Establishment of selected areas as environmentally critical and protected areas	2023-2028		CENRO CPDO CEO	150,000.00	General Fund	Approval of SP Resolution



			SP			
Strict implementation of environmental protection laws and ordinances (e.g. anti-litter ordinance, RA 9003, illegal discharge of domestic and industrial wastes to bodies of water etc.)	2023-2028	2029-2033	CENRO CGSO Bantay Dagat Barangay Officials CMO-CTMO	300,000.00	General Fund	Formulation of local policies and enactment of local ordinances/laws
Adoption of Approved 10-year Solid Waste Management Plan	2023-2028	2029-2033	All Sectors	300,000.00	General Fund	Approval of SP Resolution for adoption and implementation
Reserve local sites to accommodate waste sorting, recycling and reuse, away from climate change vulnerable areas	2023-2028		CGSO Barangay		General Fund	Regular function and CGSO initiatives
Promote best practices in solid waste mgmt e.g. reduction, reuse, recycling (IEC campaign, brochures etc.)	2023-2028	2029-2033	CGSO Barangay	500,000.00	General Fund	Regular function and initiatives of CGSO and CMO-CENRD
Community participation in Bantay-llog/Dagat Project implementation	2023-2028	2029-2033	CAgrO	300,000.00	General Fund	Assistance to Bantay Dagat coastal clean-up and management and protection of ecosystem
Plant a Tree Project for scholar beneficiaries and other sectors	2023-2028	2029-2033	CAdO- BASPD CENRO	600,000.00	General Fund	Included in AIP funding approved by the CDC
Clean and Green Contest for communities	2023-2024	2029-2033	CENRO	1,500,000.00	General Fund	Included in AIP funding approved by the CDC
Creation of Waterways and Irrigation Task Force	2023-2028		CEO	1,500,000.00	General Fund	Approval of SP Resolution and Enactment of Appropriation Ordinance, Included in AIP funding approved by the CDC
Adoption of scorecard system in environmental functions to be the barangays' eligibility to benefit from LGU programs, banning of plastics/styro	2023-2028	2029-2033	SP CPDO CAgrO CENRO	1,000,000.00	General Fund	Approval of SP Resolution and Enactment of Appropriation Ordinance, Included in AIP funding approved by the CDC
Impose stiffer penalties to those who violate environmental laws	2023-2028	2029-2033	SP CPDO CAgrO CENRO	150,000.00	General Fund	Enactment of Local Ordinance adopted to National Laws
Promote tree planting and prohibiting cutting of trees.	2023-2028	2029-2033	SP CPDO CAgrO CENRO	150,000.00	General Fund	Enactment of Local Ordinance adopted to National Laws
Formulate policies on strict imposition of penalties for illegal use and conversation of lands designated to a specific use	2023-2028		SP CPDO CAgrO CENRO	150,000.00	General Fund	Enactment of Local Ordinance adopted to National Laws



Update land inventory to determine access to land tenure and avoid conflicting/ competing land uses	2023-2028		SP CPDO	150,000.00	General Fund	Included in PPA of CPDC
Develop and implement flood plain zones	2023-2028		SP CPDO	150,000.00	General Fund	Included in PPA of CPDC
Formulate Urban Conservation Plan	2023-2028		SP CPDO	200,000.00	General Fund	Approval of Resolution for adoption
Strict monitoring of industries and households producing wastewater pollution (e. g. incidence of improper disposal of septage/sewage)	2023-2028	2029-2033	CEO CGSO CENRO CAoO-BPLD	300,000.00	General Fund	Included in PPA of CMO-CENRD
Proposed Asphaltting of Provincial Road (Sumapang Bata, Sumapang Matanda, Bungahan, Ligas)	2023-2028		CEO	10,000,000.00	General Fund 20% Development Fund	Approval of Loan and Enactment of Appropriation Ordinance
Proposed Asphaltting of Mabolo-Sto. Cristo Diversion Road	2023-2028		CEO	10,000,000.00	General Fund 20% Development Fund	Approval of Loan and Enactment of Appropriation Ordinance
Rehabilitation of Fish Port in Pamarawan and Other Coastal Barangays	2023-2028		CEO	10,000,000.00	General Fund 20% Development Fund	Approval of Loan and Enactment of Appropriation Ordinance
Prohibition of vape smoking in public areas	2023-2028	2029-2033	SP CENRO CPDO	100,000.00		Enactment of Ordinance
Improve drainage infrastructure design such as accounting for increased rainfall intensities in design flow calculations	2023-2028		CEO CPDO CDRRMO	500,000.00	DRRMF	Utilization of DRRMF upon endorsement of CDRRMC to LCE for approval
Develop locally specific flood protection programs	2023-2028		CEO CPDO CDRRMO	5,000,000.00	DRRMF	Utilization of DRRMF upon endorsement of CDRRMC to LCE for approval
Dredging and Desilting of Pamarawan and Tangib River Entrance (Part of Manila Bay)	2023-2028	2029-2033	CEO	15,000,000.00	General Fund 20% Development Fund	Approval of Loan and Enactment of Appropriation Ordinance
Proposed concreting, upgrading and widening of Provincial Road (Sto. Niño-Canalate with drainage provision)	2023-2028		CEO	11,500,000.00	General Fund 20% Development Fund	Approval of Loan and Enactment of Appropriation Ordinance
Proposed concreting, upgrading and widening of Bigaa-Plaridel National Road (Bagna-Mambog) with drainage provision	2023-2028		CEO	45,000,000.00	General Fund 20% Development Fund	Approval of Loan and Enactment of Appropriation Ordinance
Promote veterinary health program and animal welfare	2023-2028	2029-2033	SP CVO	200,000.00	General Fund	Enactment of Ordinance
Concreting, upgrading and widening of Caingin-Bulihan-Longos Provincial Roads with drainage provision	2023-2028		CEO	50,000,000.00	General Fund 20% Development Fund	Approval of Loan and Enactment of Appropriation Ordinance
Concreting, upgrading and widening of San Pablo-Sta. Isabel-Mabolo-Caniogan-Malolos Proper Provincial Roads with drainage provision	2023-2028		CEO	50,000,000.00	General Fund 20% Development Fund	Approval of Loan and Enactment of Appropriation Ordinance



Dredging, desilting of Panasahan, Pamarawan, Canalate and Calero River using backhoe dredging machine or suction excavator	2023-2028	2029-2033	CEO	10,000,000.00	General Fund 20% Development Fund	Approval of Loan and Enactment of Appropriation Ordinance
Dredging of creeks along Flash flood-prone areas	2023-2028	2029-2033	CEO CGSO CENRO	5,000,000.00	General Fund 20% Development Fund	Included in AIP funding approved by the CDC
Establishment of sewerage treatment and septage management facilities, requiring establishments/subdivisions to put up water treatment facilities, regulating the use of chemicals on fishponds, resorts and other water facilities that egress to other water tributaries	2023-2028		CEO	50,000,000.00	General Fund 20% Development Fund	Approval of Loan and Enactment of Appropriation Ordinance
Require business establishments to allocate/hire certain number or percentage of their workforce from vulnerable sectors especially the PWDs and Solo Parents	2023-2028		SP CSWDO CAAdO-BPLD	300,000.00	General Fund	Enactment of Ordinance/Resolution
Implement Full Compliance to Clean Water Act (RA 9275)	2023-2028	2029-2033	CHO	300,000.00	General Fund	Adoption of national laws
Provision of post-harvest facilities like access roads, hauling equipment, storage etc. to provide better price to farmers	2023-2028	2029-2033	CEO CAgrO	1,500,000.00	General Fund 20% Development Fund	Included in AIP funding approved by the CDC
Revisit local land use requirements so as not to hamper economic activities without prejudice to the community specifically the marginalized sector (fisher folks/farmers)	2023-2028		CPDO CEO CAgrO	100,000.00	General Fund	Included in PPA of CAgrO for inclusion to AIP
Diversify/intensify organic farming and adopt new cropping/intercropping pattern consistent with the change in seasonal pattern (Climate-resilient crops)	2023-2028	2029-2033	CAgrO	100,000.00	General Fund	Included in PPA of CAgrO for inclusion to AIP for funding
Provision of budget allocation for price subsidy on feeds for livestock and poultry thereby enabling the sector to compete with the cheap imported stocks flooding the local market	2023-2028	2029-2033	CAgrO CVO	1,500,000.00	General Fund	Included in PPA of CAgrO for inclusion to AIP for funding
Provision of funding for the development of indigenous and cheap sources of farm inputs to those affected by disasters and CC hazards to improve production and make products more competitive	2023-2028	2029-2033	CAgrO	1,500,000.00	General Fund	Included in PPA of CAgrO for inclusion to AIP for funding
Regulate the use of chemicals on fishponds, resorts and other water facilities that egress to other water tributaries	2023-2028	2029-2033	CAgrO CAAdO-BPLD CHO	300,000.00	General Fund	Enactment of Ordinance, for inclusion to AIP for funding
Locating critical water supply infrastructure away from vulnerable areas	2023-2028	2029-2033	CEO CGSO	150,000.00	General Fund	Included in AIP



Adopt formal asset management approach that can effectively consider climate inputs to maintain water supply infrastructures	2023-2028	2029-2033	CEO CGSO	500,000.00	General Fund 20% Development Fund	Included in AIP
Adoption of Plan for Provision of Potable and Adequate Water Supply	2023-2028	2029-2033	CPDO CHO	150,000.00	General Fund	Approval of SP Resolution
Provision of tax incentives	2023-2028	2029-2033	SP CAAdO-BPLD	100,000.00	General Fund	Enactment of Ordinance/ Approval of Resolution
Declaration of mangrove and fish sanctuary	2023-2028		SP CAgrO	100,000.00	General Fund	Enactment of Ordinance
Periodic education program for farmers and fishermen in coordination by Dept. of Agriculture, Dept. of Fisheries, Dept. of Trade and Industry to upgrade knowledge from subsistence to profitable farming and funding of projects that are agriculture and fishery related	2023-2028	2029-2033	CAgrO	300,000.00	General Fund	Included in AIP
Provision of modern inputs & techniques in farming, livestock production and fisheries	2023-2028	2029-2033	CAgrO	500,000.00	General Fund	Included in AIP
Encourage water use efficiency and conservation (technology, behavioural and pricing solutions and incentives) and water reuse and/or recycling	2023-2028	2029-2033	CEO CGSO CENRO	300,000.00	General Fund	Included in AIP
Strict implementation of DENR requirements for subdivision sewerage treatment facility	2023-2028	2029-2033	CAgrO CENRO CPDO CEO	100,000.00	General Fund	Enactment/adoption of local ordinance
Wastewater treatment facility for highly populated buildings and for community	2023-2028	2029-2033	CGSO CEO	300,000.00	General Fund 20% Development Fund	Approval of Resolution
Rehabilitation and maintenance of defective and out-dated water supply pipes and pumping stations	2023-2028	2029-2033	CHO CEO CGSO CMWD	1,000,000.00	General Fund 20% Development Fund	Included in AIP
Regular water quality surveillance	2023-2028	2029-2033	CHO	100,000.00	General Fund	Included in AIP
Construction of water recycling facility Provision of more shallow tube wells	2023-2028		CGSO CHO CEO	1,000,000.00	General Fund	Included in AIP funding approved by the CDC
Formulation of City storm drain and drawing sustainable waste water master plan	2023-2028		CPDO CGSO CEO	150,000.00	General Fund	Included in AIP
Strict adherence to the provisions of the Water Code and Sanitation Code	2023-2028	2029-2033	SP CHO CGSO CPDO CAgrO CEO	150,000.00	General Fund	Enactment and adoption of local laws/resolution
Construction of protective structures such as sea wall and other forms of embankments	2023-2028		CEO CGSO CENRO CAAdO-BPLD	2,000,000.00	General Fund 20% Development Fund	Included in AIP funding approved by the CDC



Rehabilitation and maintain fish sanctuaries and marine reserves	2023-2028	2029-2033	SP CAgrO	300,000.00	General Fund	For inclusion to AIP after Enactment of Ordinance o declaration
Disaster Risk Reduction and Management Program	2023-2028	2029-2033	CMO CAAdO	210,000,000.00	General Fund	Included in AIP funding approved by the CDC
Construction of additional lying-in clinics in Rural Health Units (RHU)	2023-2028		CEO CHO	7,000,000.00	General Fund	Included in AIP funding approved by the CDC
Environmental management projects that promote air and water quality, as well as productivity of coastal or fresh water habitat and agricultural land and forest land	2023-2028	2029-2033	CPDO	15,000,000.00	General Fund 20% Development Fund	Included in AIP funding approved by the CDC
Reforestation and urban greening	2023-2028	2029-2033	CENRO CPDO	45,000,000.00	General Fund 20% Development Fund	Included in AIP funding approved by the CDC
Implementation of flood and erosion control projects such as rehabilitation and construction of drainage system de-silting of rivers and de-clogging of canals	2023-2028	2029-2033	CPDO CEO	90,000,000.00	General Fund 20% Development Fund	Included in AIP funding approved by the CDC
Empower the Bantay Dagat and equip them with technological capabilities to protect the sea and coastal areas from illegal fishing and other illegal activities that endanger the coastal habitats	2023-2028	2029-2033	CAgrO		General Fund	Included in AIP funding approved by the CDC
Replacement of existing traffic lights to new traffic lights (with LED lamp and digital seconds signal)	2023-2028		CEO CGSO		General Fund	Included in AIP funding approved by the CDC





**SECTION 5:
MONITORING AND
EVALUATION**

A. REVIEW OF PLANS TO BE IMPLEMENTED

The City Government of Malolos recognizes the importance of plan implementation and policy enforcement in realizing targets, achieving goals and objectives for the realization of the ultimate vision of a climate change resilient city and citizenry. It believes that in implementing the Local Climate change Action Plan 2017-2022, resources, institutional structures and procedures, among others are required in order for it to be implemented and enforced. The Local Government Code allowed great flexibility for urbanized cities like City of Malolos to design and implement its own organizational structure and staffing pattern taking into consideration its goals and objectives are contained in the LCCAP and accountability to the community. In realistically implementing the city's LCCAP, a number of prerequisite measures and instruments other than the existing DRRM Program are needed. Plan implementation includes the establishment of detailed work systems, and institutional mechanisms that are responsive to the goals and objectives of the LCCAP and the formation of partnerships and cooperation arrangement with stakeholders. Expected outputs include Approved Institutional Structure and Systems and Procedures, Investment Programs, Information, Education and Communication (IEC) Plan /Advocacy.

The following steps shall be adopted in implementing the LCCAP:

1. Strengthening of Existing Institutional Structures and Mechanisms such as but not limited to the City DRRM Council, Climate Change Adaptation Core, Monitoring Team etc.

To implement and enforce the City of Malolos LCCAP 2017-2022, people, institutional structures and procedures, among others are needed. The City Government of Malolos shall design and implement its own organizational structures and staffing patterns taking into consideration the goals, objectives, plans, programs and activities contained in the LCCAP. It can start by strengthening existing work structures like the City Disaster Risk Reduction Management Council, Climate Change Adaptation Core Team, City Development Council, City Solid Waste Management Board, etc. The Local Government Code serves as the legal basis for the following activities.

- a. Review of existing local organizational structure, staff composition, and responsibility centers (vis-à-vis the requirements to effectively implement and enforce the LCCAP)

The review shall cover all operating units which are mandated by law or generic to the city government of Malolos and its special bodies or units that were created for purposes relevant to LCCAP implementation and enforcement. Special bodies may be on a permanent or ad hoc tenure and its mandate on the review of organizational structure shall be governed by the limitation set forth by the Local Government Code (LGC), Civil Service Commission (CSC) and other relevant laws and legally constituted authorities. Permanent structures may include, the Local Development Council, City School Board, City Health Board, the city bureaucracy that is composed of the present line up of city departments and offices, the City of Malolos Tourism Council, City Disaster Risk Reduction and Management Council, Climate Change Adaptation Core Team, and other task forces, committees, boards, and councils.

To some extent, the city government of Malolos may introduce changes in its organizational structure in order to improve development performance and eventually attain the goals and objectives of its LCCAP.



Some offices may have to be strengthened by way of additional staff and/or capacity-building programs, while others may need to be scaled down or abolished. New offices/units deemed necessary in implementing the LCCAP may have to be established. A good addition to the city's existing bureaucracy is empowerment of the Civil Society Organizations (CSOs) that were participating in planning and implementation of programs, projects and activities to be implemented by the city. Institutionalize Task Force, Boards, Technical Working Groups and Committees may assist in handling critical functions and to promote community/multi-sectoral participation in governance. Such groups are presently of a multi-sectoral composition to ensure a sustained partnership in implementing and enforcing plans and policies.

b. Revisit of existing operational guidelines (vis-à-vis the requirement of the LCCAP)

This activity is designed to ensure transparency, accountability, efficiency and compliance with recent national policies that impact on the city's Local Climate Change Action Plan 2017-2022. There is a possibility that existing operational guidelines may only have to be amended in order to sustain relevance and consistency with the development framework, goals, objectives, plans, programs, activities and policies in the LCCAP. An upcoming guideline that is soon to be issued by the DILG for cities and municipalities is the Disaster Risk Reduction and Climate Change Adaptation Integration.

c. Identification of mechanisms for LCCAP Policy Enforcement

In identifying mechanisms for implementing policies and regulations embodied in the LCCAP, the following shall be adopted:

- Institutionalization of the CDRRMO with regular staff, office, budget, office equipment and supplies
- Recruitment of a well trained and experienced DRRM Officer who shall be designated to head the institutionalized CDRRMO
- Integration of DRR and CCA concerns in the building and zoning permitting system with the CDRRM Officer's involvement in the approval process.
- Integration of DRR and CCA concerns in the review of applications for land use development permits and management schemes based on the following considerations:
 - Conformity with the LCCAP and DRRMP
 - Adoption of DRR and CCA mechanisms and principles
 - Enhancement or Promotion of food security, water sufficiency, human security, environmental and ecological stability, climate-resilient technologies and services, sustainable energy

d. Identification of other DRR/CCA and environmental regulations needed to fully implement the LCCAP

In identifying City of Malolos other DRR/CCA and environmental regulations needed to fully implement the LCCAP, the CCA Core Team and/or the CDRRMC shall regularly review existing local ordinances and issuances related to DRR and CCA and use development control for possible consistencies with the LCCAP and possible gaps in development regulation. The city's most common development regulations include special levy tax providing for incentives/disincentives, detailed area development regulations/standards



particularly for such areas as cultural heritage sites/zones, high risk/danger zones, etc., industrial estates/subdivision development regulations. The CCA Core Team or CDRRMC shall coordinate with the CPDO in studying, identifying and recommending amendments in existing statutory ordinances found to be inconsistent with the LCCAP and other plans and plan instruments. As maybe necessary, it shall also prepare draft ordinances that will respond to the identified gaps in legislative measures needed to implement and enforce the LCCAP.

- e. Consolidation of the results of the institutional review and agreeing on proposed changes (in organizational structure and additional mechanisms needed to implement the LCCAP).

In consolidating the results of the institutional review and reaching consensus on needed changes and additions, the following shall be first approved by the City Mayor and submitted to the Sangguniang Panlungsod for deliberation and adoption:

- o Proposed revised organizational structure to include special bodies/committees to be constituted as a result of the organizational/institutional review. The creation of the special bodies through an executive order shall likewise define the following: functions of the committee/body, membership requirements and qualification standards, time frame of the committee (the same special bodies are created for short term/urgent programs hence may be short-lived), operating procedures/linkages with other offices/ departments. The revised organizational structure shall identify the following: staff requirements and qualification standards, training/capacity building program, new office/unit to be created/strengthened, budget requirements.
- o Proposed amendments to existing ordinances found to be inconsistent with the LCCAP
- o Proposed new legislation/ordinance to respond to identified gaps in implementing LCCAP
- o Proposed amendments, (if any), to existing operational guidelines systems and procedures for various related permits/clearances.

2. Assessment and Prioritization of Programs and Projects Identified in the City of Malolos LCCAP 2017-2022

In undertaking the assessment and prioritization of the LCCAP's programs and projects the following assessments shall be made:

- a. First Level Assessment: Checking for Relevance

During this phase, the City Government of Malolos shall check the desirability, redundancy, practicality and efficiency of the consolidated general list of programs and projects in the LCCAP 2017-2022. These programs and projects shall be included in any investment planning exercise of the City. This initial assessment may result in the short-listing of programs and projects. The assessment of the relevance of the LCCAP's programs and projects shall be mainly undertaken by the CC Adaptation Core Group, which will watch out for the following possible negative attributes of the programs and projects:

- o Redundant projects - those that duplicate or overlap existing, new or proposed projects.
- o Impractical or unrealistic projects - those that do not conform to technical standards or feasibility indicators.



- Undesirable projects - those that pose negative side effects to the population or area or offend the values and cultural beliefs.
- Inefficient projects - projects that are costly to run at the local level because they cannot take advantage of economies of scale. For example: a nuclear power plant which is a type of project that is better operated more efficiently by the national or regional government. Other projects that may be considered inefficient are those whose modes of implementation are inefficient. For example: a health and nutrition program implemented house-to-house may be less efficient than one given at an accessible health center; or the training of all farmers on a particular technology compared to using a demo farm to promote a technology.

b. Second Level Assessment: Determination of conflicts, compatibility and complementarities

During this assessment, the city, through the CC Adaptation Core Group and the CDRRMC shall analyze the LCCAP's short listed programs and projects in order to determine conflicts, compatibility and complementarities. The assessment criteria shall be as follows:

- Conflicting projects - those with expected benefits that tend to nullify the benefits of other projects or when the implementation of which obstructs the implementation of another.
- Complementary projects - are those activities, components or objectives that mutually support each other.
- Compatible projects - those that are neutral, that is, they neither complement nor conflict with each other or those that can be implemented without affecting the benefits or costs of the other projects.

3. Preparation of an IEC Plan to ensure Transparency and Accountability in the Implementation of the LCCAP

In undertaking this step the CCA Core Team shall work with the City's Information Division in preparing an IEC and Advocacy Plan that shall include the following strategies:

- Distribution of copies of the LCCAP (text and maps) to different LGU departments and offices
- Public display of the LCCAP Maps in conspicuous places within the city
- Provision of a copies of the LCCAP to barangay centers
- Conduct of orientation briefing on the approved LCCAP for stakeholders e.g. business sector, NGOs/POs, civil society, etc.
- Preparation of brochures and flyers on the LCCAP for distribution to the general public.

4. Review and Revision of the LCCAP Budget for Institutional Structure and Mechanism; Programs/Projects for implementation; Implementation Partnership Arrangements and IEC Promotions

Process Flow for Implementing the City of Malolos LCCAP 2017-2022

- Strengthen existing institutional structures and mechanisms
- Asses and prioritize the general listing of programs and projects
- Prepare IEC plan to promote transparency and accountability in implementing the LCCAP
- Review /revise budgetary support/requirement to implement the LCCAP



- Define roles of offices/departments, operational guidelines and mechanisms vis-à-vis the implementation of the LCCAP
- Short-list of prioritized programs and projects proposal and fund sourcing
- Strategies to disseminate/inform about the LCCAP to the stakeholders and general public
- Revised budget requirements to support the implementation of the LCCAP

B. MONITORING AND EVALUATION

Monitoring and evaluation are important aspects of the LCCAP. These will be guided by the City of Malolos Local Climate Change Core Team aimed at learning from the activities – what were done and how they were done – by focusing on efficiency, effectiveness and impact. While the LCCAP is set for not longer term, the strategies and plans are not totally fixed. If they are not working, or if the circumstances change, then the LCCAP will need to be changed as well. Monitoring and evaluation informs city government decision makers when plans are not working, and when circumstances have changed. Therefore, they provide information needed to make decisions about changes that are necessary in the plan or in the implementation mechanisms. Since monitoring and evaluation are based on the targets and planned activities during the various phases in the implementation of the action plan, setting the appropriate key performance indicators and targets are crucial.

The City of Malolos LCCAP 2023-2033 is set up with the following systems:

- Collecting and recording the information;
- Analysing the information; and
- Using information to inform decision makers

LCCAP monitoring is set annually and evaluation every three years. Annual monitoring provides information that sets directions in setting priorities and budgets every year. Evaluation will focus on efficiency, effectiveness and impacts. Monitoring is also through the periodic conduct of meetings of the CCA Core Team relative to plan implementation.

With its implementation plan already established, the assessment procedures of the effectiveness of the Local Climate Change Action Plan (LCCAP) 2023-2033 shall be pursued by the city through the Climate Change Core Team and/or the CDRRMC assisted by the City Planning and Development Office (CPDO), City Disaster Risk Reduction and Management Office (CDRRMO) and the city government’s other authorized program monitoring and evaluation task units and work groups.

Monitoring, review and evaluation are to be performed basically for the purpose of assessing how fully and how effectively the climate change mitigation and adaptation plan is being carried out. On the whole, the process is meant to assess the overall impact of the plan to the quality of life of the population.

1. Purpose

The monitoring and evaluation of climate change impacts and the implementation and enforcement of specific projects, activities programs and policies are what this activity is generally all about. More specifically, this aspect of the program/project development cycle is for the purpose of establishing and



assessing the effectiveness of city's LCCAP as determined by the quality of life indicators set forth in the planned goals and objectives.

The activity is also for the purpose of evaluating conformity of approved development projects, issued permits and clearances with the city's environmental regulation offices, assessing impacts of development projects on the local economy, environment and on social services, and ensuring completion of programs or projects that are being implemented through a systematic and progressive assessment based on timetables, cost and benefits to target groups or outcome.

2. Expected Outputs

The review, monitoring and evaluation system for the LCCAP shall yield expected outputs that will include monitoring systems and procedures, and set of indicators for quality of life assessment, monitoring system and procedures for climate change-responsive activities and Project Monitoring Schemes (PMS).

3. Steps

In undertaking the city's review, monitoring and evaluation of the LCCAP implementation and enforcement the following steps shall be adopted:

- a. Creation of the City of Malolos Monitoring Review and Evaluation (MRE) Teams. As an important initial step in the M and E the establishment of Monitoring Review and Evaluation Teams should be undertaken and ensured of the membership of organic city government personnel like those at the CPDO, CMO-CENRD and CDRRMO and to include multi-stakeholders from the private sector and civil society. The team shall be a coordinative body, which should also include representatives from barangays.
- b. Development of Monitoring Systems and Procedures at this stage, the development of monitoring systems and procedures shall include the establishment of indicators, benchmark data and frequency of monitoring activities to serve as guide in monitoring in the following aspects:
 - i. Quality of Life Assessment using the essential elements of the Vision adopted by the City of Malolos through the lens of climate change. This aspect of assessment can be done through:
 - o Vision Reality Gap Analysis described in Step 3, setting the Vision. These indicators of abilities ("to be") or capabilities ("to do") include, among others, health (to be healthy); nutrition (to be well-nourished); education (to be educated or to be knowledgeable and skilled); fertility (to bear and rear desired number of children); and migration (to travel in search of better economic and social opportunities)
 - o City of Malolos can use the Core Indicators for Gender-Responsive Population and Development (POPDEV) Planning
 - ii. Project Implementation Monitoring System/Scheme (PMS) is basically a systematic design of monitoring a particular project. It is a systematic, timely, and regular gathering of feedback about the progress of a project in terms of inputs, operations and outputs, and the timely provision of



appropriate support or intervention, if need be. Actual data is compared with the plan to determine whether clearance from funding and support agencies has been sought and whether there are any deviations from the original plan. The causes of deviations, if any, are examined and solutions/persons likely to solve the problem and necessary interpretations are identified.

iii. Conduct of review and evaluation of action taken and development outcomes to determine relevance, efficiency, effectiveness, impact and sustainability. The intent is to incorporate lessons learnt in the process.

c. Conduct of actual monitoring consistent with the developed system and procedures

i. Conduct “comparing sessions”/consultative workshop on indicator of well-being for quality of life assessment.

ii. Conduct decision mapping sessions/consultations/workshops on impacts of climate change-responsive projects, activities, policies

iii. Conduct project monitoring sessions/consultation/workshop to determine stages of implementation of activities, program/projects and policies.

d. Evaluation of the results of the monitoring activities

Evaluation maybe done in two ways:

i. On-going Evaluation

On – going and periodic evaluation is conducted to provide early feedback to project management on the following concerns: policies affecting the project; attainment of sectoral goals and objectives; adequacy of institutional arrangements; and the appropriateness of project design and the level of resources. One familiar activity is the conduct of mid-program and project evaluation to determine if the assumptions made regarding the project environment and target group are still valid. The review likewise helps determine whether the project should be modified due to environmental constraints. Moreover, the review can ascertain how natural phenomena, local political events, national and international incidents have affected the project.

ii. Post Evaluation

On the other hand, post evaluation involves the systematic and objective assessment of completed climate change-responsive development projects. It may be done at the end of the project or sometime thereafter. It analyzes project outcomes and the underlying factors which contribute to the project’s success or failure so that it can identify the features that deserve replication in future projects as well as the pitfalls that need to be avoided. The monitoring of LCCAP implementation will be integrated through the established Project Monitoring Committee (PMC).

e. Submission of monitoring, review and evaluation reports, findings and recommendations to the City Mayor and the Sangguniang Panlungsod for consideration and appropriate action.

Findings and recommendations may lead to:



- i. Revisions of strategies, projects, programs, activities or policies provided for in the LCCAP and environmental regulations and development control mechanisms defined in the LCCAP.
- ii. Repacking and refocusing of programs and projects, including financial aspects.

4. Designing a Project Monitoring Scheme for the City of Malolos

The Project Monitoring Schemes (PMS) is basically a systematic design of monitoring a particular project. A properly designed PMS for the City of Malolos shall serve as a useful tool to systematize the task of monitoring. It is input-based, activity-related and output oriented. Steps in Designing and Implementing PMS for the City of Malolos includes the following steps:

a. Developing the Monitoring Objectives

City of Malolos PMS shall specify the purpose for undertaking monitoring. A set of objectives statements, which include checking of explicit consideration of population factors/issues and tracking gender-differentiated progress of projects for target beneficiaries, shall be formulated visa- vis identified project performance targets.

b. Developing a Monitoring Plan

The monitoring plan shall embody the project outputs, critical activities and project inputs (data on these can be gathered from various project documents), monitoring points, and the plans and schedule for gathering and analyzing of information.

c. Gathering Information

Actual monitoring starts with the collection of information regarding the conduct of the project. Depending on the kind of information needed, technical person assigned in the monitoring shall then select the best monitoring strategies to employ to achieve this end.

d. Analyzing Information

Analyzing information for monitoring purposes shall generally involve comparing the actual performance/ accomplishments (dates, activities, outputs) with the intended or planned; and then finding the reasons for and correcting, any discrepancies – whether the deviations are reasonable and beneficial or unjustified and harmful to the project.

e. Providing Support Intervention

When gathering and analyzing information about a project, activity or policy, one may come across many ideas on how to improve the conduct of the project, or how to correct certain deficiencies. There may be several alternatives for improving the project. One of the tasks in project monitoring shall be to discuss the alternatives with the implementer and decide what plan of action would be best for the interest of the project. There shall be a list of options for interventions. Resources needed shall be determined for each option. For



urgent cases, one may directly suggest corrective measures. Legal measures are a last resort and sought only when other options failed. Monitoring shall end with report writing, summarizing the findings and recommendations.

5. Evaluation Guidelines when Re-planning the Local Climate Change Action Plan 2017-2022

The LCCAP 2017-2022 is both a plan and a policy that are designed to be resilient and flexible in responding to the changing and varying needs of City of Malolos and its citizens in terms of climate change. As such, these instruments shall be subject to regular checking for relevance and continued applicability. Re-planning shall be undertaken as a result of the evaluation process and it shall be undertaken with the following in mind:

a. Objectives

- To provide bases in determining the need to re-plan, update and/or amend the LCCAP
- To identify areas for re-planning/updating
- To provide systems and procedures on the evaluation of LCCAP implementation
- To ensure the integration of solutions on issues/problems identified in the course of implementing the LCCAP

b. Tools for Evaluation / Assessment

- Referencing with national and local policies on climate change mitigation and adaptation
- Reports by the CEO, Zoning Administrator and City ENRO on building permit or environmental clearance issued based on conformity with the LCCAP
- Decisions of the City DRRM Officer/CDRRMC, City ENRO, CPDC/ regarding projects related to climate change mitigation and/or adaptation
- Decisions of the Sangguniang Panlungsod on climate-related issues and concerns
- Decisions on any violations of the city's regulations regarding climate change mitigation and adaptation regulations

c. Parameters

- Number of environmental clearances, Zoning clearances, building permits reviewed and issued based on conformity with the LCCAP
- Nature and number of approved ICZBAA cases reviewed and approved based on conformity with the LCCAP
- Nature and number of climate change mitigation and adaptation development projects in the city implemented by the city or national government

d. Project Inventory

- Location of climate change mitigation and adaptation projects with the necessary permits and clearances
- Location of new subdivision projects with Development Permits that have been reviewed for consistency or conformity with the LCCAP
- Projects in the city's LDIP, CLUP, CDP with proposed climate change mitigation and adaptation



- projects, whether implemented or not
- Other climate related projects not in the DRRMP and LCCAP but implemented

e. Procedural Guidelines

- Check the completeness of the LCCAP
- Determine the degree and/or extent by which the LCCAP has been implemented/enforced -
Prepare inventory of projects
- Conduct field investigations
- Conduct interviews with public and private sectors/officials

f. Review Questionnaire

- Has the LCCAP been fully implemented/enforced by the city?
- Are the proposed programs and projects indicated in the plan being implemented in the identified locations and in the timeframes as scheduled/programmed?
- Are those what the city needs in terms of mitigating and adapting to climate change?
- Are the intended clientele protecting or benefited by the projects?
- Are there other projects implemented which are not included in the LCCAP? If yes, do these projects support the climate change mitigation and adaptation goals and objectives of the city?
- Are there deviations between the actual implementation or enforcement and the proposed LCCAP? If yes, identify the specific location, nature and scope of these deviations.

g. Re-plan when:

- Climate change stressors, impacts, magnitude and scenarios further change and needs more specialized responses
- Current developments in terms of urbanization have overtaken the projected climate change mitigation and adaptation measures indicated in the LCCAP.
- LCCAP has been outdated by the city’s emerging functional role, goals and objectives, and requirements brought about by current developments.

i. Status Quo

- If at least ten (10) out of the fourteen (14) questions in the questionnaire for review have been answered “yes”
- If the plan and actual developments are at par.

The City of Malolos shall utilize the LCCAP Core Team created to be the Monitoring and Evaluation Team of the City’s Local Climate Chang Action Plan 2023-2033.

The following form will be used in monitoring the progress in the accomplishment of the various Objectives of this LCCAP. This should be updated annually by the members of the LCCAP Core Group.



Table 21: Monitoring Template for LCCAP 2023-2033 Objectives

Objectives / Targets	Performance Indicators							
	Baseline Year	Value	2023		...		2033	
			Target	Accomplishment	Target	Accomplishment	Target	Accomplishment

Another monitoring form will be accomplished annually to evaluate the progress of the various Climate Change-related Programs, Projects, and Activities (PPAs). This will be prepared and accomplished by the Local DRRM Officer, the City Planning and Development Coordinator, and the City Budget Officer, for approval of the City Mayor.

Table 22: Annual Monitoring Template for Climate Change-related PPAs

Sector & AIP Reference Code	Project Title	Implementing Office	Target Output		Estimated Cost		Timeframe of Implementation
			AIP 2023	Budget 2023	AIP 2023	Budget 2023	



LIST OF REFERENCES

- a. Annual Investment Program (AIP) of the City of Malolos 2017
- b. Local Development Investment Plan 2017
- c. Republic Act No. 9729 or Climate Change Act of 2009
- d. Republic Act No. 10174 or the People's Survival Fund in 2012
- e. National Climate Change Action Plan
- f. City of Malolos Ecological Profile 2021
- g. Local Disaster Risk Reduction and Management Plan 2022-2026
- h. National Framework Strategy on Climate Change (NFSCC) of 2010
- i. Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)
- j. LGU Guidebook on the Formulation of Local Climate Change Action Plan (LCCAP)
- k. CCC, National Framework Strategy on Climate Change, Climate Change Commission, Philippines



