Government of Nepal
Ministry of Urban Development
Kathmandu Valley Development Authority

United Nations Development Programme (UNDP), Nepal
Comprehensive Disaster Risk Management Programme

Empowered lives. Resilient nations.

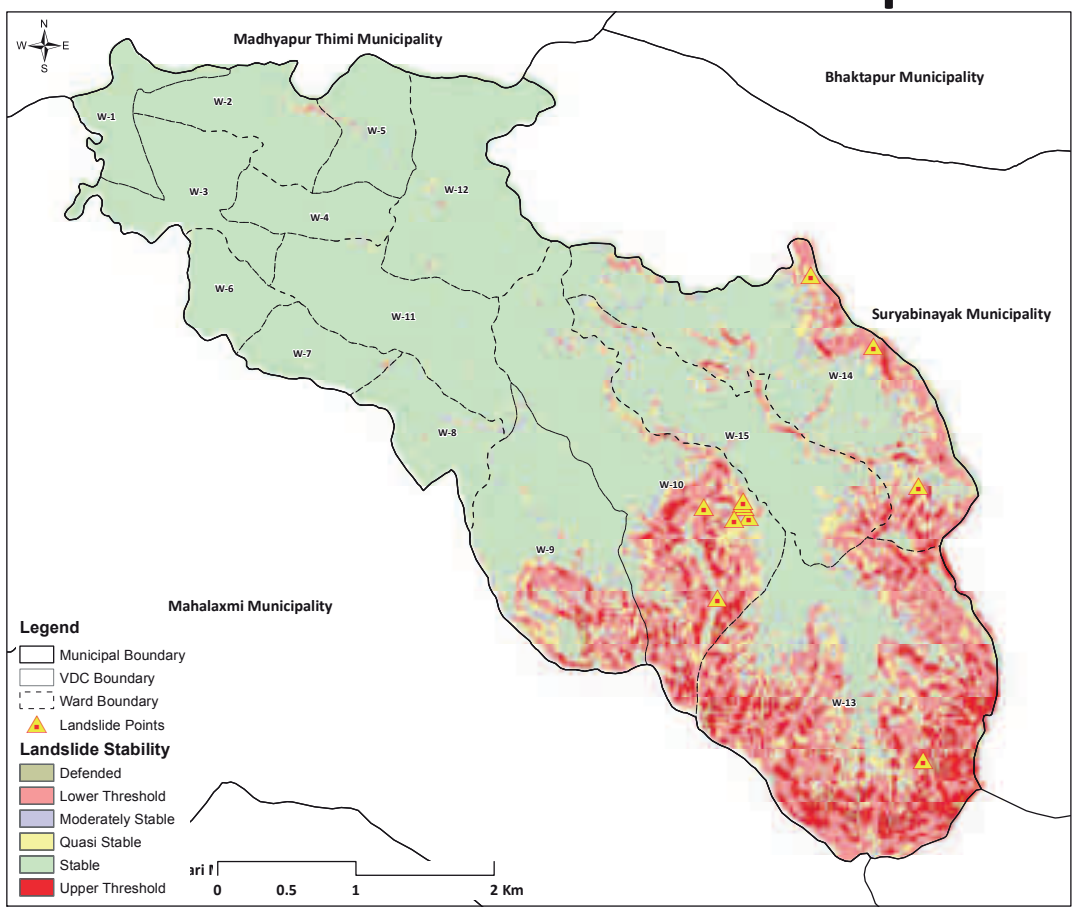
Risk Sensitive Land Use Plan of Kathmandu Valley

December 2016

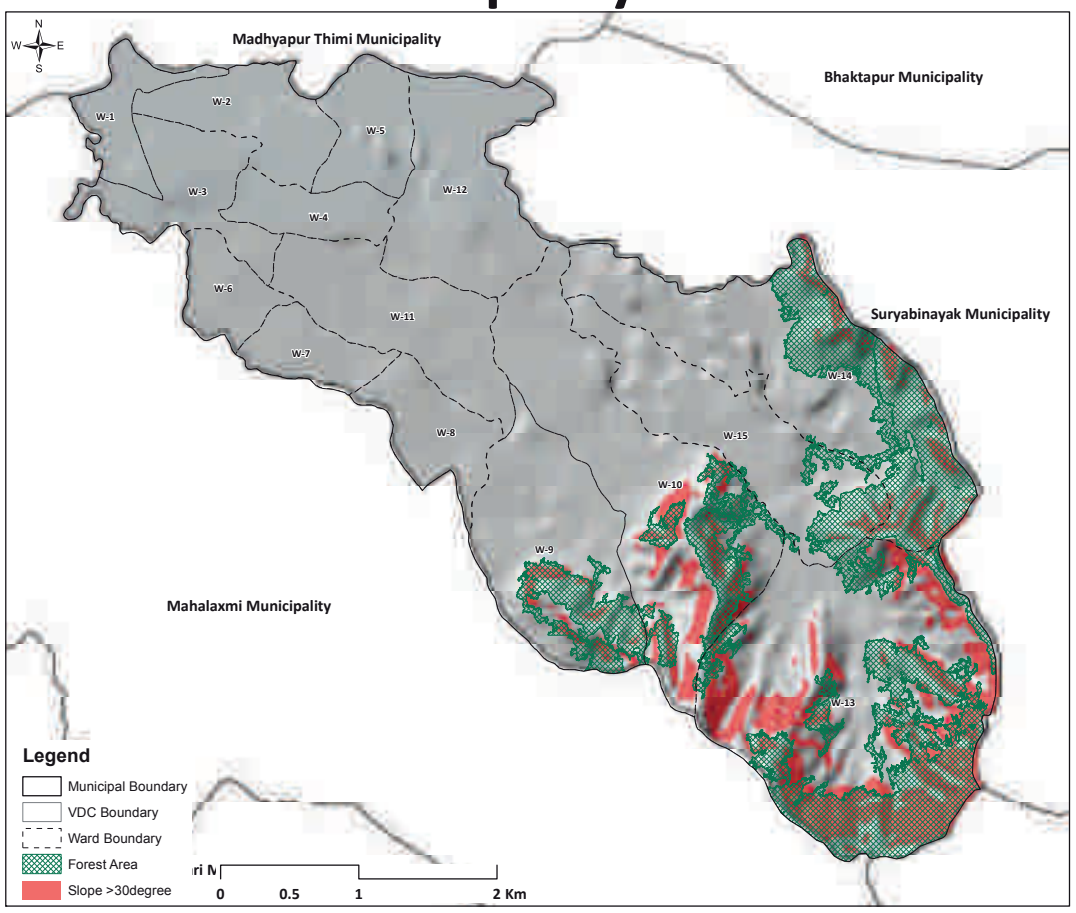
Nepal

Annex 5 Municipal Hazard Risk and Land Use Zoning Maps

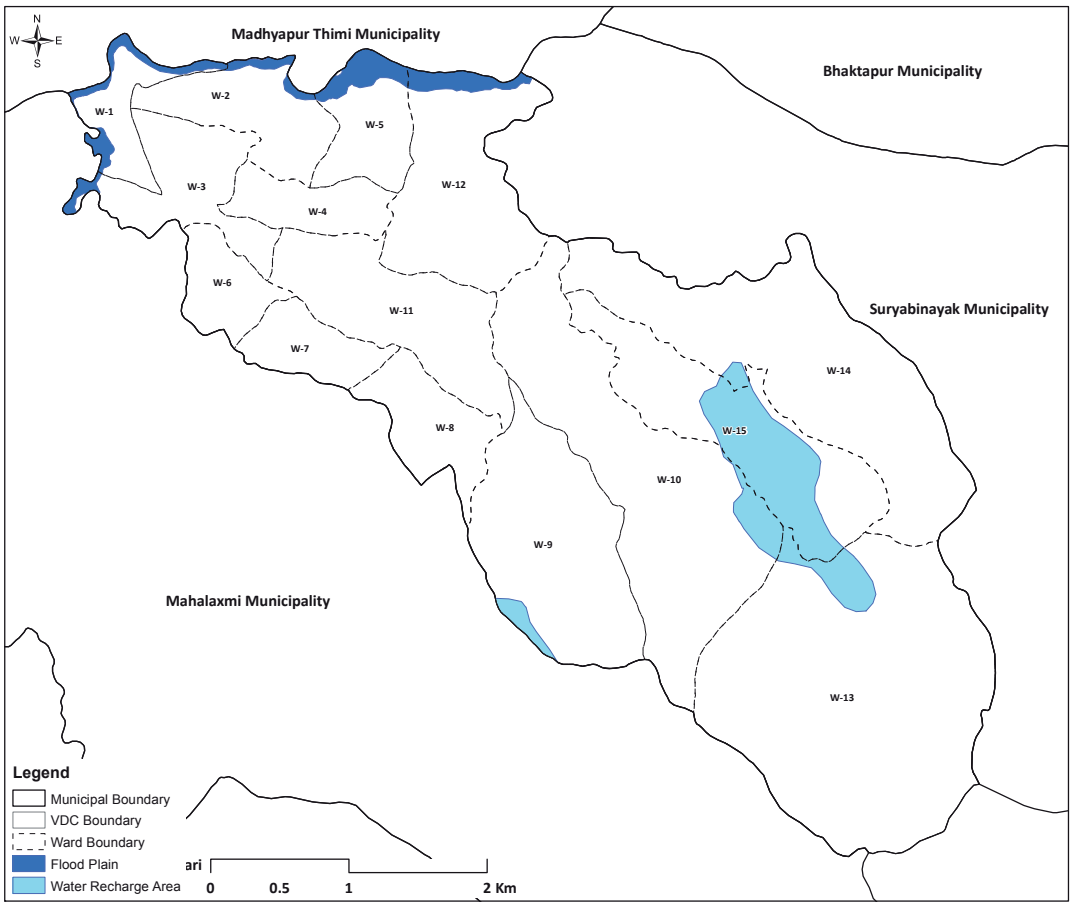
Hazard Risk Map Of Ananteshwor Municipality



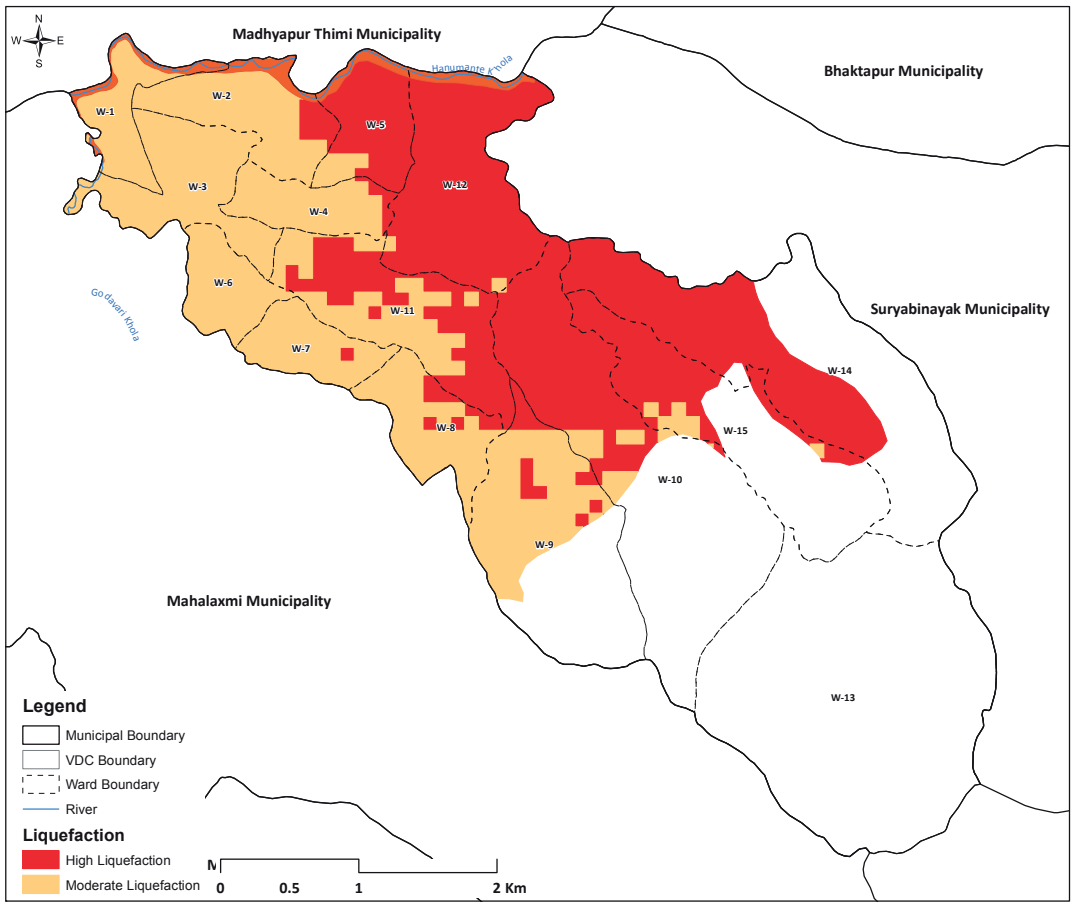
Landslide Susceptibility Map



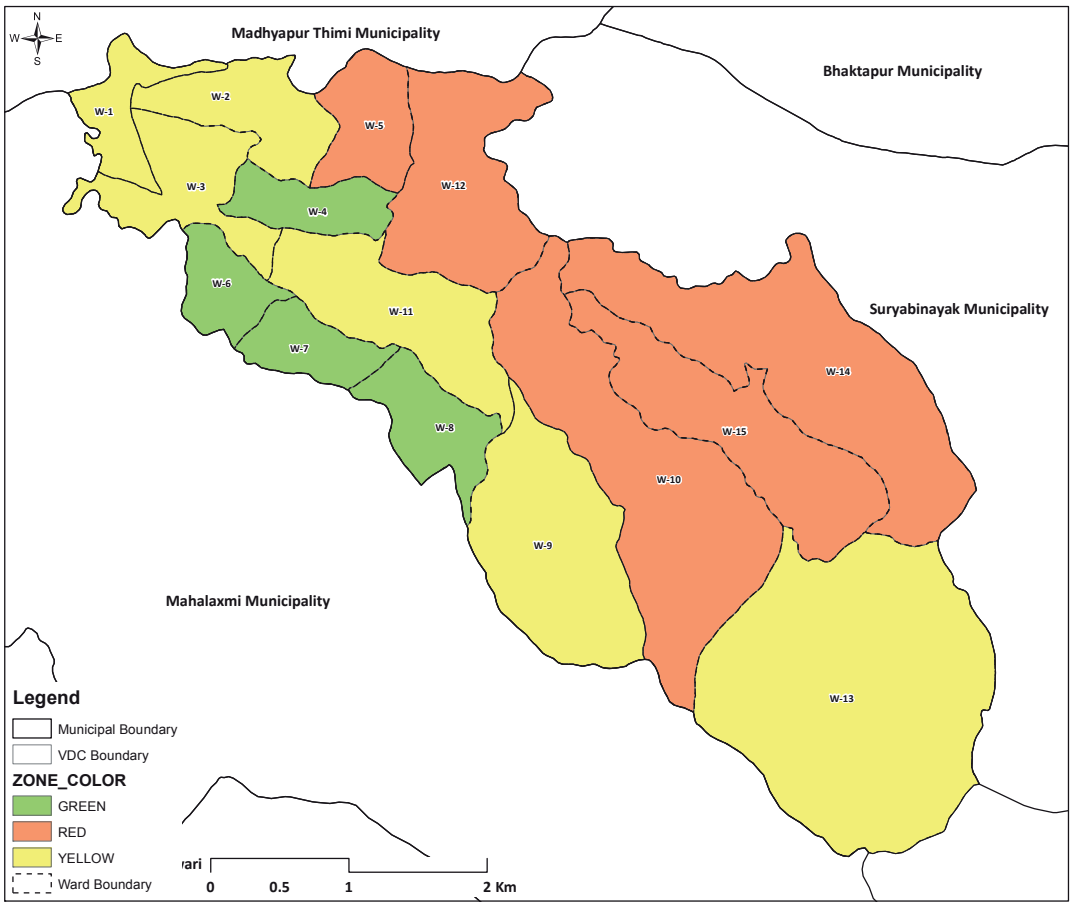
Slope Land Unsuitable For Development



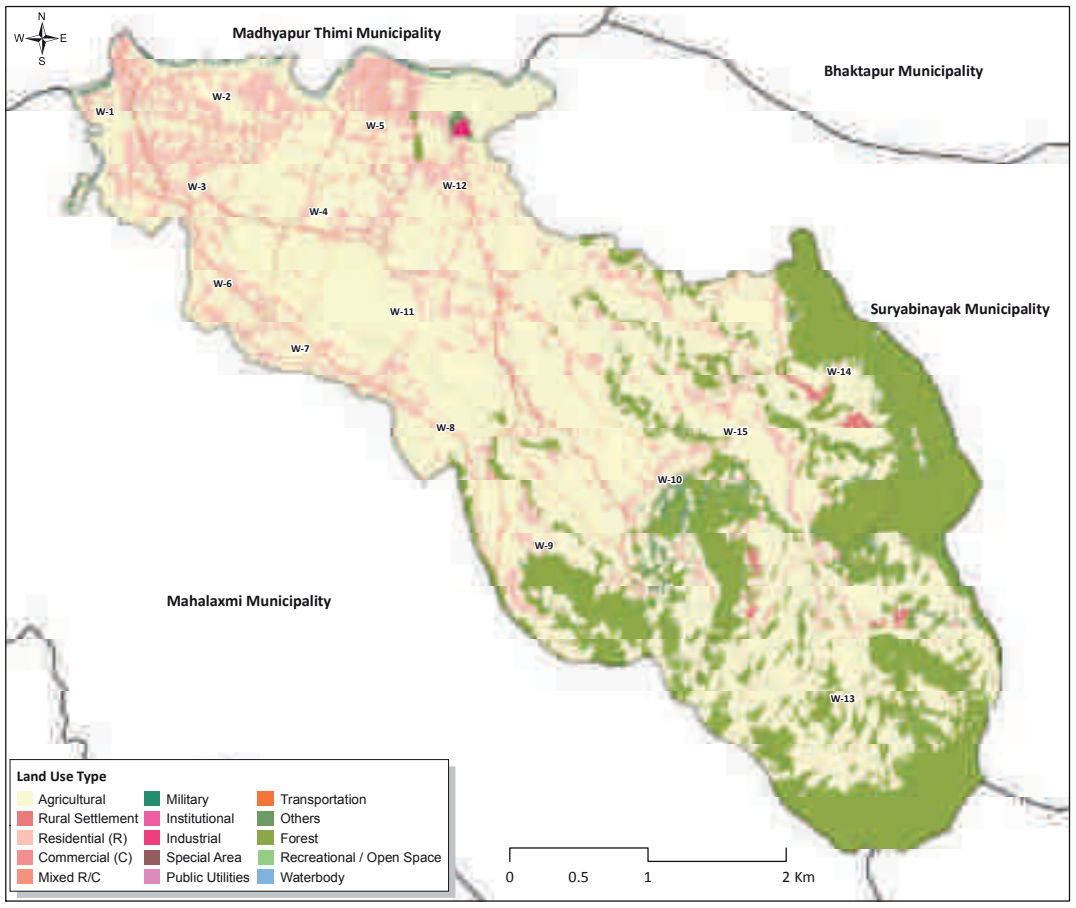
Flood Prone Areas And Water Recharge Area



Liquefaction Susceptible Area



Colour Zone Map Based On Development Constraints



Existing Land Use Map

Kathmandu Valley Development Authority

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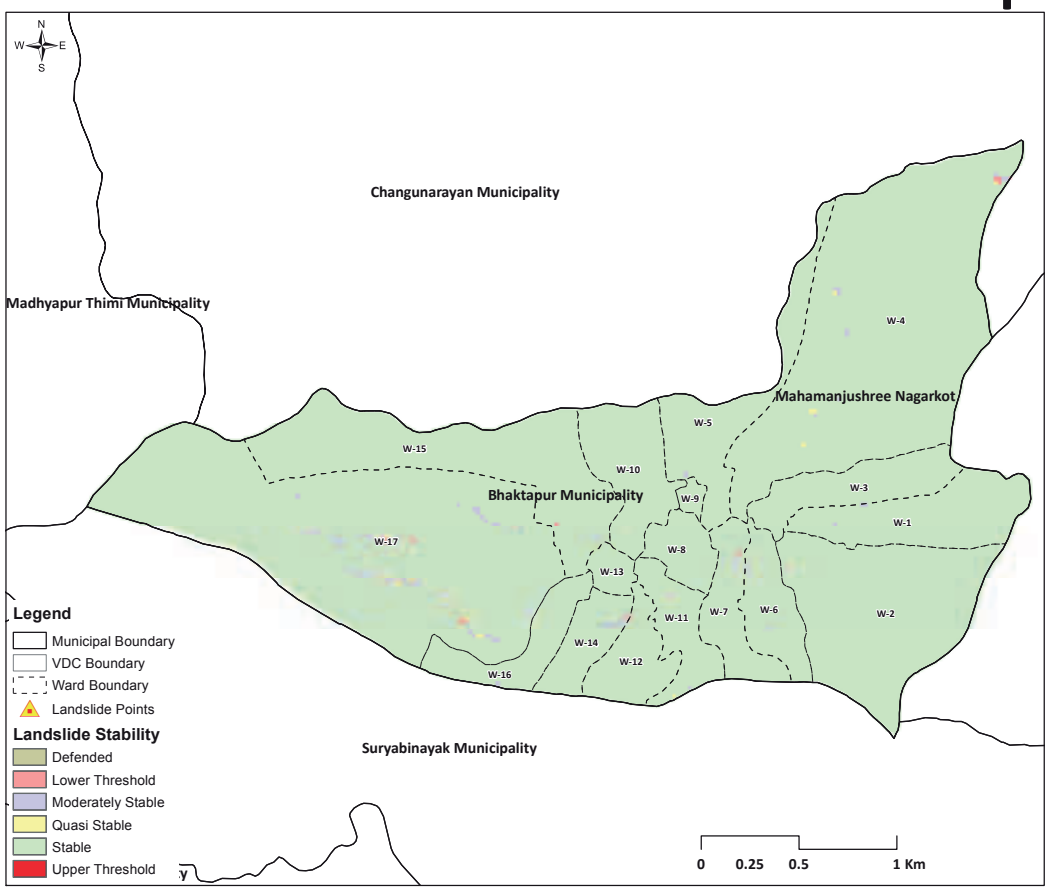
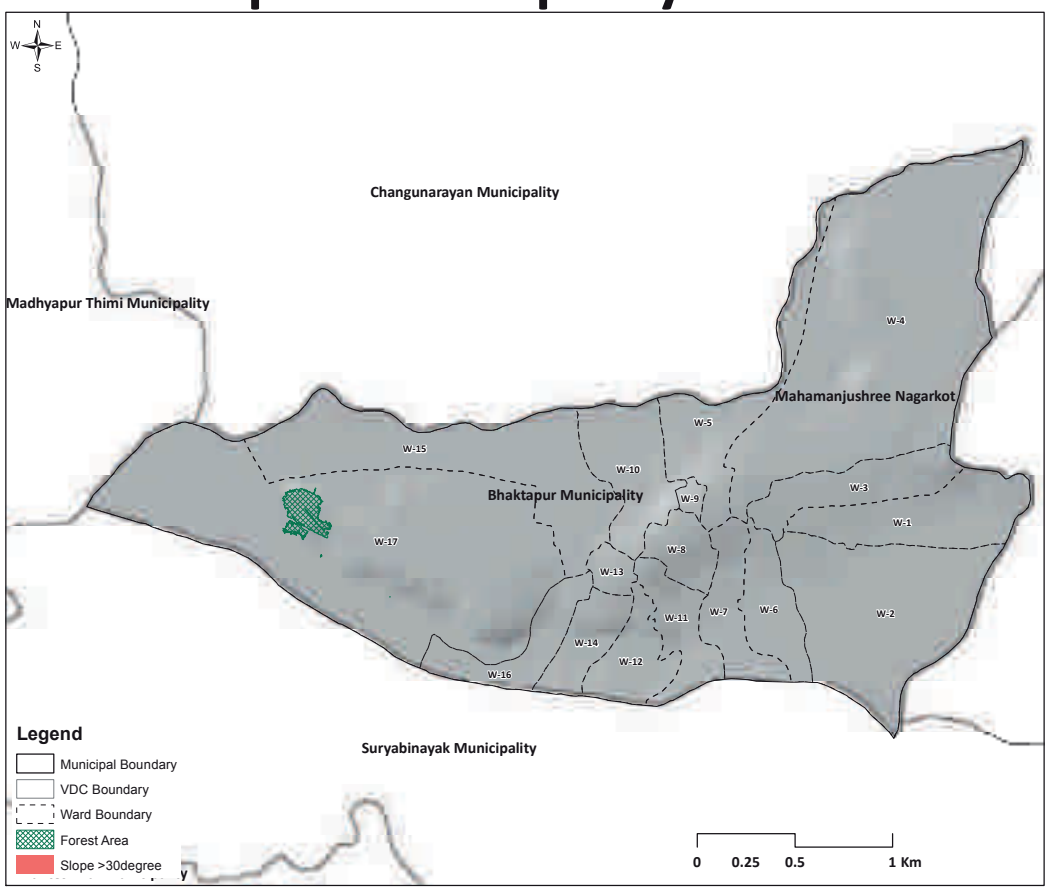
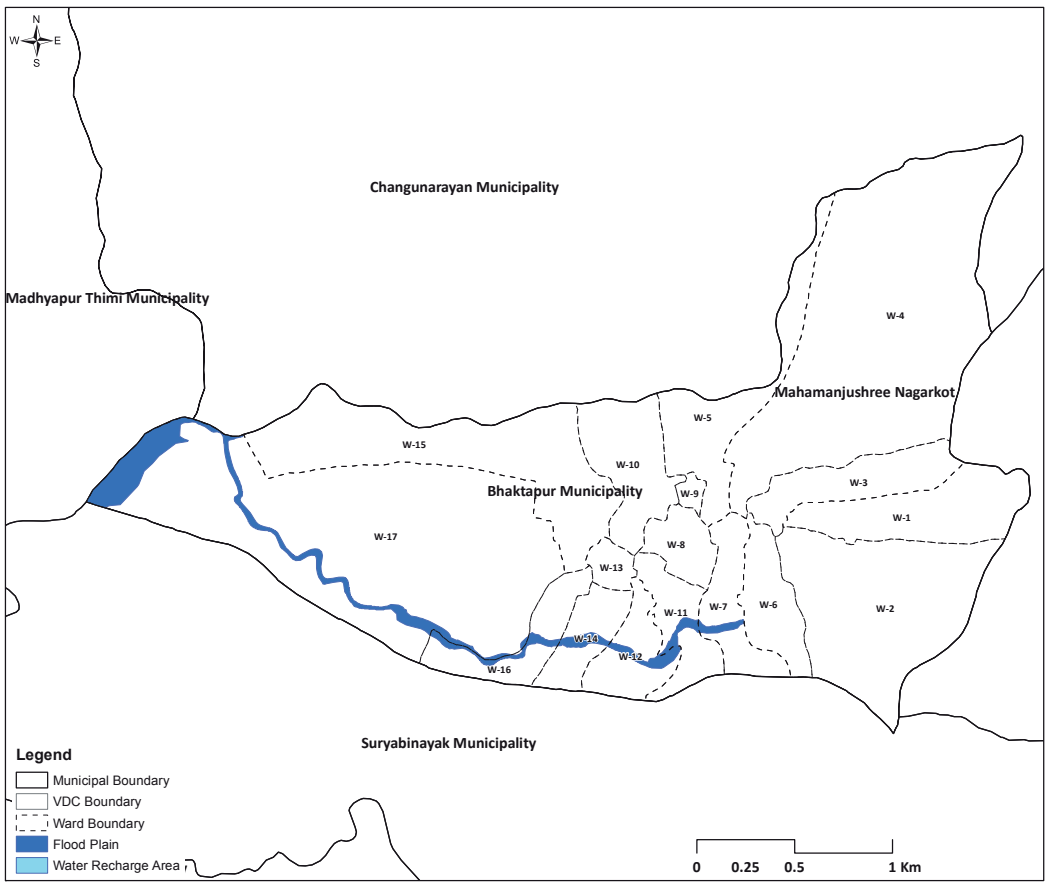
Hazard Risk Map Of Bhaktapur Municipality



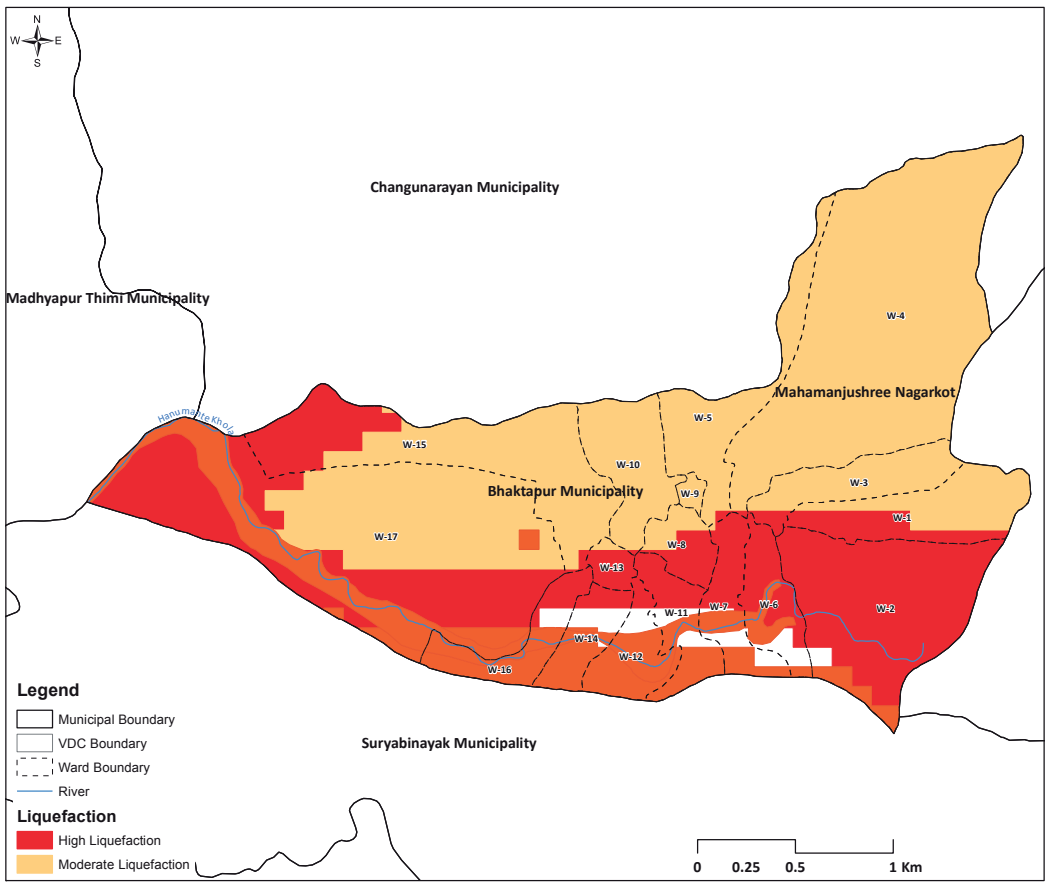
Landslide Susceptibility Map



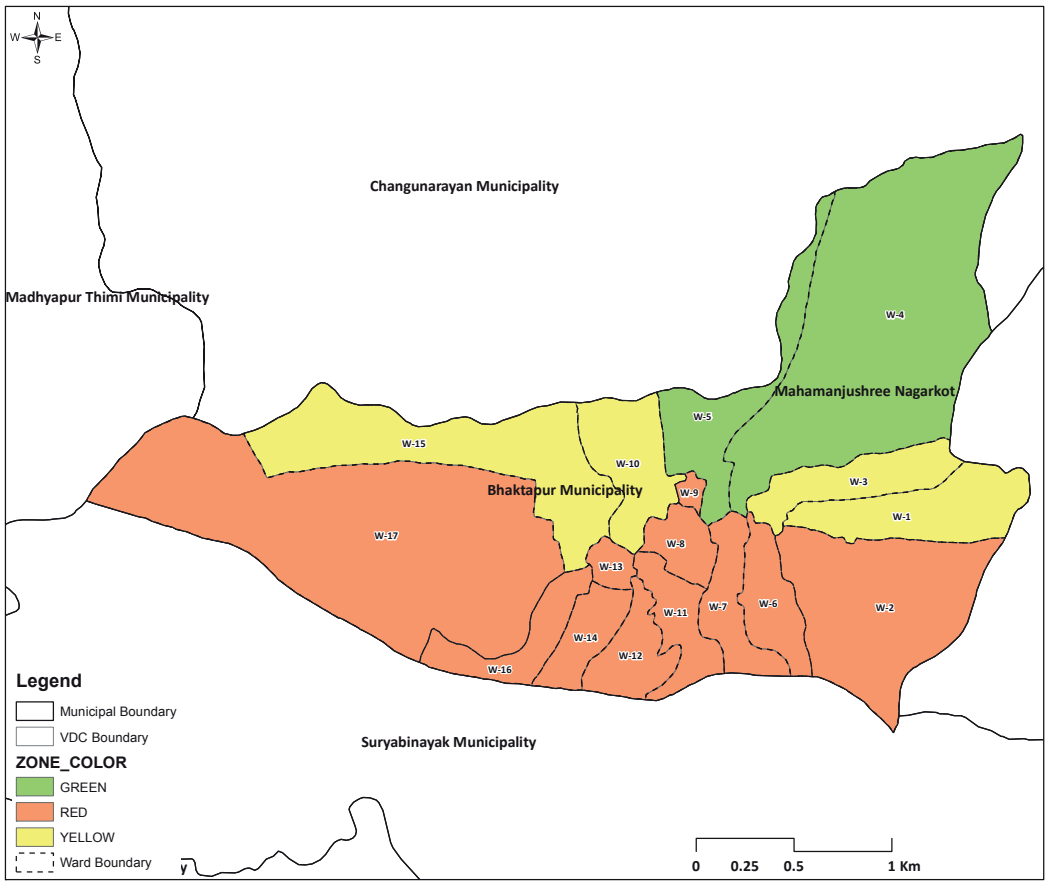
Slope Land Unsuitable For Development



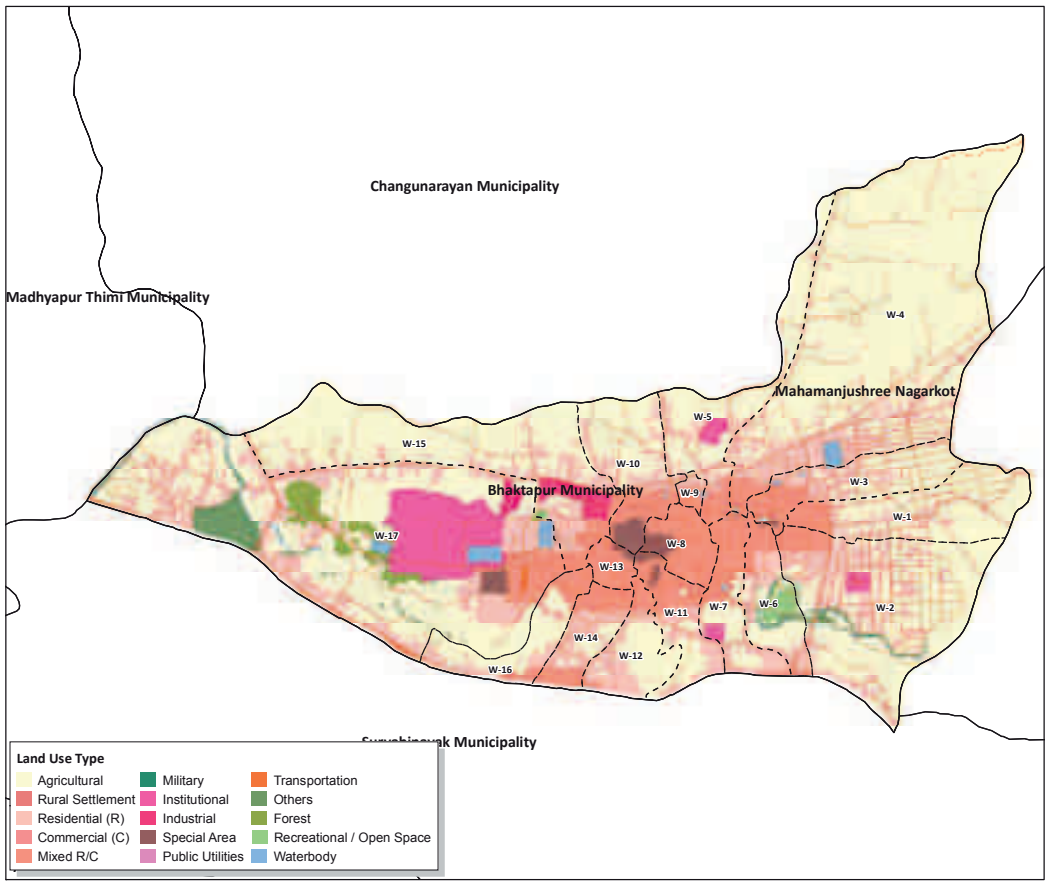
Flood Prone Areas And Water Recharge Area



Liquefaction Susceptible Area



Colour Zone Map Based On Development Constraints



Existing Land Use Map

Kathmandu Valley Development Authority

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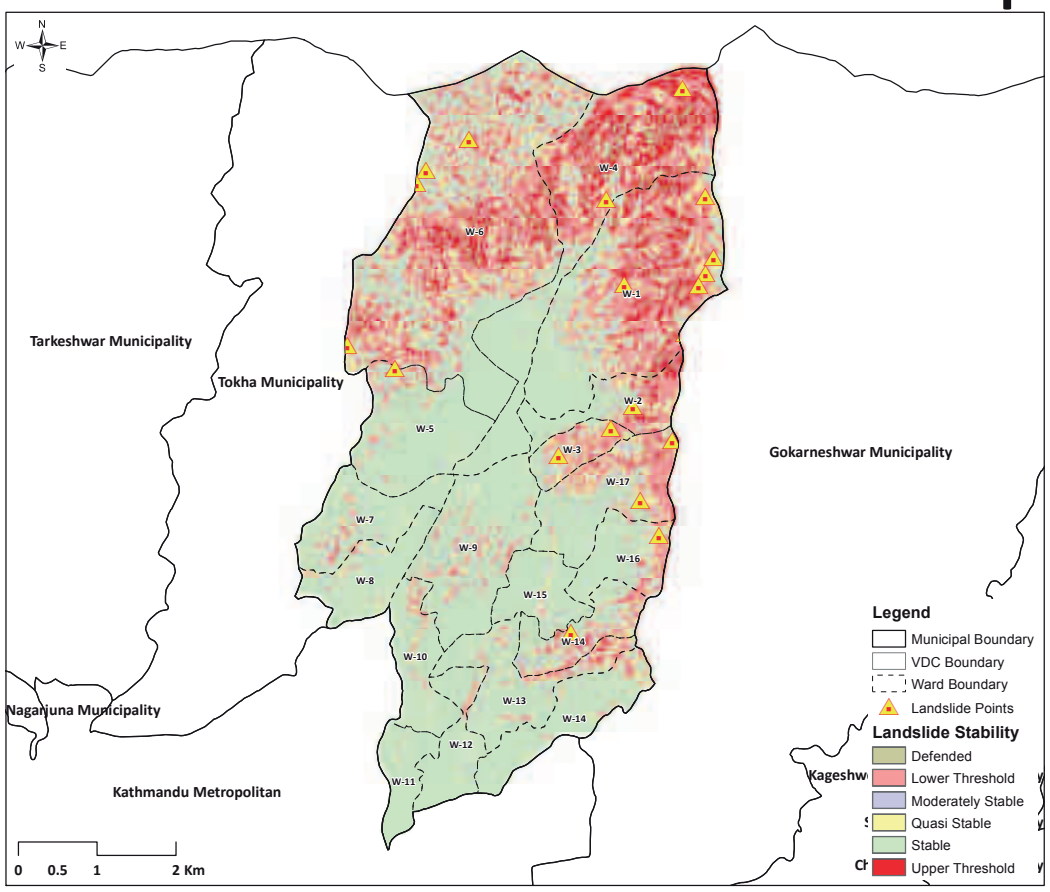
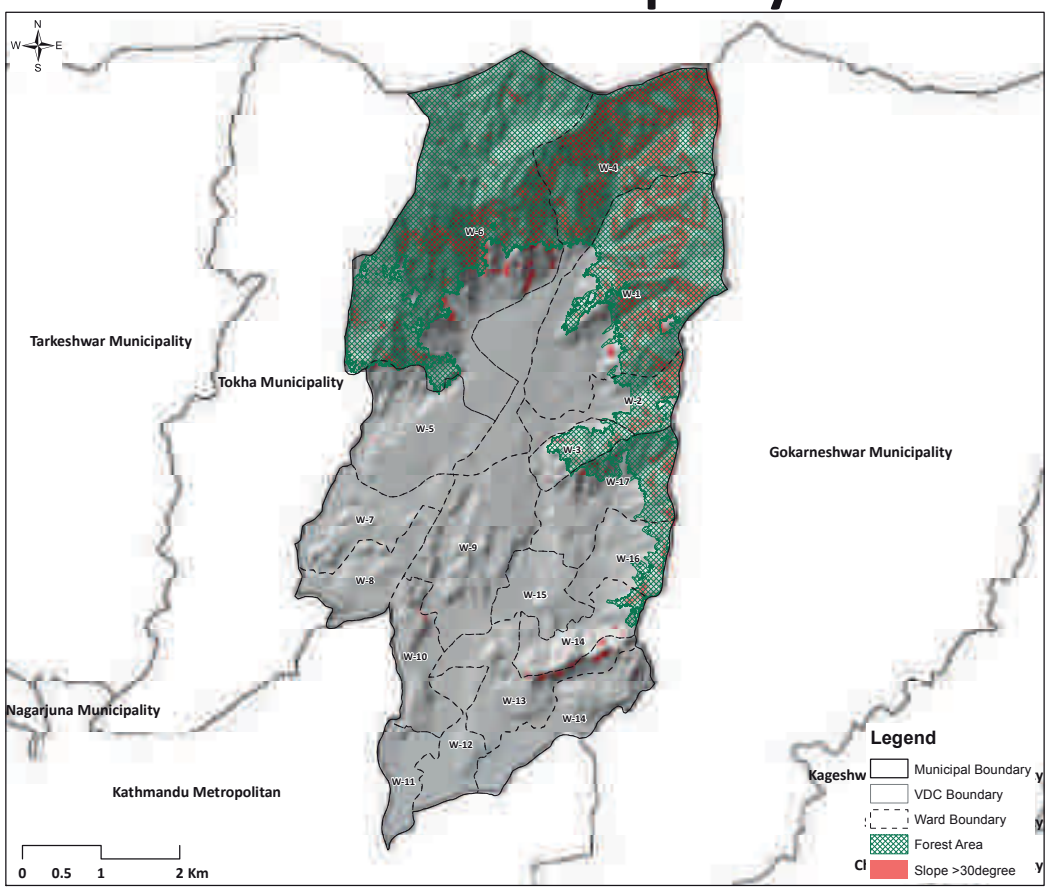
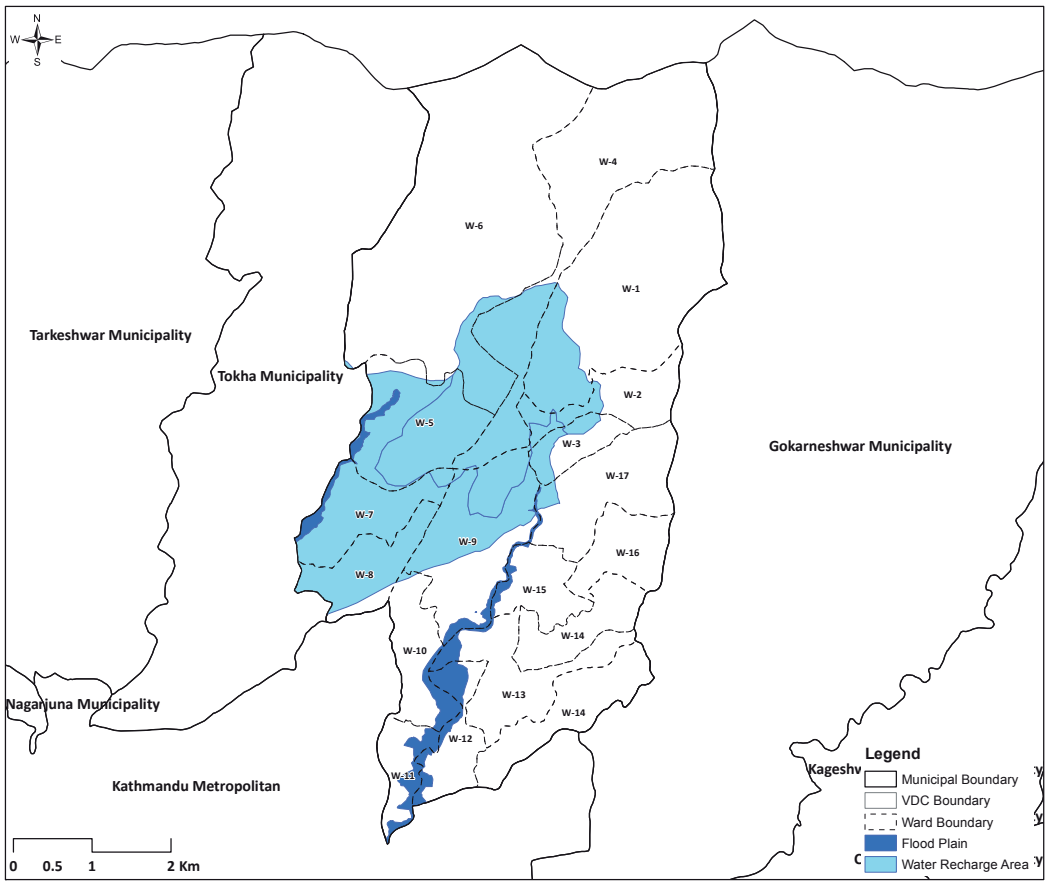
Hazard Risk Map Of Budanilkantha Municipality



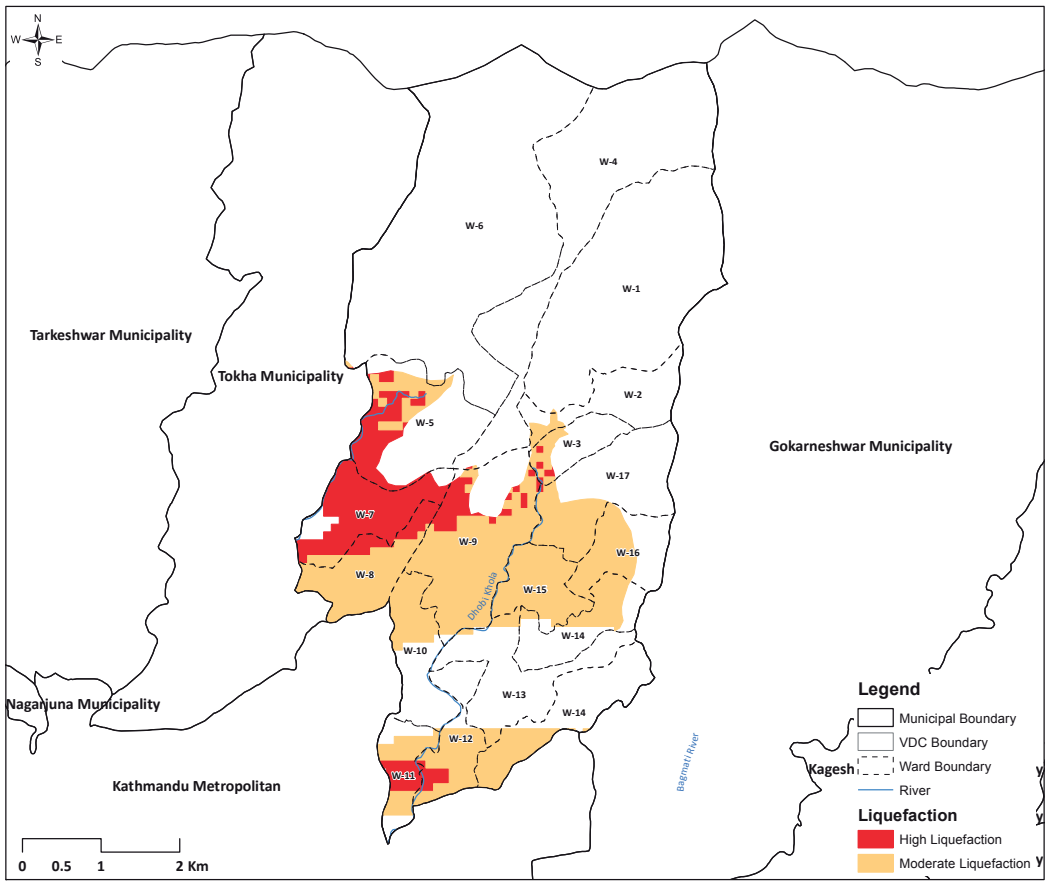
Landslide Susceptibility Map



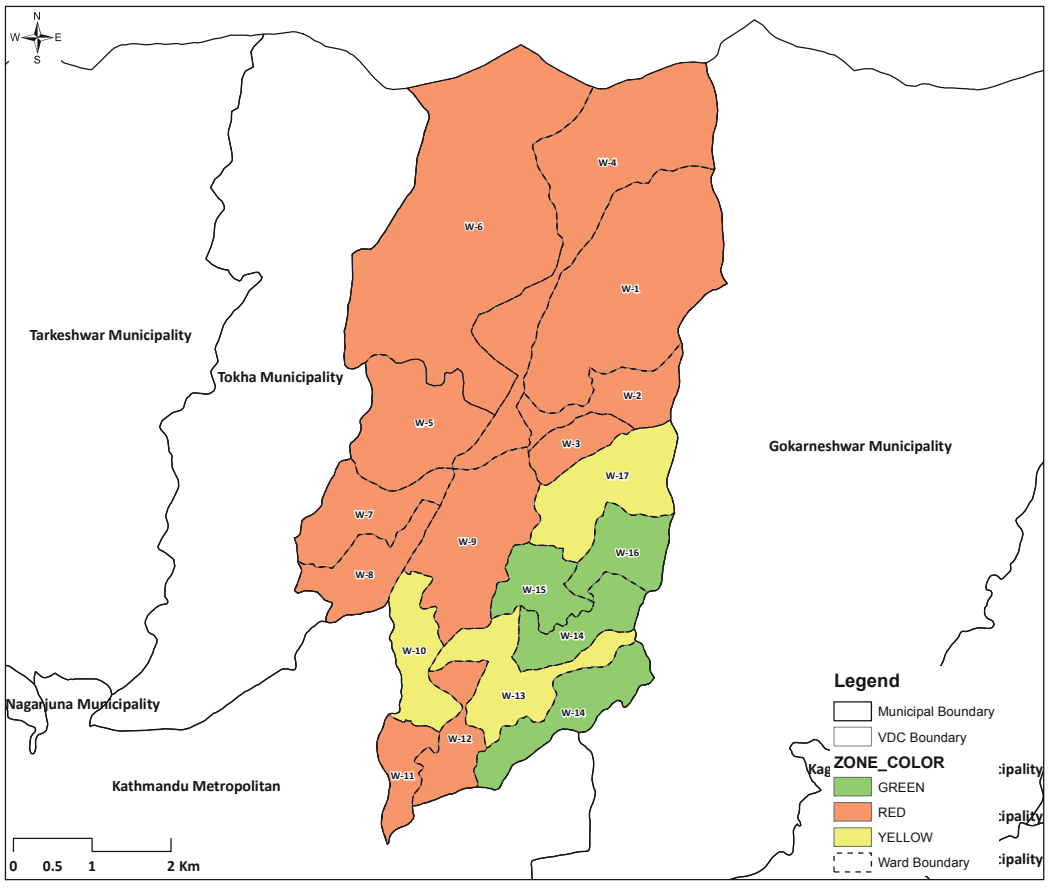
Slope Land Unsuitable For Development



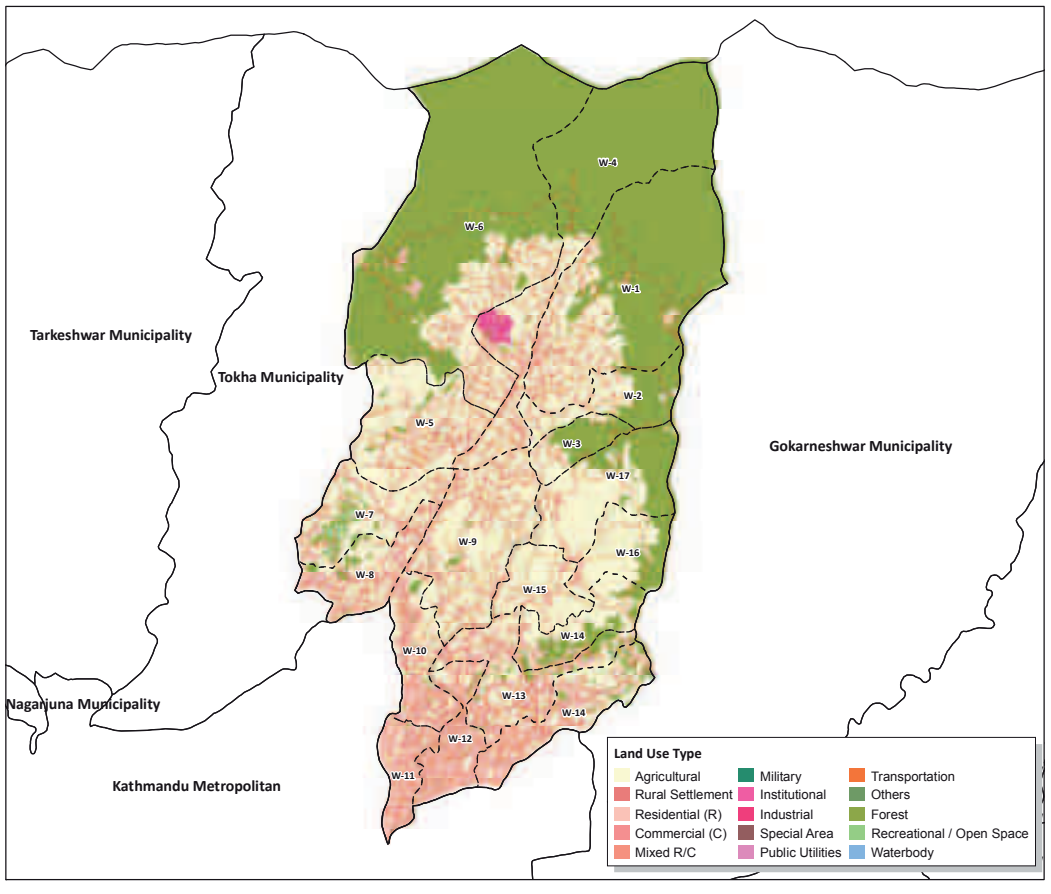
Flood Prone Areas And Water Recharge Area



Liquefaction Susceptible Area



Colour Zone Map Based On Development Constraints



Existing Land Use Map

Kathmandu Valley Development Authority

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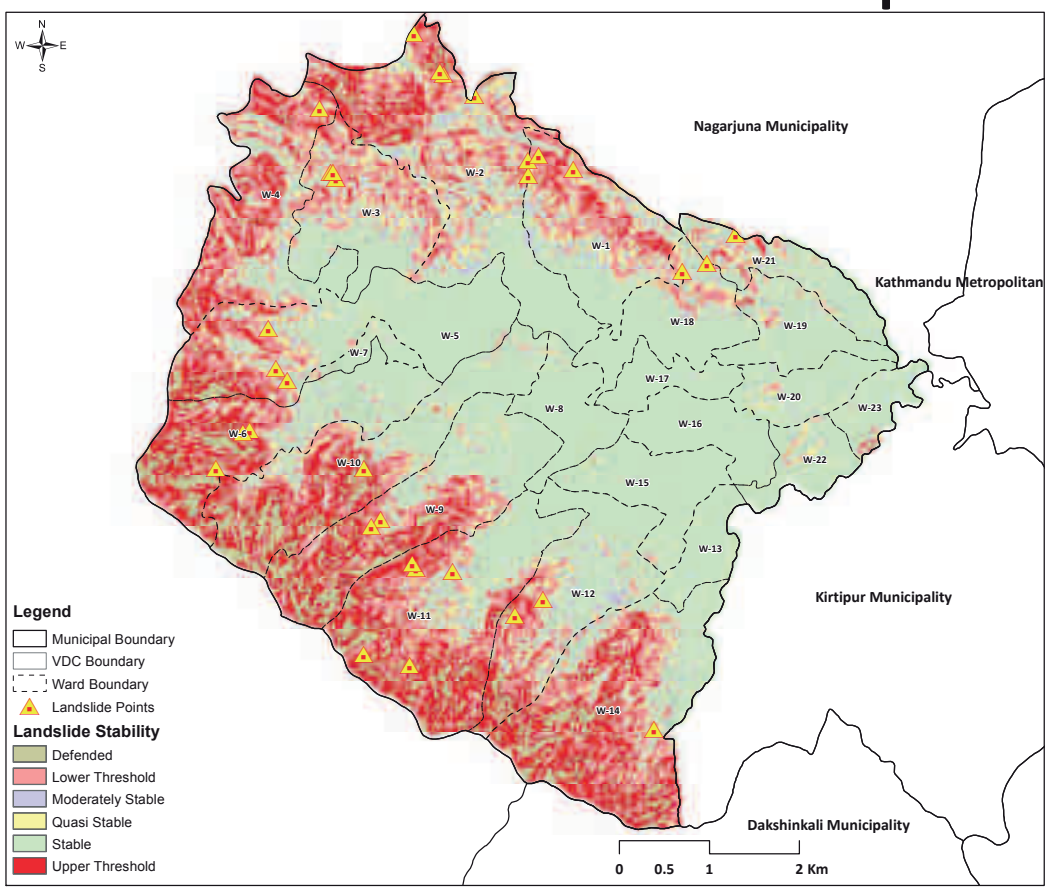
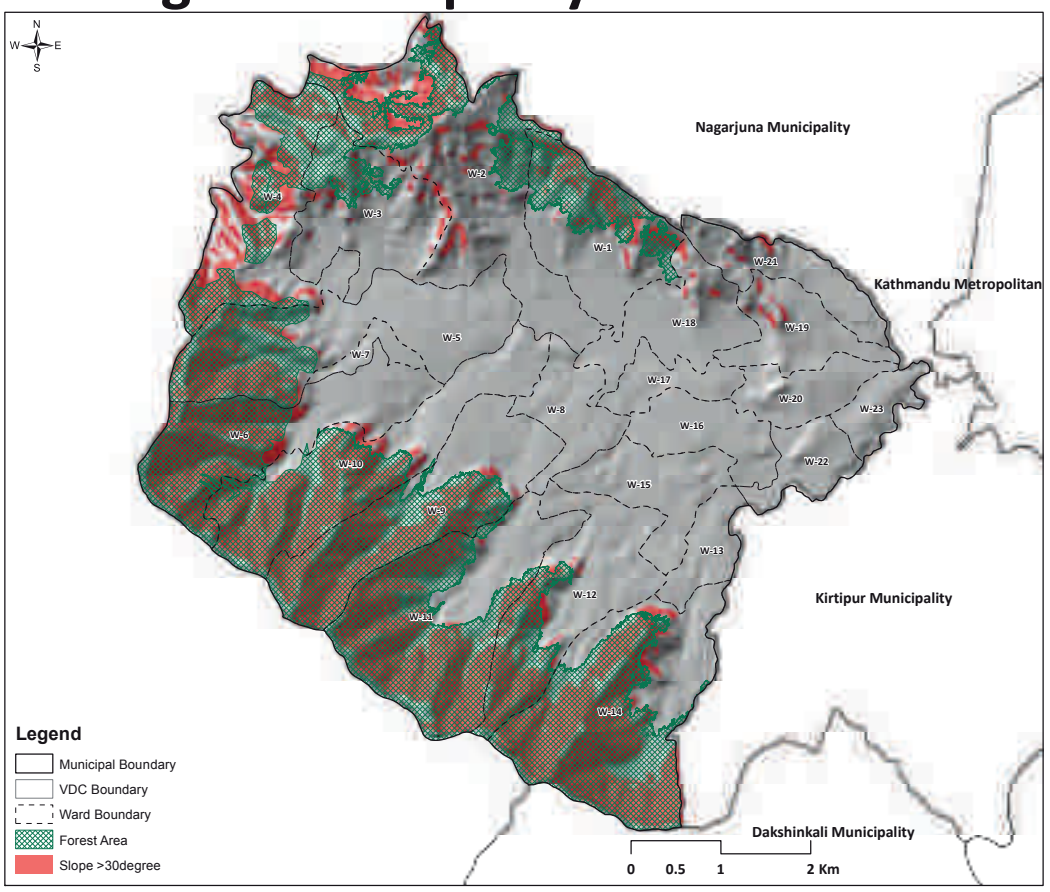
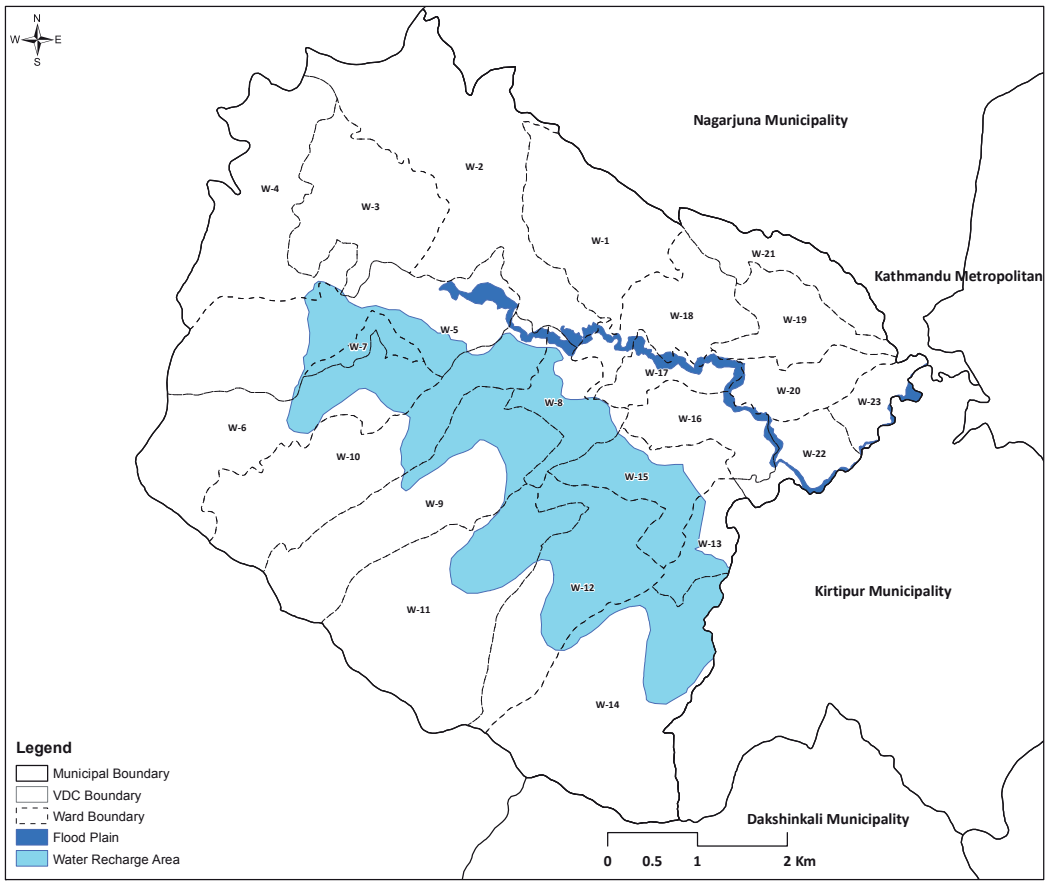
Hazard Risk Map Of Chandragiri Municipality



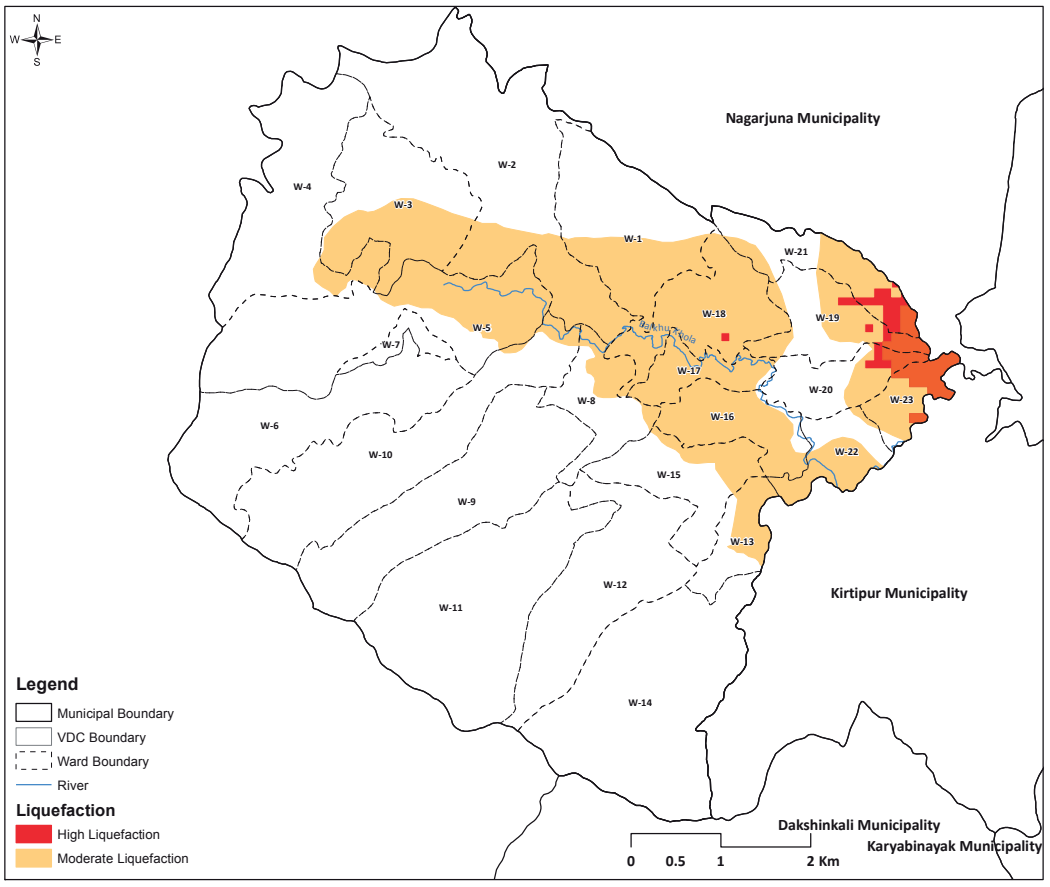
Landslide Susceptibility Map



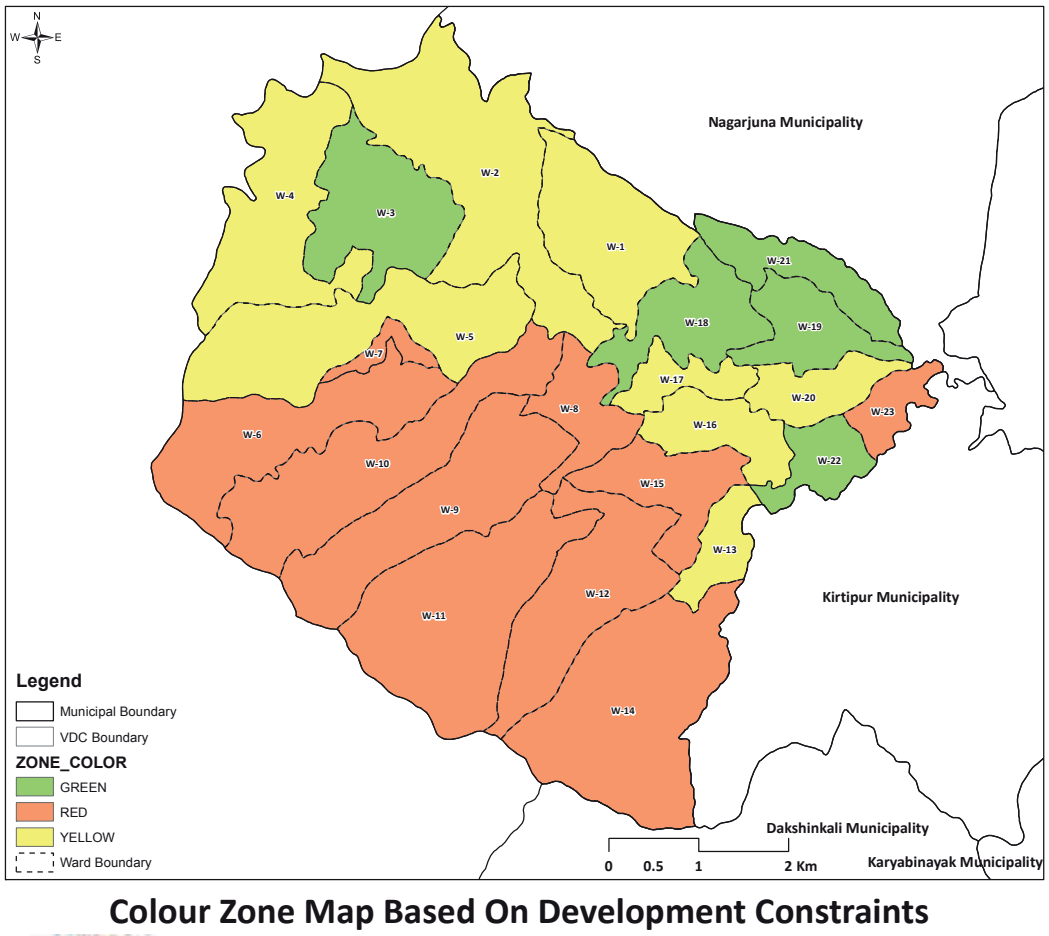
Slope Land Unsuitable For Development



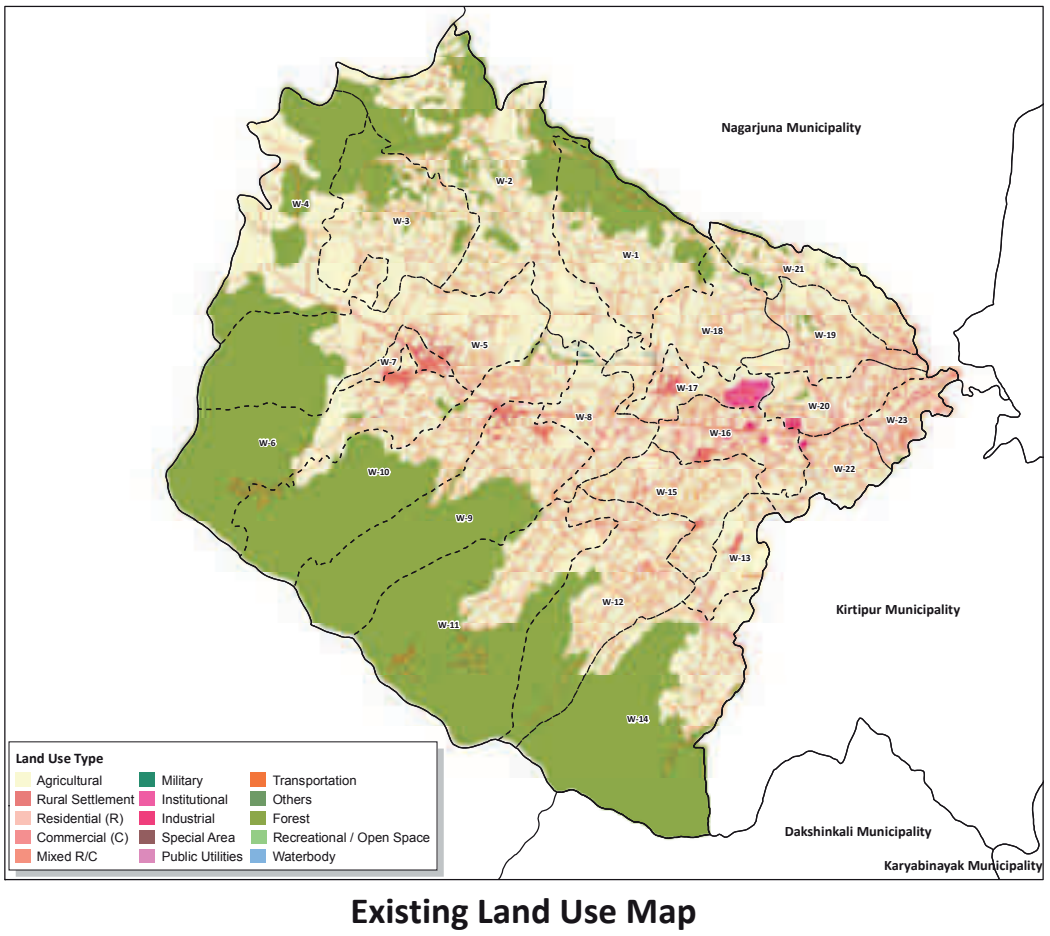
Flood Prone Areas And Water Recharge Area



Liquefaction Susceptible Area



Colour Zone Map Based On Development Constraints



Existing Land Use Map

Kathmandu Valley Development Authority

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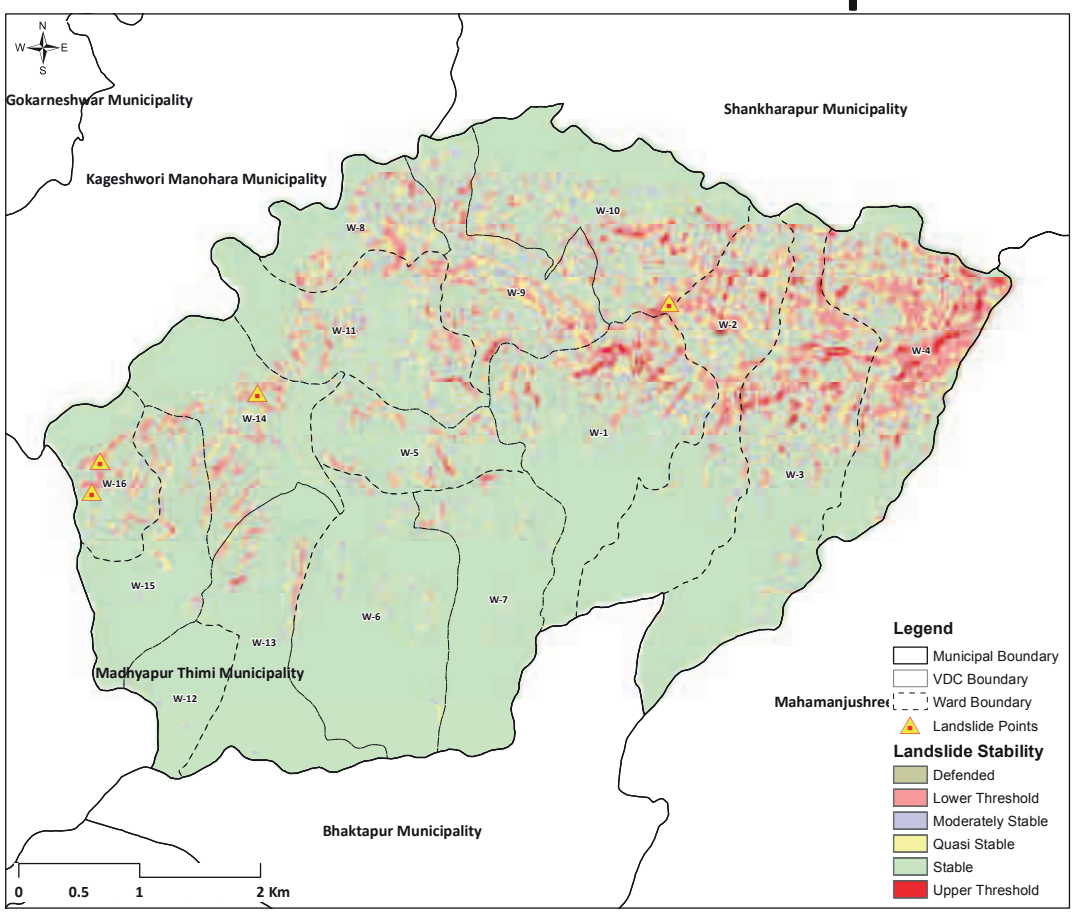
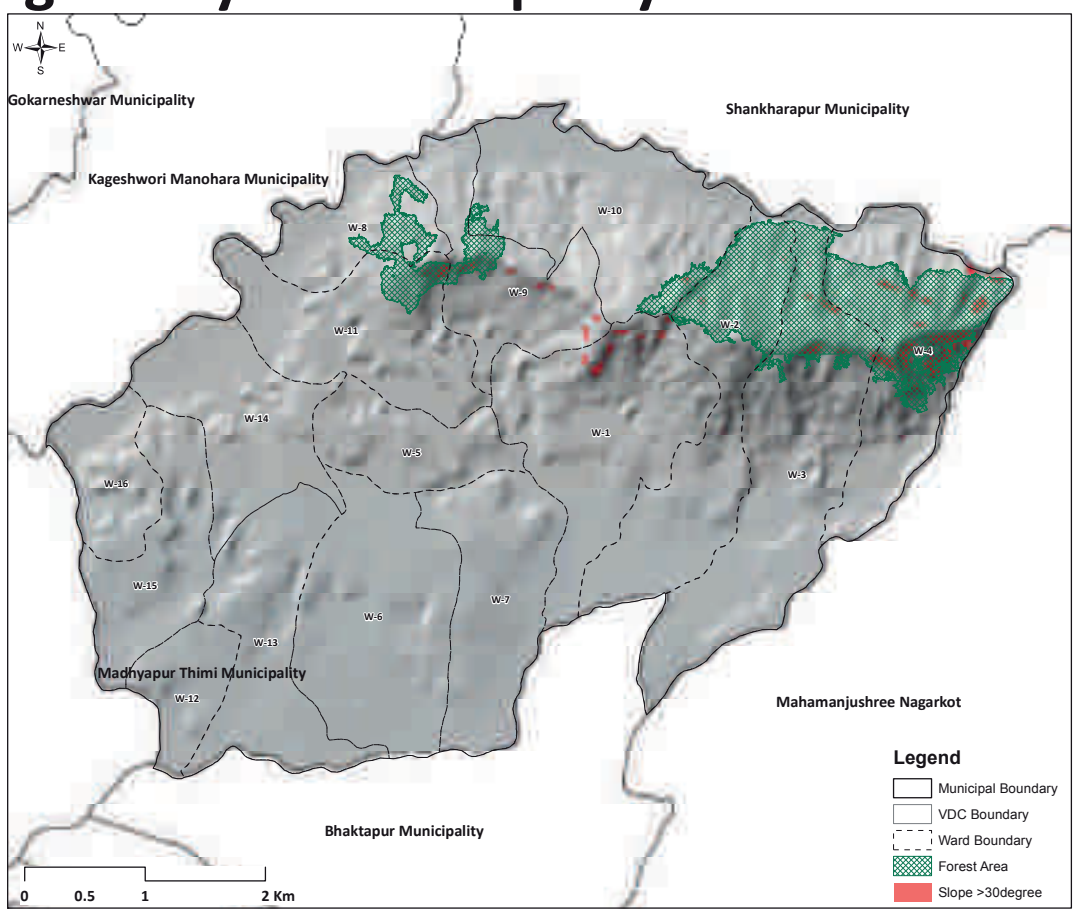
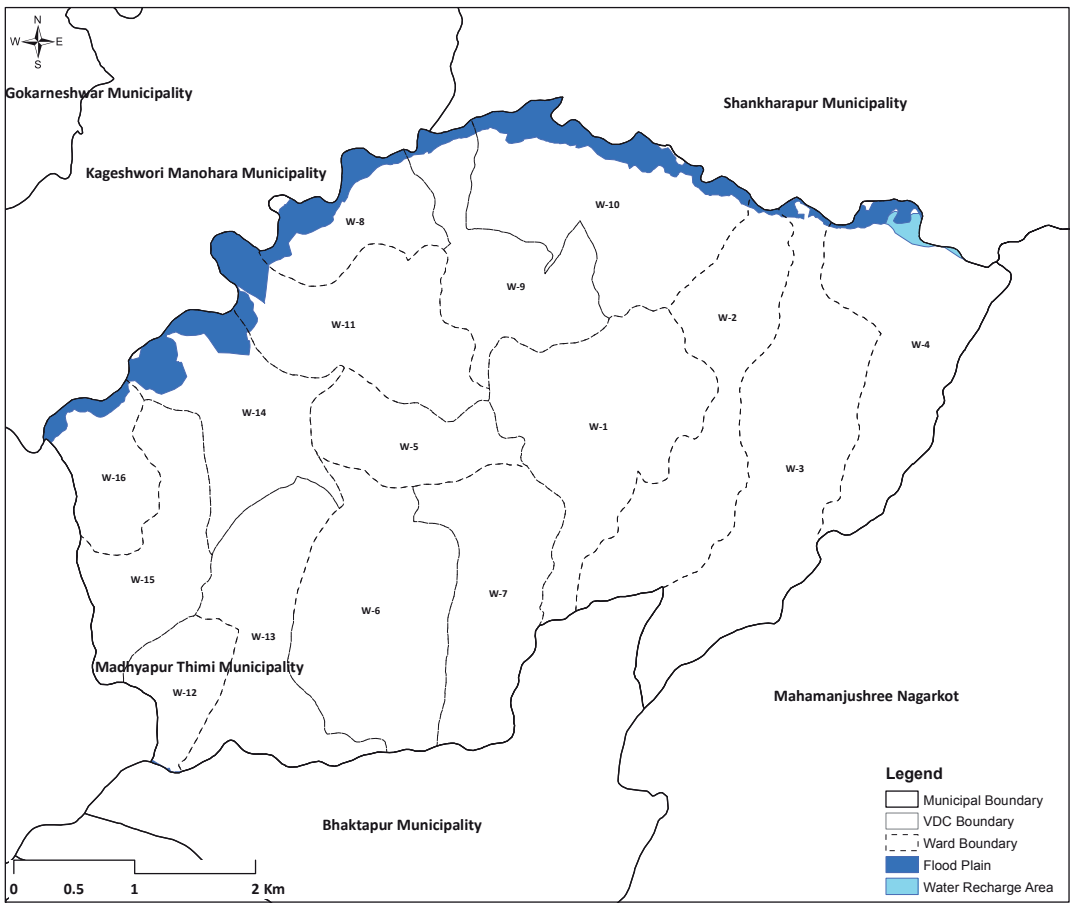
Hazard Risk Map Of Changunarayan Municipality



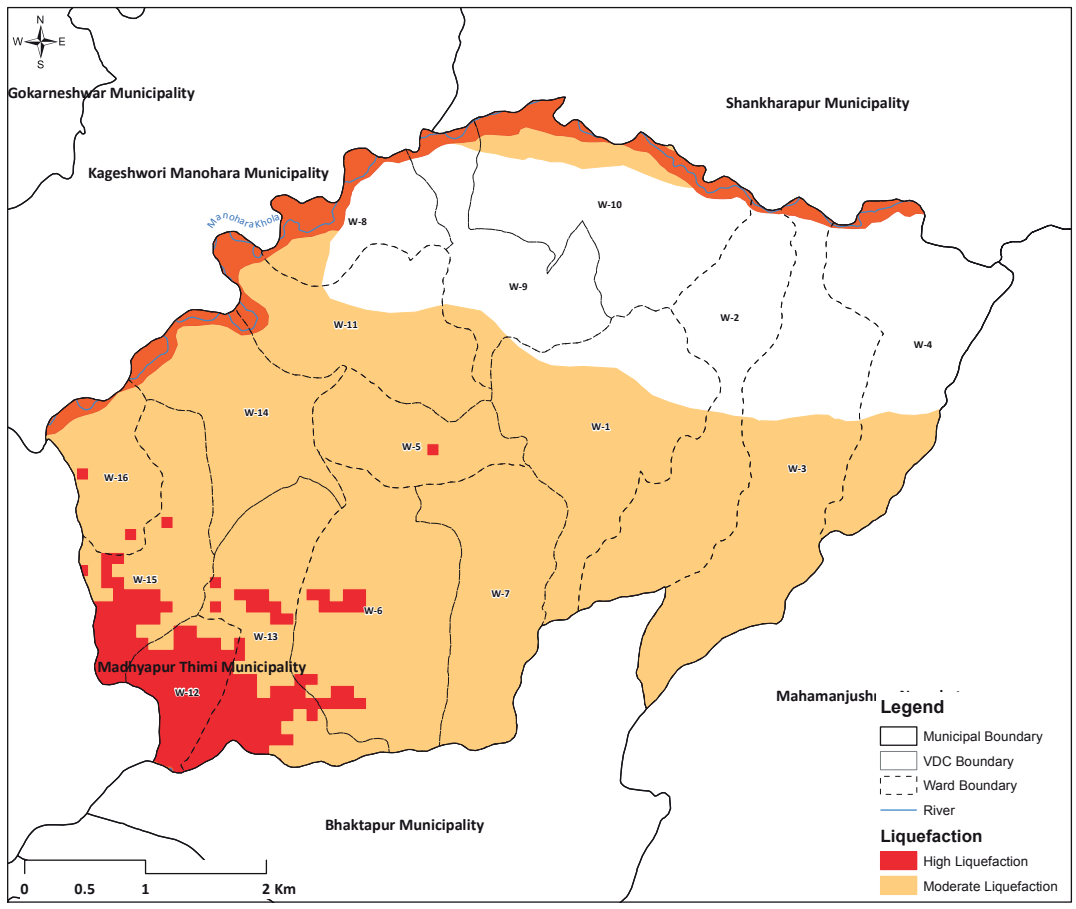
Landslide Susceptibility Map



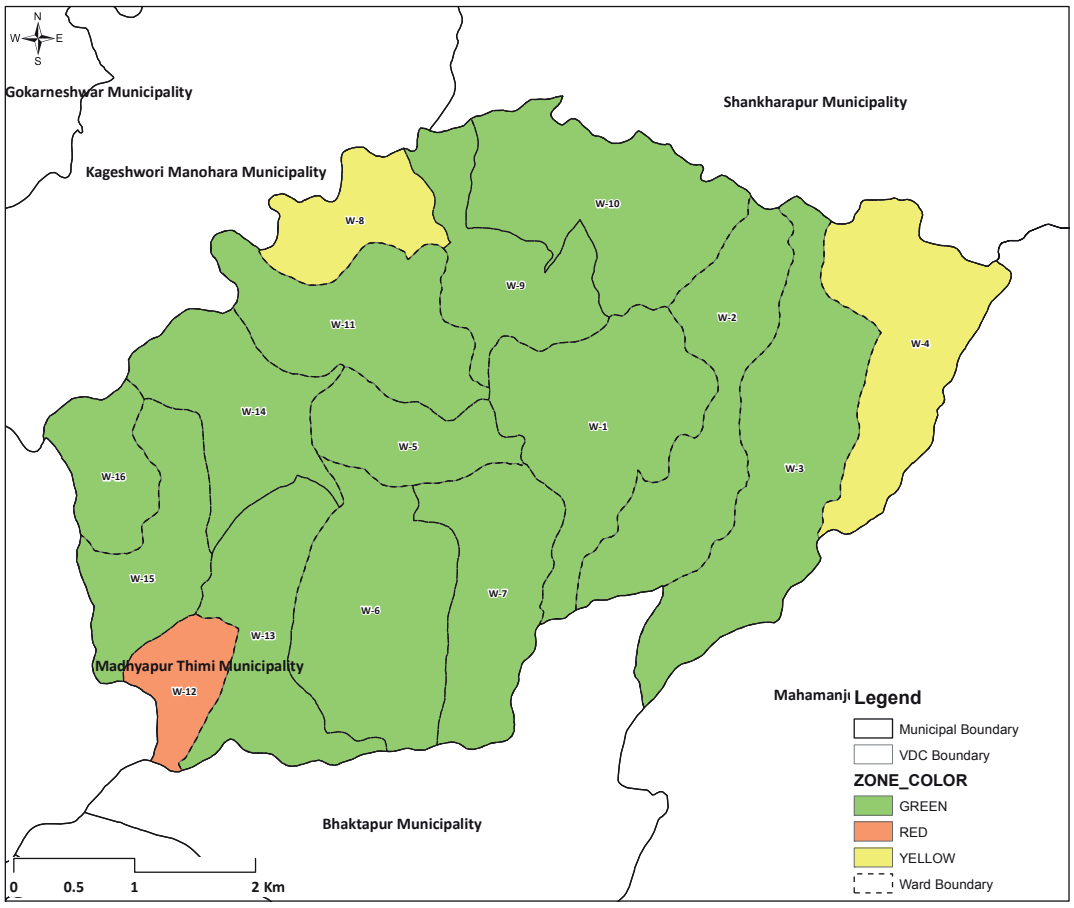
Slope Land Unsuitable For Development



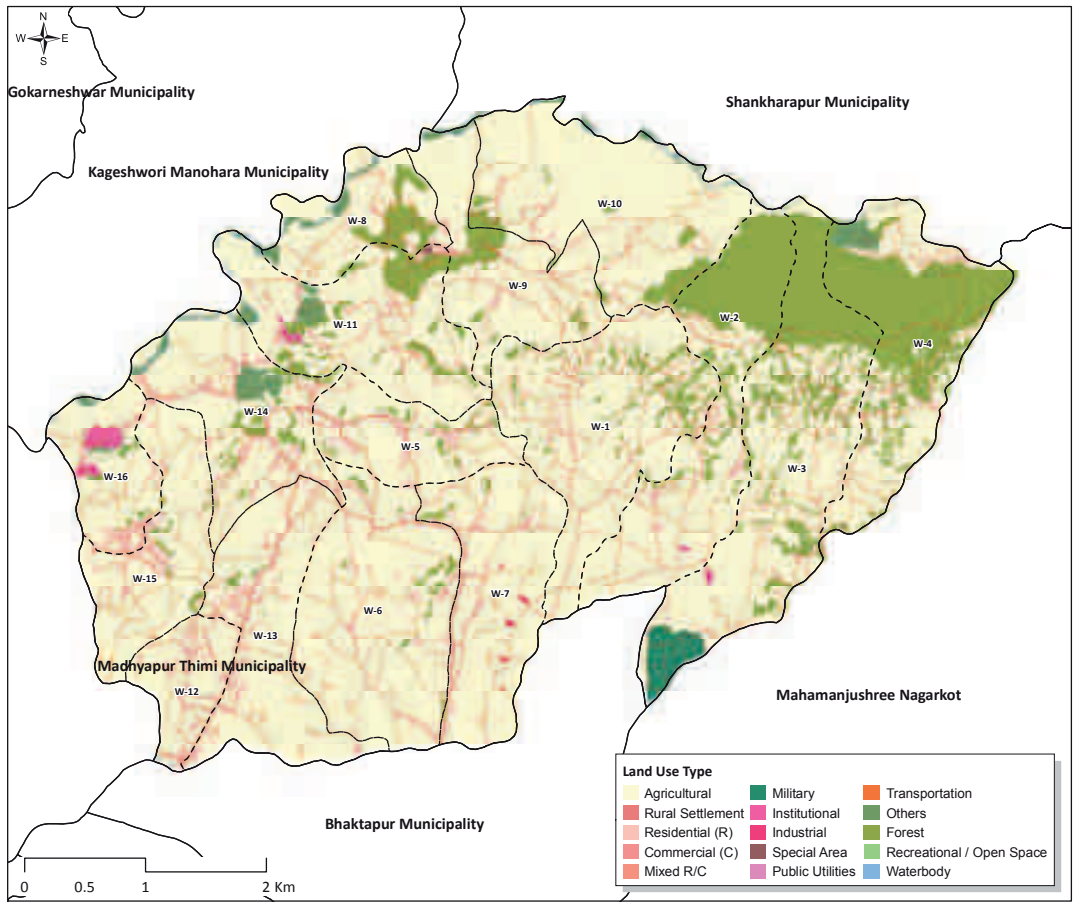
Flood Prone Areas And Water Recharge Area



Liquefaction Susceptible Area



Colour Zone Map Based On Development Constraints



Existing Land Use Map

Kathmandu Valley Development Authority

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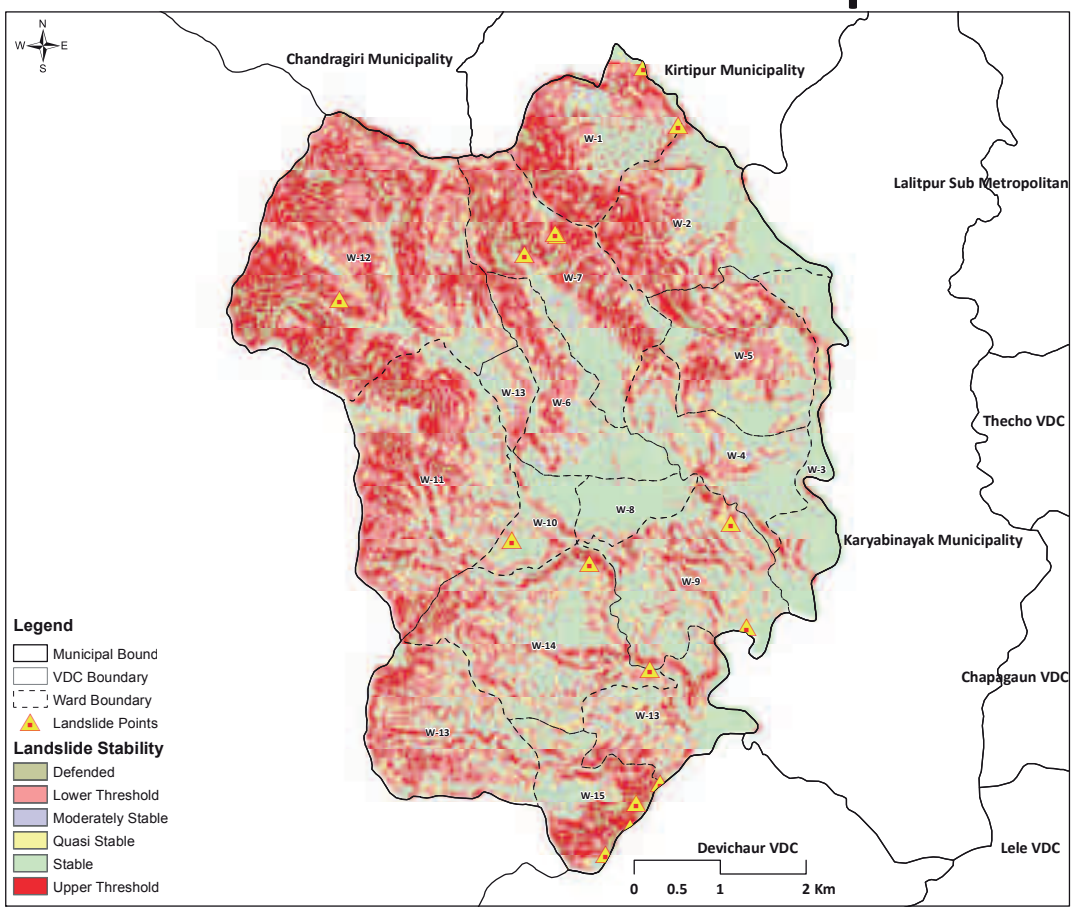
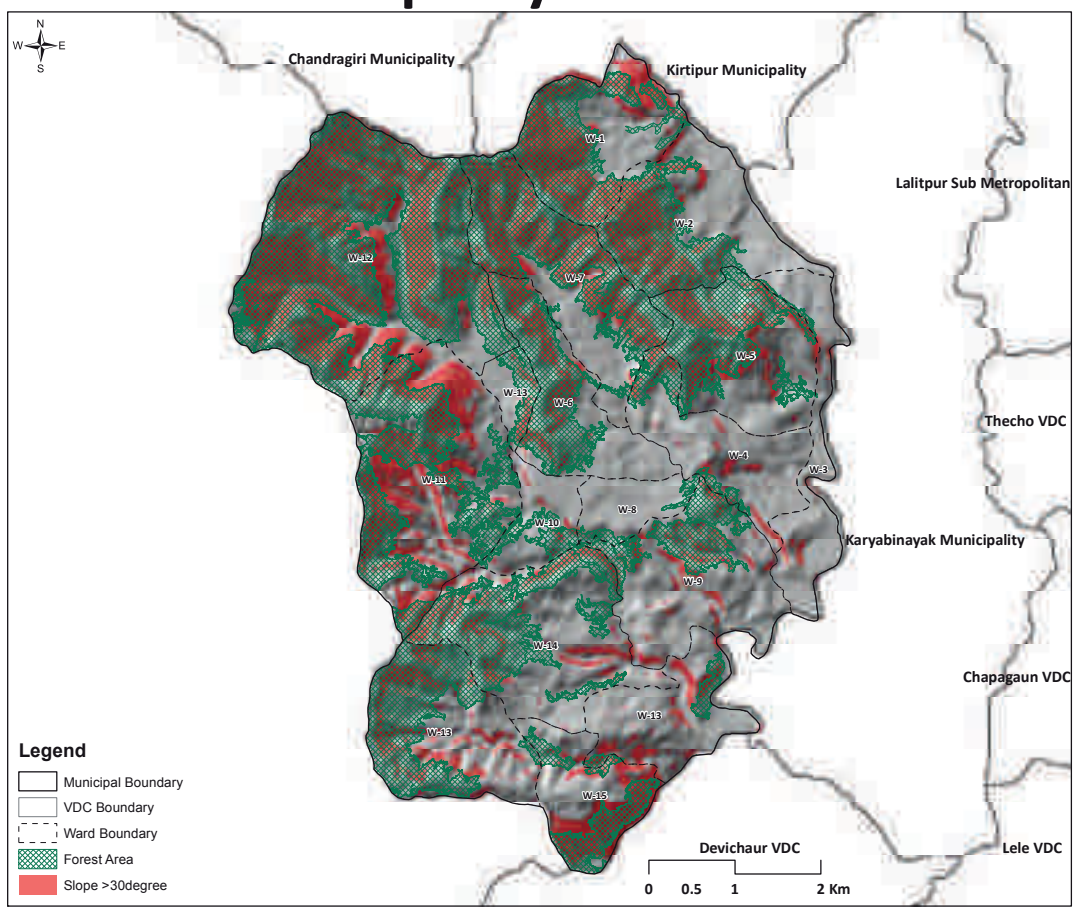
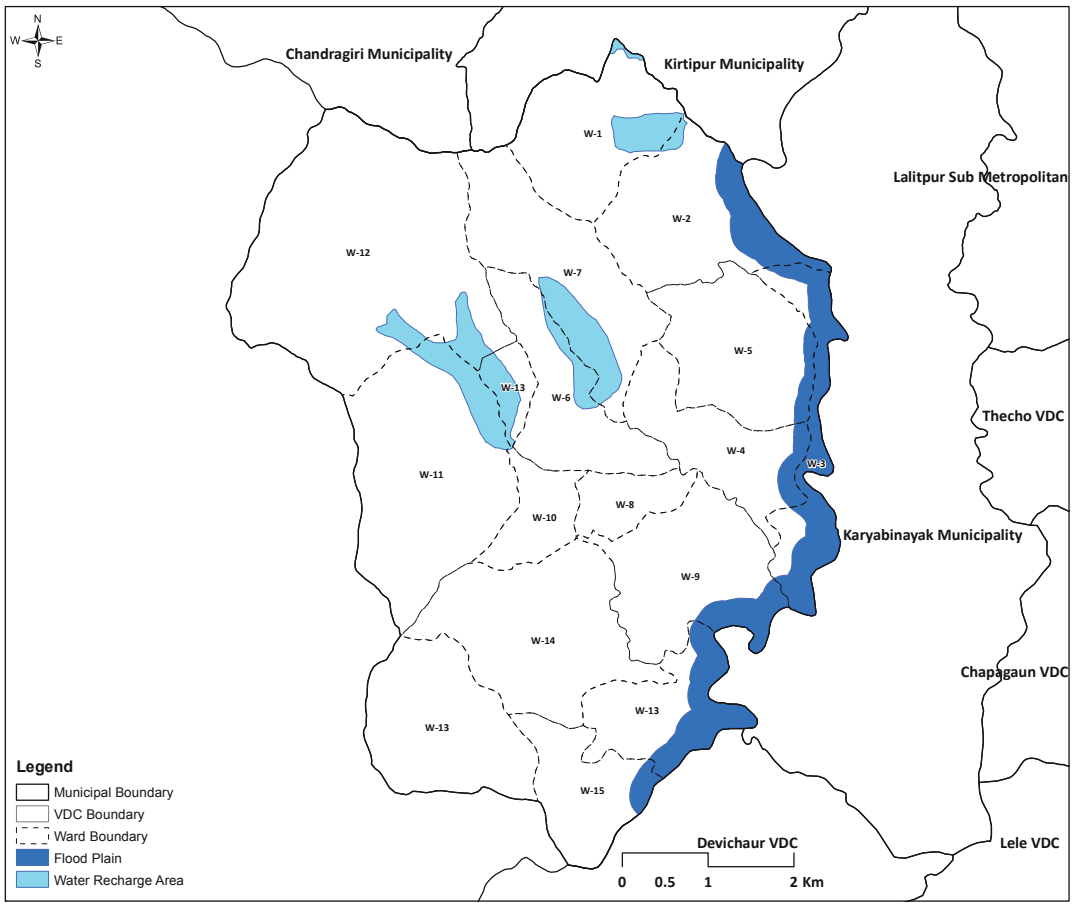
Hazard Risk Map Of Dakshinkali Municipality



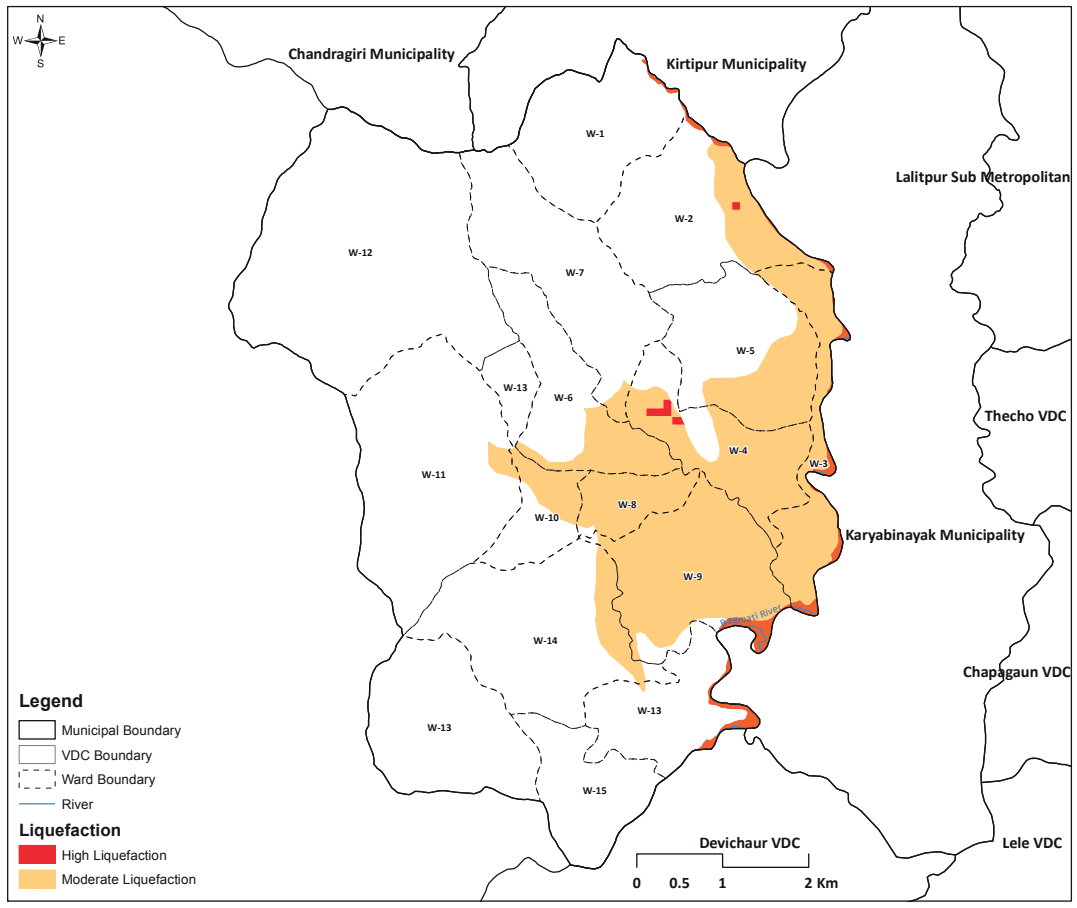
Landslide Susceptibility Map



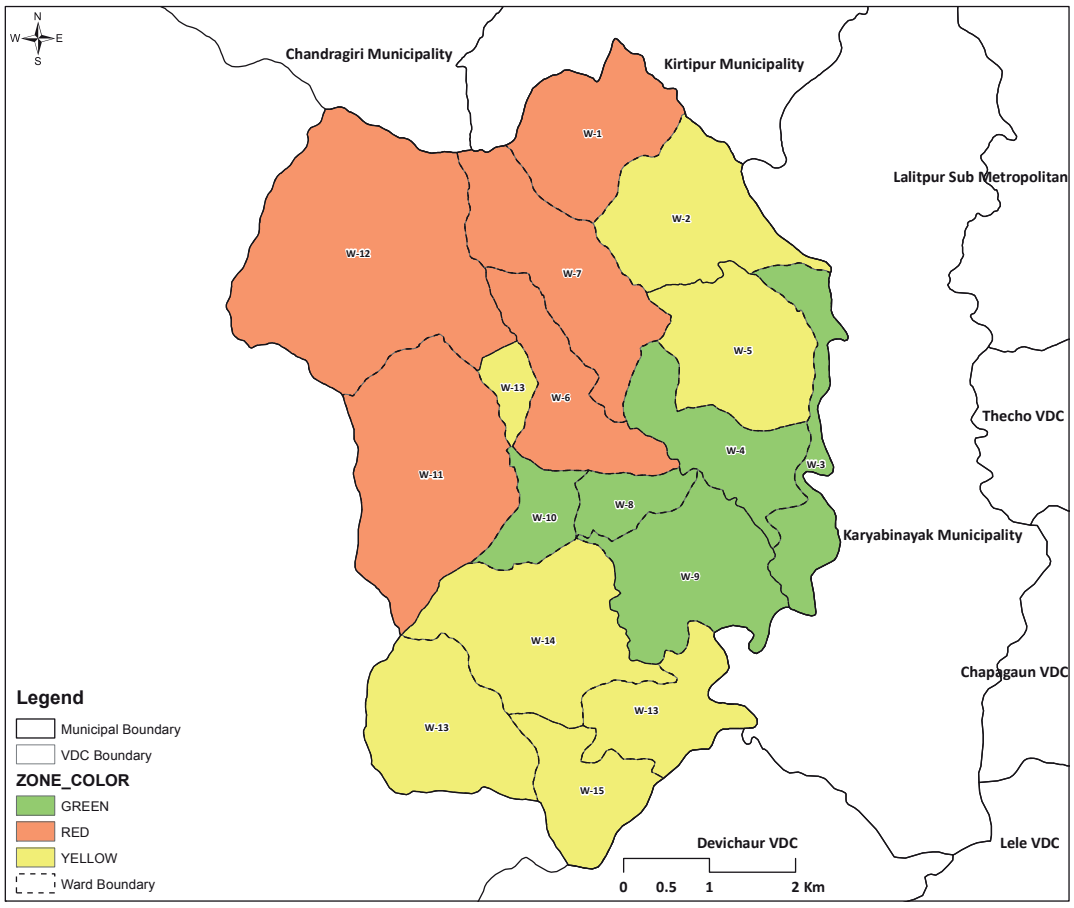
Slope Land Unsuitable For Development



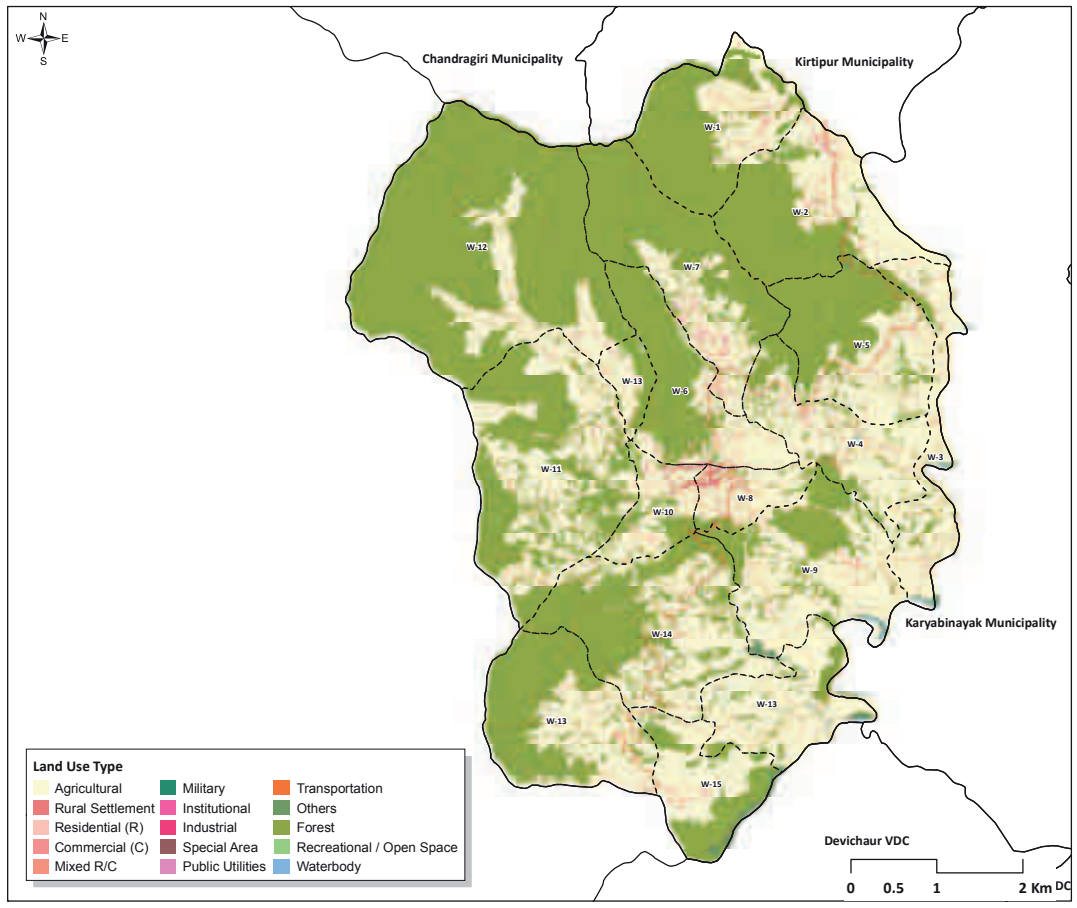
Flood Prone Areas And Water Recharge Area



Liquefaction Susceptible Area



Colour Zone Map Based On Development Constraints



Existing Land Use Map

Kathmandu Valley Development Authority

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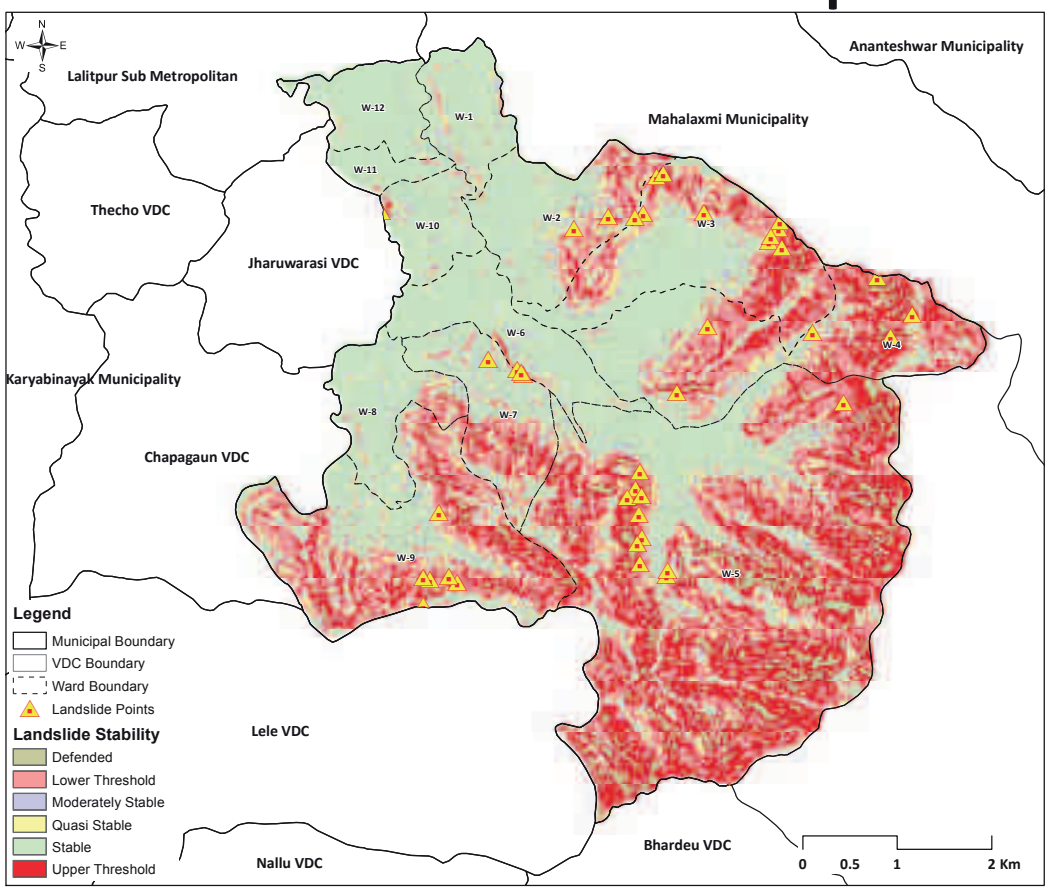
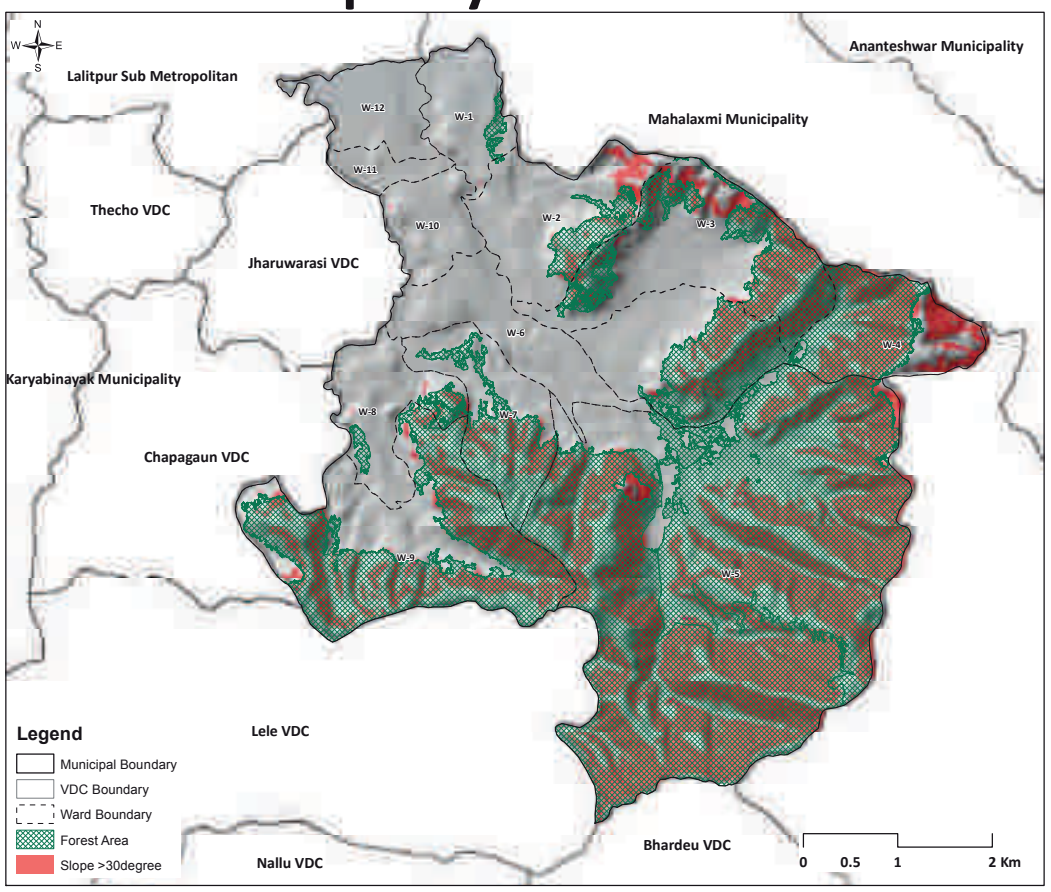
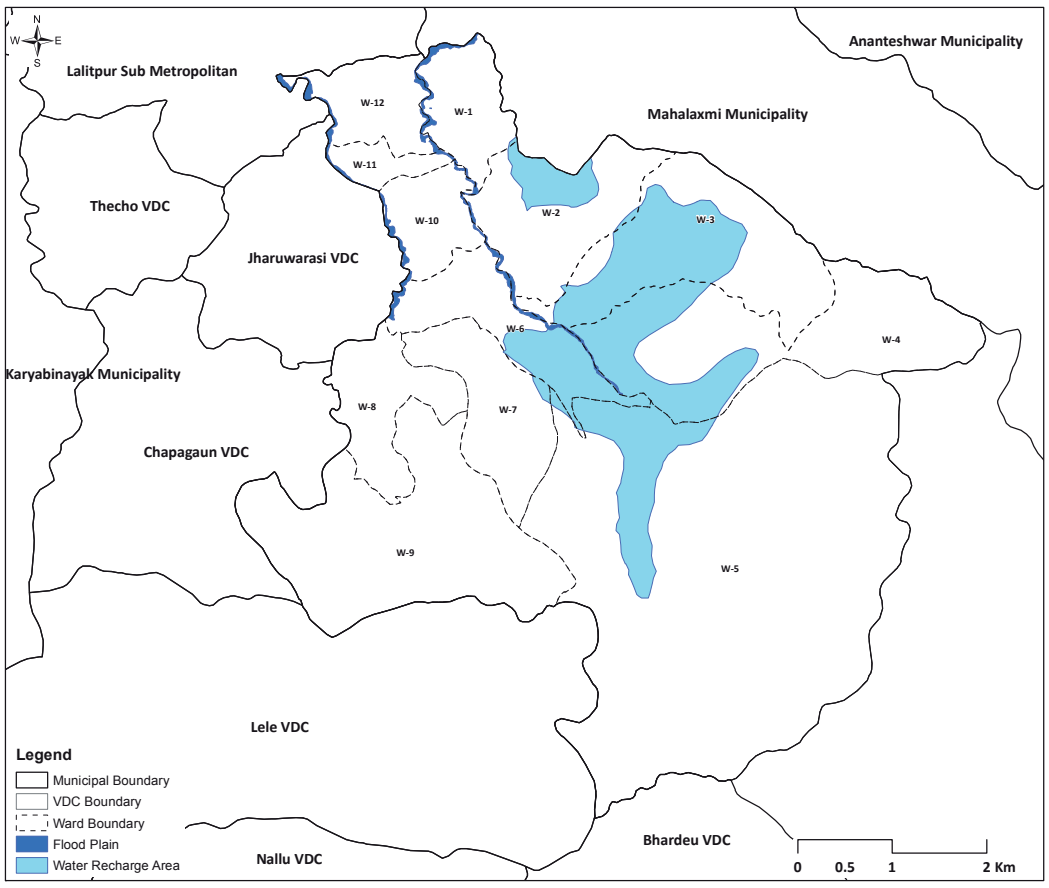
Hazard Risk Map Of Godawari Municipality



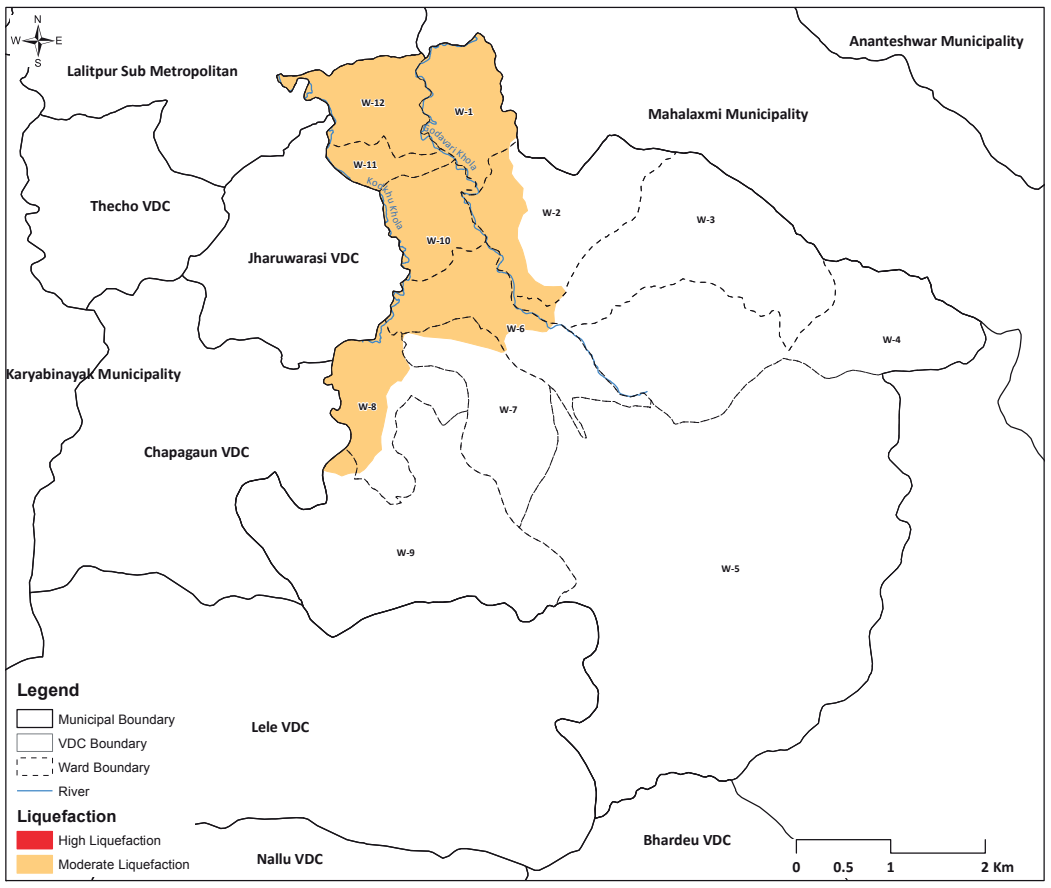
Landslide Susceptibility Map



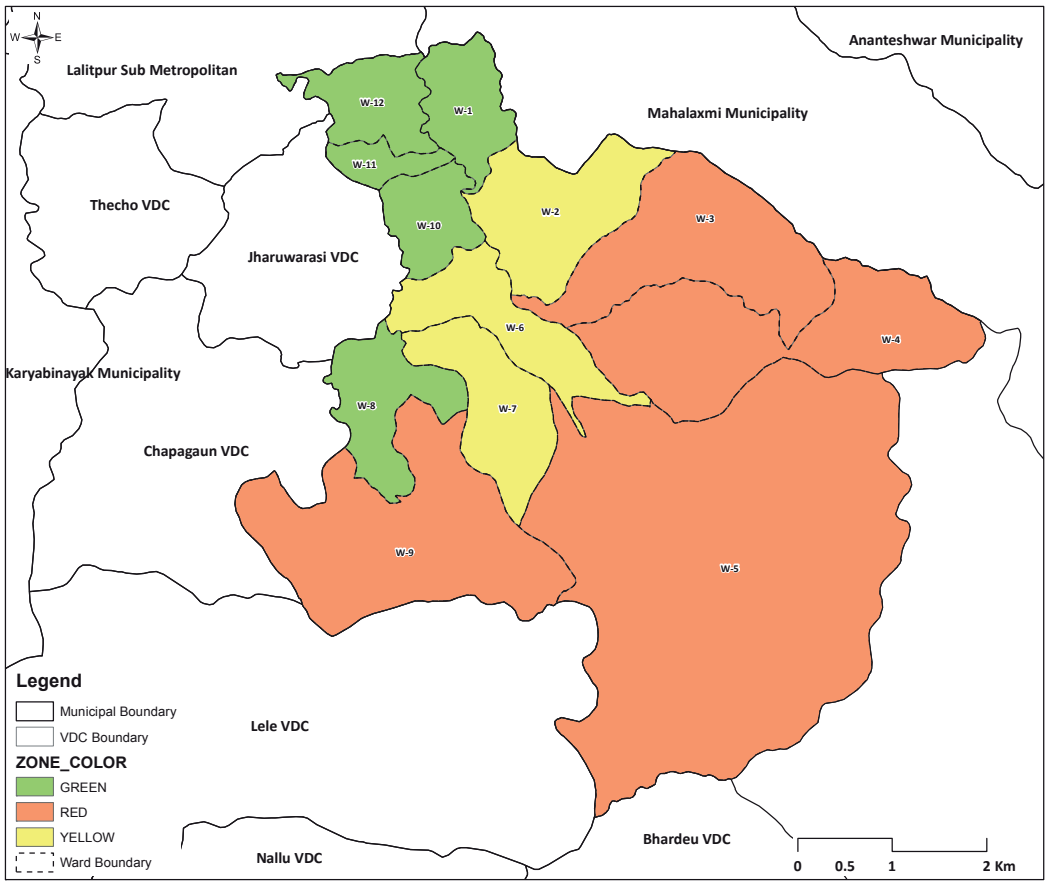
Slope Land Unsuitable For Development



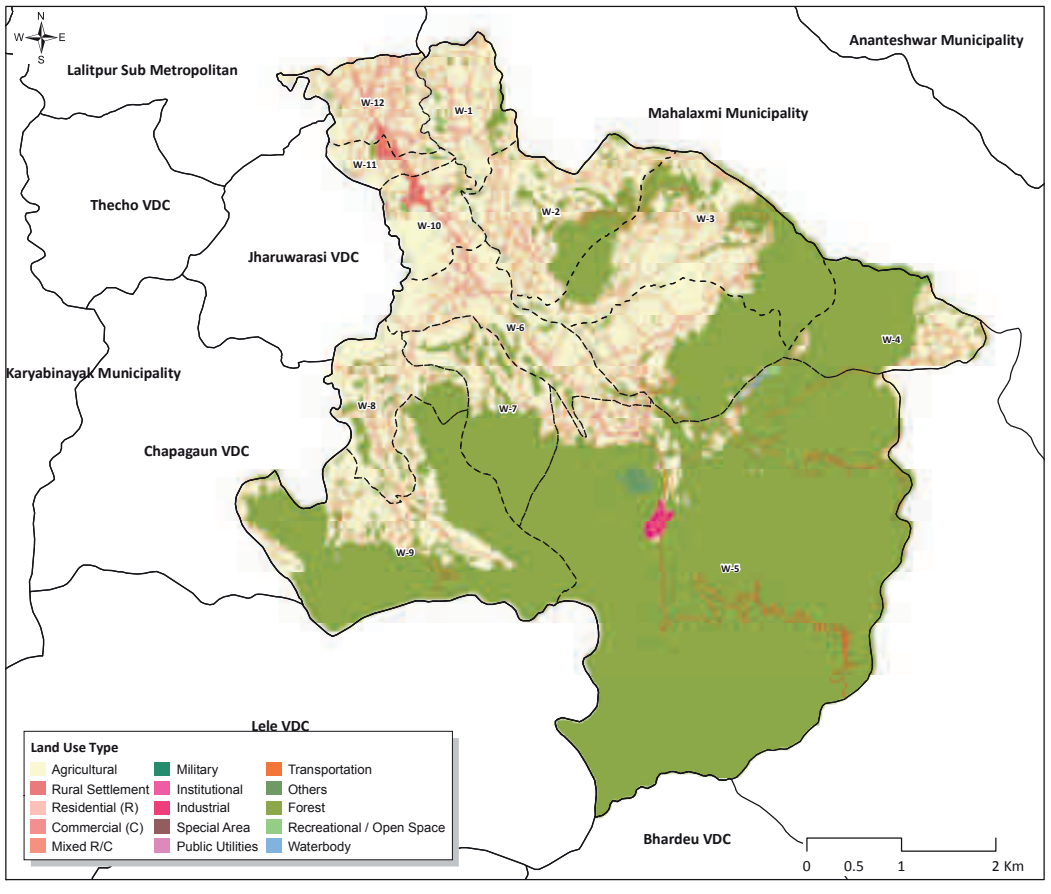
Flood Prone Areas And Water Recharge Area



Liquefaction Susceptible Area



Colour Zone Map Based On Development Constraints



Existing Land Use Map

Kathmandu Valley Development Authority

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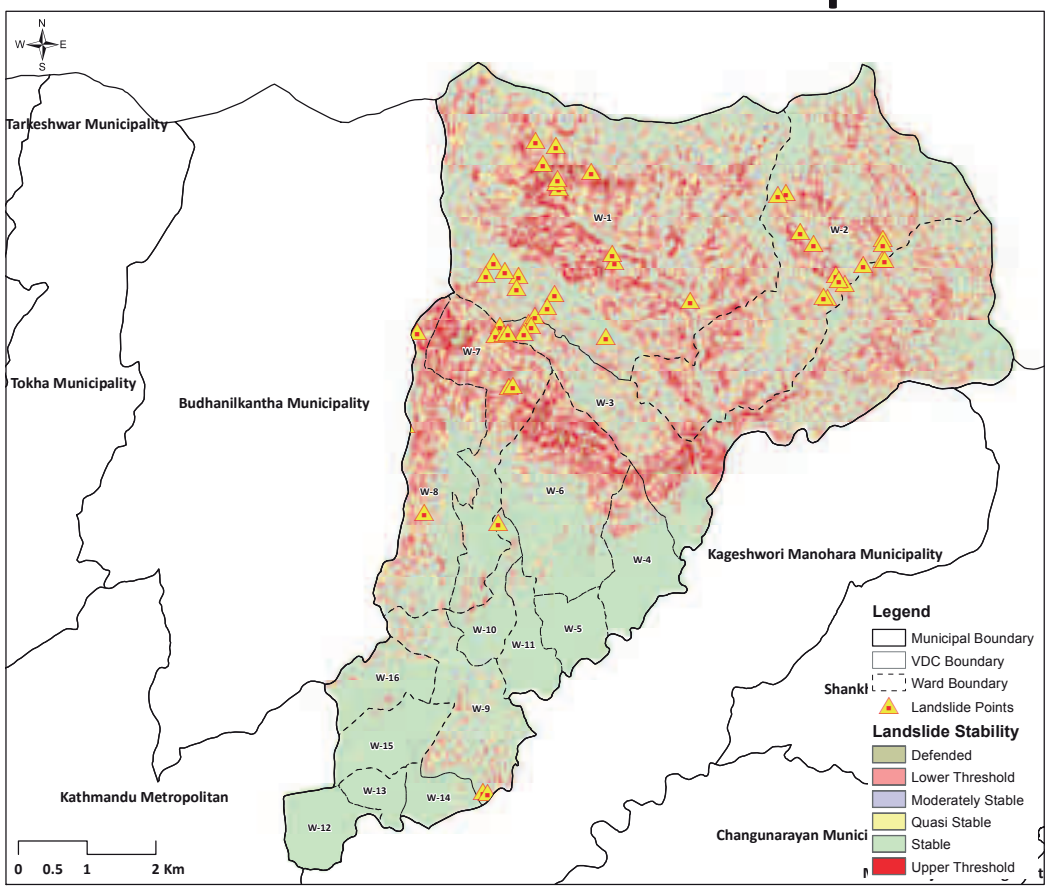
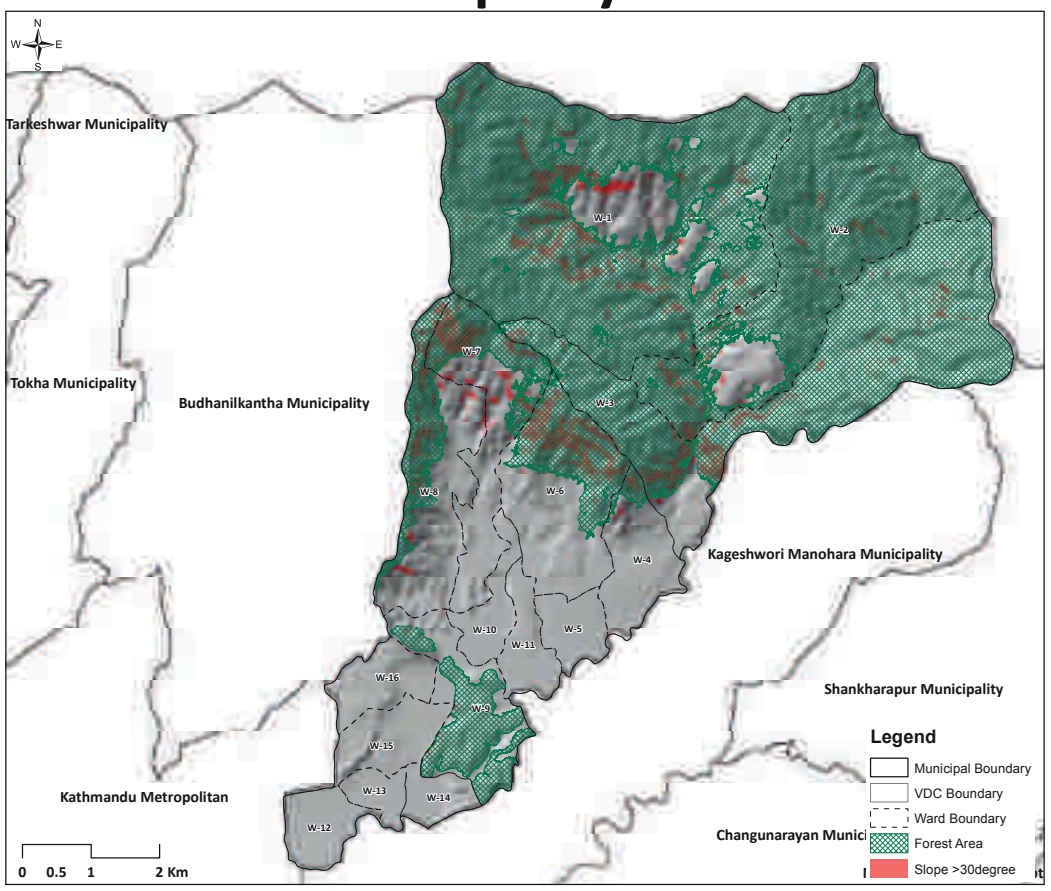
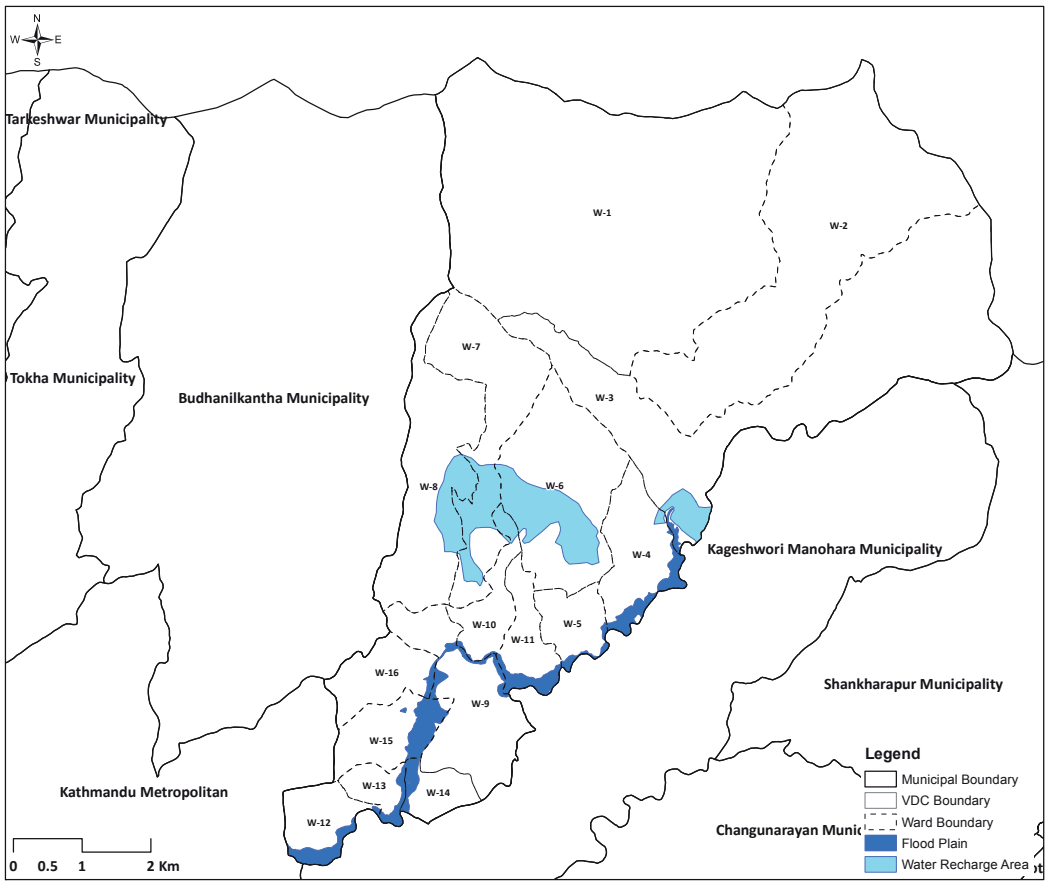
Hazard Risk Map Of Gokarneshwor Municipality



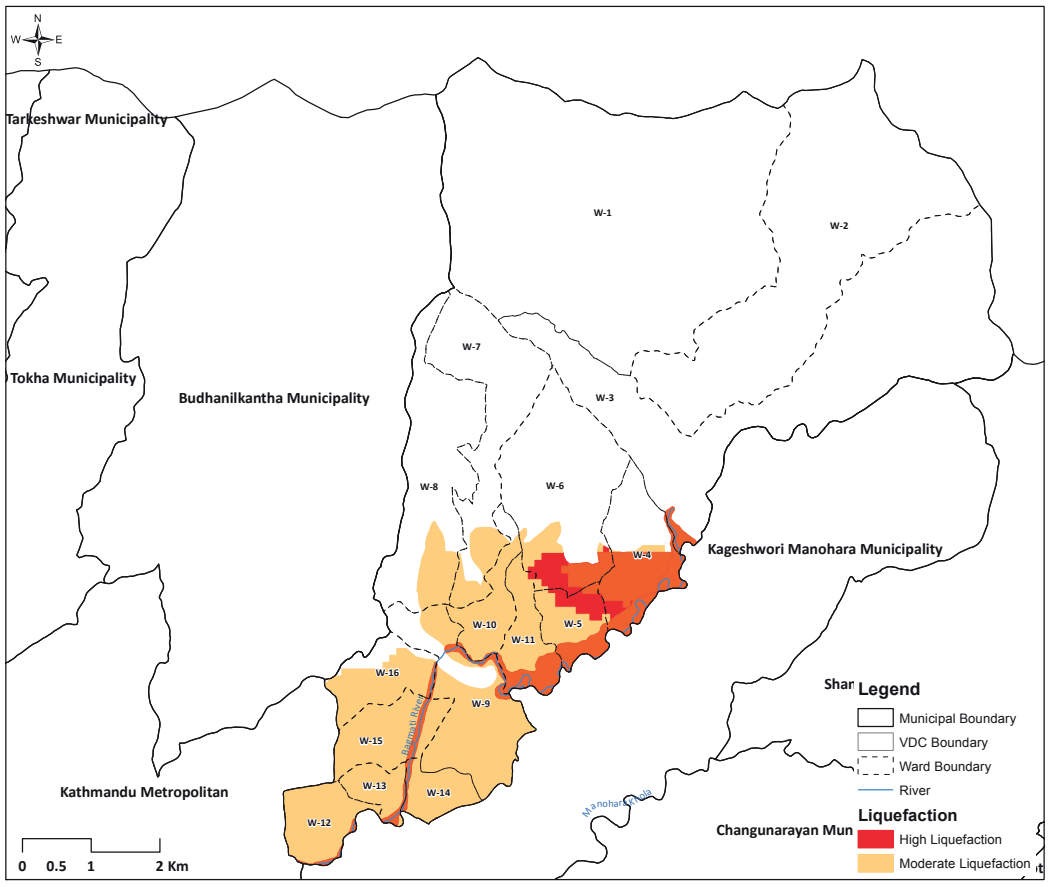
Landslide Susceptibility Map



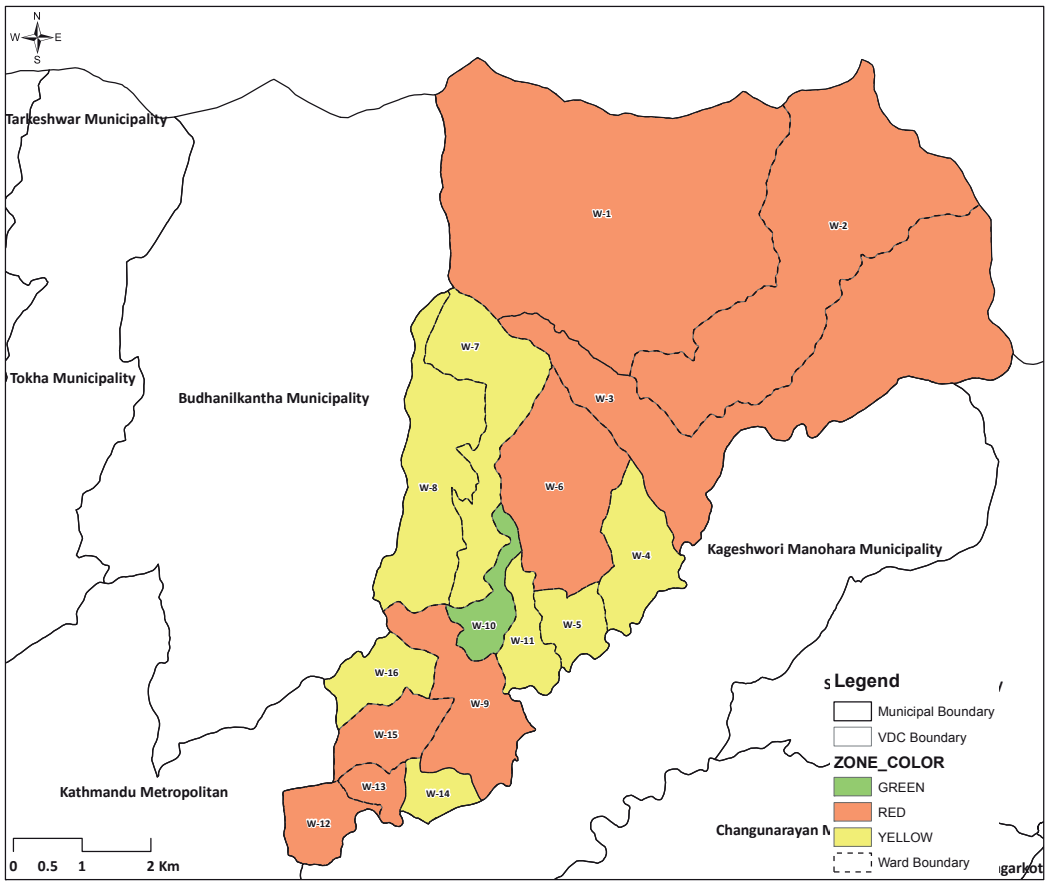
Slope Land Unsuitable For Development



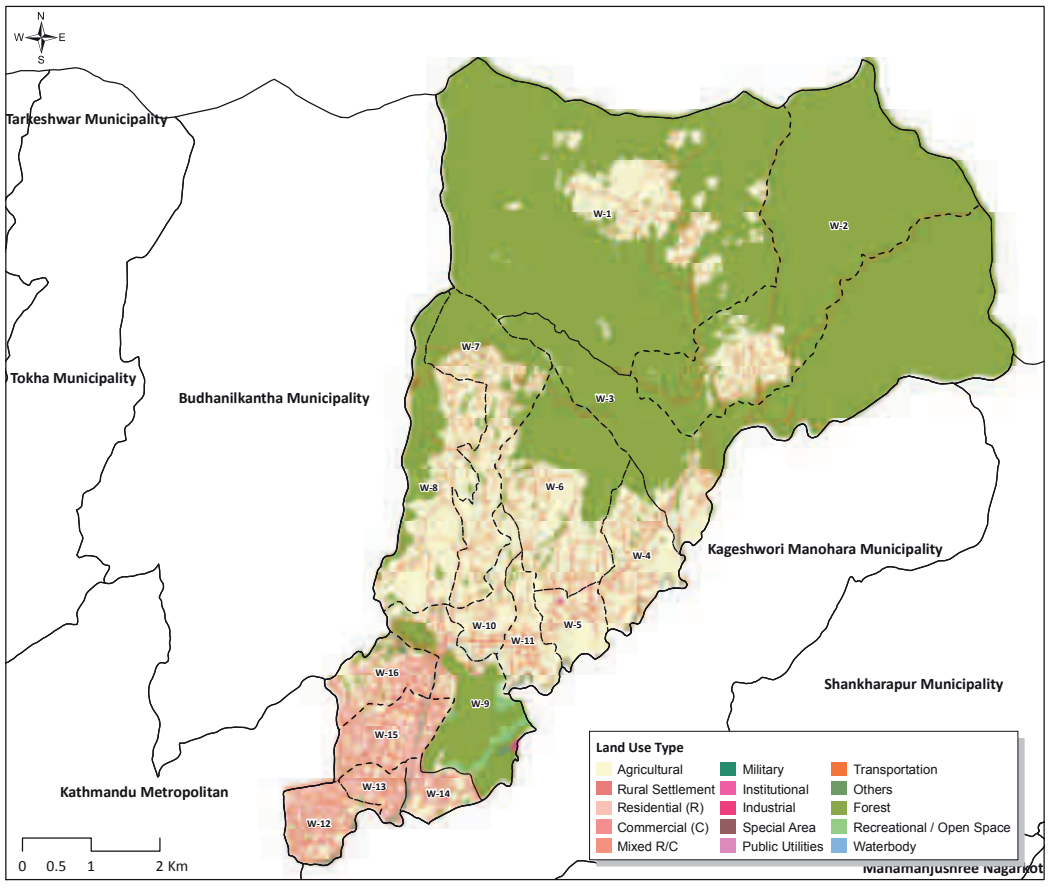
Flood Prone Areas And Water Recharge Area



Liquefaction Susceptible Area



Colour Zone Map Based On Development Constraints



Existing Land Use Map

Kathmandu Valley Development Authority

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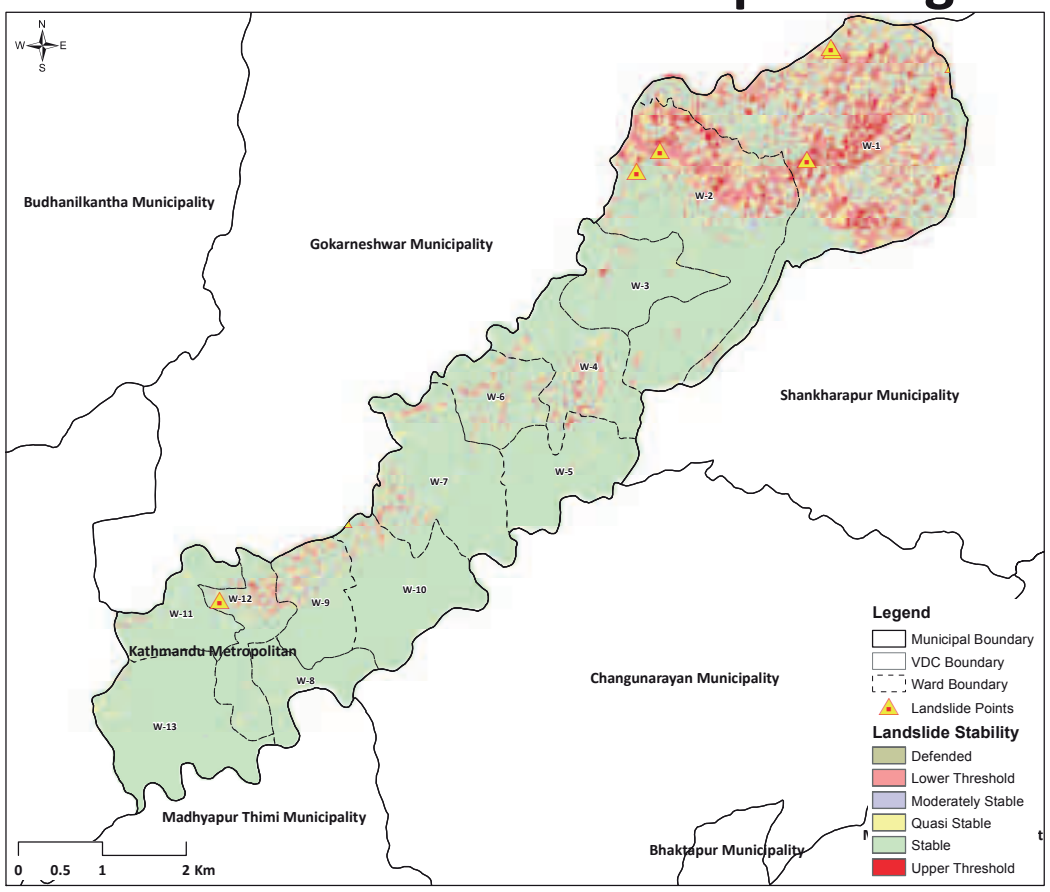
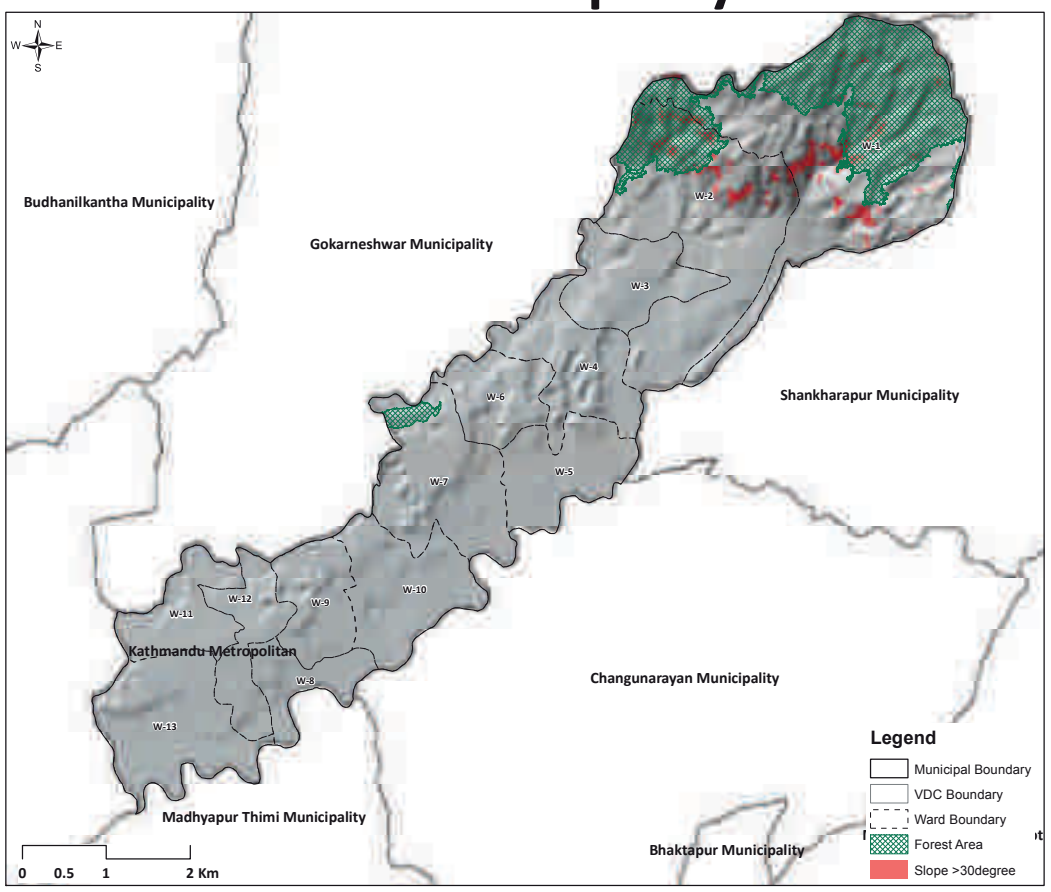
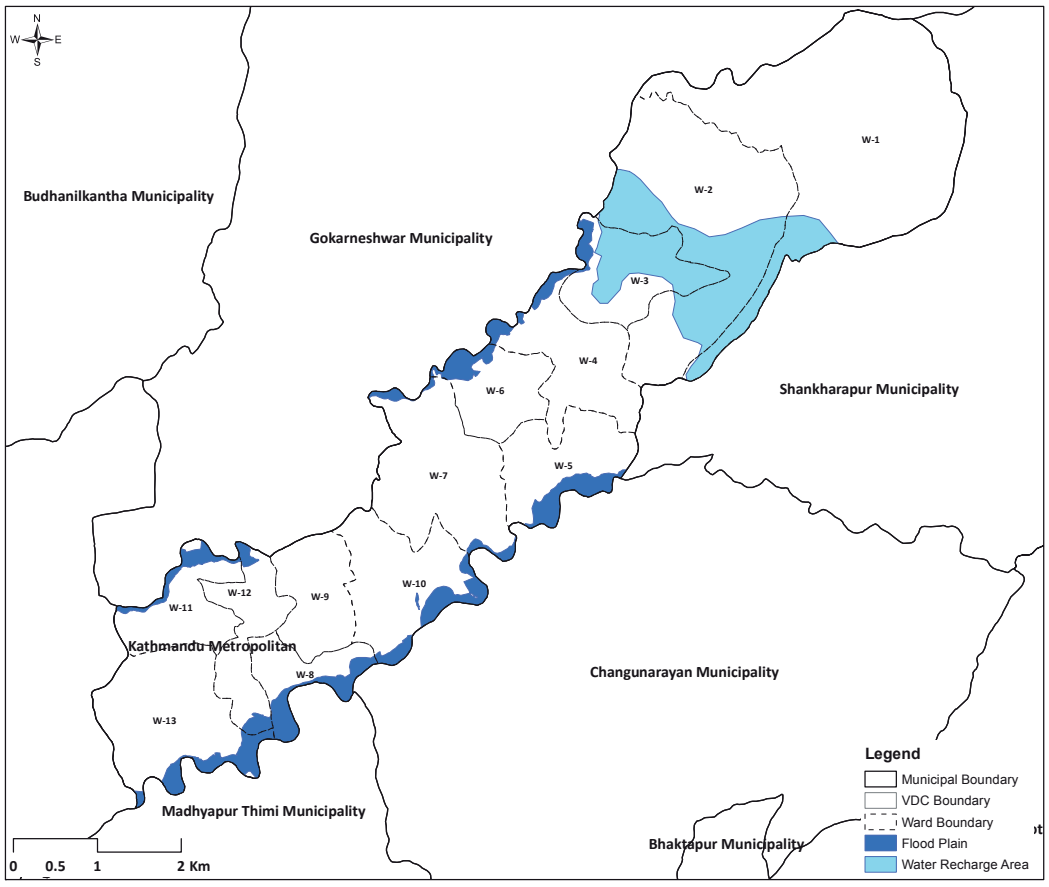
Hazard Risk Map Of Kageshwori Manohara Municipality



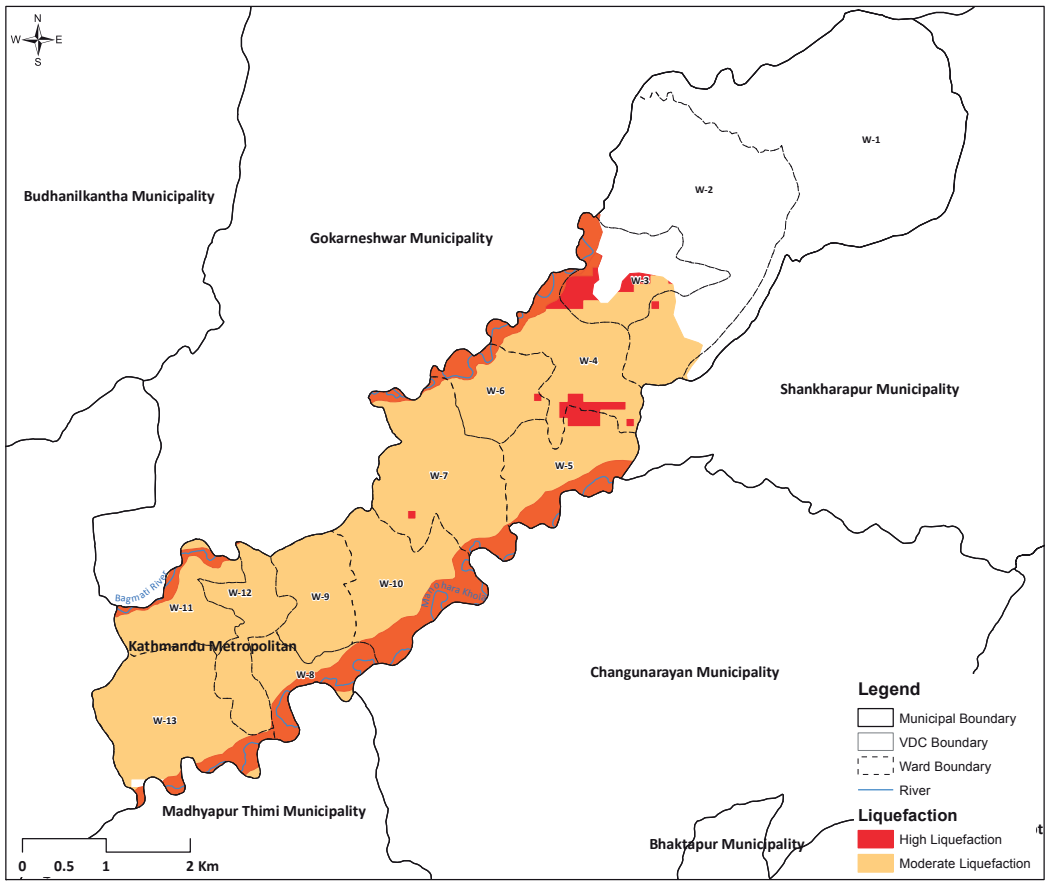
Landslide Susceptibility Map



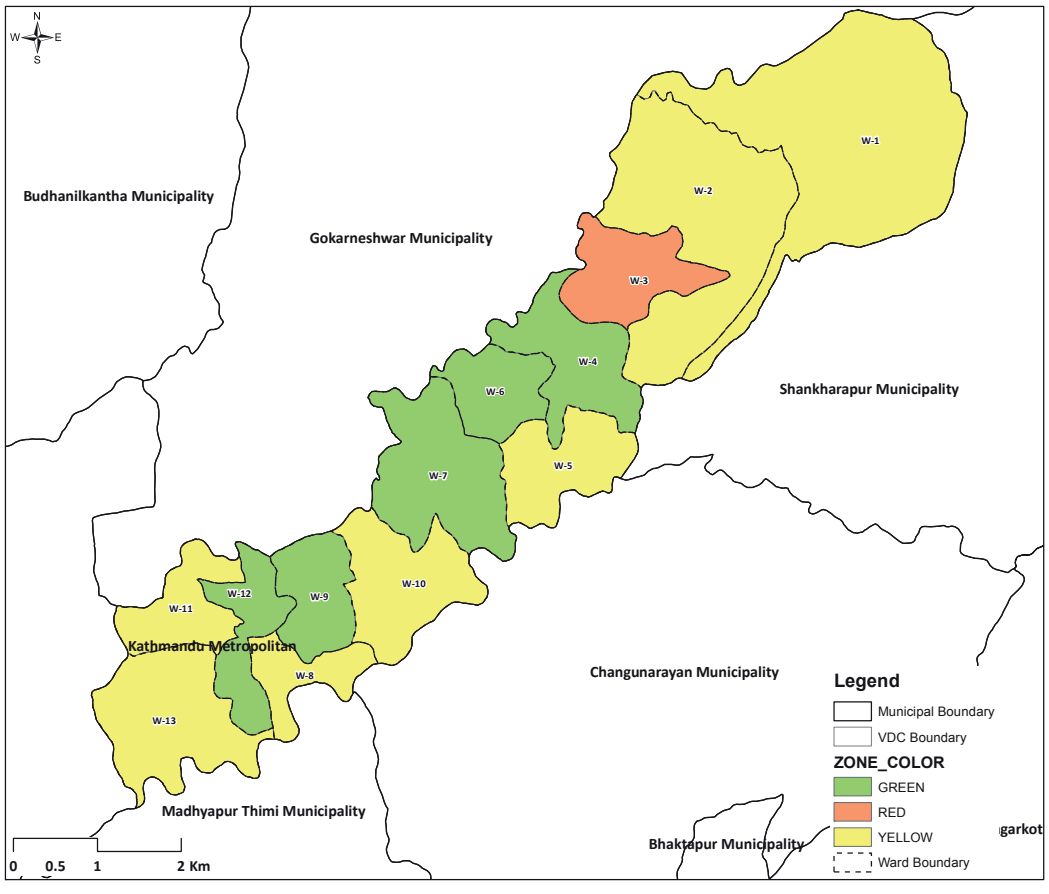
Slope Land Unsuitable For Development



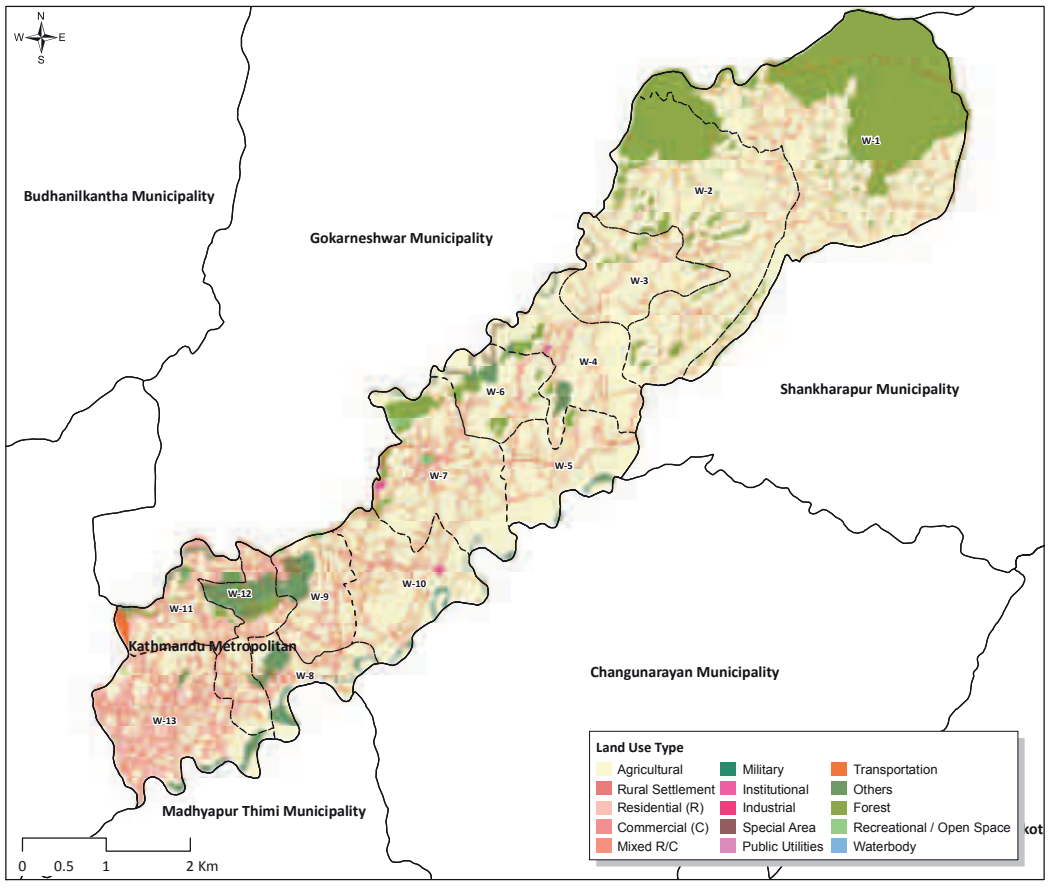
Flood Prone Areas And Water Recharge Area



Liquefaction Susceptible Area



Colour Zone Map Based On Development Constraints



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Kathmandu Valley Development Authority

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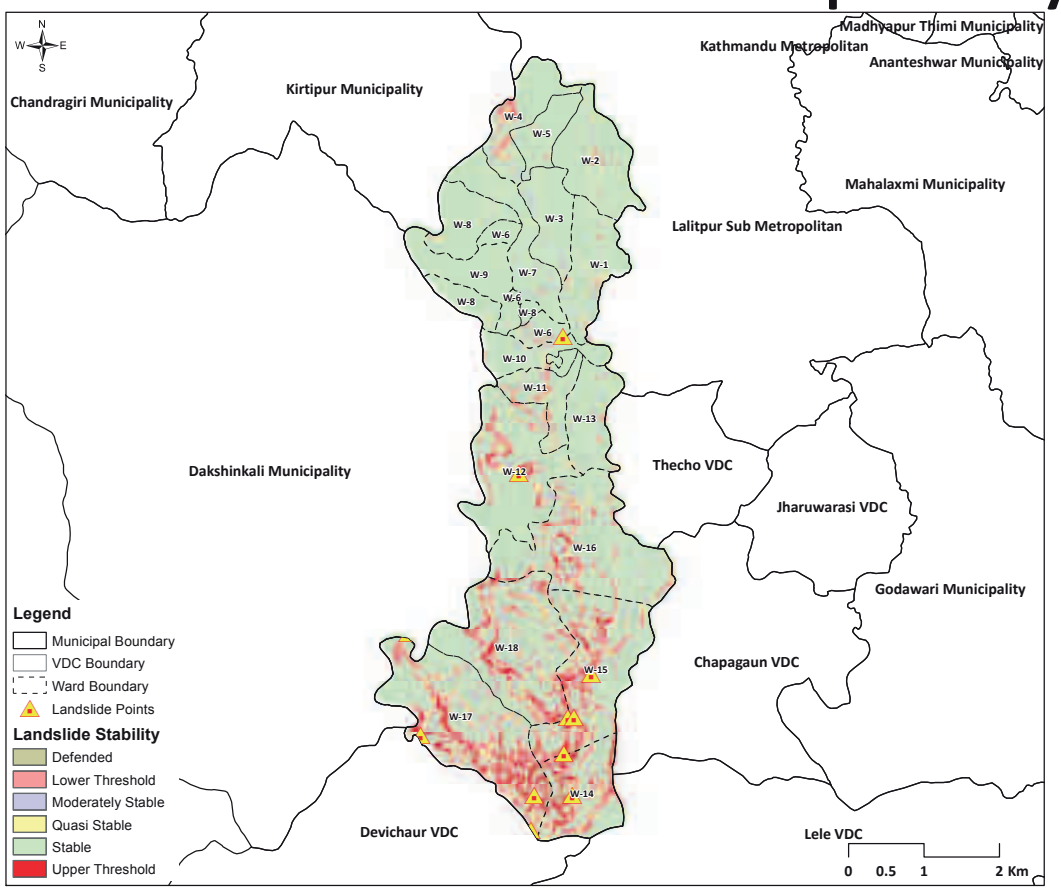
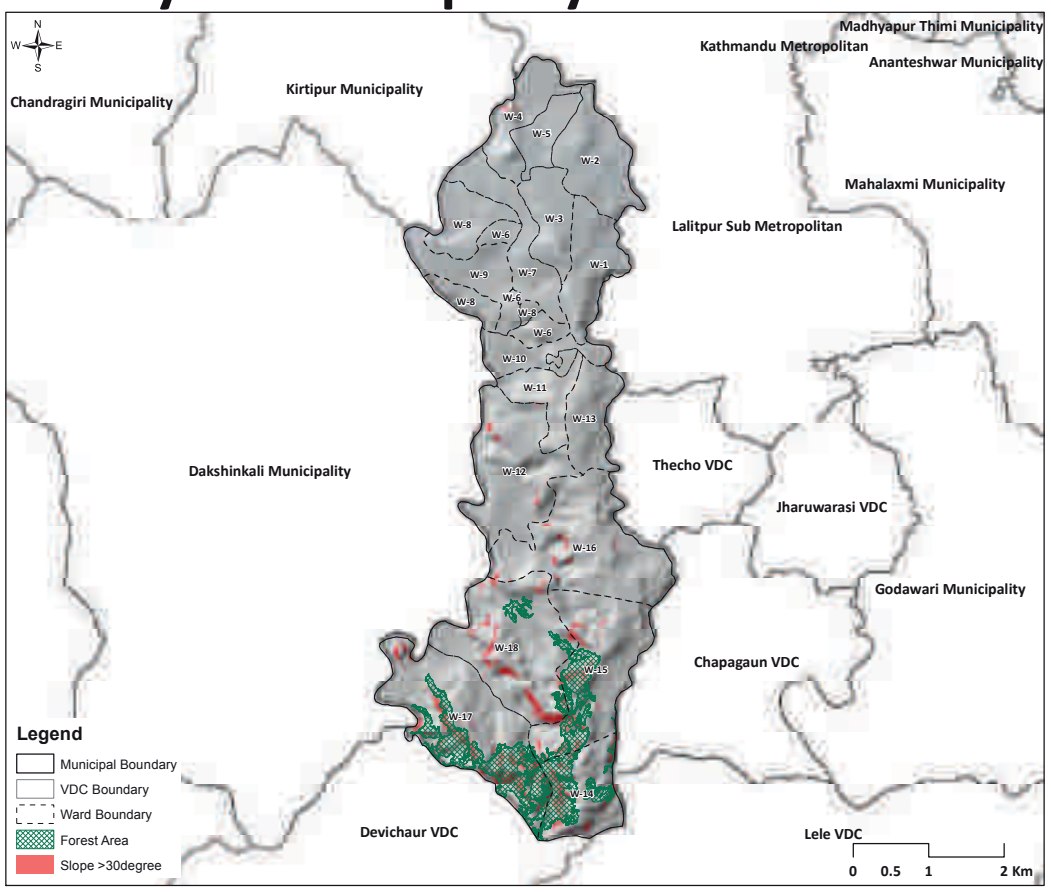
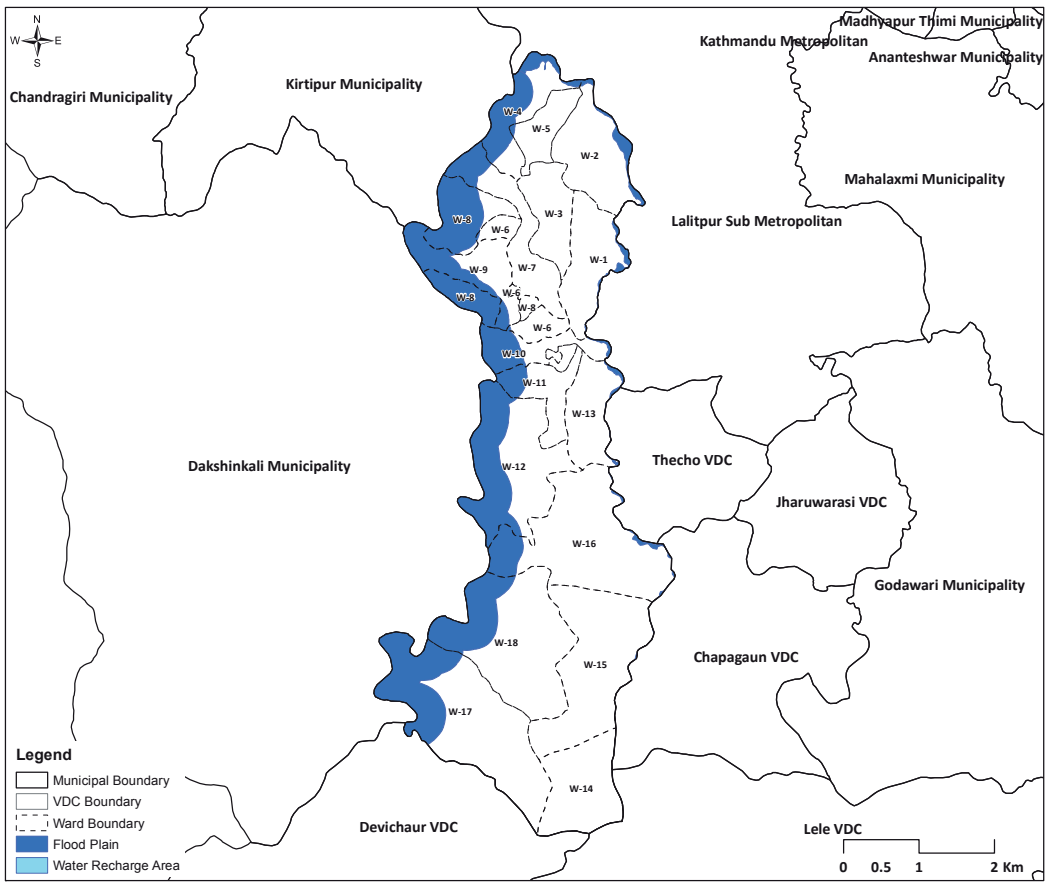
Hazard Risk Map Of Karyabinayak Municipality



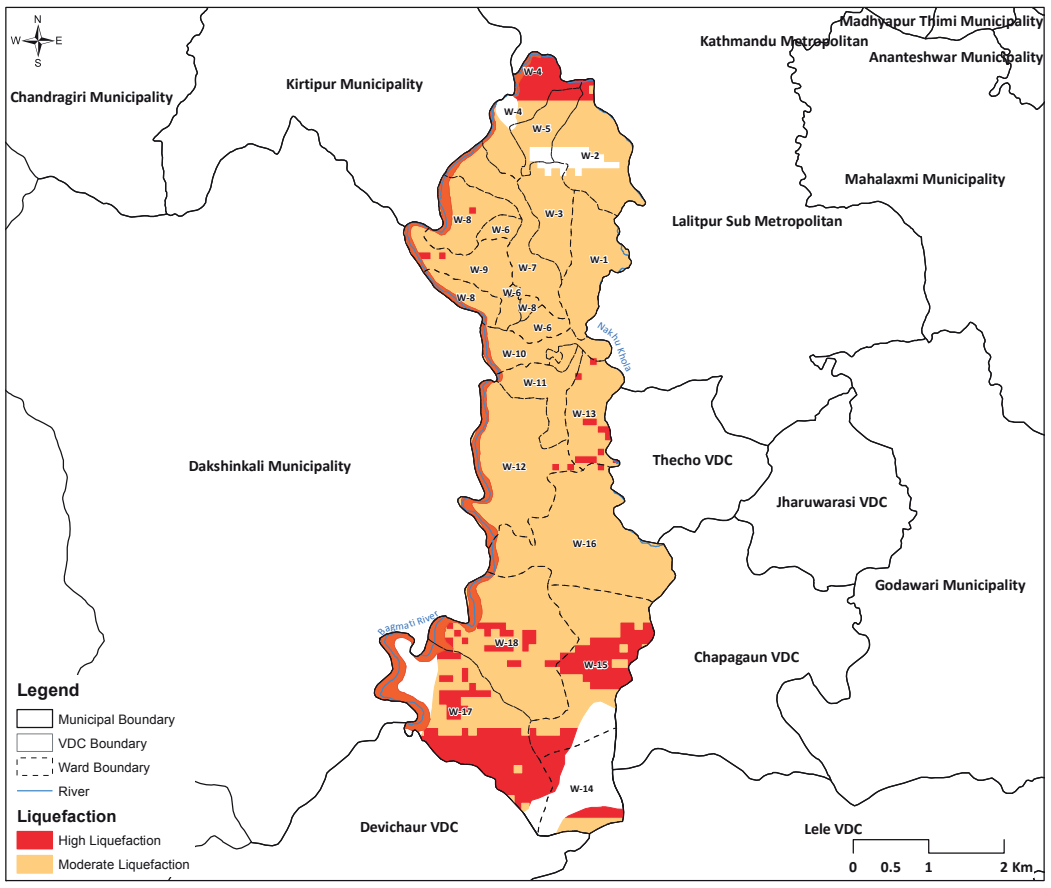
Landslide Susceptibility Map



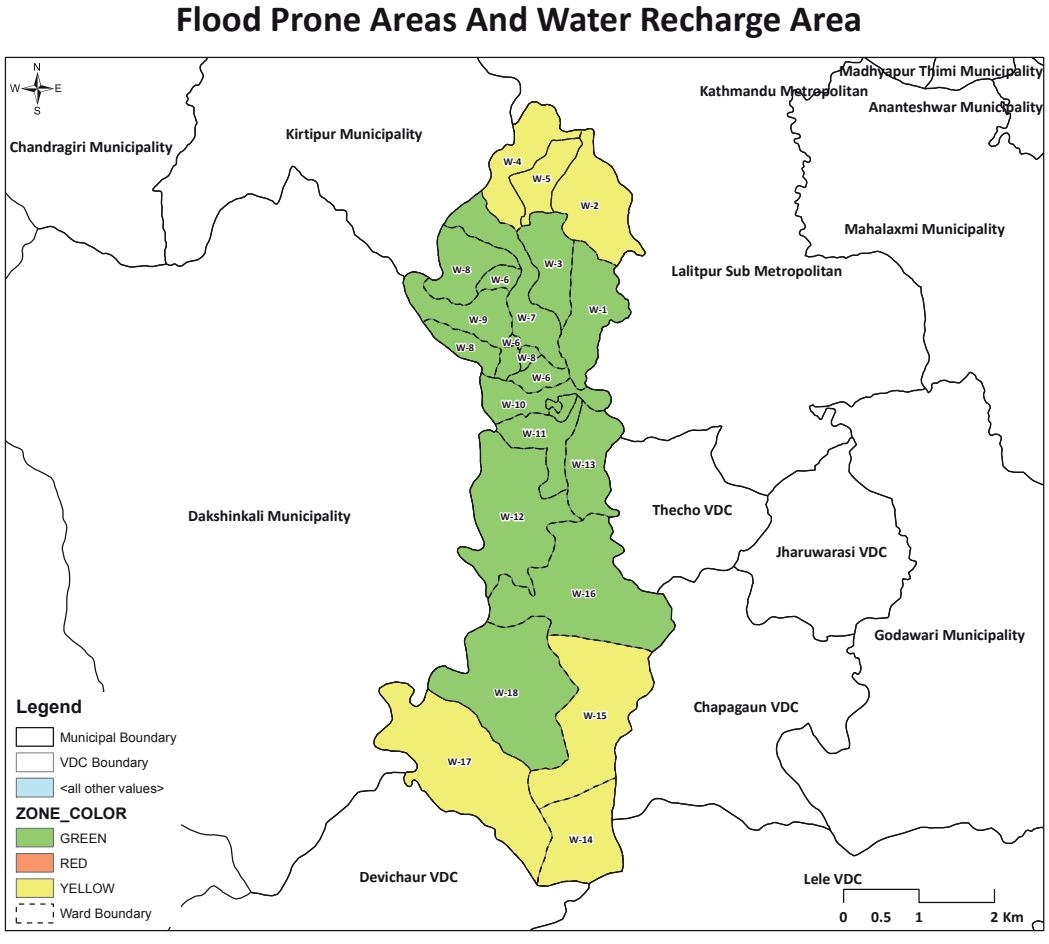
Slope Land Unsuitable For Development



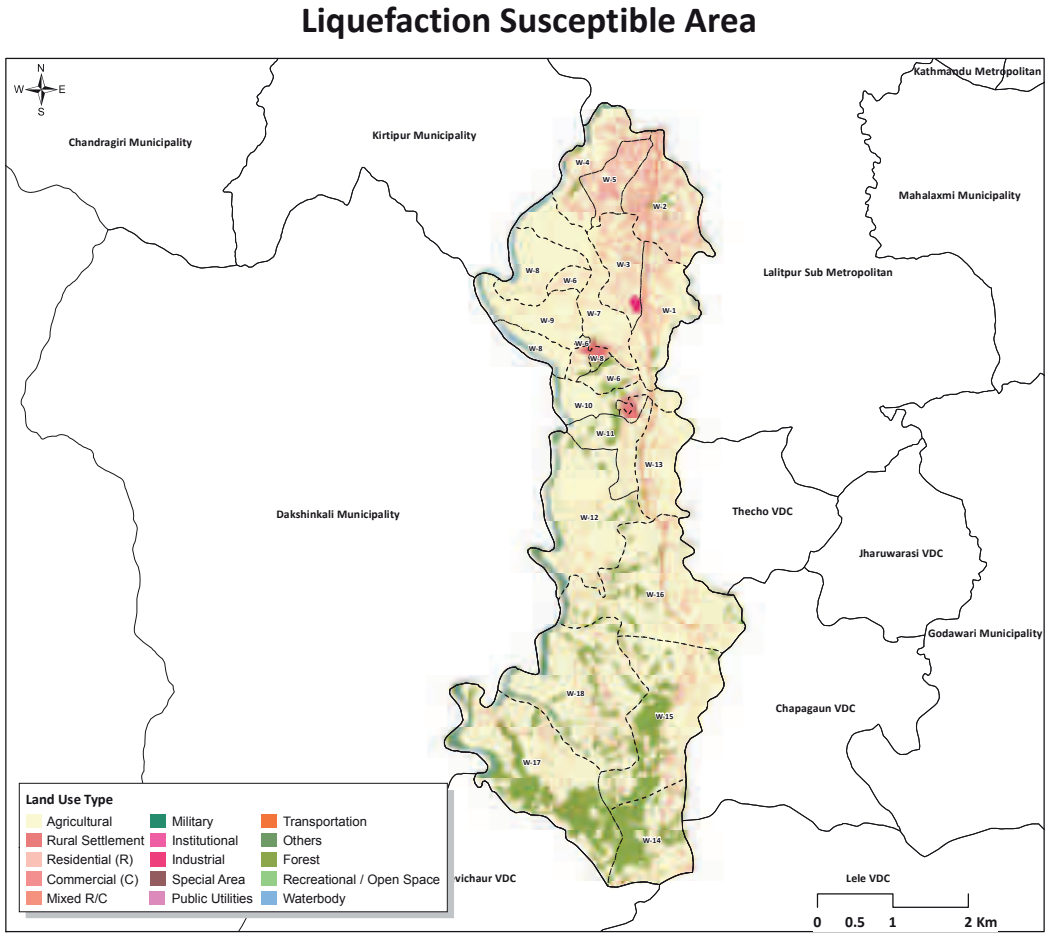
Flood Prone Areas And Water Recharge Area



Liquefaction Susceptible Area



Colour Zone Map Based On Development Constraints



Existing Land Use Map

Kathmandu Valley Development Authority

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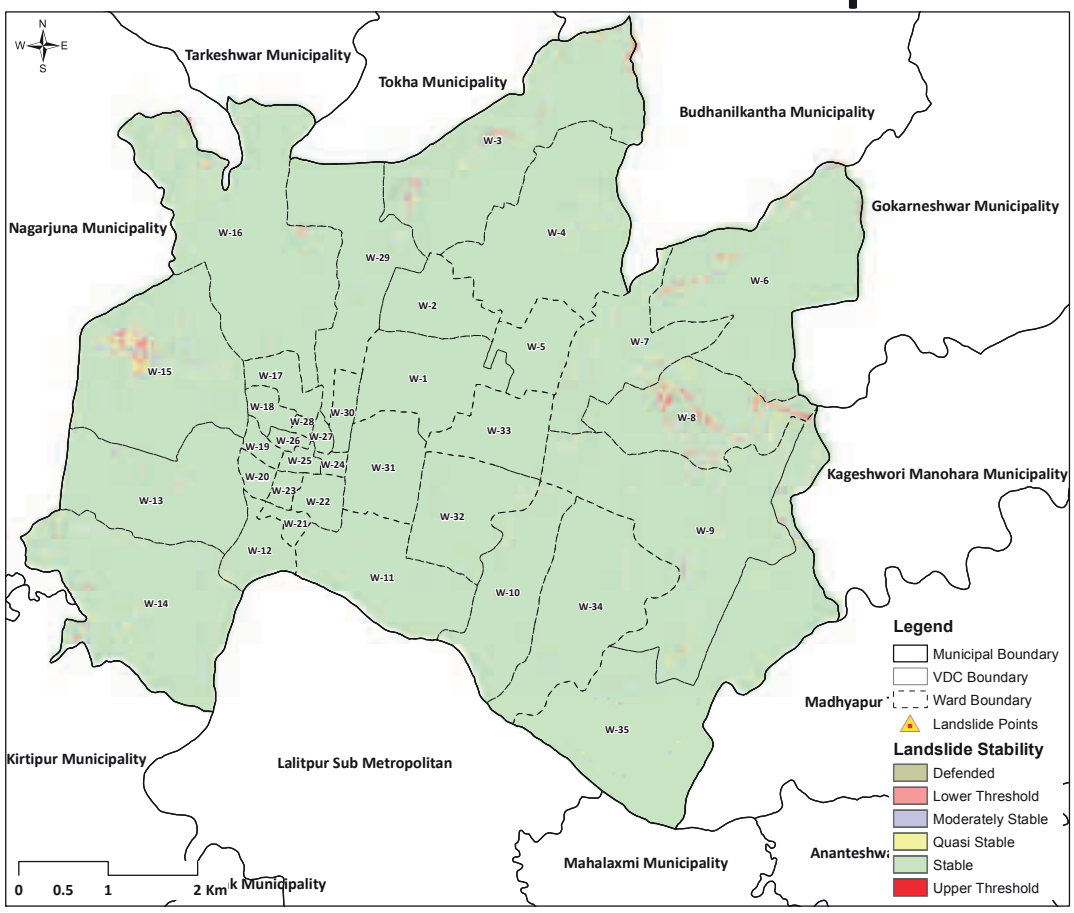
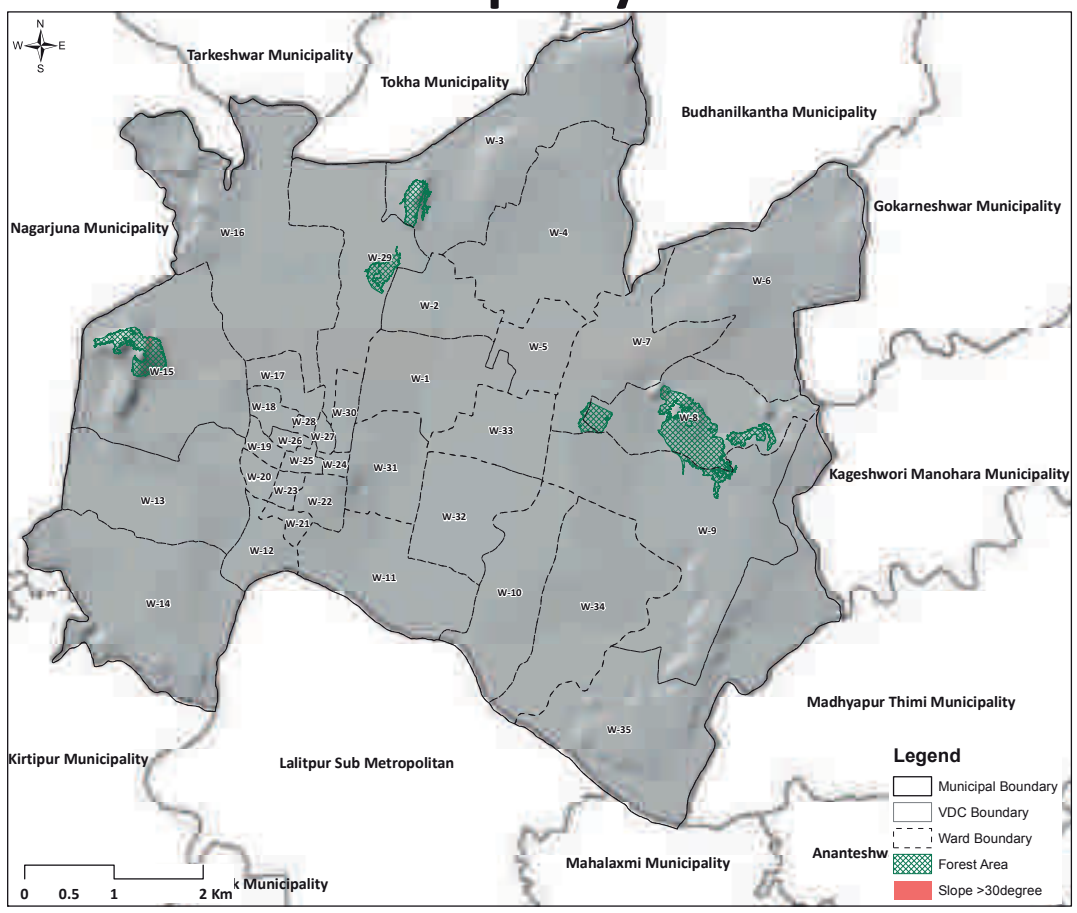
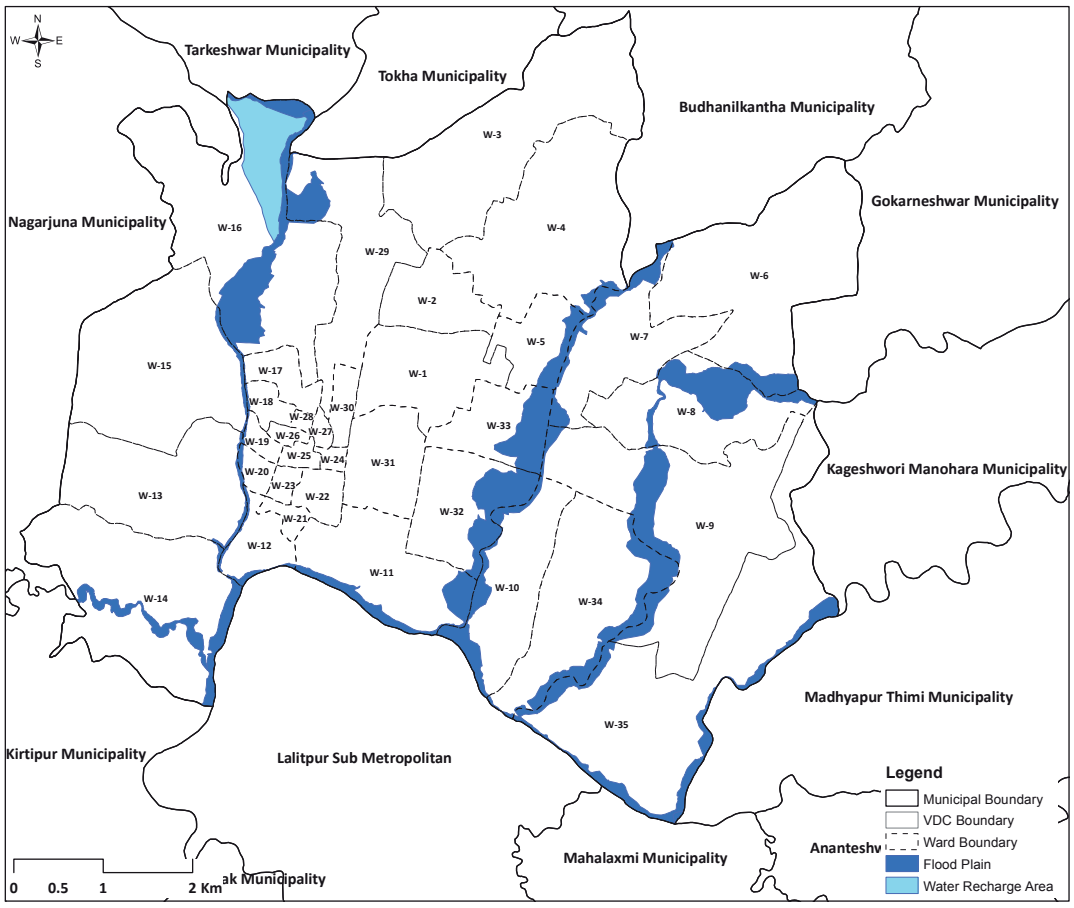
Hazard Risk Map Of Gokarneshwor Municipality



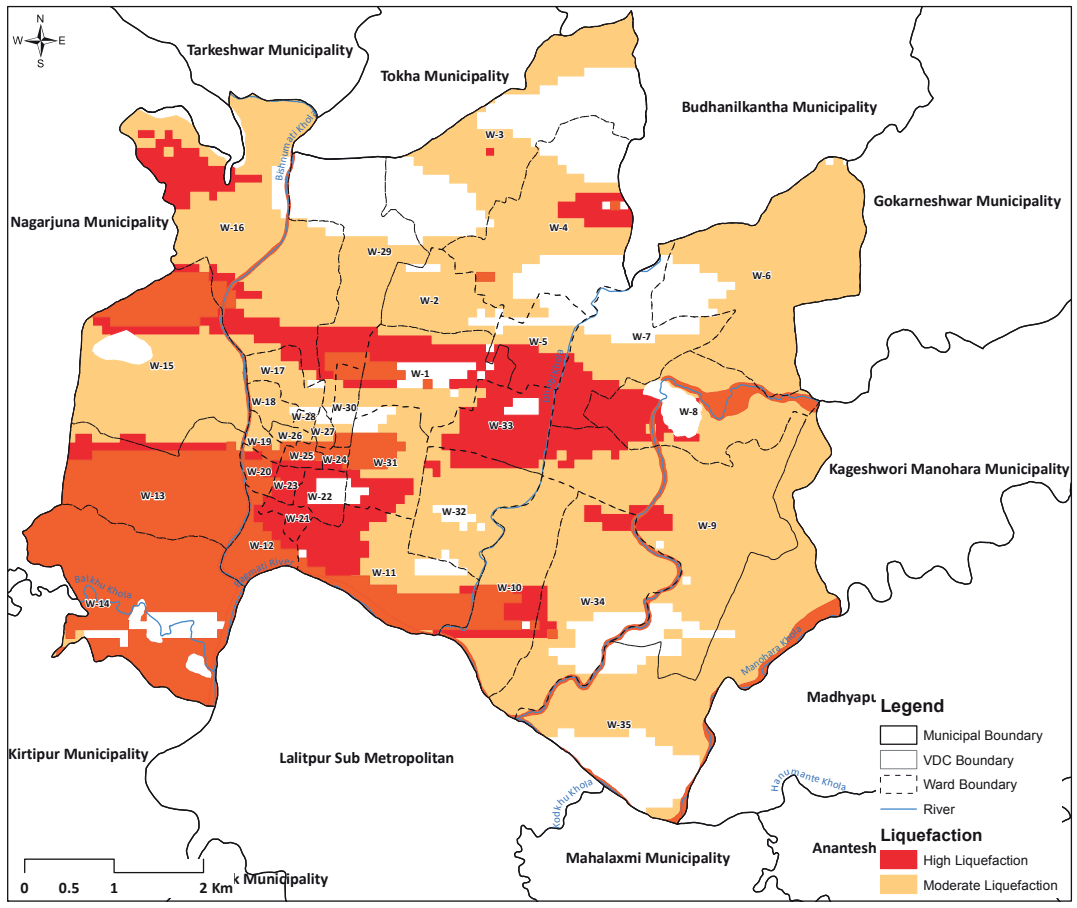
Landslide Susceptibility Map



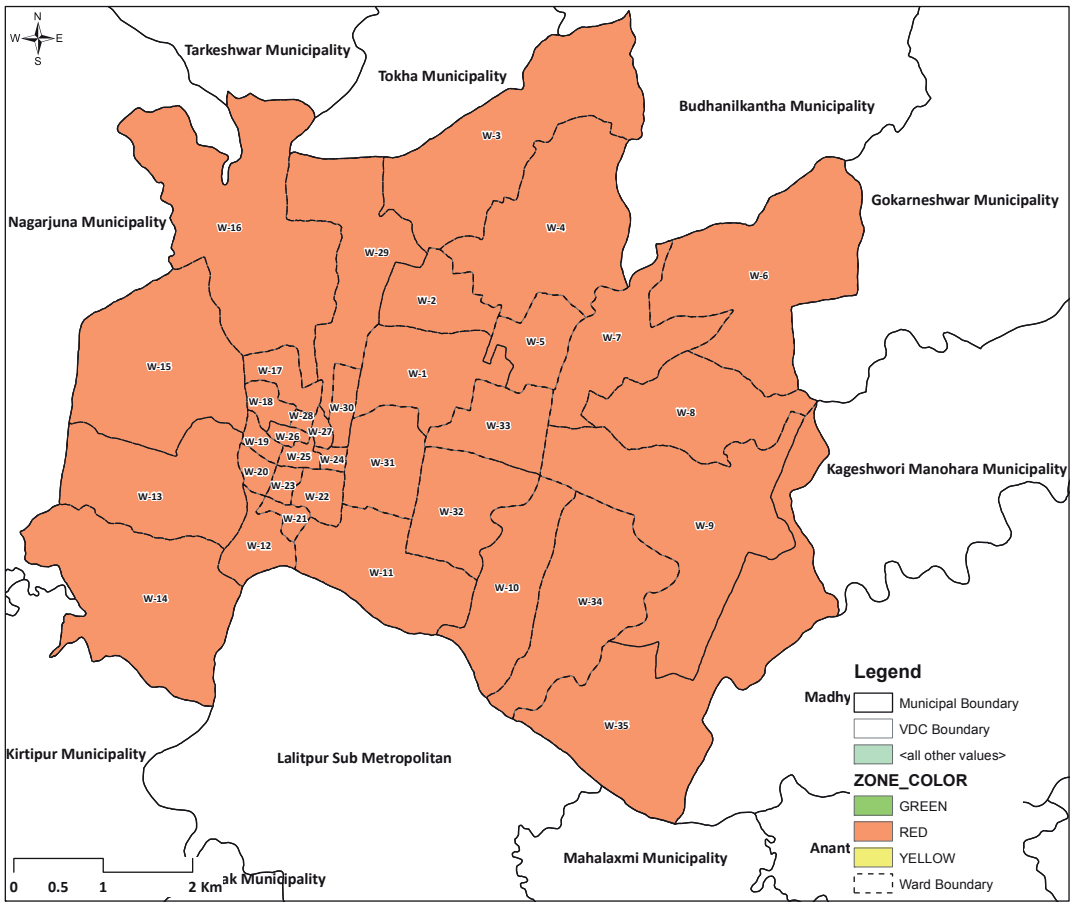
Slope Land Unsuitable For Development



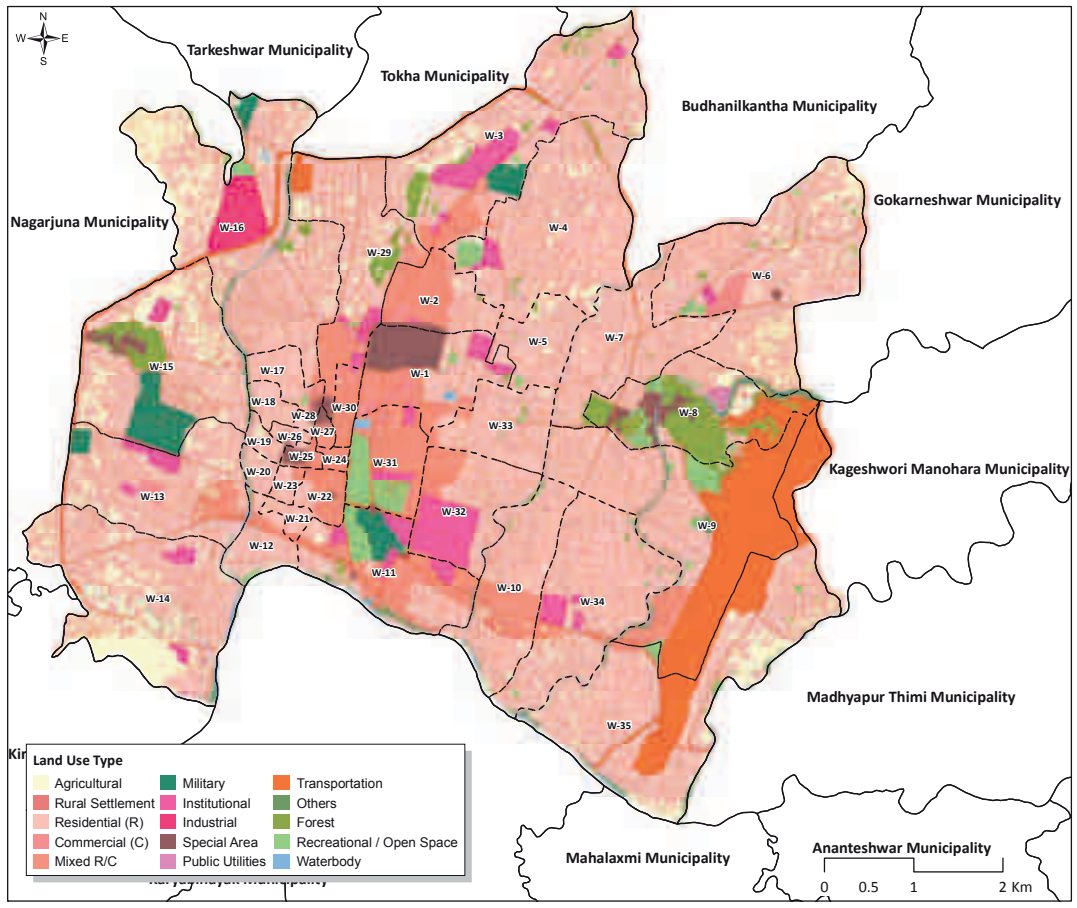
Flood Prone Areas And Water Recharge Area



Liquefaction Susceptible Area



Colour Zone Map Based On Development Constraints



Existing Land Use Map

Kathmandu Valley Development Authority

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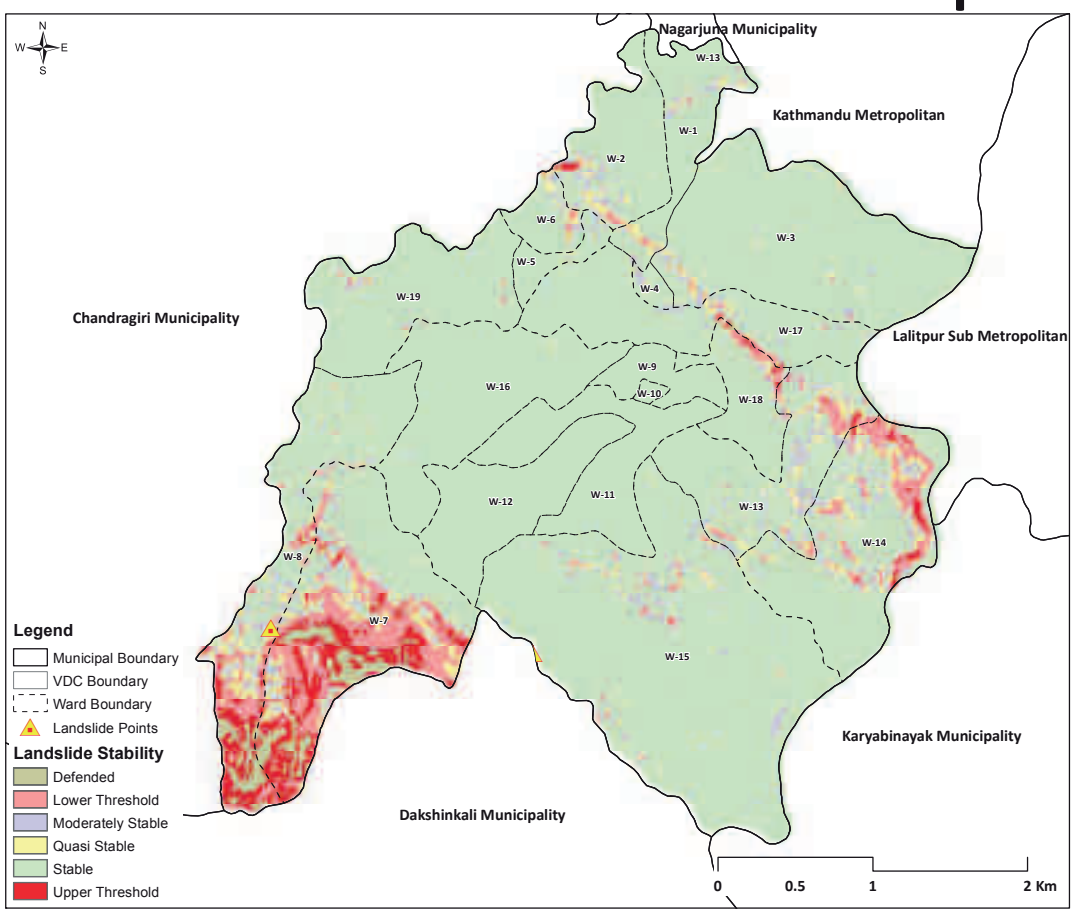
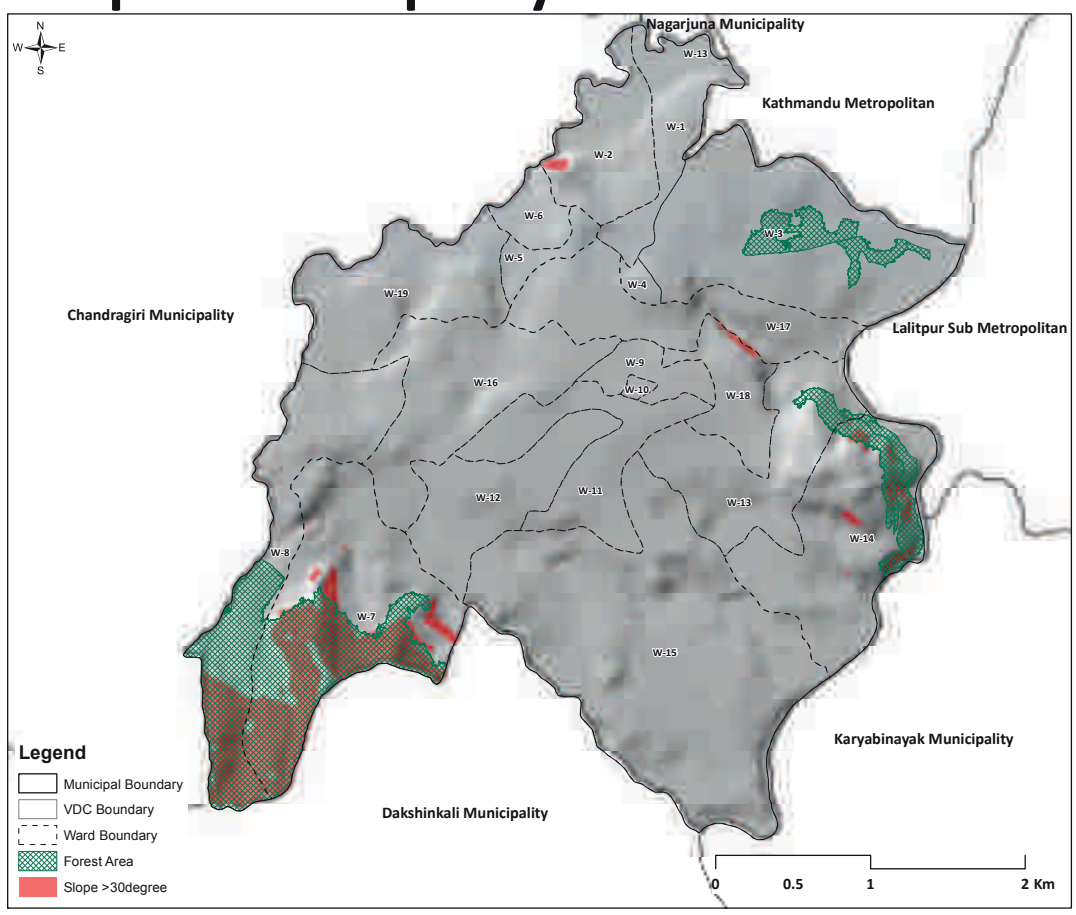
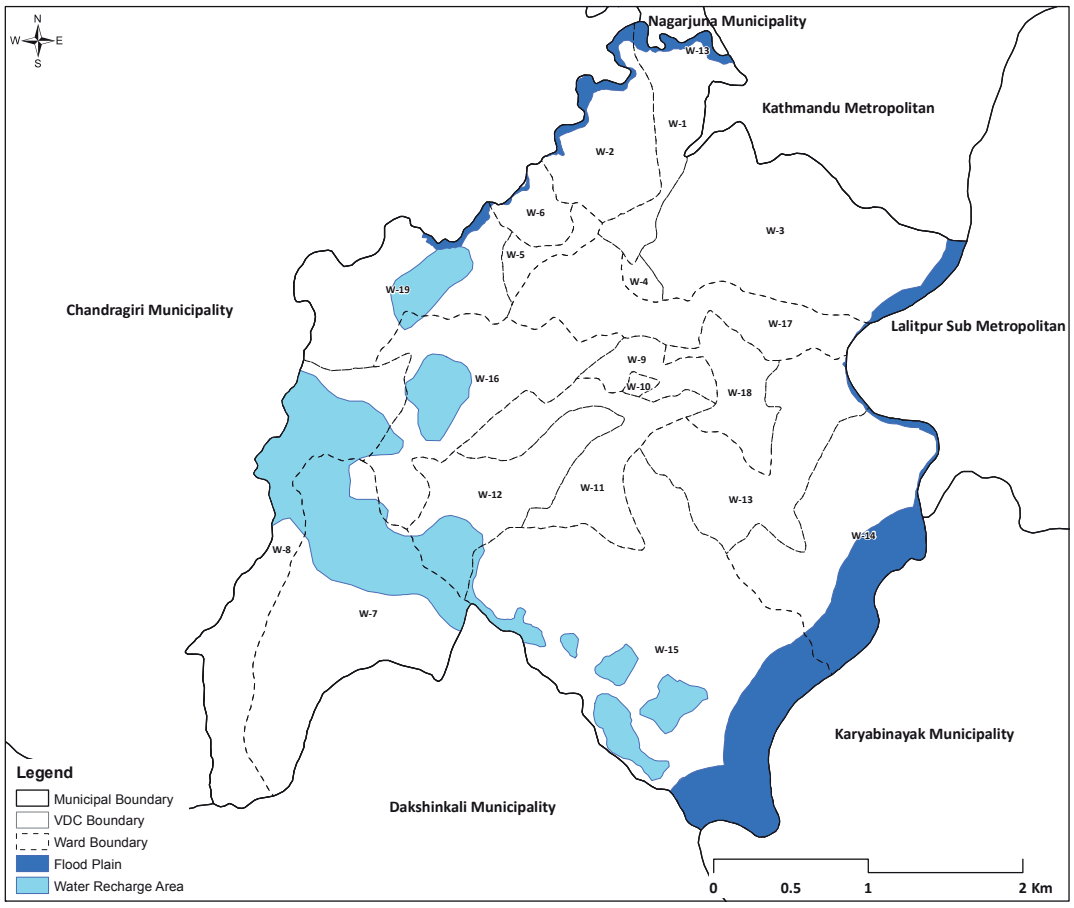
Hazard Risk Map Of Kirtipur Municipality



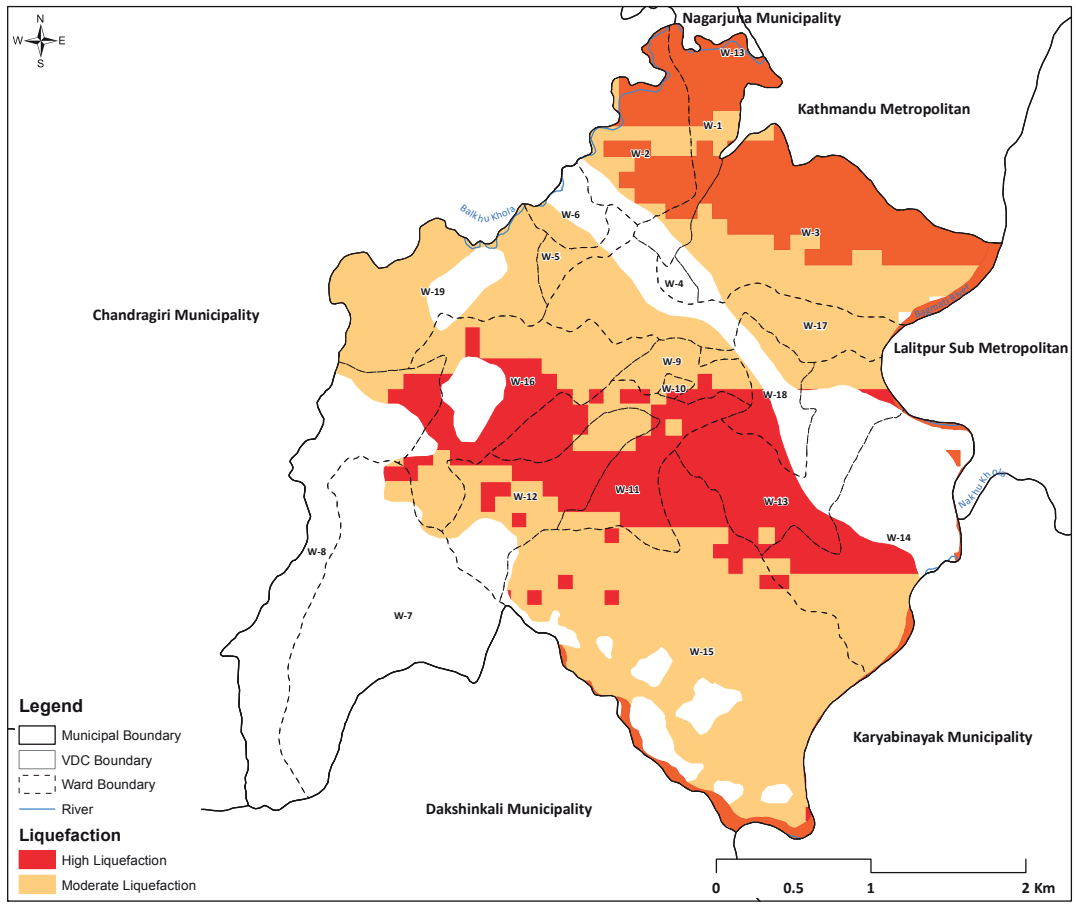
Landslide Susceptibility Map



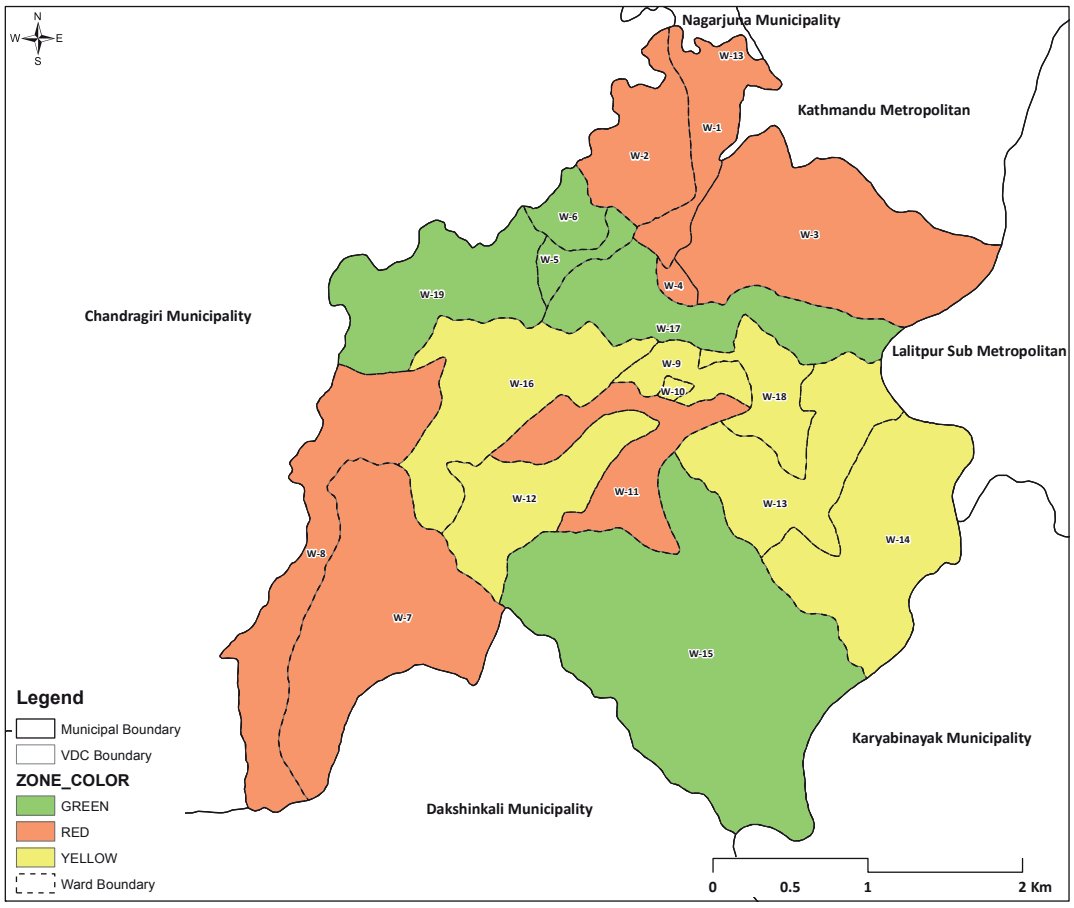
Slope Land Unsuitable For Development



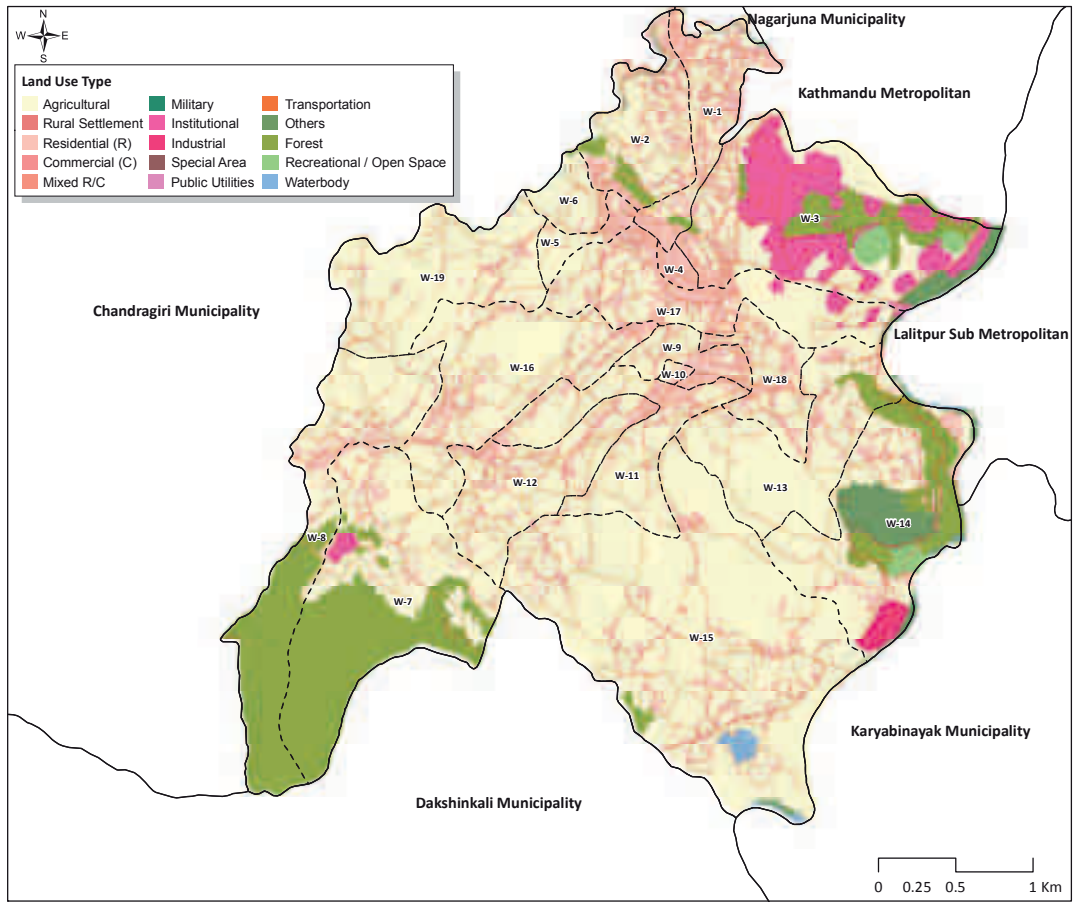
Flood Prone Areas And Water Recharge Area



Liquefaction Susceptible Area



Colour Zone Map Based On Development Constraints



Existing Land Use Map

Kathmandu Valley Development Authority

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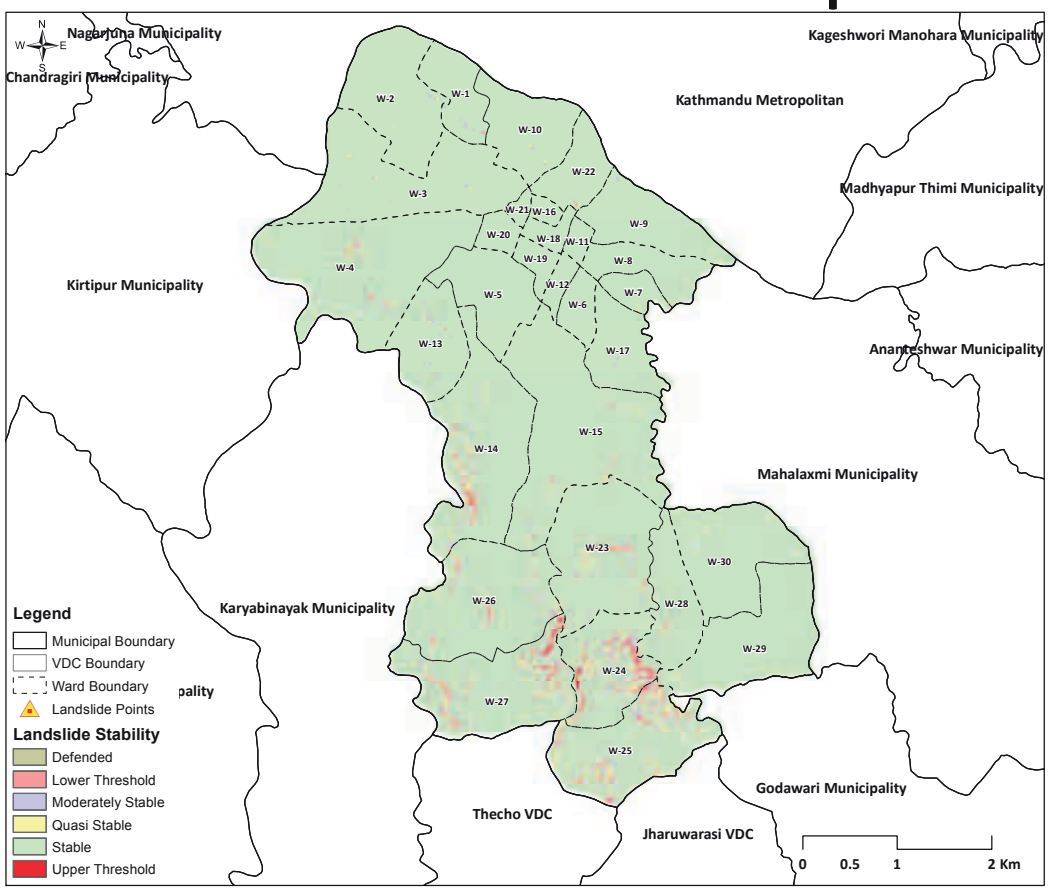
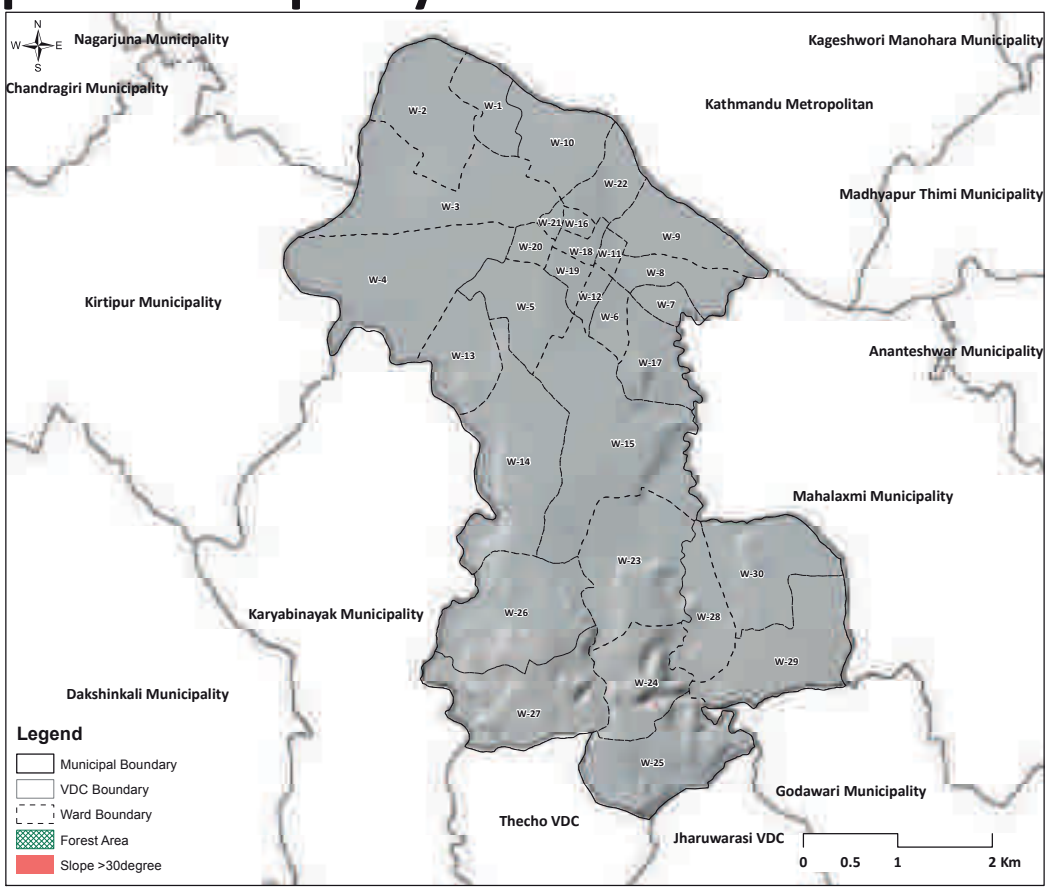
Comprehensive study of Urban Growth Trend and Forecasting of Land Use in Kathmandu Valley by UNDP/CDRMP.

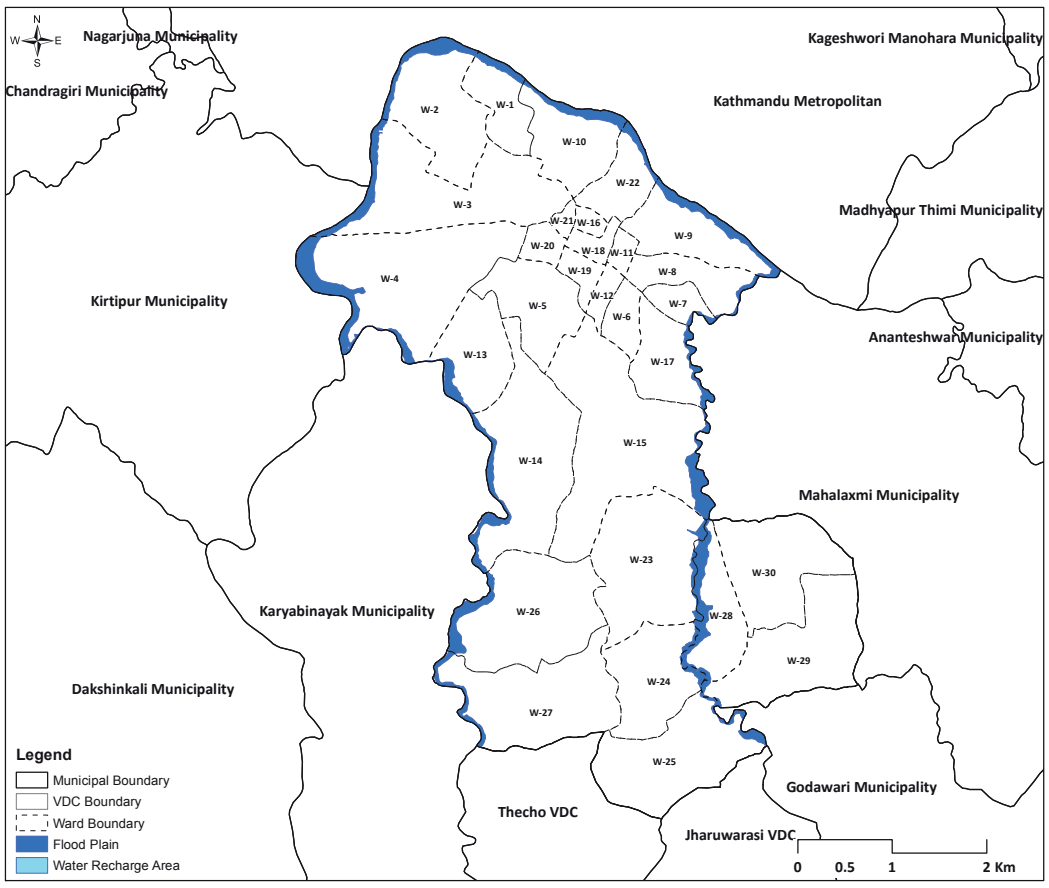
Hazard Risk Map Of Lalitpur Municipality



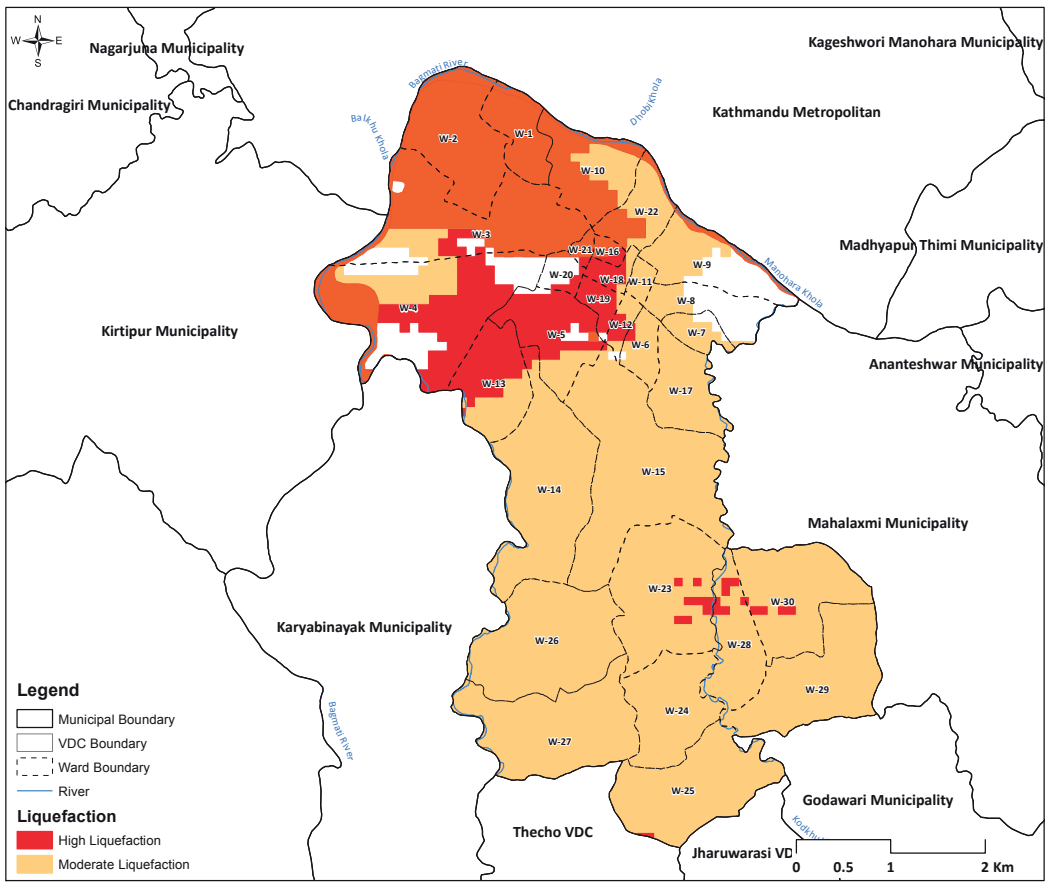
Landslide Susceptibility Map



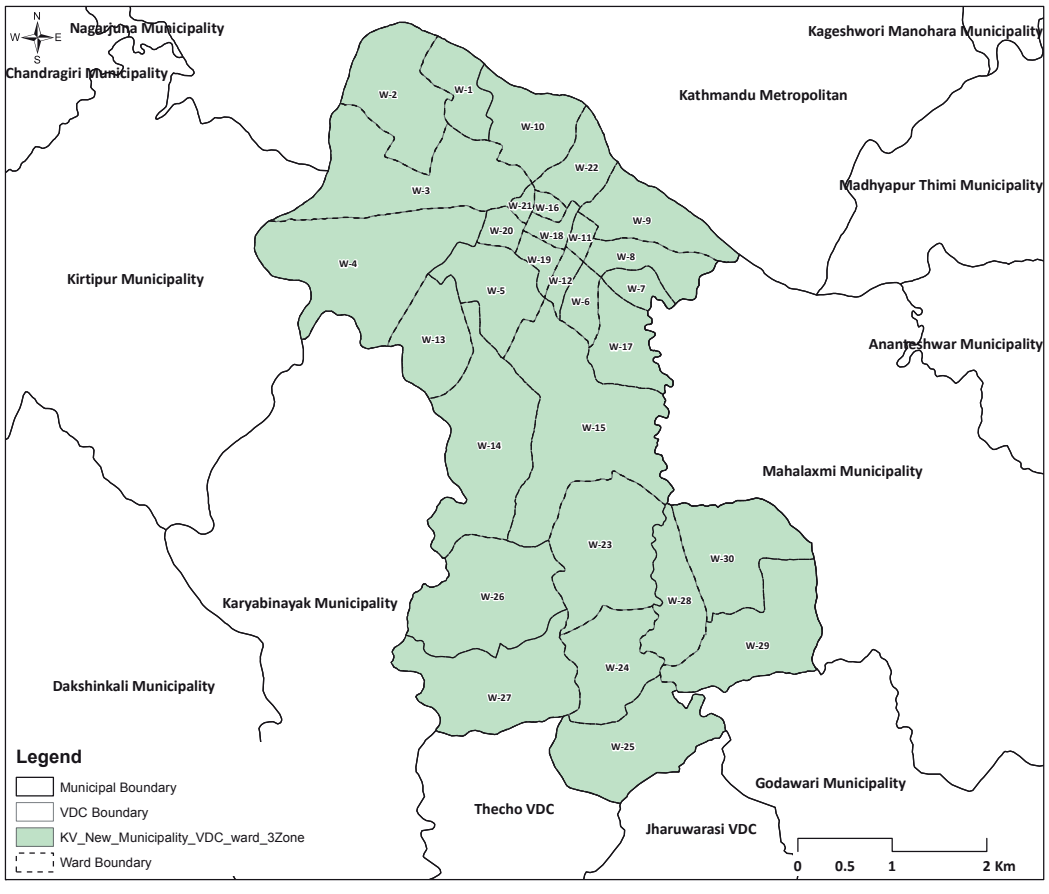
Slope Land Unsuitable For Development



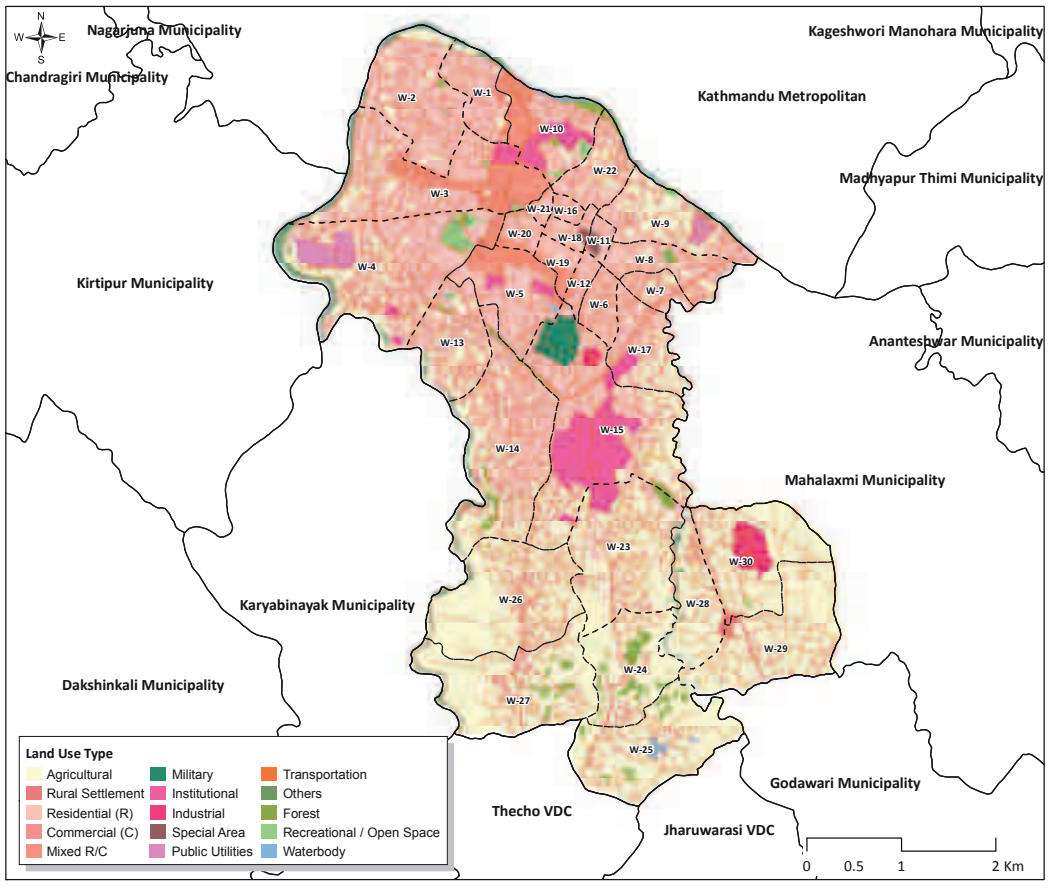
Flood Prone Areas And Water Recharge Area



Liquefaction Susceptible Area



Colour Zone Map Based On Development Constraints



Existing Land Use Map

Kathmandu Valley Development Authority

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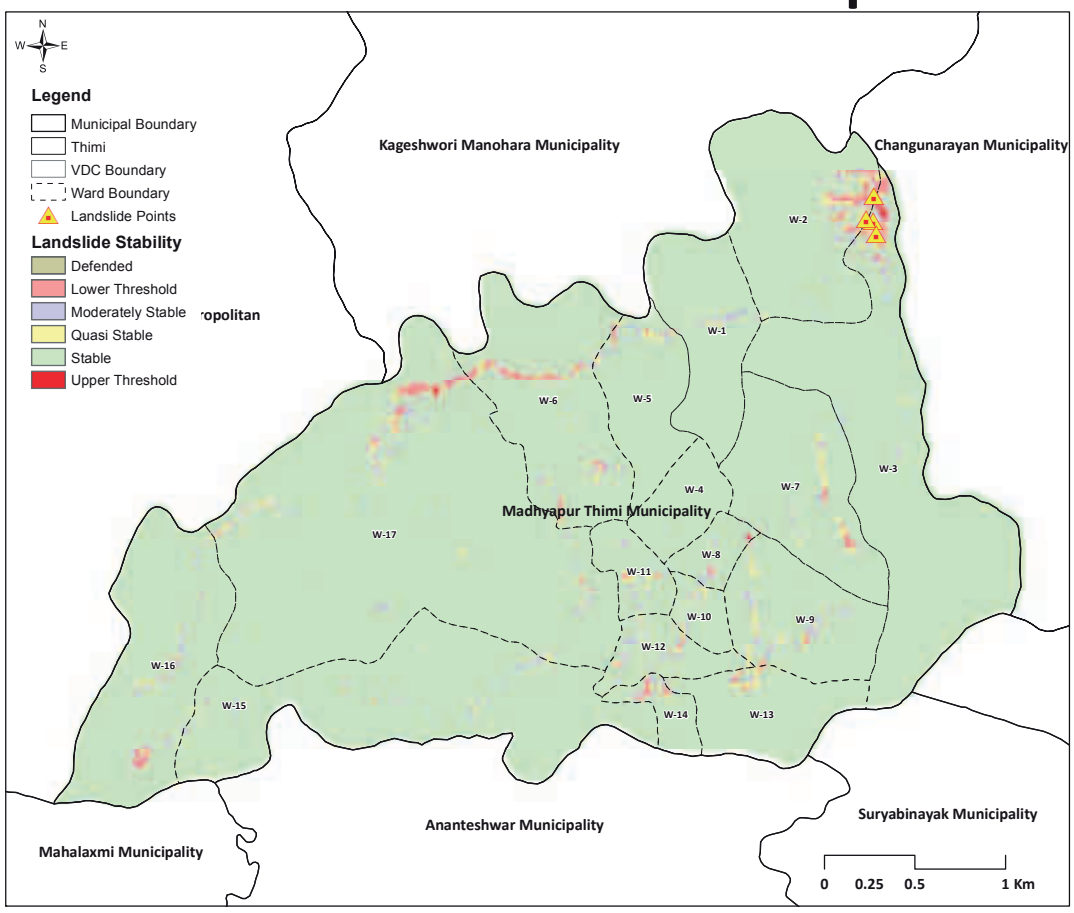
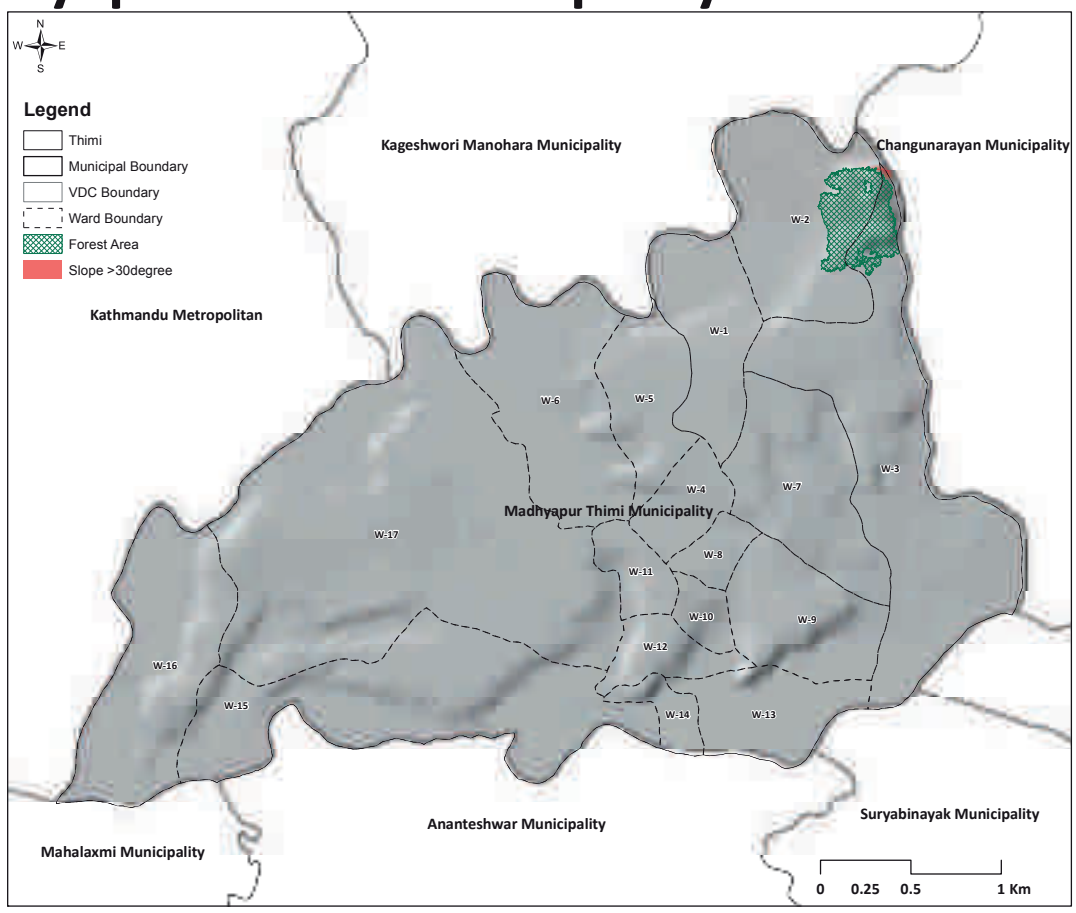
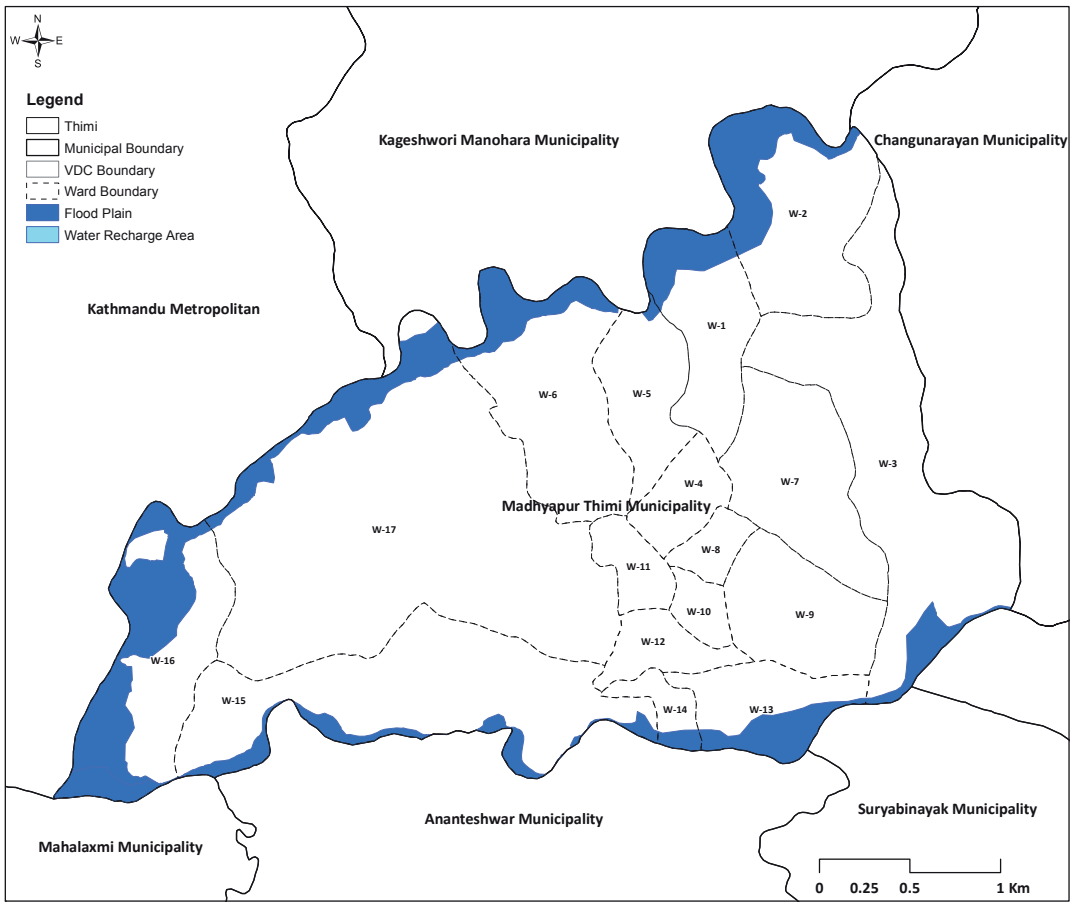
Hazard Risk Map Of Madhyapur Thimi Municipality



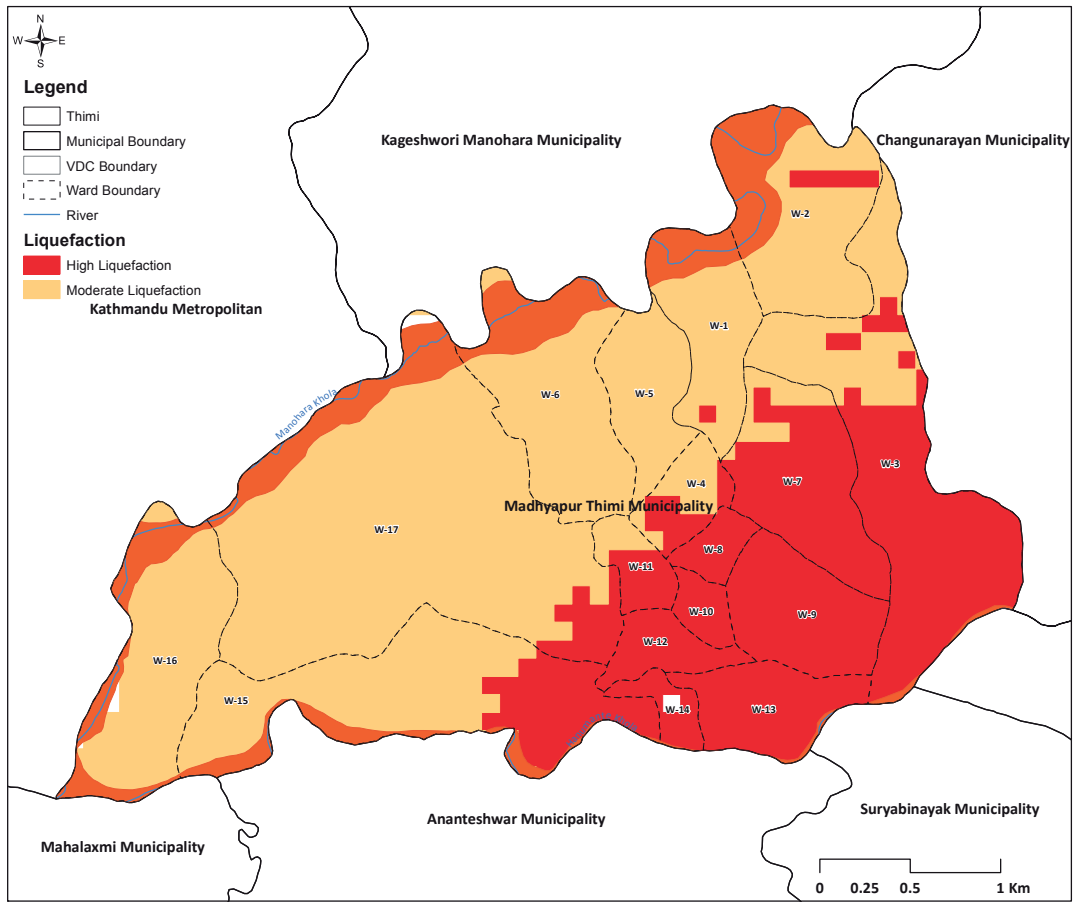
Landslide Susceptibility Map



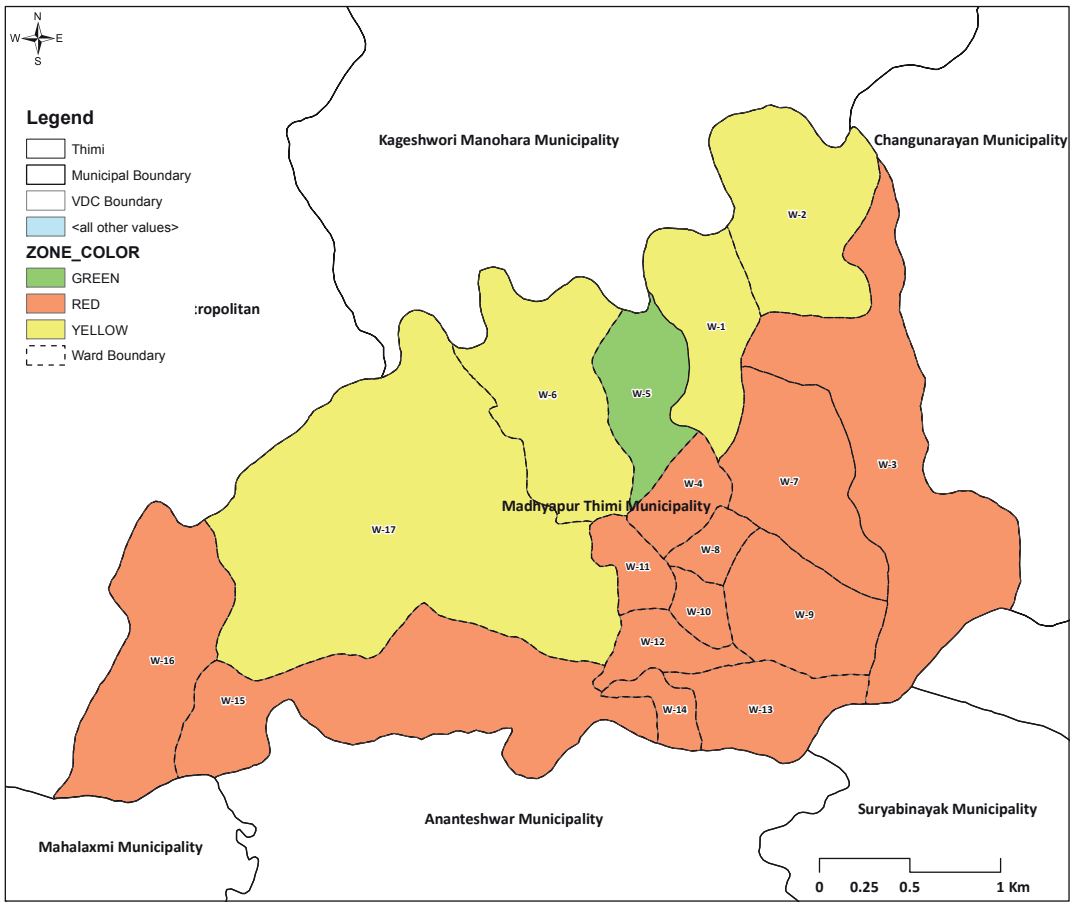
Slope Land Unsuitable For Development



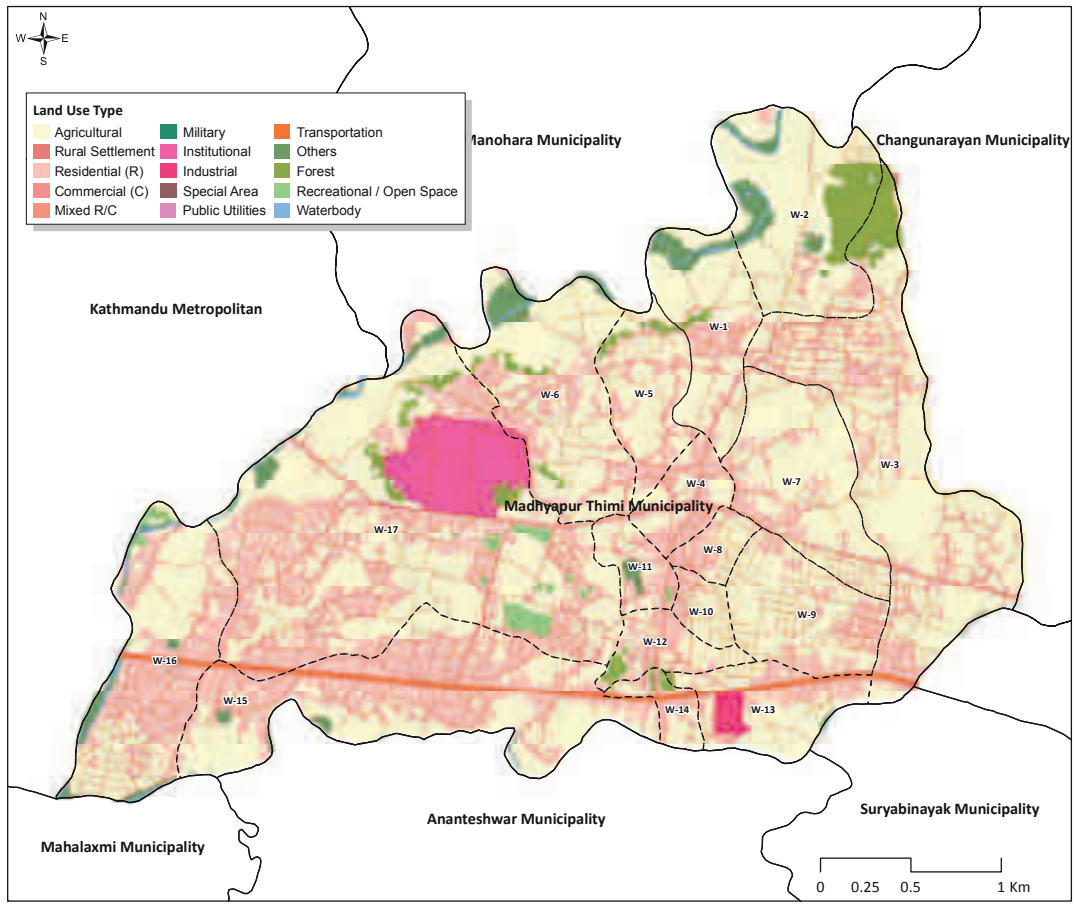
Flood Prone Areas And Water Recharge Area



Liquefaction Susceptible Area



Colour Zone Map Based On Development Constraints



Existing Land Use Map

Kathmandu Valley Development Authority

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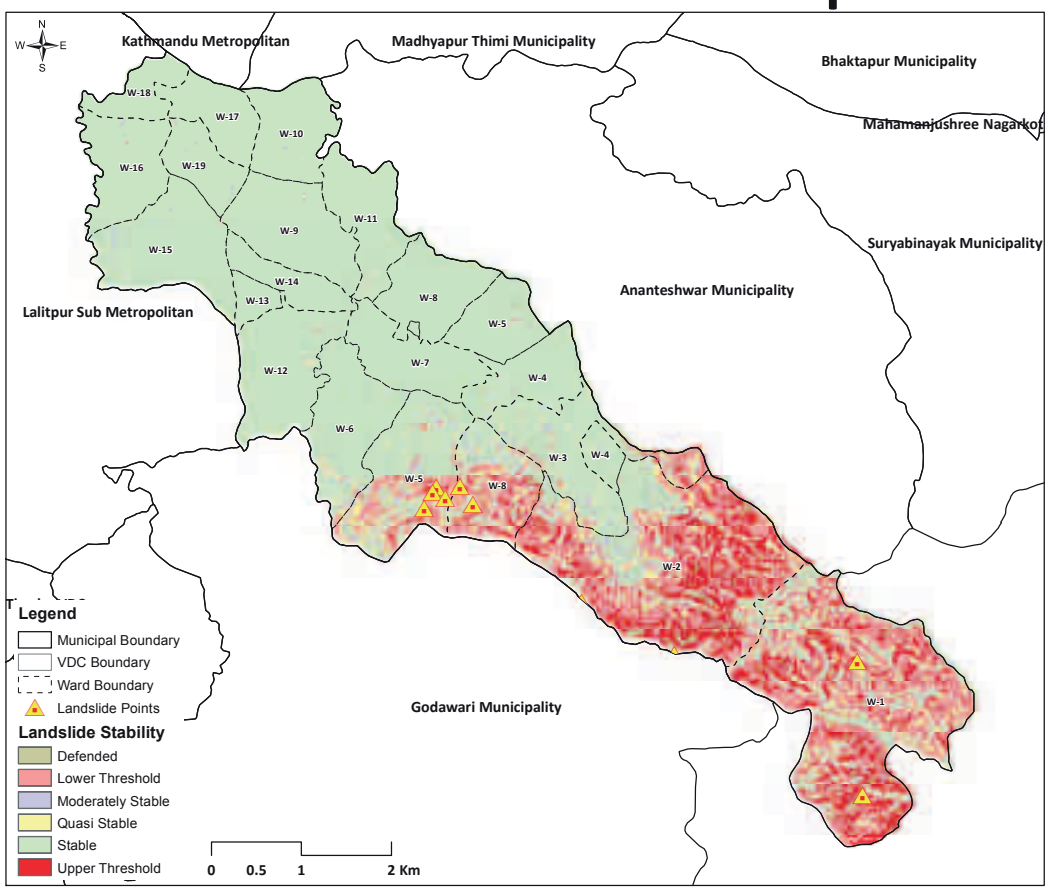
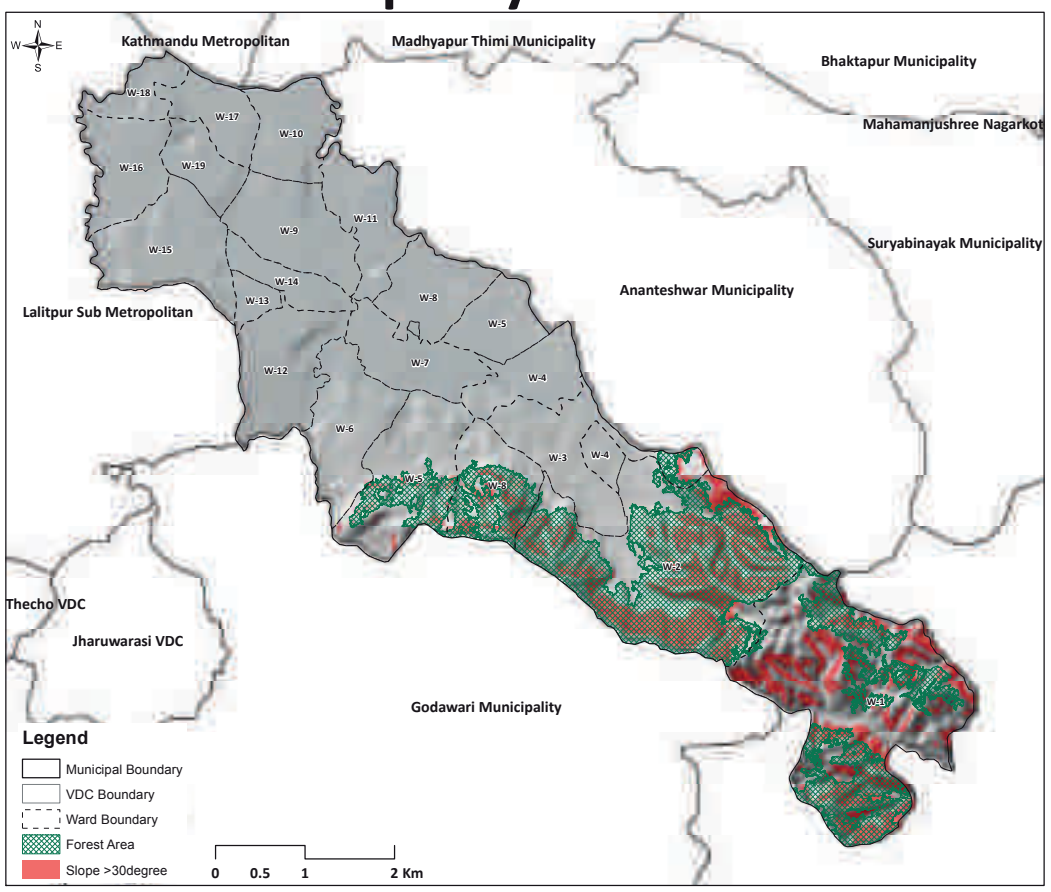
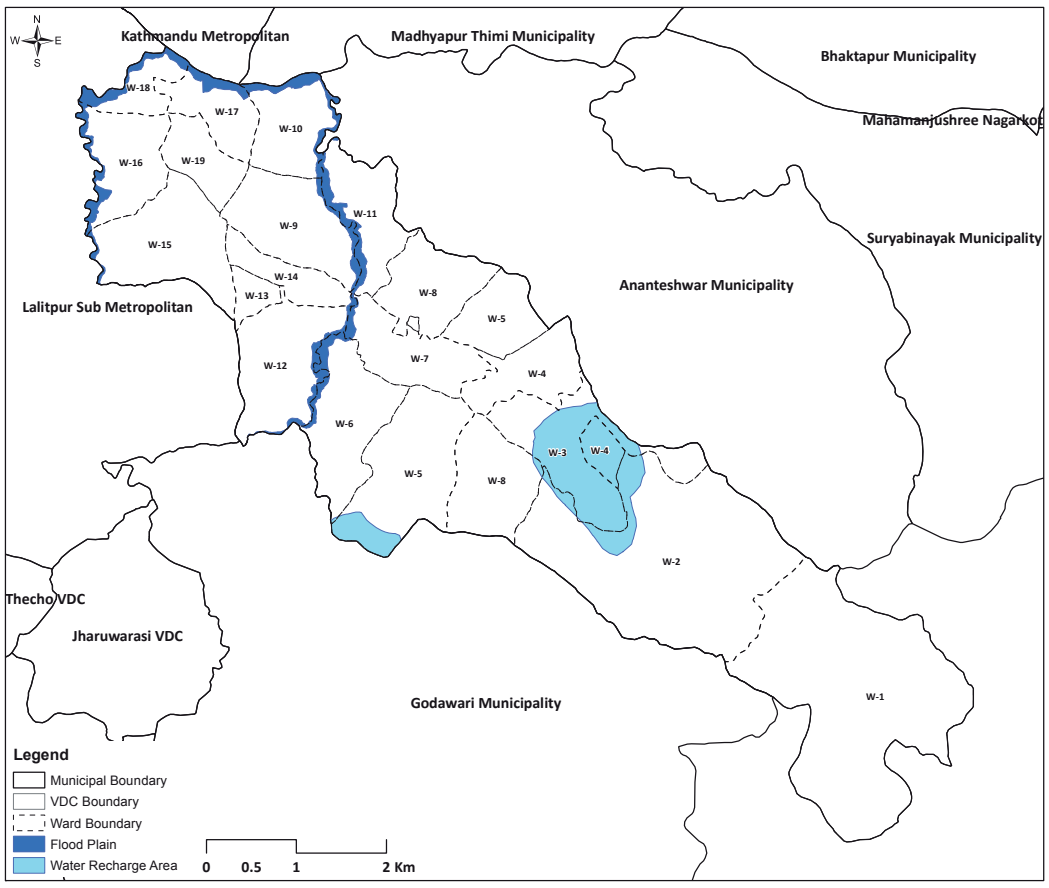
Hazard Risk Map Of Mahalaxmi Municipality



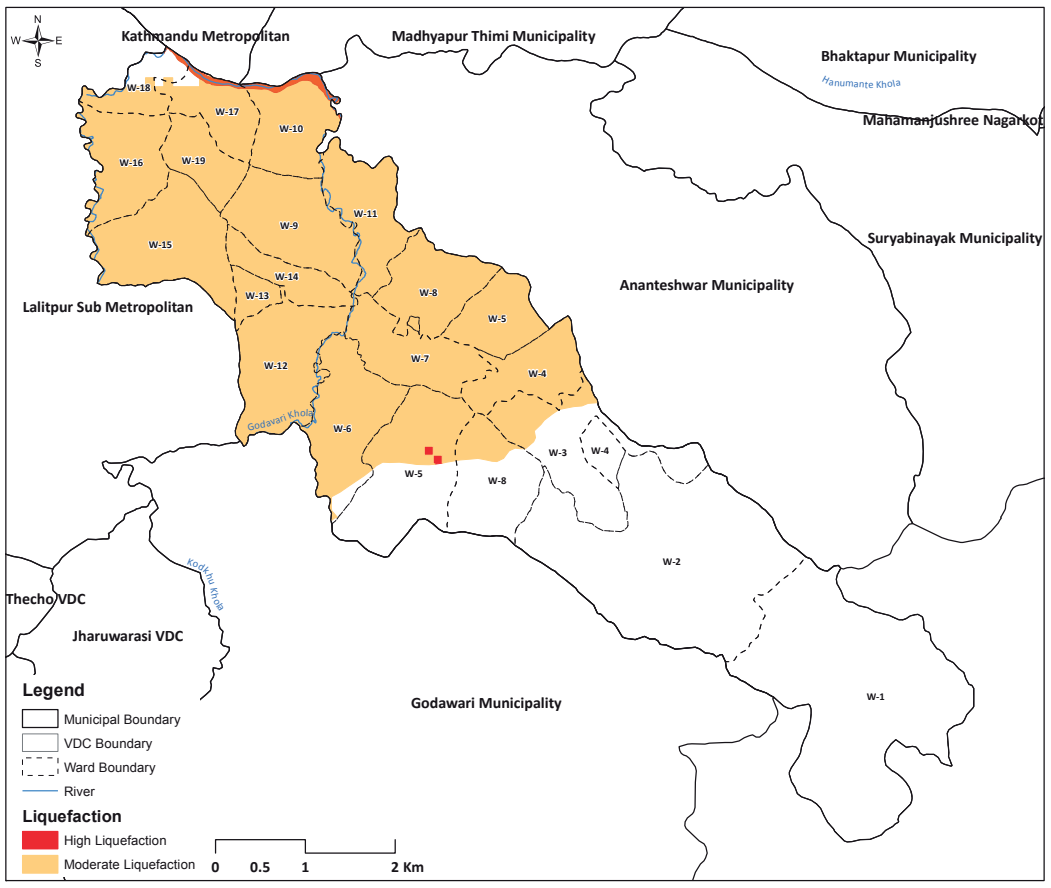
Landslide Susceptibility Map



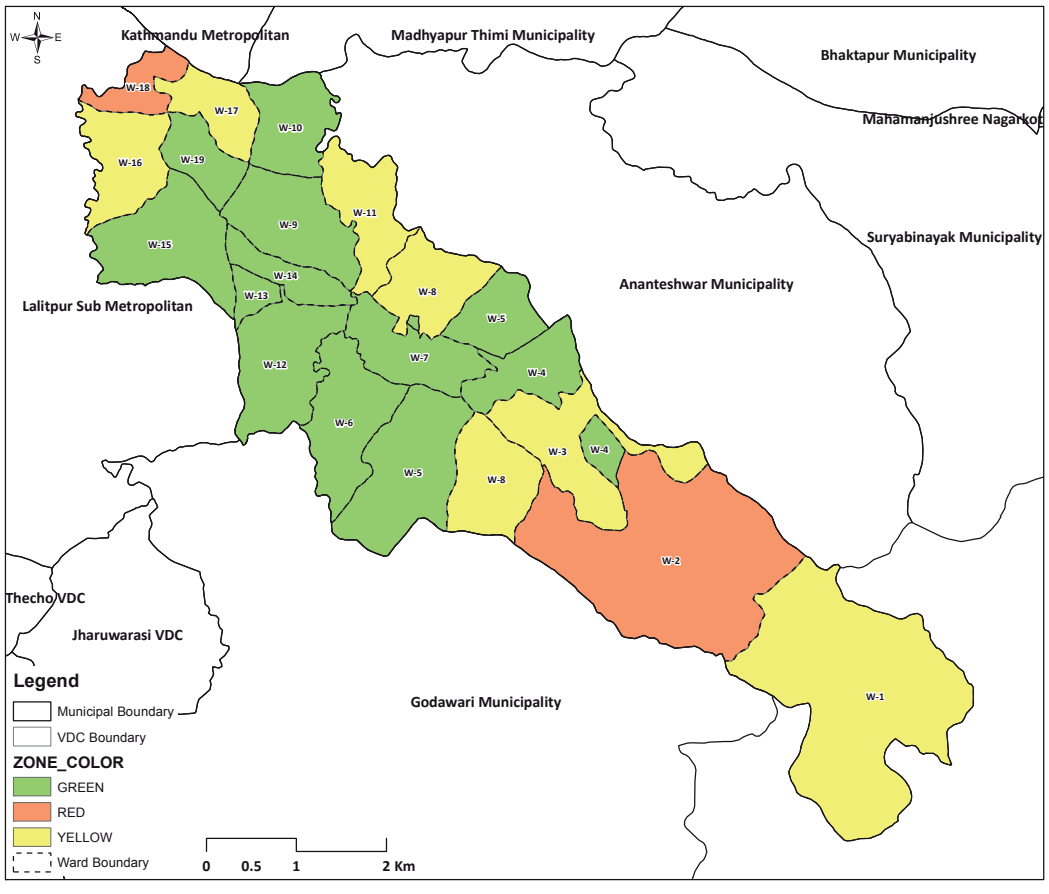
Slope Land Unsuitable For Development



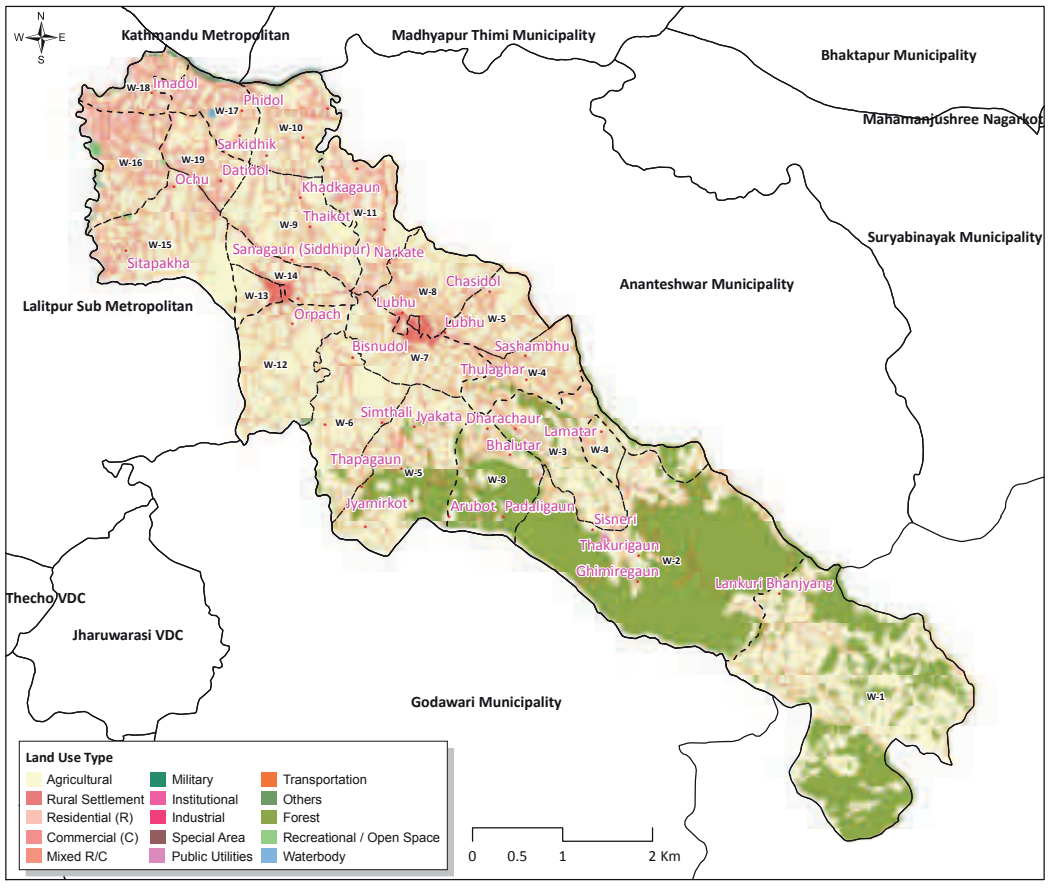
Flood Prone Areas And Water Recharge Area



Liquefaction Susceptible Area



Colour Zone Map Based On Development Constraints



Existing Land Use Map

Kathmandu Valley Development Authority

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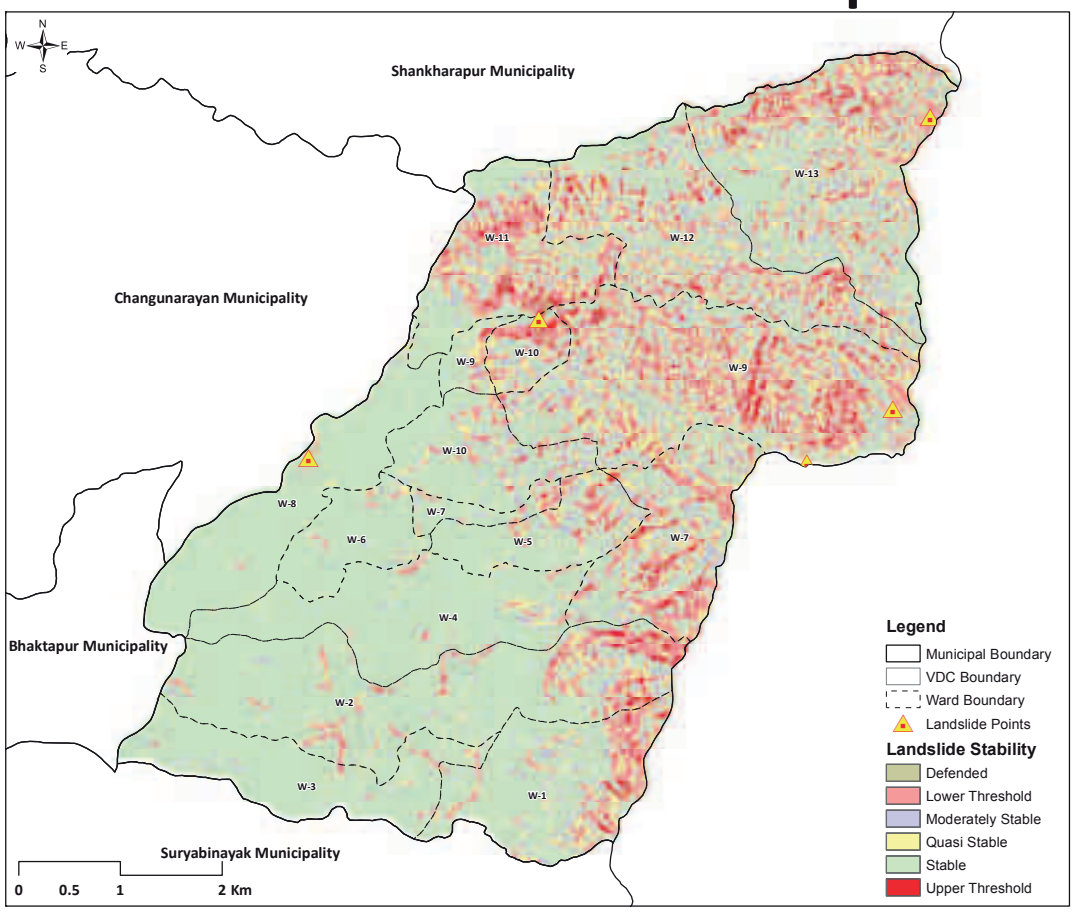
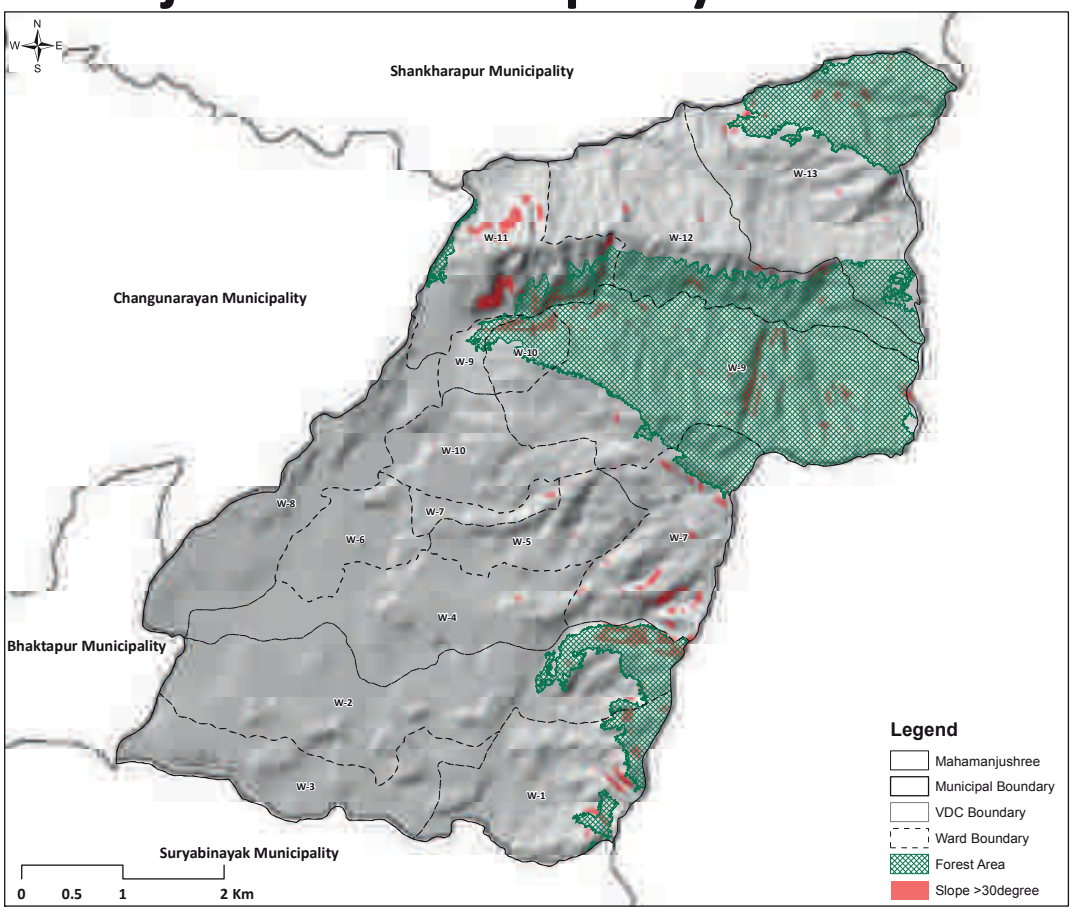
Comprehensive study of Urban Growth Trend and Forecasting of Land Use in Kathmandu Valley by UNDP/CDRMP.

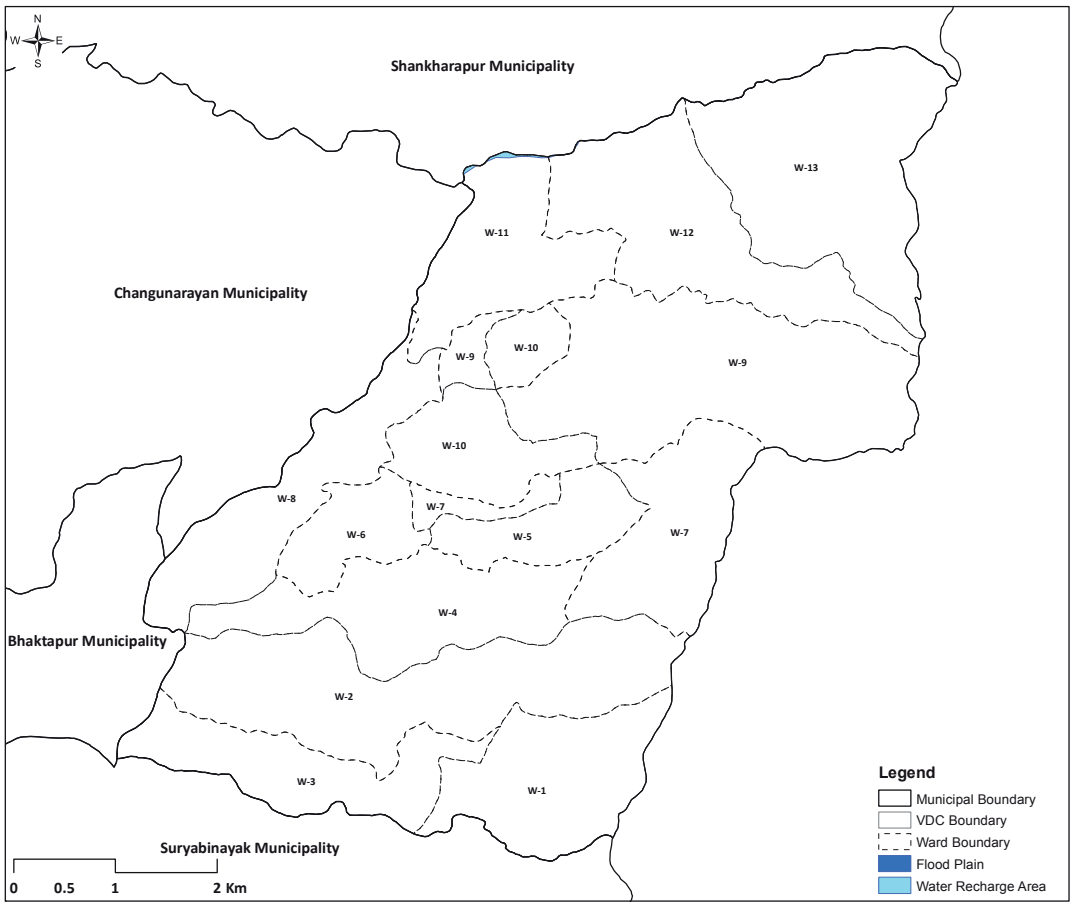
Hazard Risk Map Of Mahamanjushree Municipality



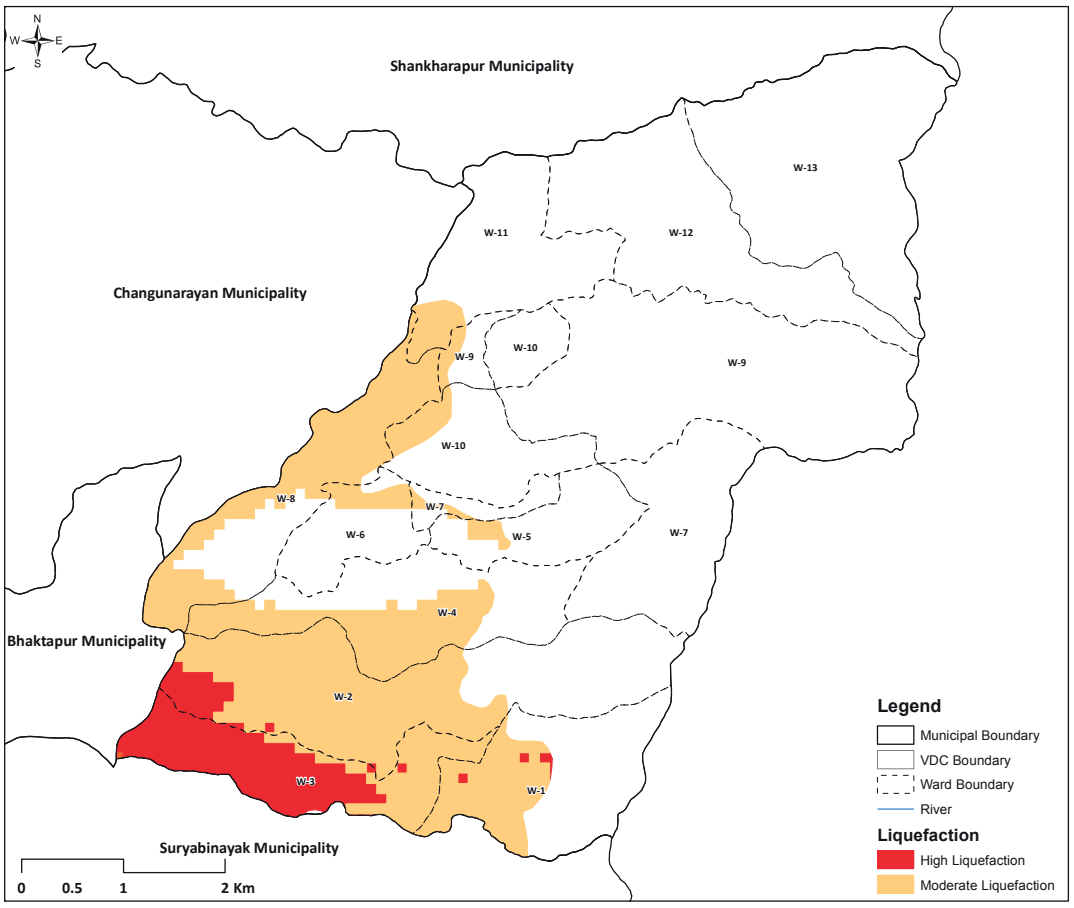
Landslide Susceptibility Map



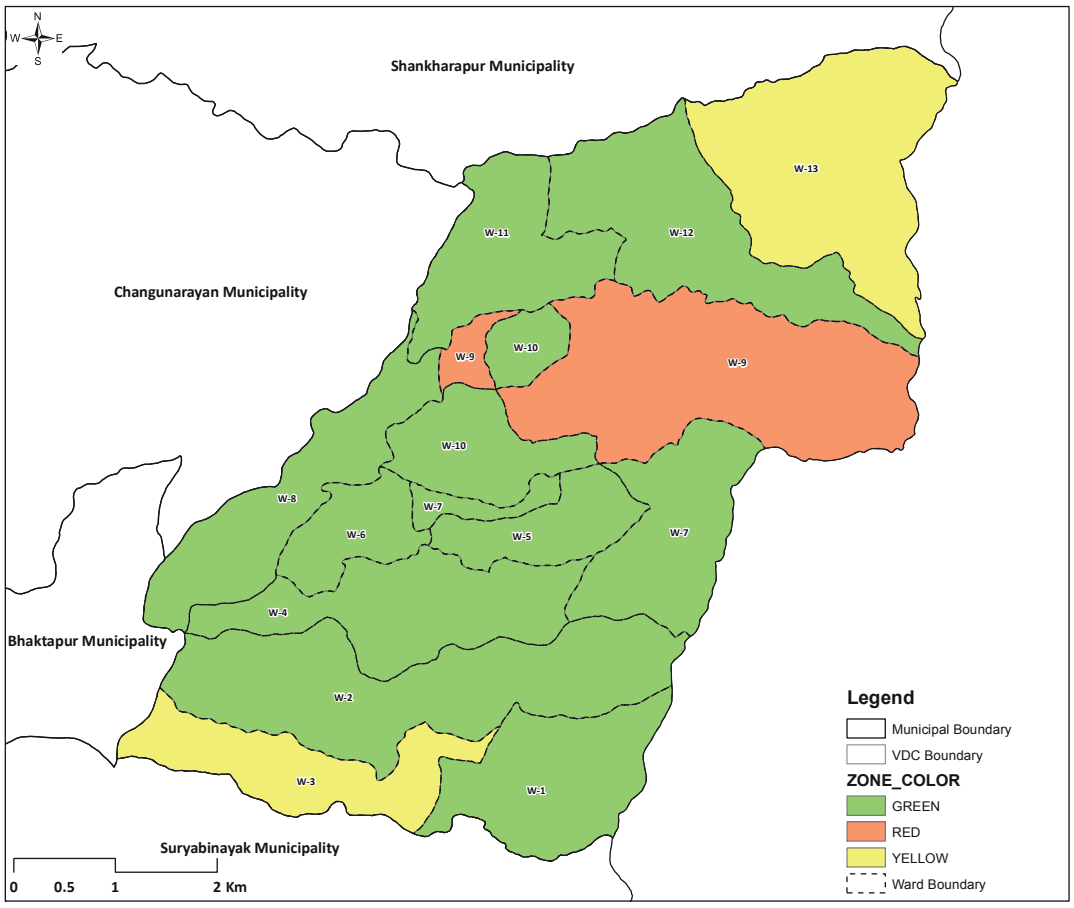
Slope Land Unsuitable For Development



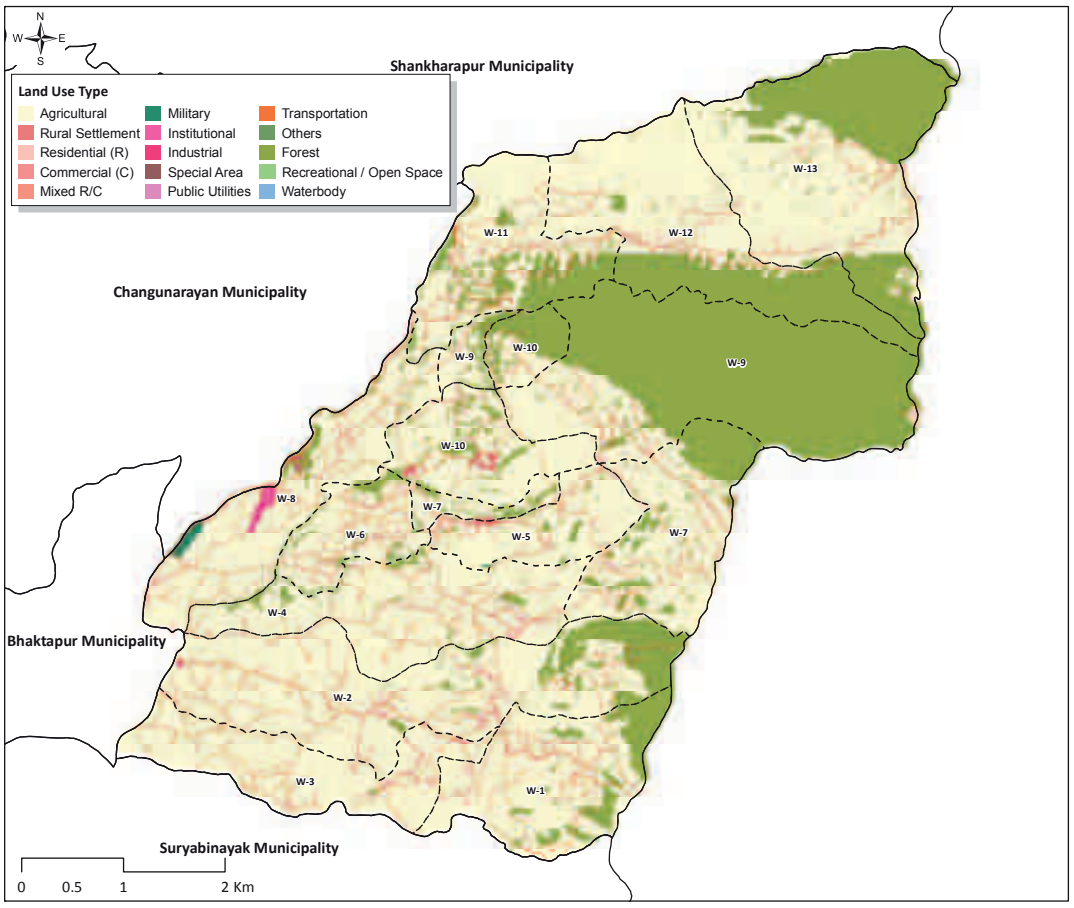
Flood Prone Areas And Water Recharge Area



Liquefaction Susceptible Area



Colour Zone Map Based On Development Constraints



Existing Land Use Map

Kathmandu Valley Development Authority

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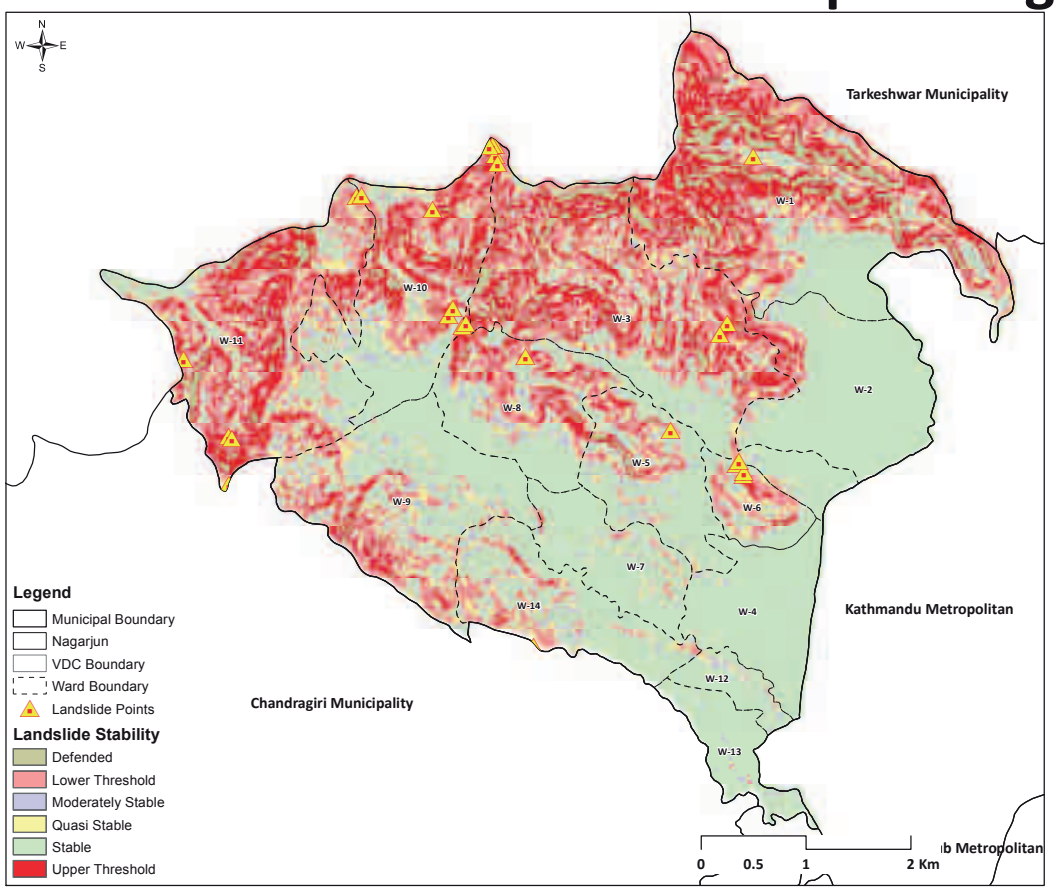
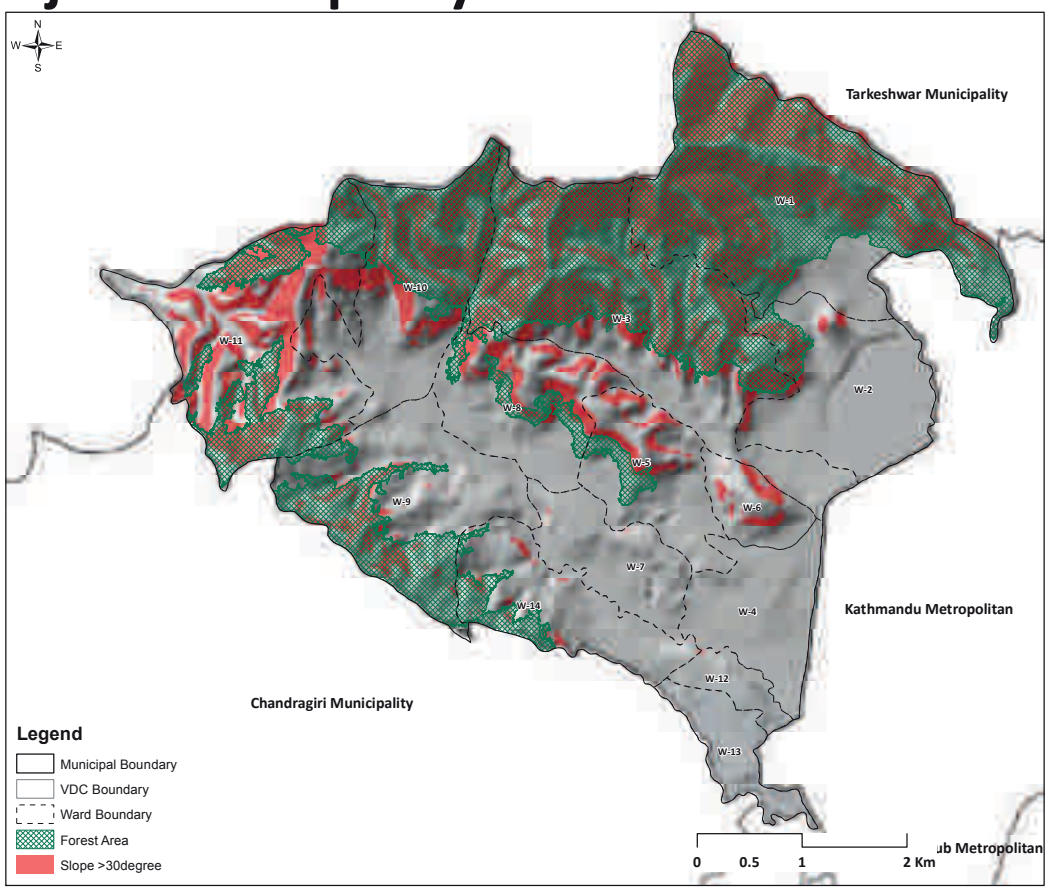
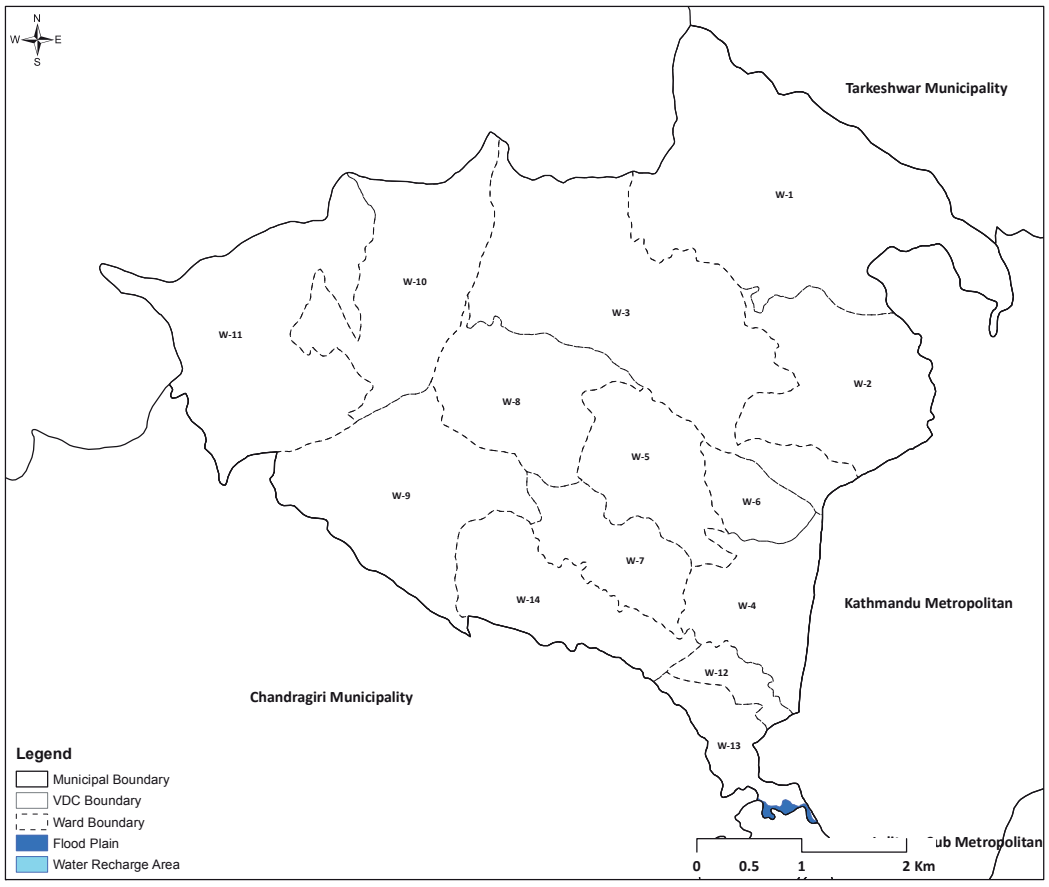
Hazard Risk Map Of Nagarjun Municipality



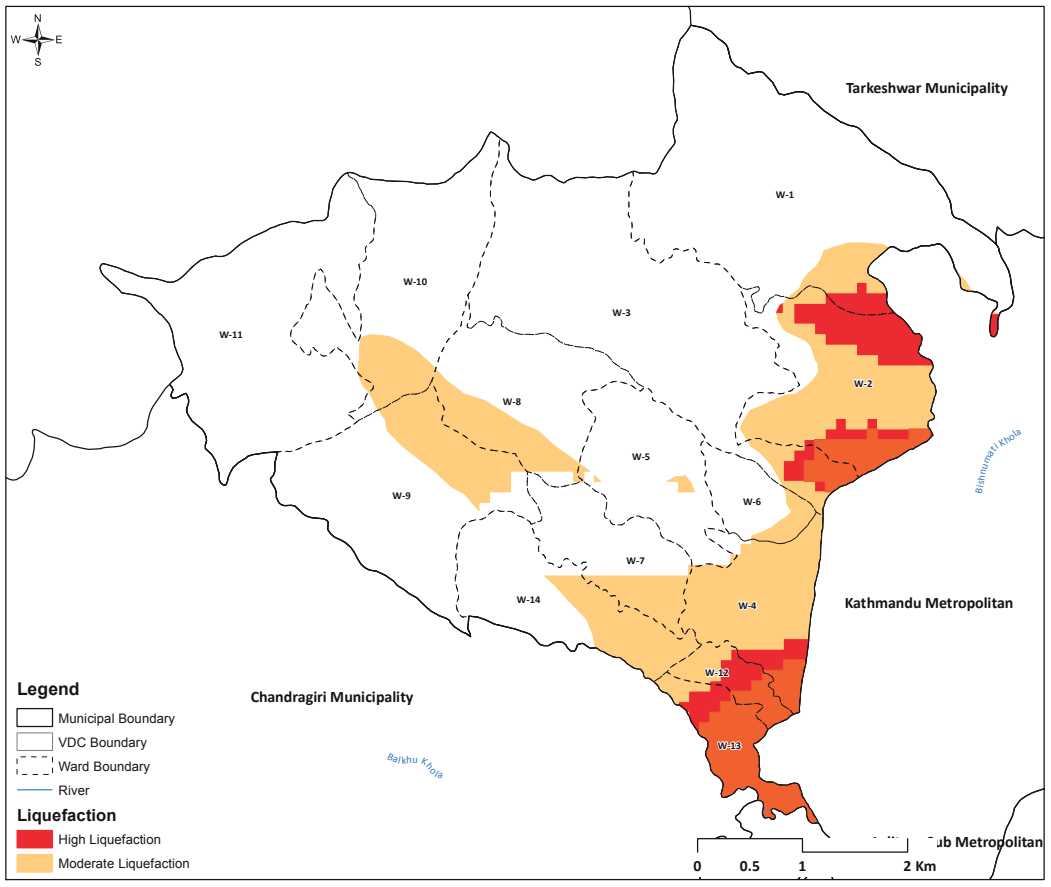
Landslide Susceptibility Map



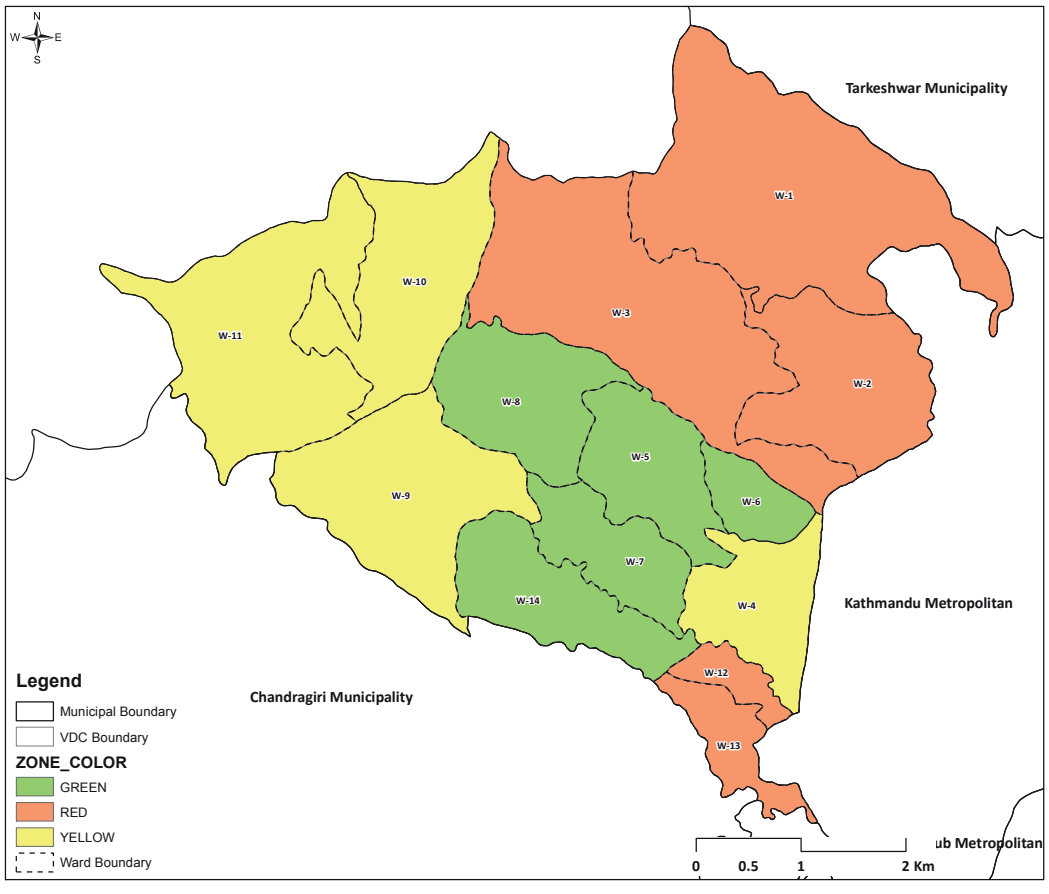
Slope Land Unsuitable For Development



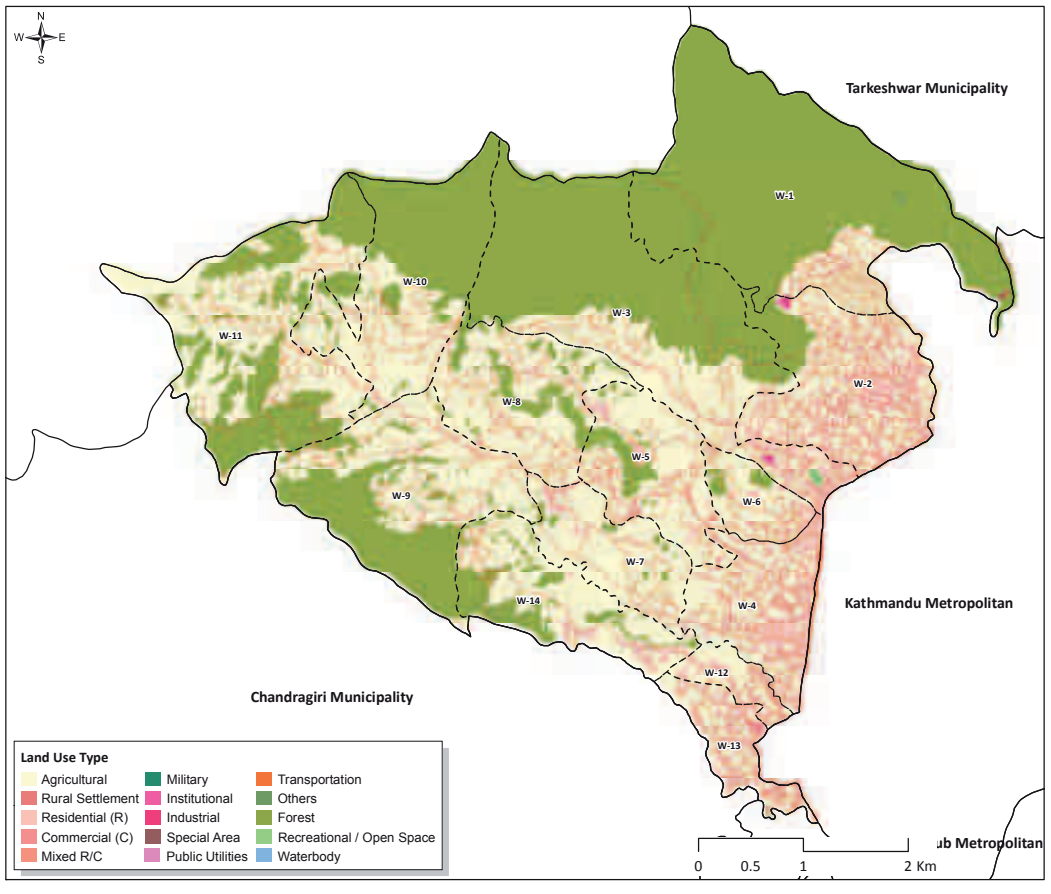
Flood Prone Areas And Water Recharge Area



Liquefaction Susceptible Area



Colour Zone Map Based On Development Constraints



Existing Land Use Map

Kathmandu Valley Development Authority

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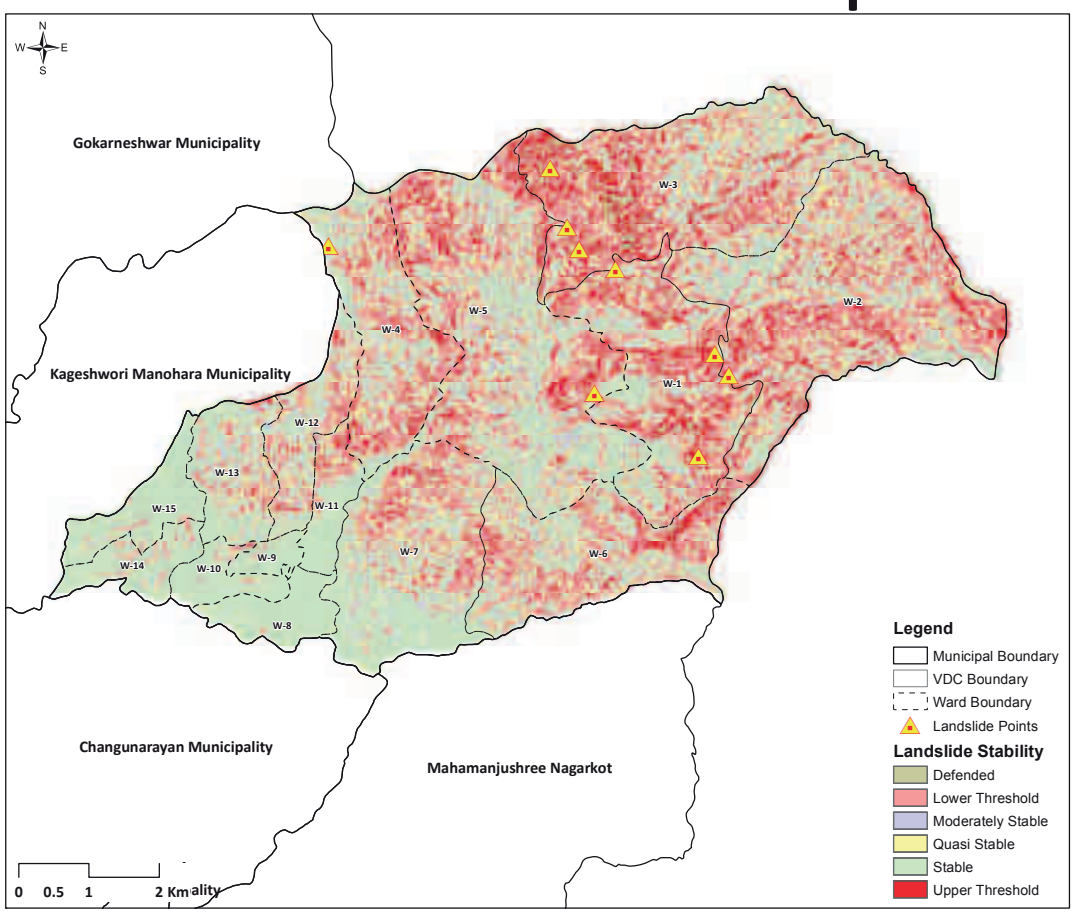
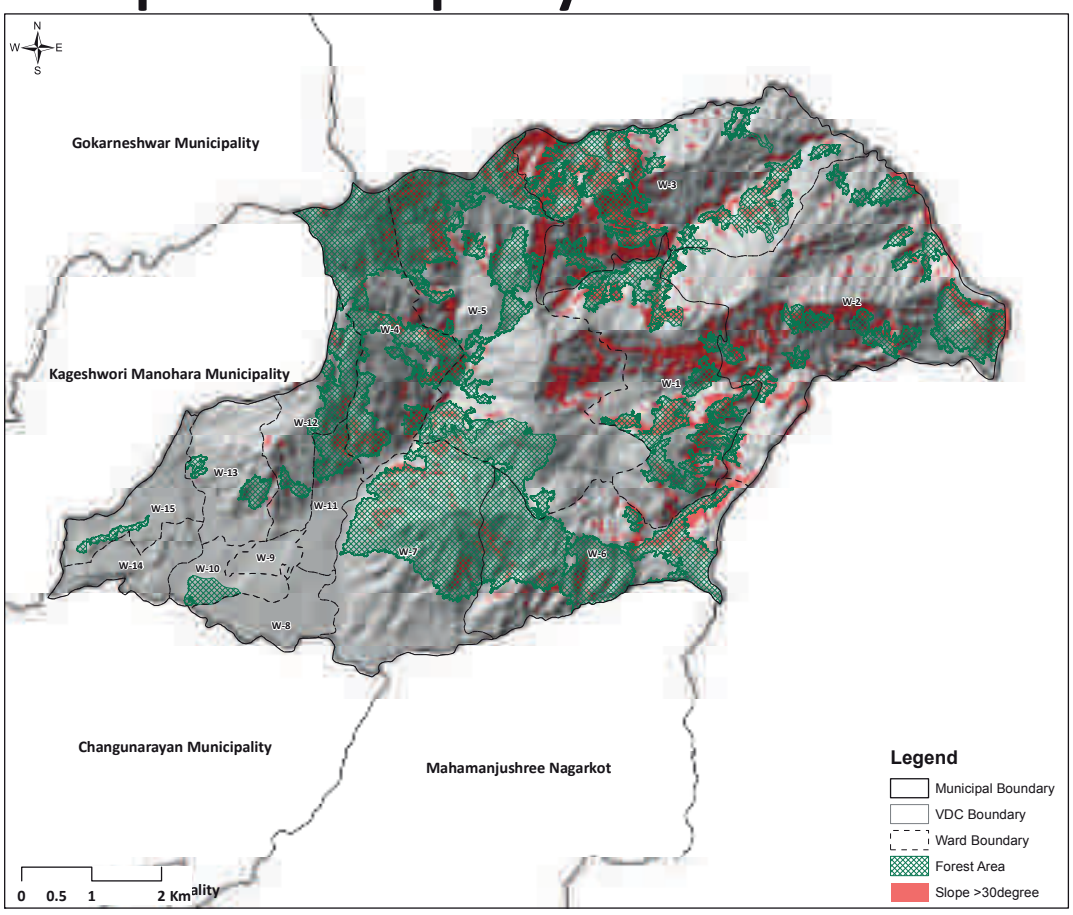
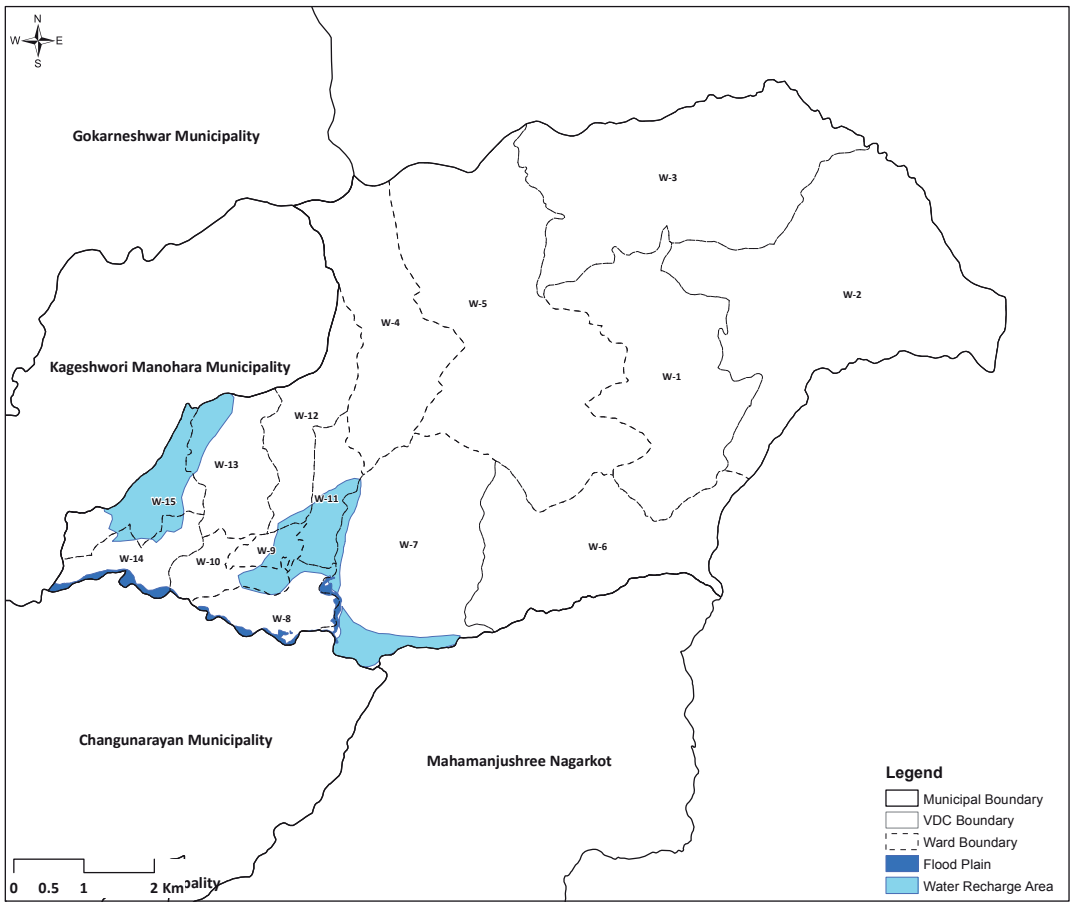
Hazard Risk Map Of Shankarapur Municipality



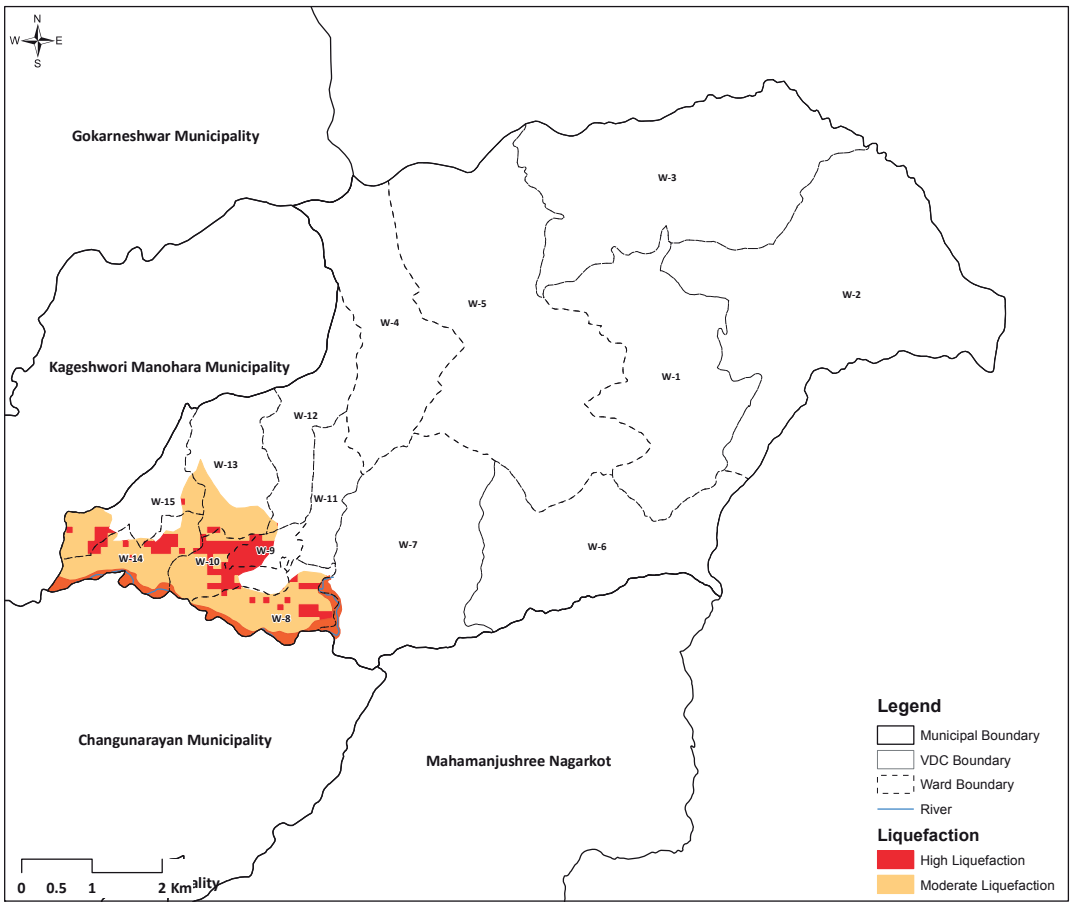
Landslide Susceptibility Map



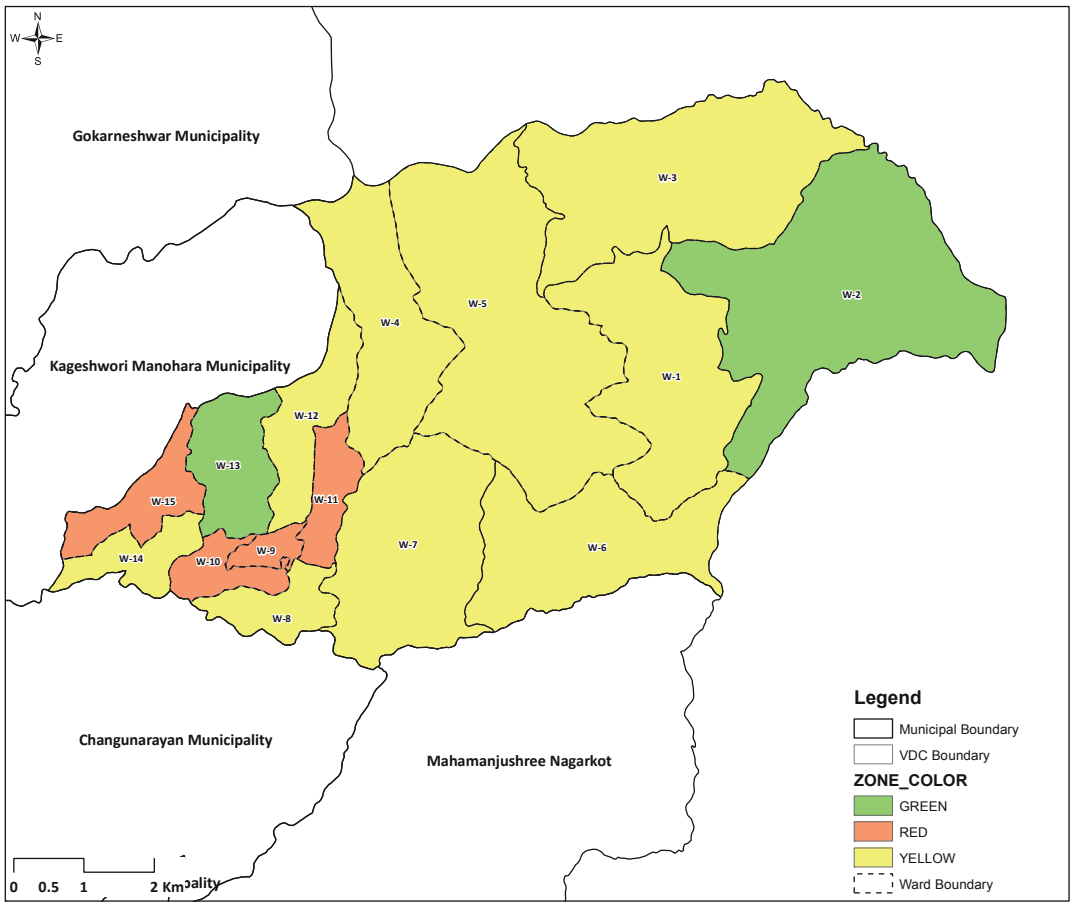
Slope Land Unsuitable For Development



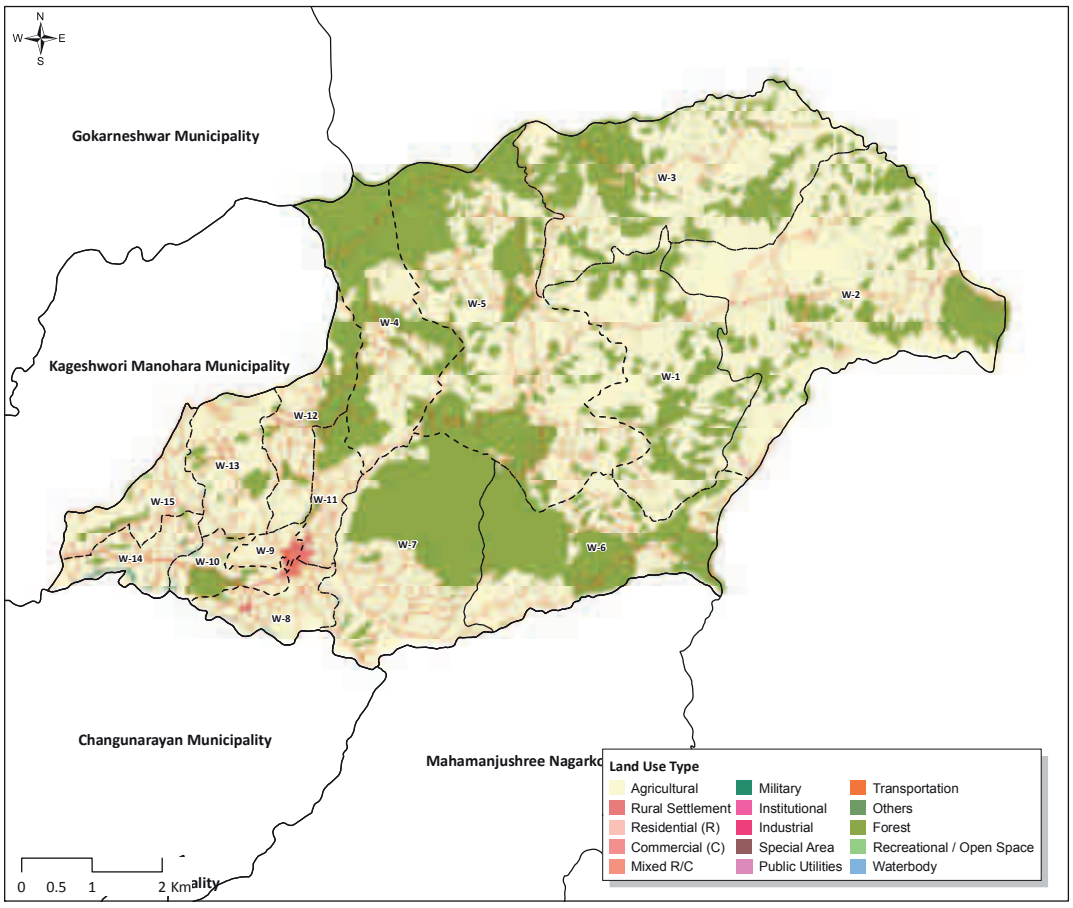
Flood Prone Areas And Water Recharge Area



Liquefaction Susceptible Area



Colour Zone Map Based On Development Constraints



Existing Land Use Map

Kathmandu Valley Development Authority

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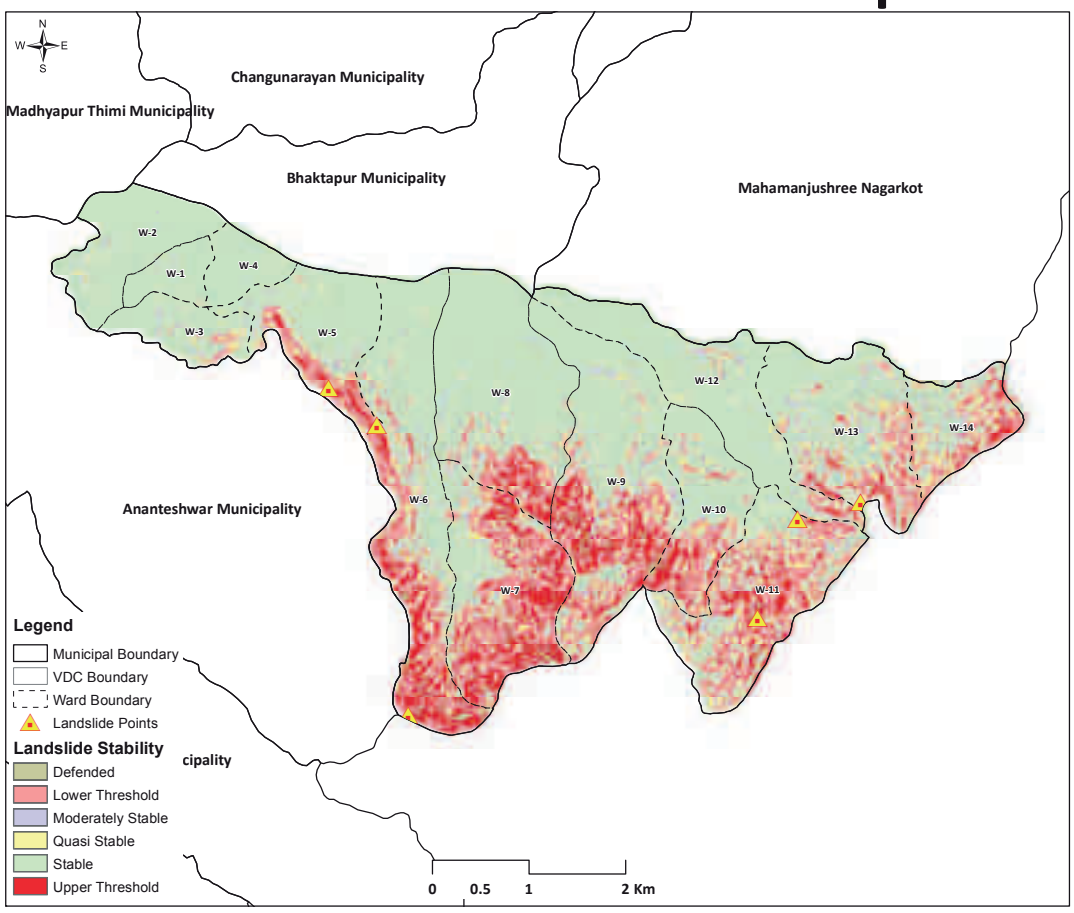
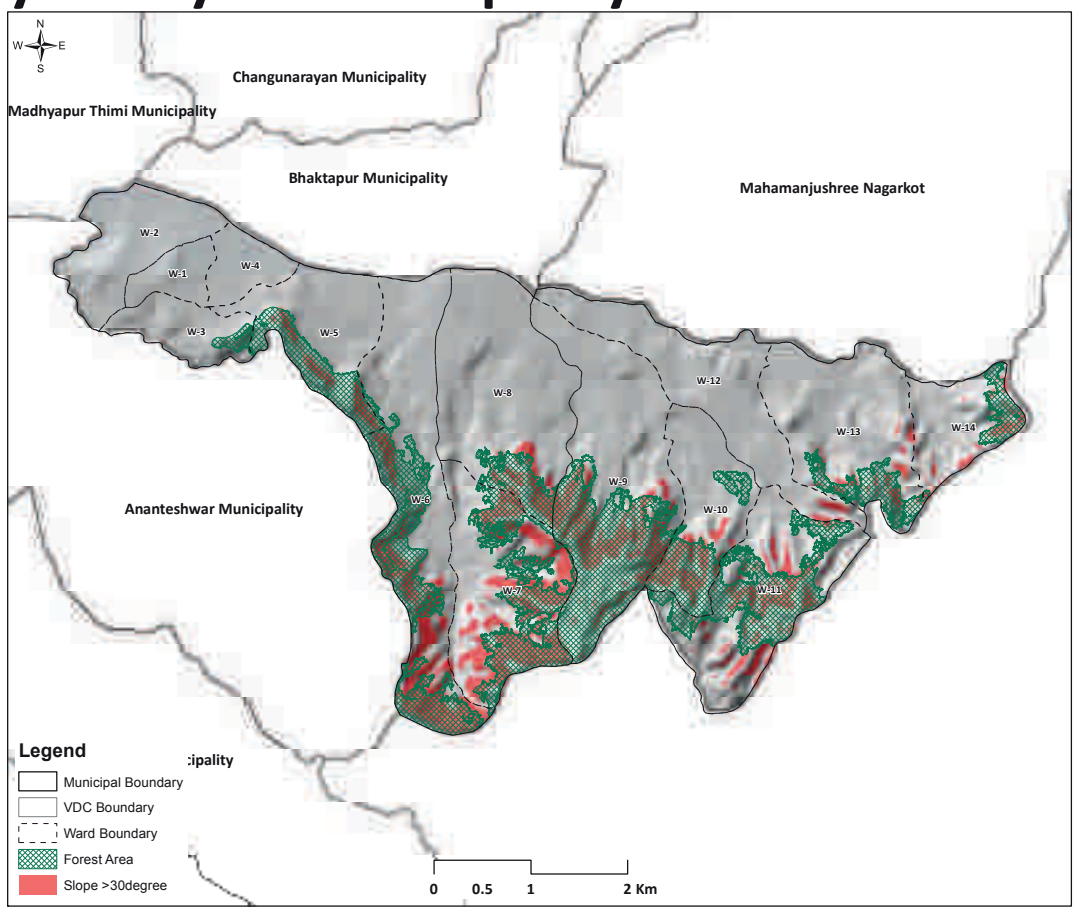
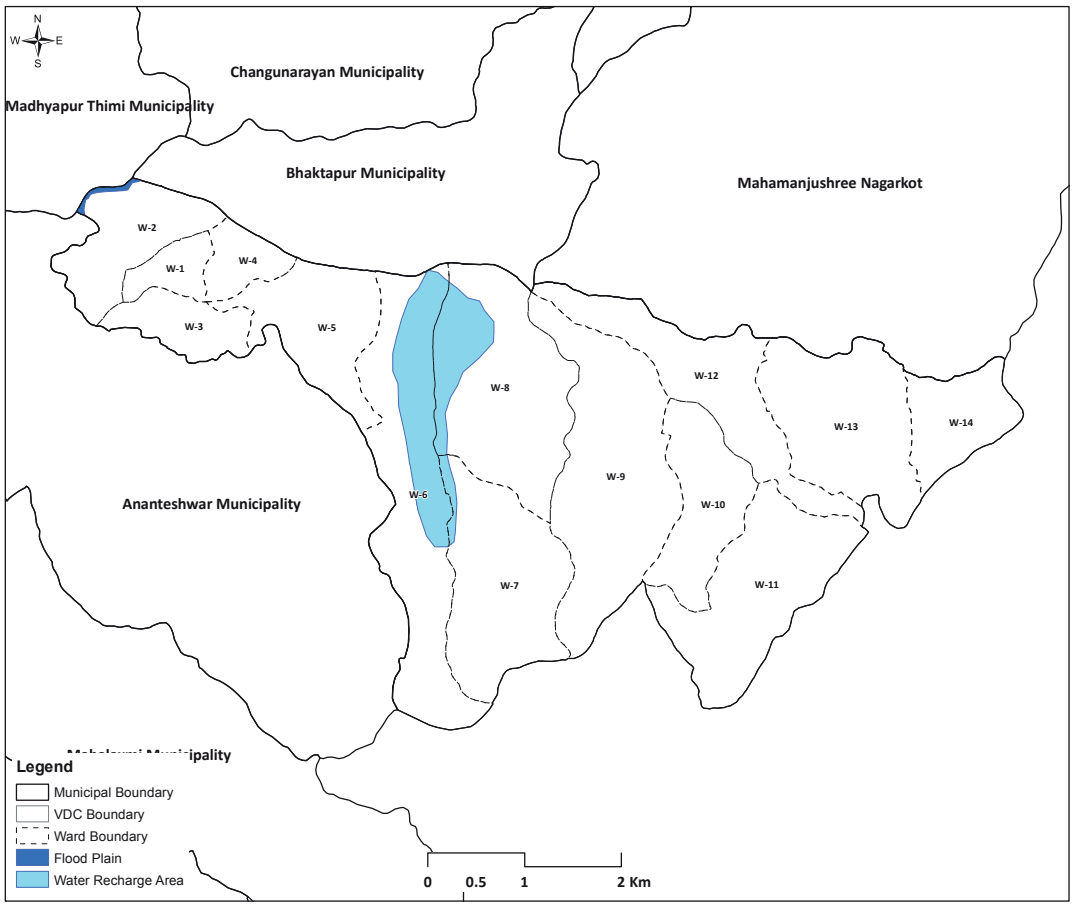
Hazard Risk Map Of Suryabinayak Municipality



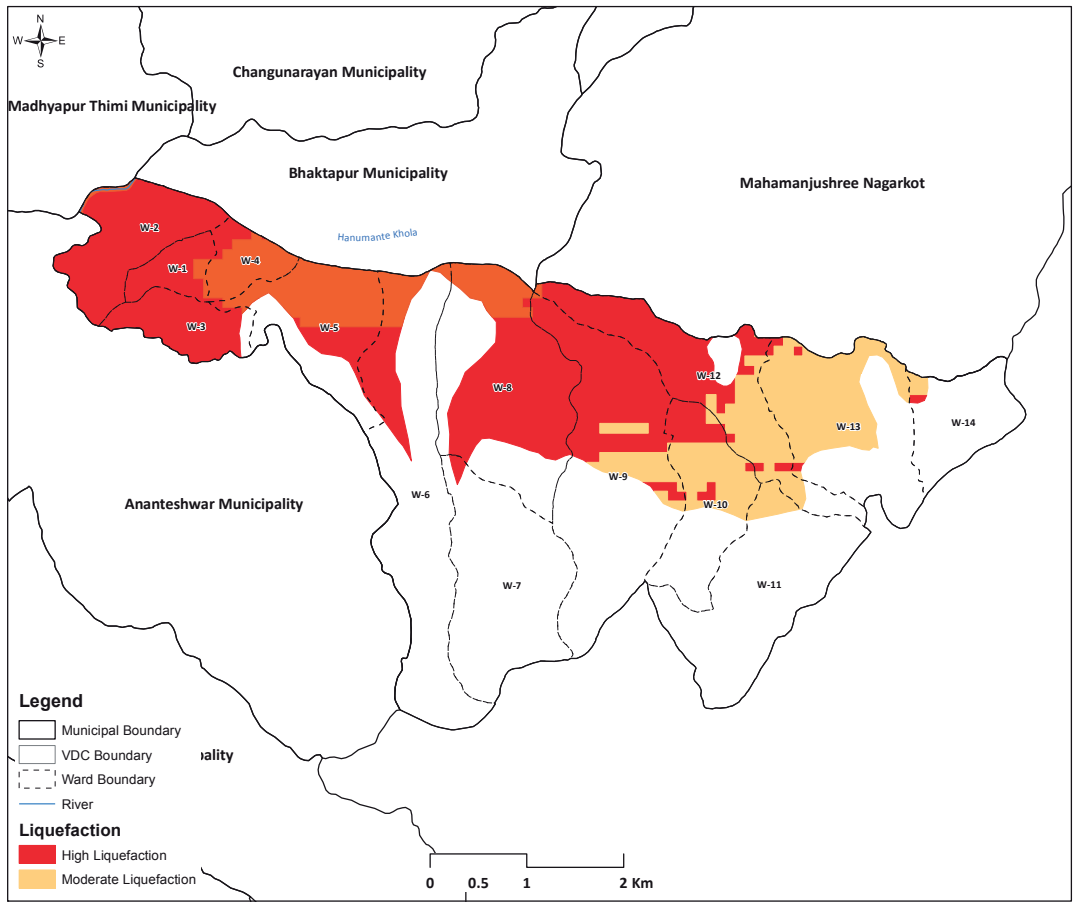
Landslide Susceptibility Map



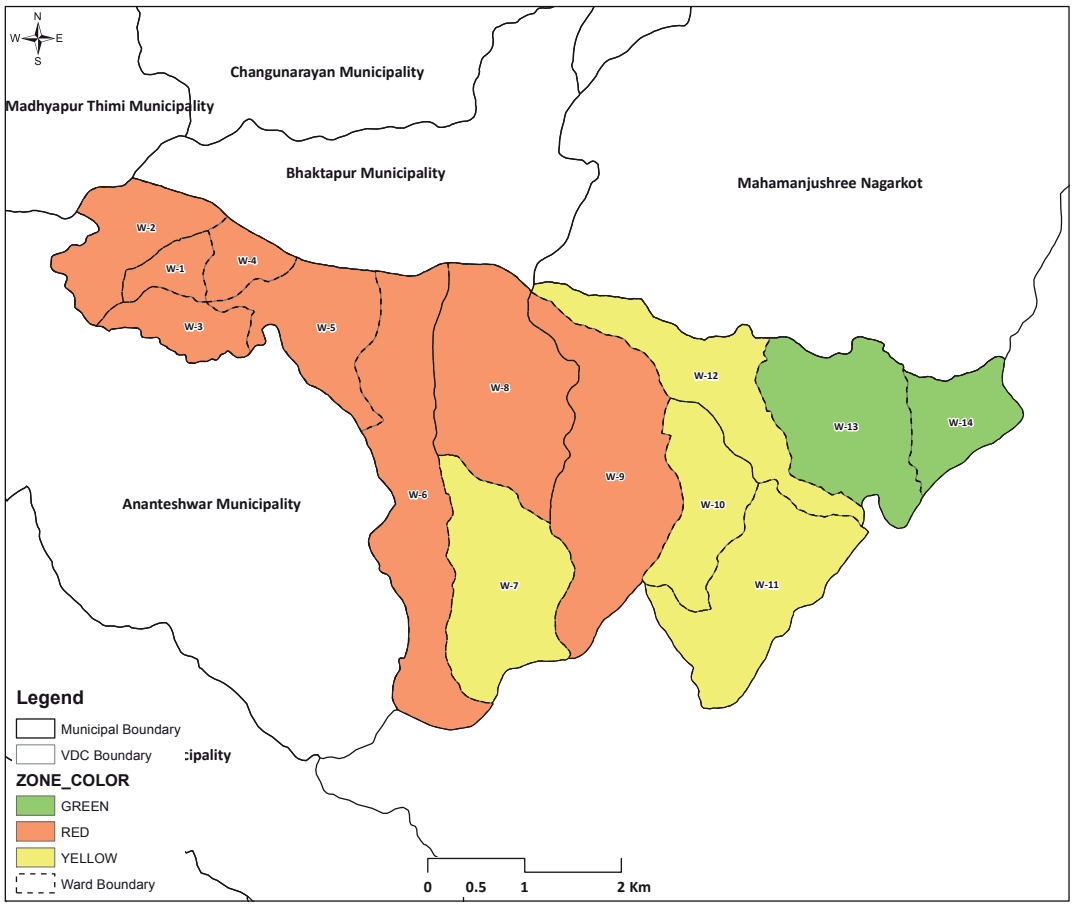
Slope Land Unsuitable For Development



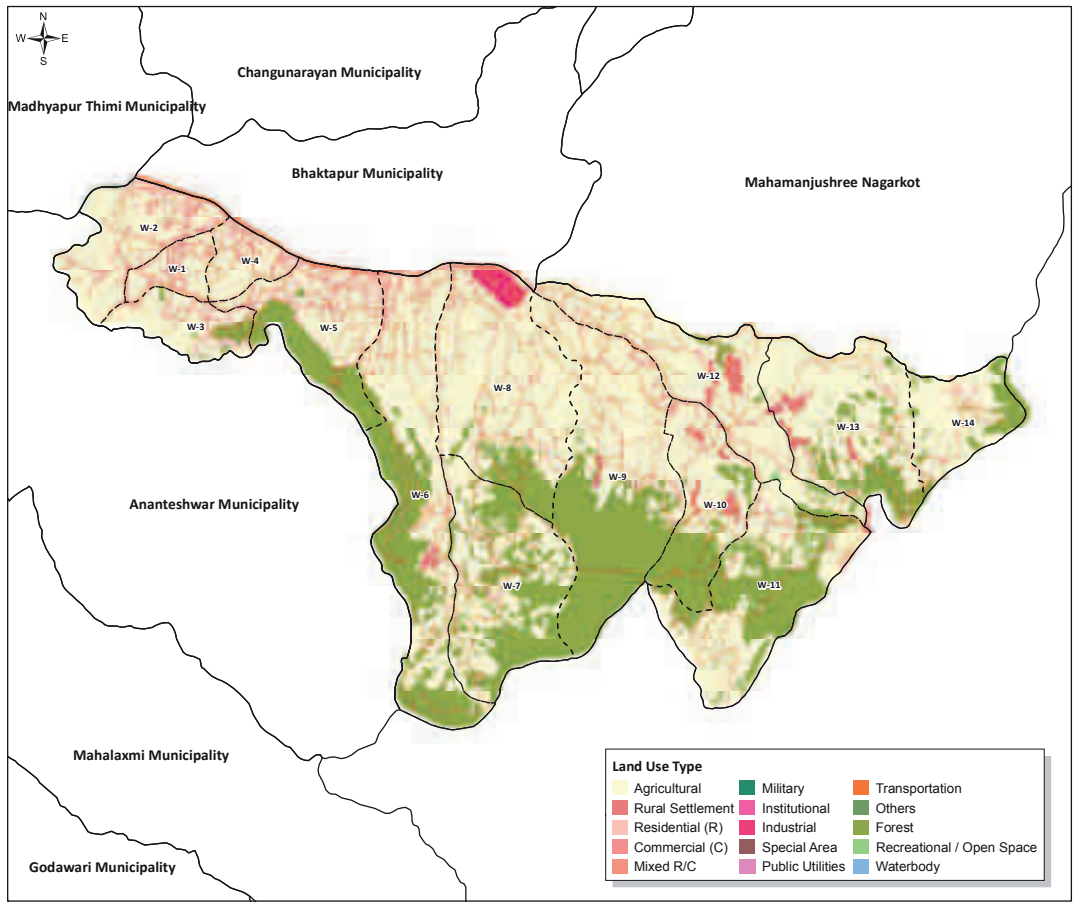
Flood Prone Areas And Water Recharge Area



Liquefaction Susceptible Area



Colour Zone Map Based On Development Constraints



Existing Land Use Map

Kathmandu Valley Development Authority

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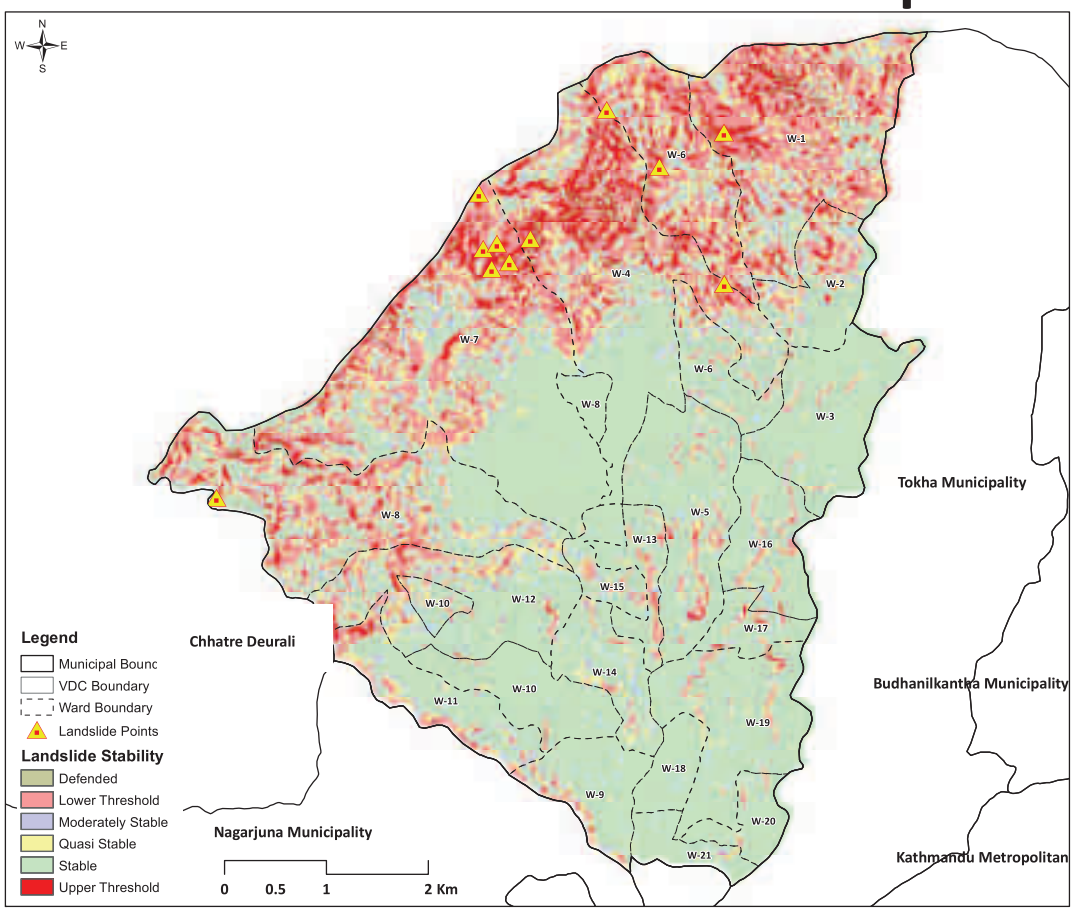
Hazard Risk Map Of Tarkeshwor Municipality



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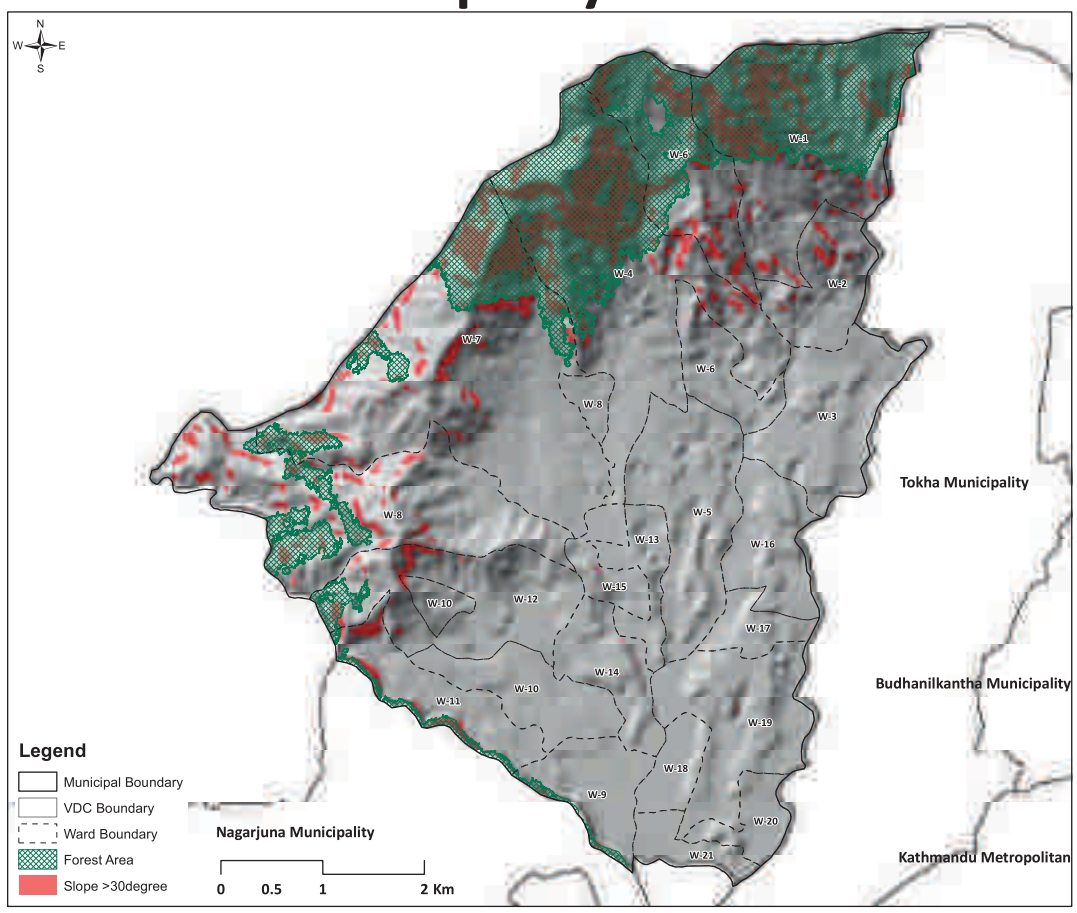

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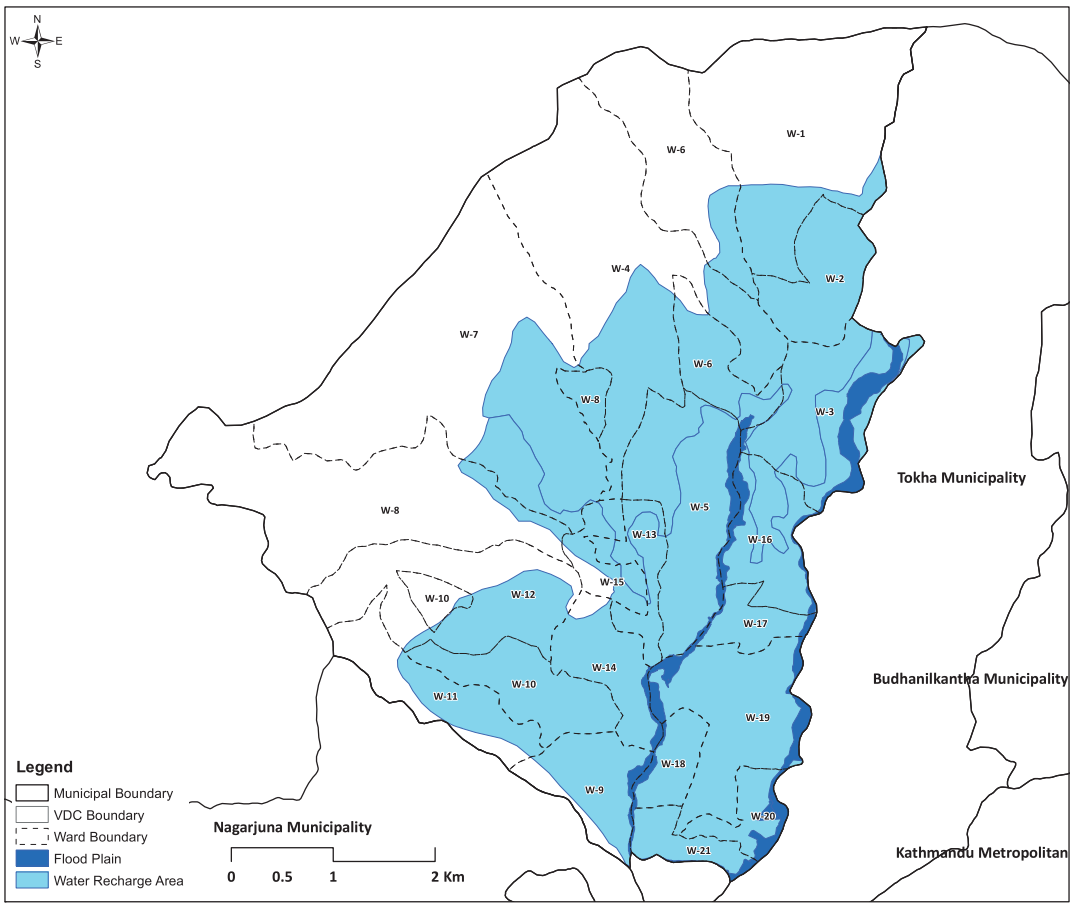
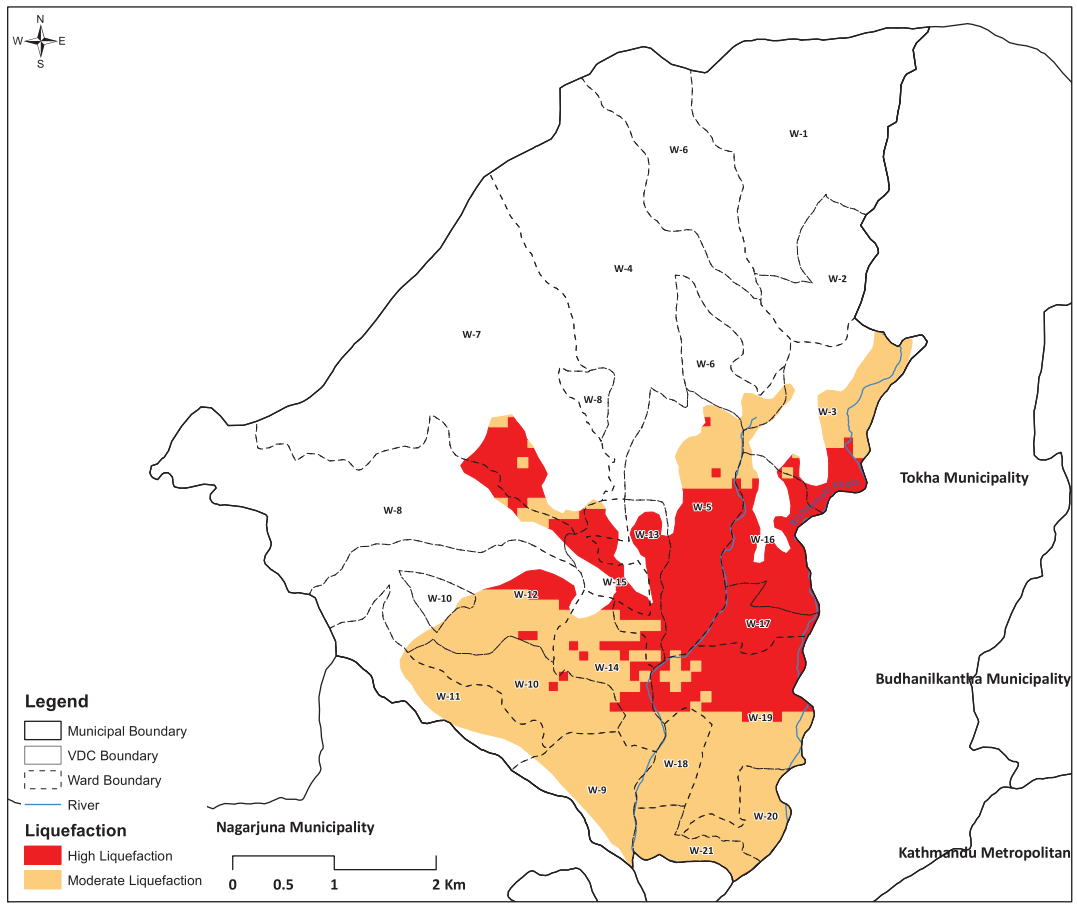


Flood Prone Areas And Water Recharge Area



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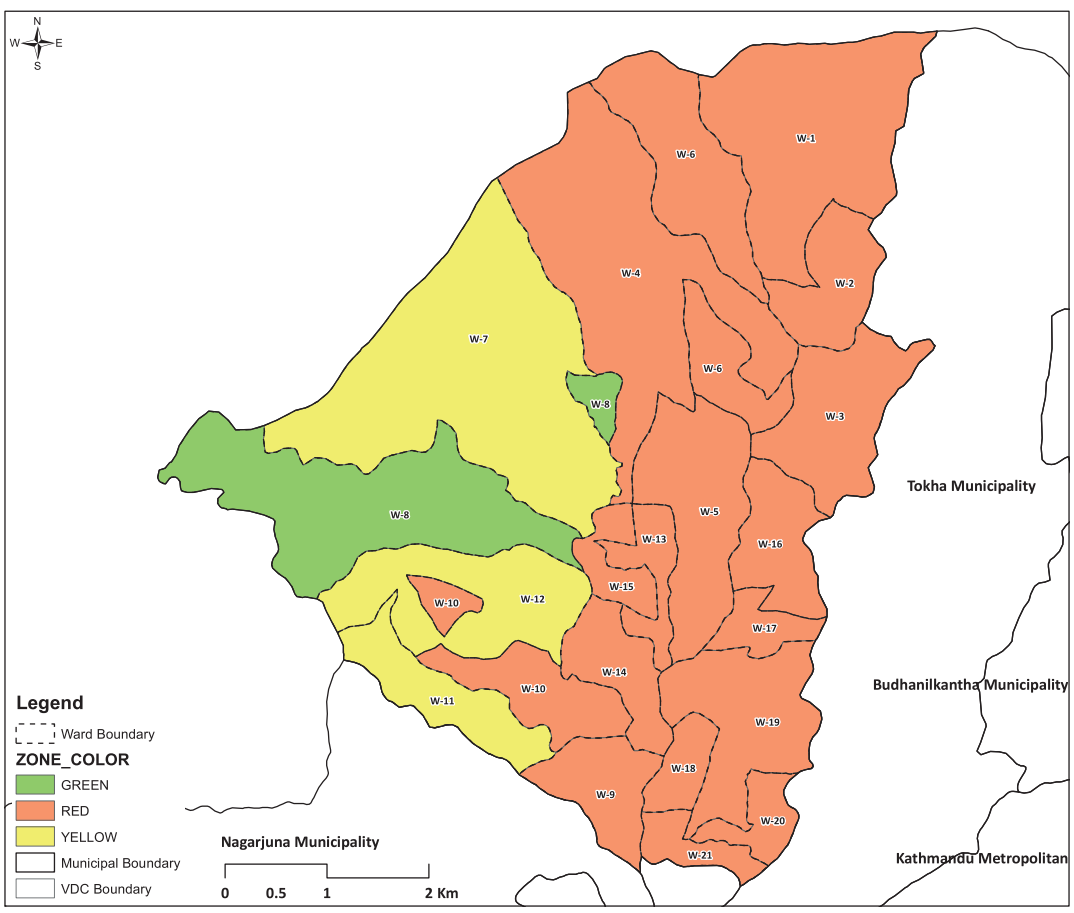

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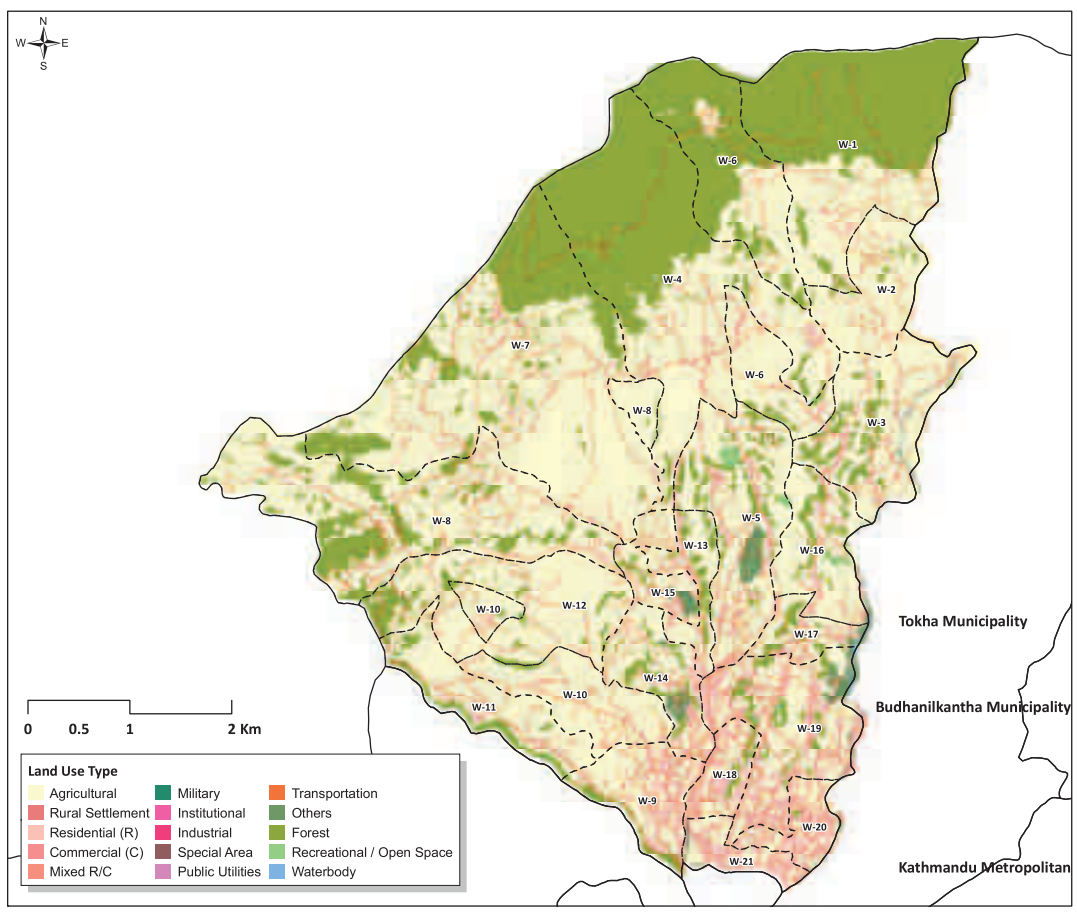

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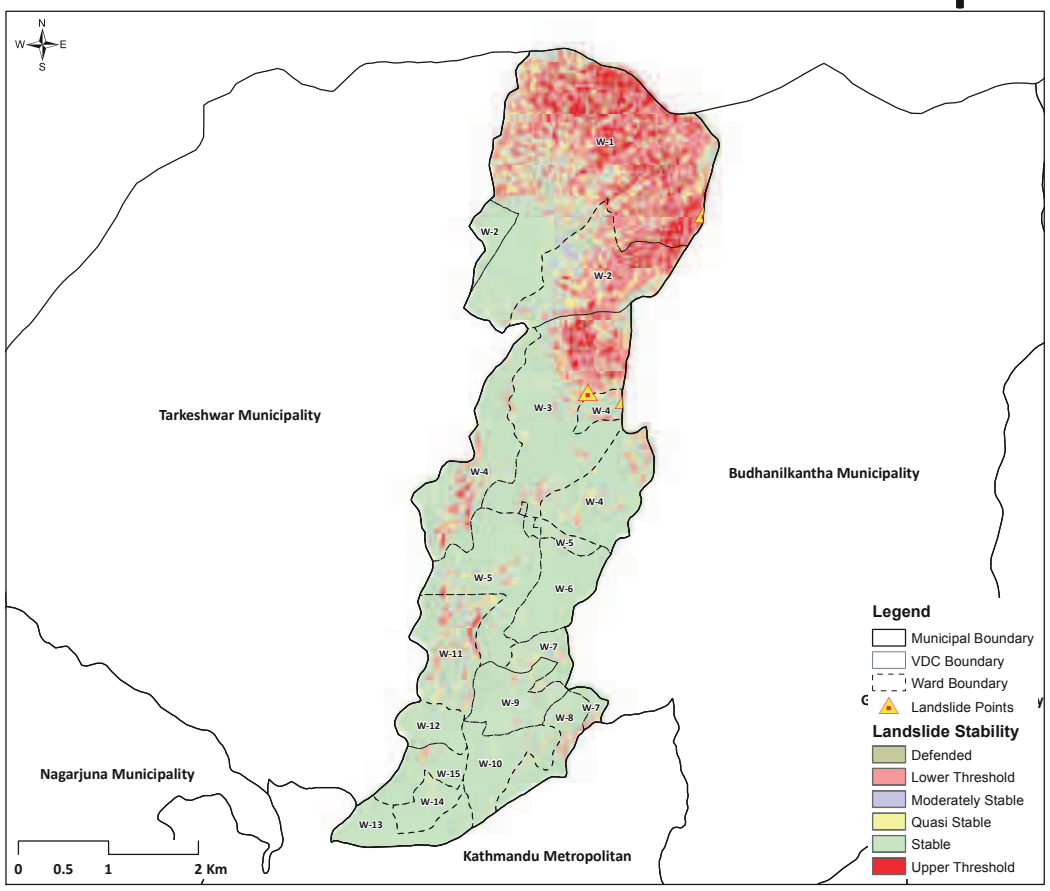
Hazard Risk Map Of Tokha Municipality



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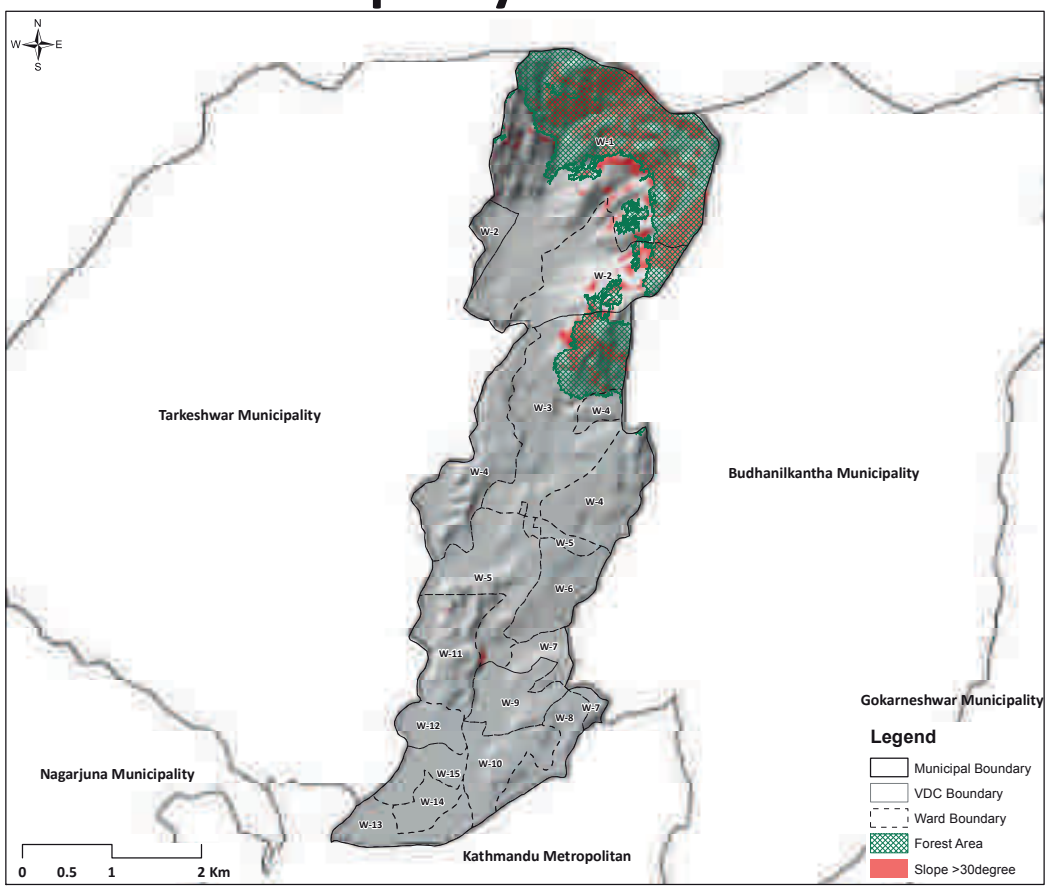

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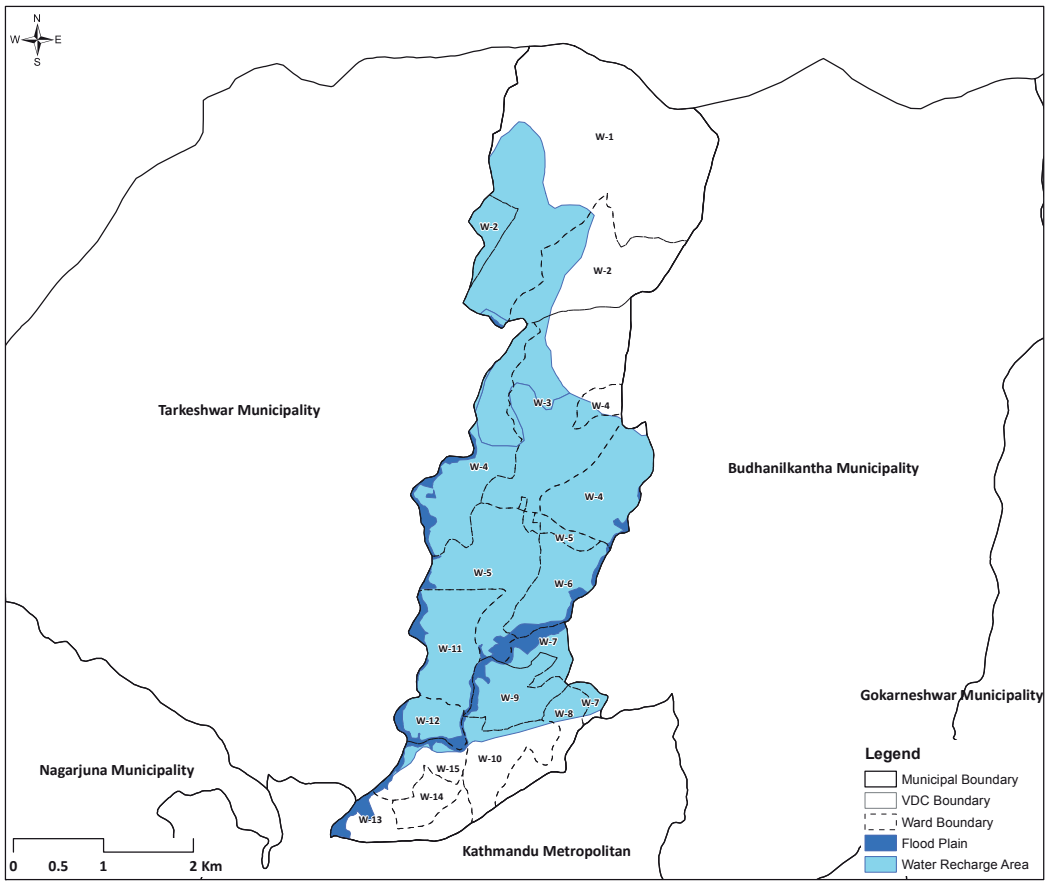

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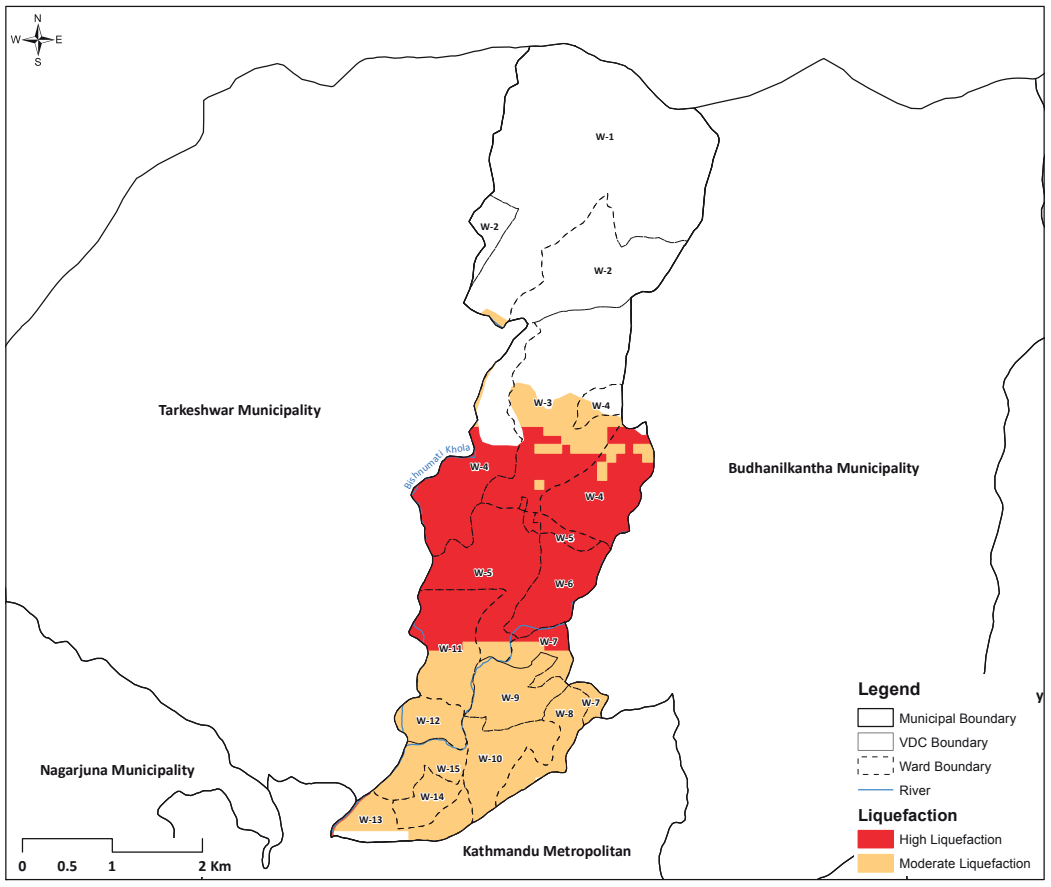

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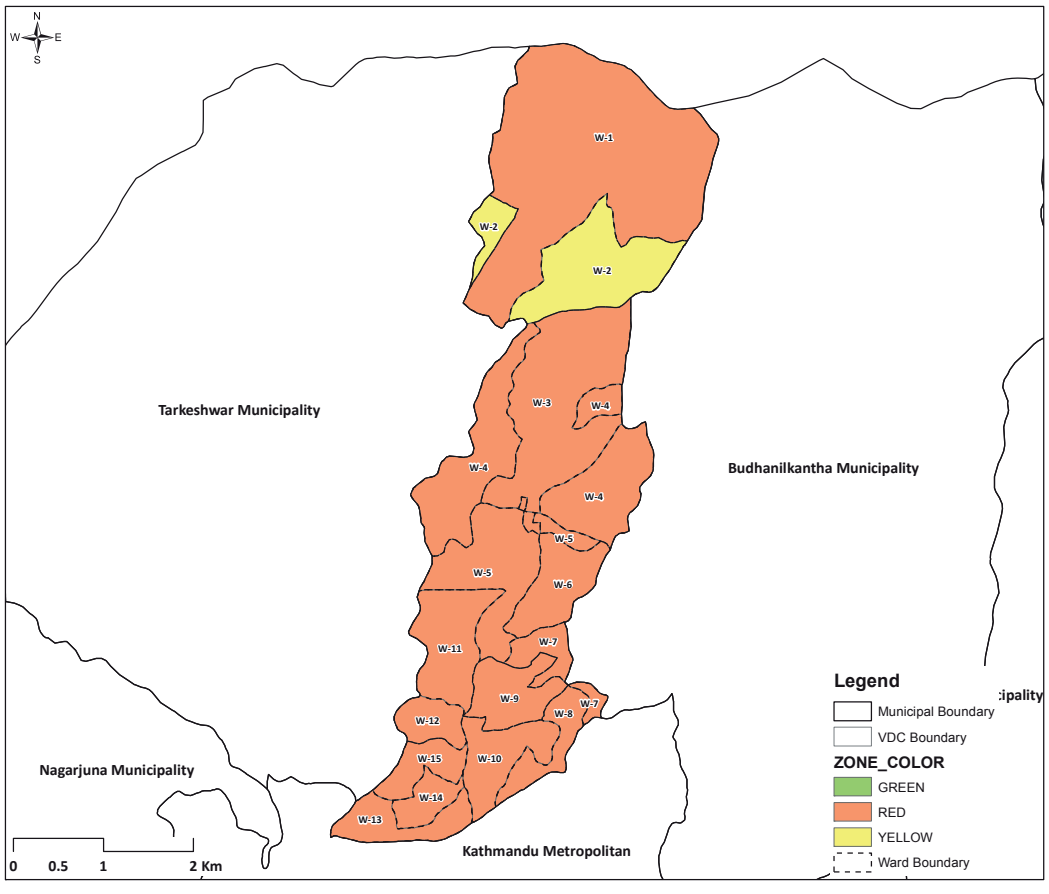

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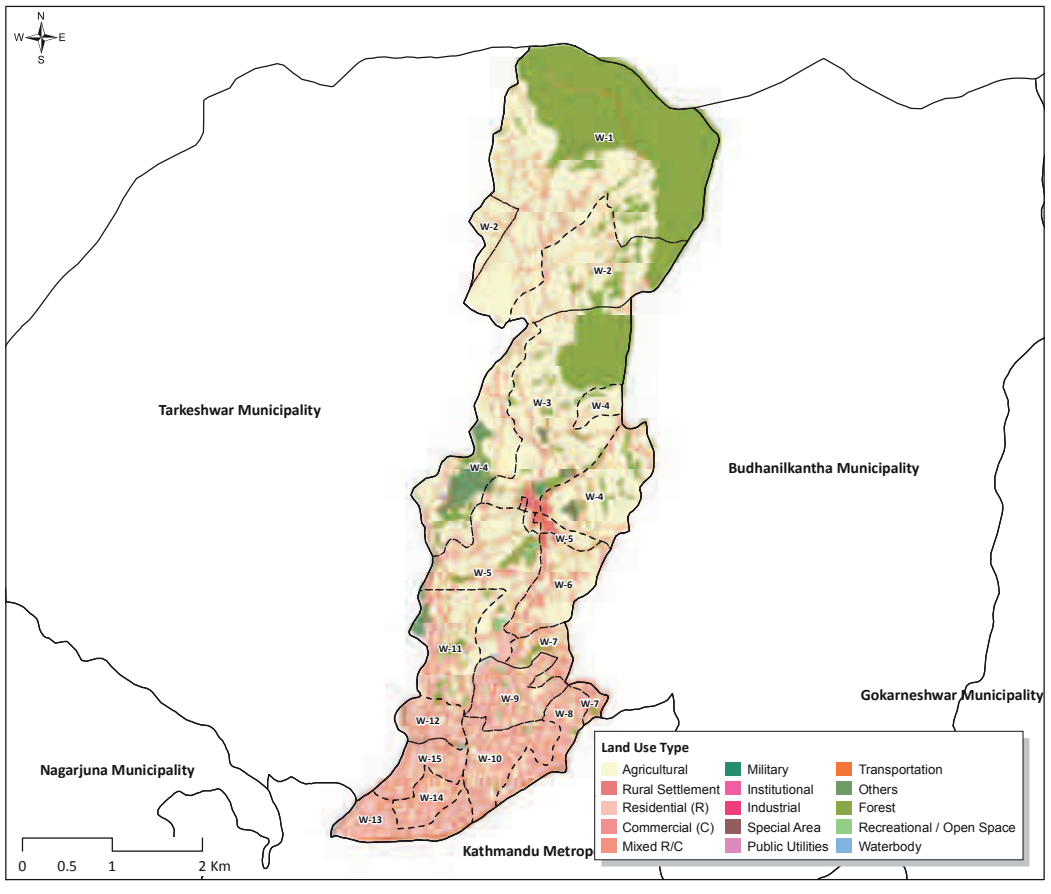

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United Nations Development Programme (UNDP), Nepal

Comprehensive Disaster Risk Management Programme

Support to Develop Risk Sensitive Land Use Plan (RSLUP) and Building Bye-Laws of Kathmandu Valley

(UNDP/RFP/013/2014)

Final Report

Kathmandu Valley Risk Sensitive Land Use Plan

December 2015

(Revised September 2016 incorporating the comments from KVDA Technical Advisory Group)

Acknowledgement

<to be inserted >

This report is an outcome of the study "Support to Develop Risk Sensitive Land Use Plan and Building Bye-Laws of Kathmandu Valley" under the assignment PISU/RFP/007/2012 undertaken for the Kathmandu Valley Development Authority (KVDA) and UNDP/Comprehensive Disaster Risk Management Program (UNDP/CDRMP) jointly undertaken by GENESIS Consultancy (P) Ltd, WELINK Consultants (P) Ltd., National Society for Earthquake Technology (NSET) in association with Multi-Disciplinary Consultants (P) Ltd. and Earthquake Safety Solution (ESS). The opinions, findings and conclusions expressed herein are those of the consultant/author(s) and do not reflect those of KVDA nor UNDP/CDRMP.

Abbreviations

BAU	Business-as-usual
BBL	Building Bye Law
BC	Building Code
BM	Bhaktapur Municipality
CANN	United Nation
CBS	Central Bureau of Statistics
CC	Climate Change
CDRMP	Comprehensive Disaster Risk Management Programme
CGS	Core Group Stakeholders
DDC	District Development Committee
DEM	Digital Elevation Model
DG	Director General
DHM	Department of Hydrology and Meteorology
DMG	Department of Mines and Geology
DoA	Department of Archaeology
DoLRM	Department of Land Reform and Management
DoR	Department of Roads
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
DUIDBC	Department of Urban Development and Building Construction
EMI	Earthquake in Megacities Initiative
EO	Executive Officers
ESS	Earthquake Safety Solution
FAR	Floor Area Ratio
GDP	Gross Domestic Product
GFDRR	Global Facility for Disaster Reduction and Recovery
GHG	Greenhouse Gas
GIS	Geographical Information System
GLOF	Glacial Lake Outburst Flood
GM	General Manager
GoN	Government of Nepal
Ha	Hectare (1 Ha = 10,000 m^2)
HFA	Hyogo Framework for Action
ICIMOD	International Centre for Integrated Mountain Development
IEC	Information, Education and Communication
INGO	International Non-Governmental Organization
IPCC	Inter-governmental Panel on Climate Change
JICA	Japanese International Cooperation Agency
km	kilometre (1km = 1,000 m)
KM	Kirtipur Municipality
KMC	Kathmandu Metropolitan City
KSUT	Kathmandu Sustainable Urban Transportation
KUKL	Kathmandu Upatyaka Khanepani Limited
KV	Kathmandu Valley
KV	Kathmandu Valley
KVDA	Kathmandu Valley Development Authority
KV-RSLUP	Kathmandu Valley-Risk Sensitive Land Use Planning
KVTDC	Kathmandu Valley Town Development Committee
LDO	Local Development Officer
LDRM	Local Disaster Risk Management
LPG	Liquid Petroleum Gas
LSGA	Local Self Governance Act
LSGR	Local Self Governance Regulations
LSMC	Lalitpur Sub-Metropolitan City
LTDCP	Long Term Development Concept Plan
MBT	Main Boundary Thrust
MCPM	Minimum Condition and Performance Measure
mld	Million liters per day
MMI	Modified Mercalli Intensity
MoF	Ministry of Finance
MoFALD	Ministry of Federal Affairs and Local Development
MoHA	Ministry of Home Affairs
MoLRM	Ministry of Land Reform and Management
MoPIT	Ministry of Physical Infrastructure and Transport
MoUD	Ministry of Urban Development
MTM	Madhyapur Thimi Municipality
NAPA	National Adaptation Plan of Action
NLFS	Nepal Labour Force Survey
NLSS	Nepal Living Standards Survey
NPR	Nepalese Rupees
NPT	Nepal Time
NRRC	Nepal Risk Reduction Consortium
NSC	National Seismological Center
NSDRM	National Strategy for Disaster Risk Management
NSET	National Society for Earthquake Technology
ODF	Open Defecation Free
PDNA	Post Disaster Needs Assessment
PGA	Peak Ground Acceleration
PPHA	Population Per Hectare
RC	Reinforced Concrete
RSLUP	Risk Sensitive Land Use Plan
RUPSON	Regional and Urban Planners' Society of Nepal
SAR	Synthetic Aperture Radar
SC	Steering Committee
SCOPE	Safe, Clean, Organized, Prosperous and Elegant
SDE	Senior Divisional Engineer
SDG	Sustainable Development Goals
SDMP	Strategic Development Master Plan
SINMAP	Stability Index Mapping)
SONA	Society of Nepalese Architects
TDR	Transfer of development rights
TIA	Tribhuvan International Airport
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
USGS	United States Geological Society
VDC	Village Development Committee
WC	Working Committee
WHO	World Health Organization
WS	Wider Stakeholders

Glossary of Terms

Acceptable risk
The level of potential losses that a society or community considers acceptable given existing social, economic, political, cultural, technical and environmental conditions.

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.

Adaptive capacity
The combination of the strengths, attributes, and resources available to an individual, community, society, or organization that can be used to prepare for and undertake actions to reduce adverse impacts, moderate harm, or exploit beneficial opportunities.

Anthropogenic
Resulting from or produced by human beings.

Anthropogenic emissions
Emissions of greenhouse gases, greenhouse gas precursors, and aerosols associated with human activities. These activities include the burning of fossil fuels, deforestation, land use changes, livestock, fertilization, etc. that result in a net increase in emissions.

Atmosphere
The gaseous envelope surrounding the Earth. The dry atmosphere consists almost entirely of nitrogen (78.1% volume mixing ratio) and oxygen (20.9% volume mixing ratio), together with a number of trace gases, such as argon (0.93% volume mixing ratio), helium, and radiatively active greenhouse gases such as carbon dioxide (0.035% volume mixing ratio) and ozone. In addition, the atmosphere contains the greenhouse gas water vapour, whose amounts are highly variable but typically around 1% volume mixing ratio. The atmosphere also contains clouds and aerosols.

Buffer
Land set aside for the purpose of separating land areas where uses are incompatible (e.g. vegetation separating residential development).

Building code
A set of ordinances or regulations and associated standards intended to control aspects of the design, construction, materials, alteration and occupancy of structures that are necessary to ensure human safety and welfare, including resistance to collapse and damage.

Capacity
The combination of all the strengths, attributes, and resources available to an individual, community, society, or organization, which can be used to achieve established goals.

Capacity Development
The process by which people, organizations and society systematically stimulate and develop their capacities over time to achieve social and economic goals, including through improvement of knowledge, skills, systems, and institutions.

Climate
Climate in a narrow sense is usually defined as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization. The relevant quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the climate system. In various chapters in this report different averaging periods, such as a period of 20 years, are also used.

Climate change
The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods".

Community-based disaster risk management
The process in which local actors (citizens, communities, government, non-profit organizations, institutions, and businesses) engage in and have ownership of the identification, analysis, evaluation, monitoring, and treatment of disaster risk and disasters, through measures that reduce or anticipate hazard, exposure, or vulnerability; transfer risk; improve disaster response and recovery; and promote an overall increase in capacities. LDRM normally requires coordination with and support from external actors at the regional, national, or international levels. Community-based disaster risk management is a subset of LDRM where community members and organizations are in the center of decision-making.

Critical facilities
The primary physical structures, technical facilities and systems which are socially, economically or operationally essential to the functioning of a society or community, both in routine circumstances and in the extreme circumstances of an emergency.

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 using its own resources.

Disaster management
Social processes for designing, implementing, and evaluating strategies, policies, and measures that promote and improve disaster preparedness, response, and recovery practices at different organizational and societal levels.

Disaster risk
The likelihood over a specified time period of severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to

widespread adverse human, material, economic, or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery.

Disaster risk management (DRM)
Processes for designing, implementing, and evaluating strategies, policies, and measures to improve the understanding of disaster risk, foster disaster risk reduction and transfer, and promote continuous improvement in disaster preparedness, response, and recovery practices, with the explicit purpose of increasing human security, well-being, quality of life, and sustainable development.

Disaster risk reduction (DRR)
Denotes both a policy goal or objective, and the strategic and instrumental measures employed for anticipating future disaster risk; reducing existing exposure, hazard, or vulnerability; and improving resilience.

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.

Easement
An easement is a non-possessory right to use and/or enter onto the land (real estate) property of another without possessing it.

Ecosystem services
The benefits that people and communities obtain from ecosystems.

Emergency management
The organization and management of resources and responsibilities for addressing all aspects of emergencies, in particular preparedness, response and initial recovery steps.

Emergency services
The set of specialized agencies that have specific responsibilities and objectives in serving and protecting people and property in emergency situations.

Environmental impact assessment
Process by which the environmental consequences of a proposed project or programme are evaluated, undertaken as an integral part of planning and decision-making processes with a view to limiting or reducing the adverse impacts of the project or programme.

Exposure
The presence of people; livelihoods; environmental services and resources; infrastructure; or economic, social, or cultural assets in places that could be adversely affected.

Flood
The overflowing of the normal confines of a stream or other body of water, or the accumulation of water over areas that are not normally submerged. Floods include river (fluvial) floods, flash floods, urban floods, pluvial floods, sewer floods, coastal floods, and glacial lake outburst floods.

Floodplain
A low lying area adjoining a watercourse, which is subject to periodic, semi or complete inundation. These areas typically accommodate the greatest volumes of water and fastest flow rates during flood events.

Geographic Information System (GIS)
A computer-based system whereby mapping and information are linked for a variety of uses, such as capturing spatial land uses and property data.

Governance
The way government is understood has changed in response to social, economic, and technological changes over recent decades. There is a corresponding shift from government defined strictly by the nation-state to a more inclusive concept of governance, recognizing the contributions of various levels of government (global, international, regional, local) and the roles of the private sector, of nongovernmental actors, and of civil society.

Hazard
The potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources.

Heritage Conservation Area
Areas of important architectural or historic interest, the character or appearance of which it is desirable to preserve or enhance. E.g. world heritage sites.

Impacts
Effects on natural and human systems. In this report, the term 'impacts' is used to refer to the effects on natural and human systems of physical events, of disasters, and of climate change.

Infill Development
Development that takes place on vacant or underutilised parcels of land within an area that is already defined by urban development and maintains access to urban services.

Infrastructure
The essential built facilities necessary to service the needs of a population in a given locality. Infrastructure may include roads, water and sewer systems, storm water drainage systems or footpaths, schools, health facilities etc.

Landslide
A mass of material that has moved downhill by gravity, often assisted by water when the material is saturated. The movement of soil, rock, or debris down a slope can occur rapidly, or may involve slow, gradual failure.

Land use and land use change

Land use refers to the total of arrangements, activities, and inputs undertaken in a certain land cover type (a set of human actions). The term land use is also used in the sense of the social and economic purposes for which land is managed (e.g., grazing, timber extraction, and conservation). Land use change refers to a change in the use or management of land by humans, which may lead to a change in land cover. Land cover and land use change may have an impact on the surface albedo, evapotranspiration, sources and sinks of greenhouse gases, or other properties of the climate system and may thus have radioactive forcing and/or other impacts on climate, locally or globally.

Mitigation (of disaster risk and disaster)
The lessening of the potential adverse impacts of physical hazards (including those that are human-induced) through actions that reduce hazard, exposure, and vulnerability.

Mitigation (of climate change)
A human intervention to reduce the sources or enhance the sinks of greenhouse gases.

Preparedness
The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions.

Prevention
The outright avoidance of adverse impacts of hazards and related disasters.

Projection
A projection is a potential future evolution of a quantity or set of quantities, often computed with the aid of a model. Projections are distinguished from predictions in order to emphasize that projections involve assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realized, and are therefore subject to substantial uncertainty.

Recovery
The restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors.

Resilience
The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions.

Response
The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected.

Retrofitting
Reinforcement or upgrading of existing structures to become more resistant and resilient to the damaging effects of hazards.

Return period
An estimate of the average time interval between occurrences of an event (e.g., flood or extreme rainfall) of (or below/above) a defined size or intensity.

Ribbon Development
Development, usually residential, extending along one or both sides of a road but not extended in depth.

Risk
The combination of the probability of an event and its negative consequences.

Risk assessment
A methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend.

Risk management
The systematic approach and practice of managing uncertainty to minimize potential harm and loss.

Risk transfer
The process of formally or informally shifting the financial consequences of particular risks from one party to another whereby a household, community, enterprise, or state authority will obtain resources from the other party after a disaster occurs, in exchange for ongoing or compensatory social or financial benefits provided to that other party.

Scenario
A plausible and often simplified description of how the future may develop based on a coherent and internally consistent set of assumptions about driving forces and key relationships. Scenarios may be derived from projections, but are often based on additional information from other sources, sometimes combined with a narrative storyline. See also Climate scenario and Emissions scenario.

Settlement Pattern
A settlement pattern describes the way in which populated areas are distributed and interrelated.

Sustainable Development
The Brundtland Report Our Common Future states: “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

Transfer of development rights (TDR)
Is the voluntary transfer of growth from unsuitable development areas (called sending areas) to places that are more suitable for development (called receiving areas). The sending areas can be environmentally-sensitive areas, open space, agricultural land, wildlife habitat, historic landmarks or any other places that are important for the society. The receiving areas should be places t are appropriate for extra development because they are close to social infrastructure, transportation and other urban services. (Source:Pruetz, AICP, 1999).

SECTION 1

BACKGROUND FOR RSLUP IN KATHMANDU VALLEY

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1. Introduction

1.1. Project Background

Under the auspices of *Kathmandu Valley Development Authority (KVDA*) with the support of UNDP's *Comprehensive Disaster Risk Management Programme (CDRMP),* this study and planning initiative entitled *"Support to Develop Risk Sensitive Land Use Plan and Building Bye Laws of Kathmandu Valley"* is aimed to develop a comprehensive land use plans of the Kathmandu Valley (KV) and its administrative sub-units viz. the municipalities and erstwhile VDCs[1] with due consideration of multi-hazard risk sensitivity and climate change stimuli. The envisioned land use plan will be based on evidences of current urbanization scenarios of the KV, multi-hazard risk probability in the KV and will be aligned with the National Land Use Policy 2012, National Urban Development Strategy 2015, recent Long Term Development Concept Plan 2035 and the 20 Years Strategic Development Master Plan 2015-2035 developed by the KVDA.

The envisioned Risk Sensitive Land Use Plan (RSLUP) proposes mainstreaming of risk reduction strategies and their implementation actions at two levels of planning implementations viz. at the Kathmandu Valley level as a single planning unit, to be implemented by the KVDA as an authority for planning, developing, monitoring and regulating/prohibiting in coordination and cooperation with wider stakeholders; and at the municipalities/VDCs levels as an administrative units, to be implemented by the respective local bodies through consultative participation of the local stakeholders. The RSLUP takes strategic approaches essentially to reduce the exposure and vulnerabilities to risks through non-structural approaches that identifies the safest locations for prioritizing investments in urban and infrastructure development (Jha, Miner, and Stanton-Geddes 2013). Land use plans are implemented not only to mitigate the risks but also for optimum economic use of land through a combination of regulations and incentives for private sector and communities.

This development of RSLUP is built upon the previous UNDP/CDRMP supported study that developed a comprehensive set of information and evidence base under the study named "Comprehensive Study of Urban Growth and Forecasting of Land Use in the Kathmandu Valley" during 2012-2103. The study developed comprehensive set of spatial information and analysed on land use change trends and its driving factors, multi-hazard scenarios and vulnerabilities, future land use projections based on business-as-usual, The analysis thus made was instrumental in revising LTDCP-2020 prepared in 2002 by KVDA (then KVTDC) and shaping 20 years Strategic Development Master Plan (SDMP) for KV (2015-2035). SDMP aims to address issues of urban growth with a vision "**To establish Kathmandu Valley as Safe, Clean, Organized, Prosperous and Elegant (SCOPE) National Capital**".

1.2. Scope of Work, Outcomes and Activities

The overall objective of the initiative is to **"Contribute to risk resilience development of Kathmandu Valley through development and enforcement of Risk Sensitive land Use Plan and Building Byelaws."**

Under this overall objective, following four interrelated objectives and their outcomes have been defined and developed under this assignment:

Outcome 1: Development of a Comprehensive RSLUP of KV
Under this scope, a comprehensive Kathmandu Valley wide Risk Sensitive Land Use Plan has been prepared at the Macro Level, covering the plan for the valley and incorporating plan for legal and institutional arrangements, implementation strategies, implementation action plans and guidelines, tools and mechanisms including zonings, densification and de-densification tools, taxation and exaction regulations, horizontal and vertical development regulations, framework for major infrastructure and buildings development, conservation strategies and regulations and others. To achieve this outcome, following activities have been undertaken with defined outputs presented as analysis, maps and macro level recommendations.

Sub Components and Activities
Sub –Component 1.1 Assessment of Multi-Hazard, vulnerability and risk estimation
1.Secondary Data, Report, maps collection
2.Hazard Assessment
3.Vulnerability/Risk Assessment
4.Evaluation of Emergency Management System
Sub –Component 1.2 Mainstreaming and Stakeholders Engagement
5.Stakeholders consultations and engagement
6.Institutionalization
7.Awareness and educational campaigns and explaining the risk information
Sub –Component 1.3 Risk-Sensitive Land Use Planning
8.Setting KV RSLUP vision, mission, goals, objectives, strategies and tactics
9.Develop alternative risk-sensitive land use plans
10.Identify/finalize preferred/optimal risk-sensitive land use plan
Sub –Component 1.4 Develop and Adopt Risk-Sensitive Land Use Plan Implementation Strategy
11.Legal and Institutional Framework Analysis
12.Development of RSLUP implementation strategy and strategic action plan
13.Consensus building for implementation among all stakeholders

Outcome 2: Development of Municipal/VDC Level RSLUP

[1] Kathmandu Valley had 5 municipalities and 94 VDCs in three districts before the GoN's declaration of 72 new municipalities on 8 May 2014. GoN further declared 61 new municipalities on 2 December 2014 and 26 more municipalities later on 16 September 2015 through the cabinet decision. There are 217 municipalities throughout Nepal and 22 within the Kathmandu Valley. During the initiation of the development of KV-RSLUP, there were 5 municipalities in the KV, which increased to 21 during the draft phase of this study with an additional Bajrabarahi Municipality during the completion phase of this study. This study has therefore addressed only 21 municipal regions in the KV.

Under this objective, Micro Level Planning incorporating the plans for the municipalities and the VDCs at the district levels will be prepared with inclusion of institutional mechanisms, implementation action plan, tools and mechanisms and bye-laws.

Sub Components and Activities
Sub –Component 2.1 Micro level Hazard and Risk Assessment
14.Local level Hazard Assessment
15.Local level Vulnerability/Risk Assessment
16.Local level Emergency Management
Sub –Component 2.2 Translation/adaptation/detailing of KV RSLUP in local context
17.Detail RSLUP at local level
Sub –Component 2.3 Local level RSLUP Framework
18.Guideline for Disaster Risk Assessment and update at local level
19.Guideline for updating and improvement of local level RSLUP
20.Guideline and generic action plan for implementation of RSLUP at local level
Sub –Component 2.4 Policy and Implementation Guideline
21.Legal and Institutional Framework at local level
22.Local RSLUP implementation strategy and action plan

Outcome 3: Revise/Update Existing Building Bye-Laws

To support effective implementations of macro KV-RSLUP and municipal/VDCs micro RSLUP, bye-laws have been prepared to entail the implementation and enforcement of zoning plan regulations, density regulations, land use change regulations, building use change regulations, ground coverage and Floor Area Ration (FAR) regulations, development right regulations, large lot zoning, infrastructure development zoning, special service area zoning, land use/vacant land taxation and exaction regulations etc. Under this outcome, following activities have been undertaken:

Sub Components and Activities
Sub –Component 3.1 Develop Effective Organizational Structure of Building Bye Laws
23.Review of recent update of building Bye-laws
24.Review of the problems and Issues identified by recent studies
25.Comparative Study of Building Bye Laws (national, regional and International)
26.Identify Structural Needs of Building Bye Laws for Nepal/Kathmandu Valley with
27.Identify Gaps in Existing Bye Laws
28.Derive Bye Law Tools to implement zonal and Local Level Plans
29.Consultation with stakeholders
Sub –Component 3.2 Incorporating Building Code Requirements in the Building Bye Law Structure
30.Review of recent update of Building Codes
31.Review of recommendation of Building Code Updating and incorporation of family of Codes
32.Review the problems and Issues on interrelation of BBL and BC
33.Establish Interrelation of Building Byelaws and Building Codes
34.Establish Quality Standards of Compliance to the requirement of Building Bye-Laws and Building Codes
35.Identify Pilot Areas for testing of the proposed Building Bye Laws
36.Analyse Socio-economic and environmental impact of the proposed Building Bye Laws
37.Establish unified Procedural mechanism for undertaking building permit, certification and Technical auditing
38.Establish Peer review Mechanism of certifying compliance to requirement of Building Bye-Laws and Building Codes as part of Building Bye-Laws
39.Establish mechanism for verification for compliance with Family of Codes such as Fire, Environmental, Water Supply and Sanitation, Structural/earthquake Safety, Electrical safety, Internal Ambience, Vernacular Aesthetics and Heritage, high rise and low
40.Prepare recommendation
41.Consultation with stakeholders
Sub –Component 3.3 Develop Local Area Plans and Building Bye Laws for disaggregated and identified Local Areas based on Zonal Plan and Building Code Compliance requirement
42.Incorporate the zoning plan requirements into the Building Bye Laws
43.Monitoring compliance to Risk Sensitive Land Use Plan in the Building Bye Laws for zoning plan and local area development plan
44.Develop Building Bye Laws for each zoning categories
45.Develop Building Bye Laws for each of the Local Area categories
46.Develop Building Bye Laws for each of Building and service categories
47.Develop Building Bye Laws for each of Infrastructure and service categories
48.Develop Land Use Taxation Policy and Fees for Building code Implementation
49.Record of Implementation and collection of feed back
50.Approach to Periodic Review and Updating Bye laws
51.Approach Life cycle monitoring for compliance to RSLUP, BBL and BC
52.Consultation with concerned stakeholders, working
Sub –Component 3.4 Review for Policy Gaps and Develop Policy Reform and Implementation Guidelines
53.Review Existing Policy and Implementation Guidelines governing the Building Bye Laws
54.Review Building Act 2011
55.Identify Gaps in Policy and Implementation Guidelines
56.Identify the implication of Climate Change impact in the Policy reform requirements
57.Prepare approach for reform of Policy and implementation Guidelines
58.Prepare proposal for Policy Reform and Implementation Guidelines
59.Prepare Tax reform policy
60.Consultation with stakeholders
61.Prepare Recommendation
Sub –Component 3.5 Develop Institutional Set Up, Roles and Responsibilities, Monitoring and Evaluation
62.Develop Various Institutional Models capable to undertake the Building Bye Laws Implementation, Monitoring and Evaluation

63.Review existing institutional setup related to the implementation of Building Bye Laws
64.Review existing institutional setup responsible for monitoring the implementation of Building Bye Laws and deriving lessons learnt
65.Identify the conflict of interest areas between KVDA, municipalities and VDC
66.Identify the conflict of interest between MoUD and MoFALD
67.Identify capacity gap of existing Institutional setup
68.Propose alternative institutional models that would be effective in Implementation of proposed Bye Laws for selected areas
69.Prepare Roles and Responsibilities of stakeholder institutions
70.Analyse financial implications of proposed models
71.Share with stakeholders and steering committee
72.Recommend final preference

Outcome 4: Enhancing Capacities of Stakeholders on RSLUP and Bye-Laws Implementation

To institutionalize the RSLUP concept, its effective implementation and monitoring, replication in other areas, extensive capacity building initiatives will be undertaken. RSLUP training curricula will be developed and approved along with training materials. Two levels of trainings will be imparted as i) Training for trainers (30 personnel) and ii) Training for planners and engineers (90 personnel)

Sub Components and Activities
Sub –Component 4.1 Development of RSLUP Training Curriculum
73.Training need analysis
Sub –Component 4.2 Develop Training Curricula and Strategies
74.Training Curricula
75.Training implementation strategies
Sub –Component 4.3 Conduct Trainings
76.TOT
77.Final Trainings

1.3. Change in Project Implementation Environment

Upon recommendation of Ministry of Federal Affairs and Local Development (MoFALD), the government announced 159 new municipalities in three stages from May 2014 to September 2015. The total number of municipalities are 217, including the existing 58 municipalities. Kathmandu and Bhaktapur District no longer have VDCs and Lalitpur district is left with four VDCs within the boundary of the valley; the total number of municipalities in the KV is now 22. The four remaining VDCs are Devichaur, Ghusel, Nallu and Bhardeu VDCs in the southern regions of Lalitpur District.

This decision of government is expected to implicate the project implementation environment. The study and presentation of the maps and reports is now based on new spatial formation of these newly designated municipalities (21 municipalities[1]). Similarly, the training curricula and programs is also developed accordingly. Since, the declaration of these municipalities has been made very recently, it may take several months for them to become functional. Further the 25 April 2015 Earthquake has delayed any formal planning function in these municipal bodies. A decision on the procedural approach has to be taken by KVDA and UNDP in this regards.

Figure 1 Twenty-two municipalities in Kathmandu Valley

[1] Bajrabarahi municipality was declared during the project completion phase, and therefore has not been included exclusively in the preparation of KV macro and micro RSLUPs.

2. Project Implementation Mechanism

2.1. Steering Committee

A multi-stakeholder Kathmandu Valley-Risk Sensitive Land Use Planning (KV-RSLUP) Steering Committee (SC) has been proposed to be formed under the Chairmanship of KVDA Development Commissioner. The function of the SC will be to guide the study team in developing the KV-RSLUP and review the developed KV-RSLUP and bye-laws for further refinement and recommendation for endorsement. Understandably, this Steering Committee will continue functioning even after the project with a role to oversee and monitor the implementation of the developed KV-RSLUP. The SC is proposed to consist of the following members:

Table 1 Preliminary structure of Steering Committee

SN	Designation	Position/Organization
1	Chairperson	Development Commissioner, KVDA
2	Member	Joint Secretary, MoUD/Physical Planning and Urban Development Division
3	Member	Joint Secretary, MoFALD/Municipal Management Division
4	Member	Joint Secretary, MoPIT/Construction and Transportation Division
5	Member	Joint Secretary, MoLRM/Land Administration Division
6	Member	Joint Secretary, MoHA/ Disaster Management Division
7	Member	Director General, DUDBC
8	Member	Director General, DoR
9	Member	Director General, DoLRM
10	Member	General Manager, KUKL
11	Member	Executive Officer, Kathmandu Metropolitan City
12	Member	Executive Officer, Lalitpur Sub Metropolitan City
13	Member	Executive Officer, Bhaktapur Municipality
14	Member	Executive Officer, Madhyapur Thimi Municipality
15	Member	Executive Officer, Kirtipur Municipality
16	Member	Local Development Officer, Kathmandu
17	Member	Local Development Officer, Lalitpur
18	Member	Local Development Officer, Bhaktapur
19	Member	Representative, RUPSON
20	Member	Representative, Institute of Engineering/Dept. of Architecture and Urban Planning
21	Member	Project Director, MoLRM/National Land Use Project
21	Member	Program Manager, UNDP/CDRMP
22	Member	RSLUP Project Team Leader/Co-Team Leader/Coordinator
23	Member Secretary	Designated RSLUP Project Coordinator, KVDA
25	Invitees	As deemed necessary and approved by the Chairman

The SC is the apex body steering the project and was initially proposed to meet quarterly and in as-and-when needed basis upon the call from the Chairman. The SC will have following roles and responsibilities:

- Policy setting, planning, coordination, implementation, monitoring and supervision of the overall project
- Approval of strategies, guidelines, implementation plans required for the KV-RSLUP development and implementation
- Resolving any issues during KV-RSLUP development and piloting, facilitation with related GoN line agencies/organizations
- Formation and approval of Working Committees (WCs) and its members
- Coordinate and guide the Working Committees (WCs) to take necessary actions to facilitate the development and implementation of the KV-RSLUP and to endorse the decisions and guidance by the WGs.

These functions of the SC are stipulated for the duration of the entire project and will need to be revised upon the completion of the project, such that the SC will continue to exercise its function and authority in the implementation phases of the KV-RSLUP. The Chairperson of the SC will have interim authority to take necessary and urgent decisions recommended by the WCs and endorsed by the SC to ensure smooth running of the project and its effective implementation.

Terms of References for the Chairman, members and member secretary of the SC will need to be developed and approved by the KVDA. The SC was proposed to be formulated during the 2nd and third week of December 2014 (8-19 December 2014) so that the first SC meeting could be conducted by the end of December 2014 to approve the terms of references, formation of the WCs and its member's appointment. However, due to various issues including the existence of similar SC for the coordination of ongoing Kathmandu Sustainable Urban Transportation (KSUT) and Transportation Master Plan projects, a separate SC was not formed in discussion with the KVDA. It was also discussed to revise the scope of works of the existing SC to include coordination of KV-RSLUP development works. A Working Group on Land Use and Urban Development (WG1) under the same SC was designated to oversee and coordinate the KV-RSLUP study development works. Further, the declaration of 17 new municipalities and delay in their internal processes to form technical bodies caused delay in field visits and had consequential effect on delivery time. The earthquake of April 25 and series of aftershocks that prolonged for a couple of months also pushed back the schedule significantly.

However, during the development of this draft RSLUP document, formal Steering Committee was not formed. Guidance and instructions were directly received from the Development Commissioner, KVDA on the way forward and development of KV-RSLUP. Several technical meetings were conducted on the chairmanship of the Development Commissioner for guiding the RSLUP development and coordination with other planning initiatives from the KVDA.KVDA planners were also directly involved in preparation of the KV-RSLUP under the guidance of the Development Commissioner.

Formation of a new SC or direct coordination by the existing SC is strongly advised to review this draft KV-RSLUP document and the building bye-laws. Coordination with the KVDA will be done during the draft phase of the KV-RSLUP and bye-laws to formulate new SC or designate existing SC with the scope of reviewing and endorsement of the developed RSLUP documents.

2.2. Working Committee

Working Committees' (WCs) proposed to bear responsibilities to guide and facilitate the project team to develop municipal and VDCs RSLUPs in effective and inclusive manner. Eight WCs was proposed to work under the SC and chaired by the leadership of the municipalities and District Development Committees (DDCs). Respective Executive Officers (EOs) (members of SC) of five municipalities was proposed to chair five municipal WCs and respective Local Development Officers (LDOs) of three districts to chair

the district WCs with the authorization of the KVDA. In case of the municipalities, to avoid the conflict of interests and opinions between the EOs and district LDOs, the three district WCs chaired by the LDOs was proposed to guide RSLUPs prepared at respective district levels to address the VDCs.

The WCs chairperson (EOs and LDOs) appoints the public representative members of the WCs and the KVDA to appoint its district representatives as the members. Other line agencies appoints their respective representatives as the members of WCs upon the request of the KVDA. The SC approves the appointment of the WCs and its members. The WCs was initially planned to be formed by the end of third week of December 2014, such that the WCs will be approved by the SC by the end of December in the first SC meeting. Each municipal/VDC WCs was proposed to consist of the following members:

Table 2 Preliminary structure of Working Committees

SN	Designation	Position/Organization
1	Chairperson	EOs of 5 Municipalities/LDOs of 3 districts
2	Member	Respective KVDA District Commissioners
3	Member	SDE, DUDBC Division Offices
4	Member	SDE, DoR Division Offices
5	Member	Appointed representative of Civic Society
6	Member	Appointed representative of NGO/CBO working in environment, land management, DRM/DRR sectors
7	Member	Representative, District Land Reform Offices
8	Member	Representative, KUKL
9	Member	Project Officer, UNDP/CDRMP
10	Member	RSLUP Project Team Leader/Co-Team Leader/Coordinator
11	Member Secretary	Designated Engineer/Planner, Urban Development/Planning /Physical Development Division/Section of the Municipalities/DDCs
12	Invitees	As deemed necessary and approved by the Chairperson

The WCs are the technical advisory committee's facilitating and guiding the development of municipal and VDC level RSLUPs. Any local issues will be resolved by the facilitation of the WCs during the preparation of the Micro Level RSLUPs. The WCs will have following roles and responsibilities:

- Guide, facilitate and support the KV-RSLUP team for formulation of Micro level Municipal/VDC RSLUPs, bye-laws and implementation guideline
- Review and recommendations for the Micro level Municipal/VDC RSLUPs
- Review and recommendation on KV-RSLUP and Bye Law
- Approval of strategies, guidelines, implementation plans required for the micro level Municipal/VDC RSLUP development and implementation
- Resolving any issues during Micro level RSLUP development and piloting, facilitation with related GoN line agencies/organizations, local communities etc.
- Facilitate communication and coordination with local communities and organization during field studies, consultation meetings, focus group/key informant meetings etc.

The WCs meetings has been proposed to convene prior to every planned SC meetings to formulate any agendas to be resolved by the SC and in between the SC meetings in as-and-when required basis to guide and channelize the Micro Level RSLUPs.

Similarly, formulation of WGs and proposed working timeline could not be fulfilled due to disruption after the April 25 Earthquake. Only four meetings at the municipal levels could be held just prior to the earthquake. Further meetings WG will be held during the finalization of Micro RSLUP's and preparation of Bye-Law during the months of September-October 2015.

2.3. Participatory Planning Approach

The project intends to undertake its works in developing macro and micro level RSLUPs, bye-laws and pilot in a selected area through implementing participatory and inclusive approach. Two groups of stakeholders are identified (stipulated in the ToR of the project) *viz.* core group stakeholders and wider stakeholders.

2.3.1. Core Group Stakeholders

The Core Group Stakeholders (CGS) consist of the expert representatives of the stakeholder organizations, individual experts, academia and technical representatives of professional and civil societies. The participating members of the core group stakeholders will be identified through the consultation and coordination by the KVDA. The main function of the CGS will be as hereunder:

- Technical inputs to the consulting team and WGs sat various stages of the RSLUP development process
- Technical backstopping as-and-when required

Inputs from the CGS will be acquired through interview/consultations, dialogue, advocacy, focus group meeting, dissemination workshops etc. These events will be planned and coordinated with the KVDA and CDRMP in as-and-when needed basis. A preliminary list of the CGS and planned activities is presented in *Chapter 4*.

2.3.2. Wider Stakeholders

Wider Stakeholders (WSs) will consist of representatives of local bodies, civil societies, official media, development partners, implementing partners, financial institutions, regulating agencies, political representation, advocacy groups etc. who will have other direct implications on the implementation of the RSLUP and thereafter its monitoring and evaluations. Media will also play crucial role in dissemination of various aspects of RSLUP and its implementation as well as its adaptation in the other urban regions of Nepal and internationally.

WSs have been brought into the development of RSLUP process. Several technical meetings with the JICA Transpiration Master Plan Team, representatives from SONA, RUPSON and other societies have been held in the project office during the preparation of KV-RSLUP. Their inputs in risk sensitive land use zones and the regulatory mechanism has been incorporated in the KV-RSLUP. Further meetings are planned for consultative workshops and seminars, dissemination workshops as well as through development and online deployment of participatory planning.

3. KATHMANDU VALLEY-PROFILE

3.1. Kathmandu Valley

Kathmandu Valley (KV) covers an area of 654.7 km^2 covering parts of Kathmandu (approx. 85%), Lalitpur (approx. 50%) and Bhaktpur districts. Geographically, the KV extents from 27°49'4" latitude, 85°11'19" longitude to 27°34'33" latitude, 85°34'57" longitude in the mid-mount physiographic region of Nepal.

KV, a part of Middle Mountain Physiographic region lies in Bagmati River Watershed and covers 677.58 km^2 area. Bagmati River that originates from Middle Mountains is the main river system of this watershed. The watershed is nearly circular in shape consist of 227 km stream length with a density of 335.33 m/km^2 and is surrounded by Rosi Khola, Jhikhu Khola, and Indrawati Nadi Watersheds in the east; Tadi Khola, Kolpu Khola, Mahesh Khola, Palun Khola Watersheds in west.

3.2. Bio Physical Settings

3.2.1. Physical Environment

Kathmandu Valley (KV) covers an area of 721.87 km^2 covering parts of Lalitpur (approx. 50%), Kathmandu and Bhaktpur districts. Geographically, the KV extents from 27° 31'42" latitude, 85°11'18" longitude to 27°49'4" latitude, 85°33'57" longitude in the mid-mount physiographic region of Nepal. The elevation ranges from approximately 833 m to 2726 m above mean sea level within Kathmandu valley.

3.2.2. Administrative Boundary

Kathmandu valley lies in Bagmati zone of central development region. KV boundary covers whole of Kathmandu and Bhaktapur district and parts of Lalitpur district. Until December 2014, Kathmandu Valley was administratively divided into five municipalities (Kathmandu Metropolitan City, Lalitpur Sub-Metropolitan City, Bhaktapur Municipality, Kirtipur Municipality and Madhyapur Thimi Municipality) and 99 VDCs. In December 2014, the existing VDCs were merged to become 16 new municipalities and later in September 2015 one more municipality was added.

Kathmandu Valley now has only 4 VDCs remaining in Lalitpur District along with 5 Municipalities, 11 Municipalities including Kathmandu Metropolitan city within Kathmandu District and 6 Municipalities in Bhaktapur district.

3.2.3. Climate

The annual average maximum rainfall (Thankot) is 1905mm and minimum rainfall (Khumaltar) is 1208 mm found. The rainfall trend and rainy days of Kathmandu valley is desecrated from place to place. The monthly average temperature of Kathmandu valley is maximum in April 30.8 ^{0}C and minimum in January -1.2^{0}C

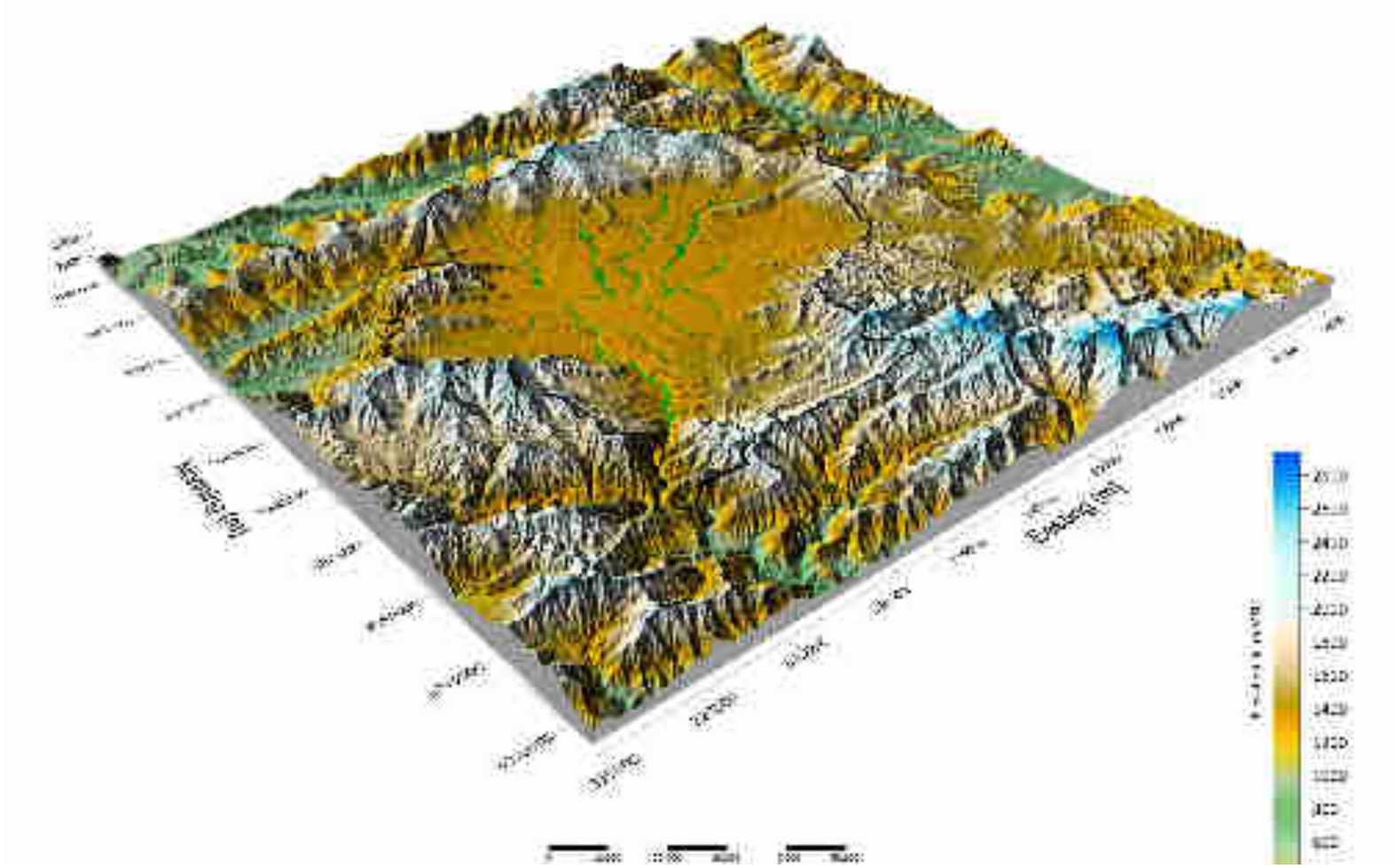

Figure 2 3D perspective view of KV

3.2.4. *Geology*

The Kathmandu Valley has formed a basin where the peripheral hilly area comprises low to medium grade metamorphic rocks and intrusive rocks belonging to Lesser Himalayas as well as sedimentary rocks equivalent to Tibetan Tethys Zone (Stocklin and Bhattarai, 1977). The central part of the valley comprises semi-consolidated fluvio-lacustrine sediments. The depth of valley sediments is more than 650 m. at the central part of the valley, under Baneshwor, which gradually decreases towards the marginal ends (Moribayashi and Maruo, 1980).

3.2.5. *Land Use*

The landscape of Kathmandu Valley is dominated by cultivated land covering about 47% of the total 722 sq.km of the valley. Forested land covers about 251 sq.km i.e. about 34% of the valley area. Built-up area consisting of residential area covers more than 14%, commercial/mixed residential and commercial has been increasing since the previous decades and now covers about 5%. Other land use classes based on satellite image analysis for 2015 is presented in the table below and shown on the map *Figure 3*.

Table 3 Land use of Kathmandu Valley, 2015

Land Use	Area (sq.km)	Acreage (%)
Agricultural	337.60	46.76
Commercial/Mixed Residential Commercial	4.77	0.66
Forest	251.07	34.78
Industrial	1.00	0.14
Institutional	4.40	0.61
Military	1.20	0.17
Others	5.98	0.83
Public Utilities	0.30	0.04
Recreational / Open Space	1.91	0.26
Residential	102.14	14.15
Special Area	0.87	0.12
Transportation	8.71	1.21
Water body	1.98	0.27
Total	**721.94**	

Source: Based on satellite image analysis of 2015

3.2.6. *Rivers and Watershed*

KV, a part of Middle Mountain Physiographic region lies in Bagmati River Watershed and covers 677.58 km^2 area. Bagmati River that originates from Middle Mountains is the main river system of this watershed. The watershed is nearly circular in shape consist of 227 km stream length with a density of 335.33 m/km^2 and is surrounded by Rosi Khola, Jhikhu Khola, and Indrawati Nadi Watersheds in the east; Tadi Khola, Kolpu Khola, Mahesh Khola, Palun Khola Watersheds in west.

The major river networks that pass through Kathmandu valley are Nakhu Rver, Manohara River, Kodkhu River, Hanumante River, Godavari River, Dhobi River, Bishnumati River, Balkhu River and Bagmati River.

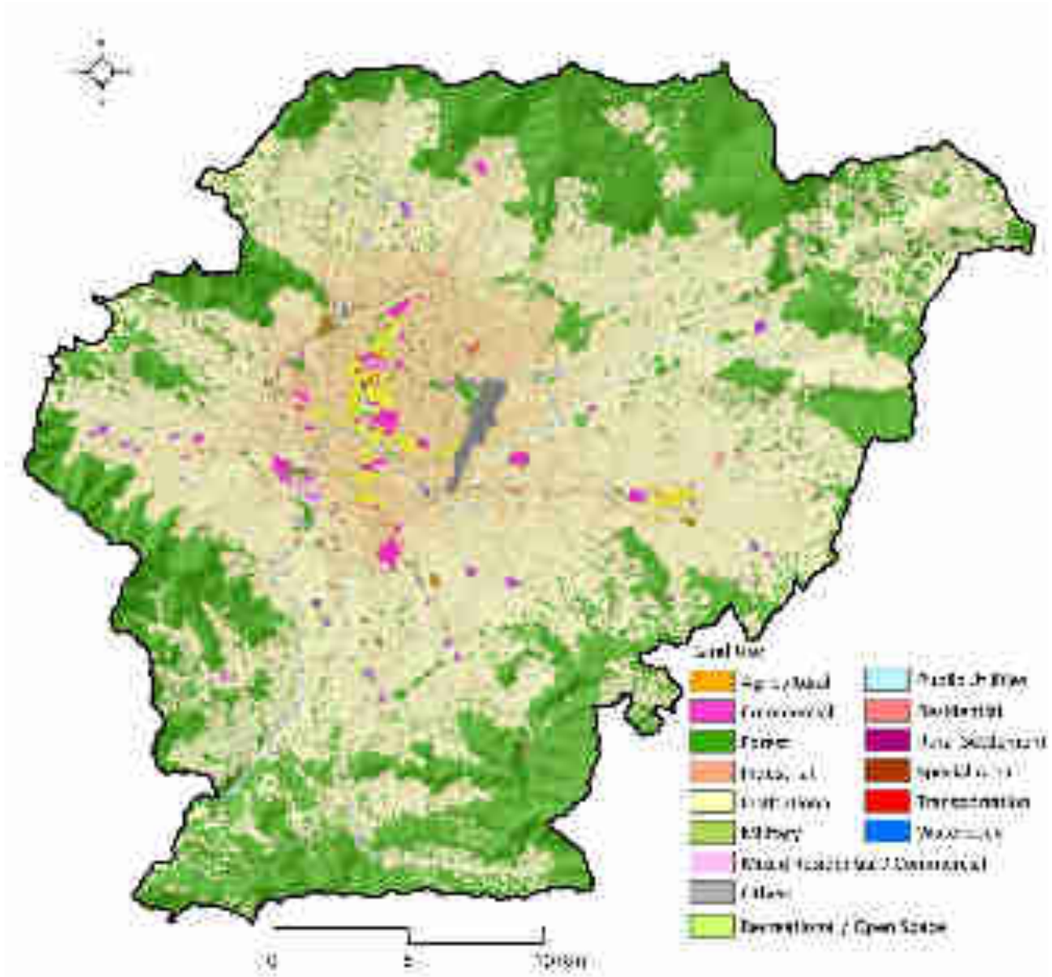

Figure 3 Land use map of KV, 2015

3.2.7. *Lakes and Ponds*

Lakes have been at the center of daily life in the lives of residents of Kathmandu valley since long ago. Lakes provide water for irrigation and daily use. It has cultural, religious and spiritual significance for many communities as well. Lakes/wetlands also maintain biodiversity and help enhance livelihoods through eco-tourism. The lakes had previously been spread throughout the Kathmandu valley in proximity to the traditional settlement areas. The list of lakes found within the Lalitpur, Bhaktapur and Kathmandu districts area as follows:

Table 4 Lakes and ponds in KV

Lalitpur District	Bhaktapur District	Kathmandu District
Boje Pokhari	Kamal Pokhari	Gahana Pokhari
Boke Daha	Naag Pokhari	Ikha Pokhari

Godavari Kunda	Nu Pukhu	Kamal Pokhari
Lagankhel Pokhari	Bodegaun Ponds	Naag Pokhari
Naag Daha	Siddha Pokhari	Rani Pokhari
Pimbahal Pokhari		
Taudaha		
Zoo Pokhari		

Source: Nepal lake conservation development committee

3.3. Urban Form

Kathmandu Valley has been a center of economic growth since long ago and being a capital city of the country, its growth has been in no less terms tremendous. The Kathmandu valley like other urban clusters within Nepal had a core urban center surrounded by hinterland of small towns and rural areas and functions as extended urban economic regions. The development of market infrastructures within the core center of Kathmandu valley and centralized government functions established the core urban center as the most desired place to live in. With increasing economic opportunities, urban facilities, better education facilities and development of roads, the migration of people from rural areas to urban areas increased. Owing to the lack of strict regulation implementation, the growth of Kathmandu valley started haphazardly. The sporadic form of settlements within the Kathmandu created the chaos network of buildings and roads that we find today in Kathmandu valley.

The urban sprawl of Kathmandu has spread away from the core urban center within Ring road as there is almost no space for development within the Ring road and the price of land is very high. Primarily, the residential development without sufficient utility infrastructural development which has gone unnoticed and ignored, has led to these haphazard urban sprawl. Limited and insufficient development of urban infrastructure, particularly roads, led to an octopus growth pattern that followed roads linking one town to another or the towns to the villages in the hinterland.

3.4. Urban Growth Trends

Built-up has increased from 38 sq. km in 1990 to 119 sq. km in 2012 over the period of 22 years, a staggering 211 percent increase. Consequently, cultivated land has changed from 421 sq.km to 342 sq.km, a decrease of 19 percent over the period of 22 years. Interpretation of 2012 satellite imagery[1] showed the built-up area covers 16 percent of the total area of the KV, agriculture area covers 47 percent and forests/vegetation covers 35 percent.

3.5. Urban Growth Projections

The previous study on urban growth trends by UNDP/CDRMP (KVDA and UNDP/CDRMP 2014) projected the urban growth using two scenarios; BAU (Business as Usual) model and LTDCP (Long tern development concept plan) model. The later model imposed more restrictions and focused towards controlled development.

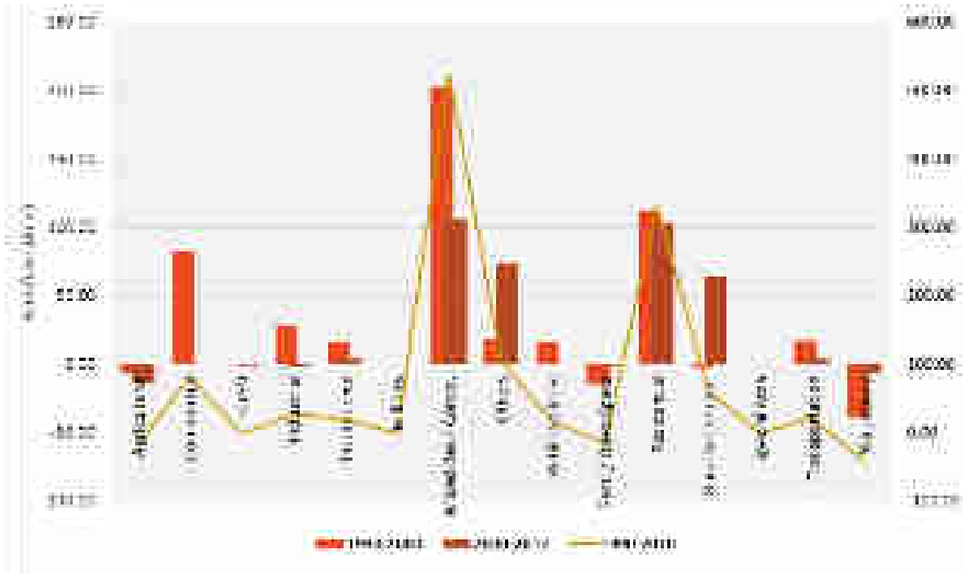

Figure 4 Land use change trends in KV (1990-2000-2012)

BAU model estimated that at each decade approximately 6000 hectares of arable land in Kathmandu valley will be converted into the built-up area. It was estimated that during 2030 the urban area of the valley will be 213.8 km^2 which is twice as much as present built-up area.

LTDCP model expected that urban growth will be significantly low i.e. in 2020 there will be 118.2 km2 built-up area which is around 1.07 times of existing built-up area. Similarly, during 2030 it is expected to increase by 1.2 times (i.e. 131.1 km2).

[1] GeoEye 0.5m multispectral satellite image that cover entire KV of the date 2012 was used

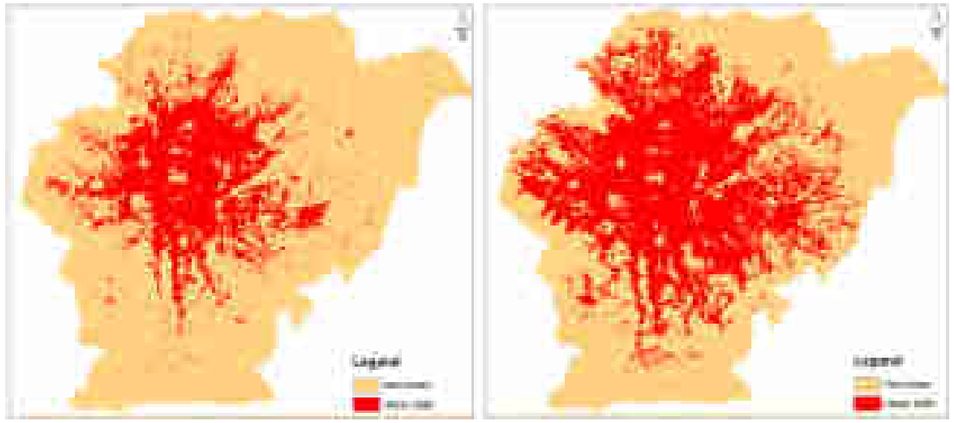

Figure 7 Probability of urban growth in 2020 and 2030 according to BAU model

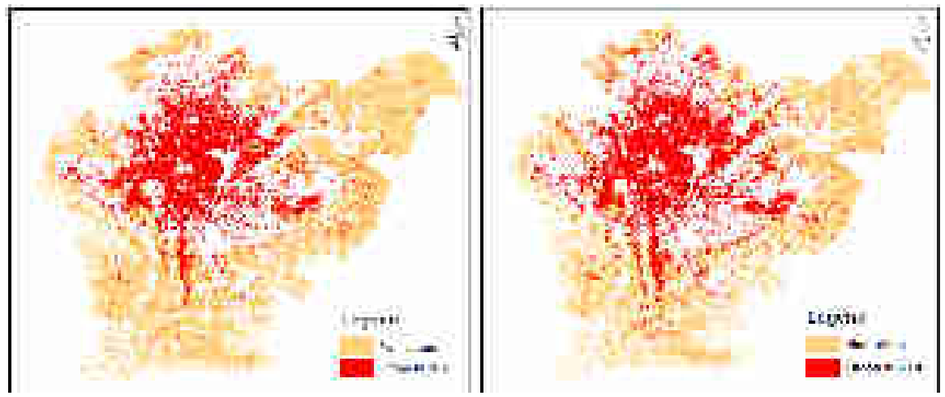

Figure 6 Probability of urban growth in 2020 and 2030 according to LTDCP model

3.6. Sectoral Profile of Kathmandu Valley

3.6.1. Growth and Present Population

The total population of Kathmandu Valley in the census year 2011 was 2,468,316 with the annual growth rate of 4.63%. This represents the 9.32% of entire population of country in mere 0.49% area of the country.

3.6.2. Population Projection

Kathmandu Valley is vibrant city which attracts a lot of people from all over the country in search of better living for economic, educational and security reasons. The population for 2020 and 2030 for Kathmandu Valley, projected using geometric growth method[1]indicates 3,794,866 and 6,249,958 respectively. The growth rate in the former VDCs and municipalities of KV is shown in *Figure 5*.

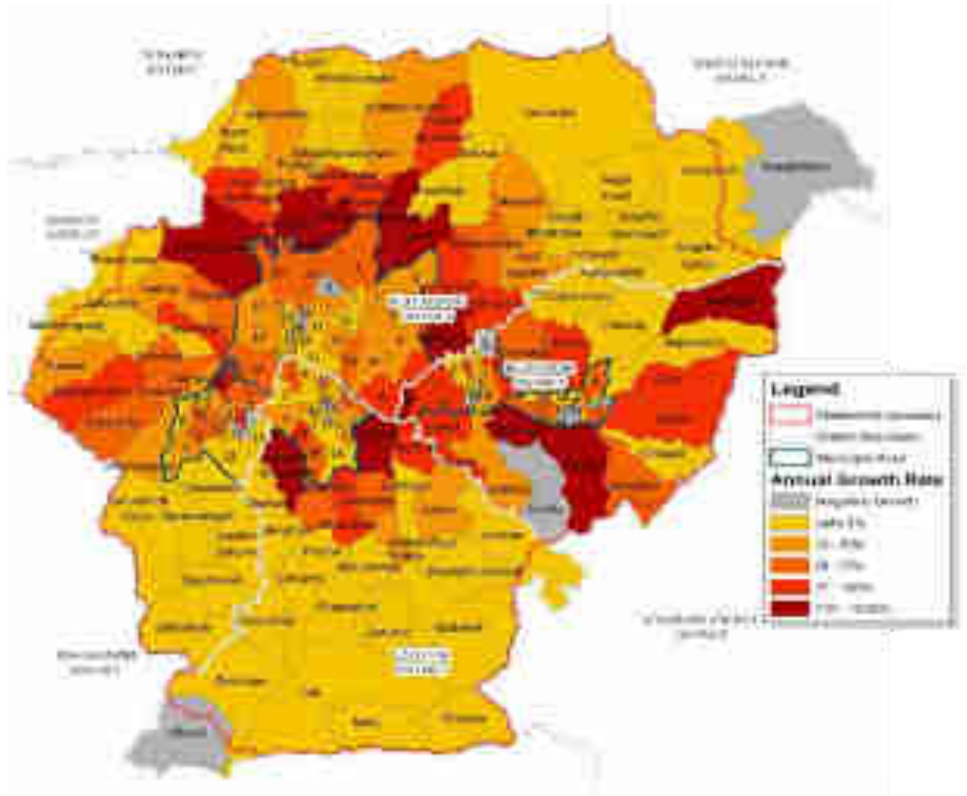

Figure 5 Annual population growth rate

[1][$P_t = P_0 (1+r)^t$], where $P_t$is latter year population, $P_0$is Earlier year population , r is the rate of annual increase of population and t is the time interval.

3.6.3. *Differently Abled Population*

About two percent (1.94%; 513,321) of the total population have been reported to have some kind of disability. Among them, number of population with disability in different districts of Kathmandu Valley are; Kathmandu: 17122, Lalitpur: 4934 and Bhaktapur: 3214.

Figure 8 Statistics of differently abled population in KV

3.6.4. *Social*

Literacy

The literacy rate refers to the number of people who can read and write. It represents the level of education within the region. National literacy rate is 65.9% which is a low percentage since many nations within South-east Asia have achieved literacy rate above 90%.

Looking at each of the district composing Kathmandu Valley, literacy rates of Kathmandu, Bhaktapur and Lalitpur districts are respectively 86.25%, 81.68% and 82.3%. Comparing with the national literacy rate, Kathmandu has more literate population owing to the centralized nature of economy, politics, administrative functions and urban facilities within the Kathmandu Valley.

Table 5 Statistics of literacy in KV

Total Schools (Unit)	Primary Level (Grade 1-5)	Lower Secondary Level (Grade 6-8)	Basic Level (Grade 1-8)	Secondary Level (Grade 9-10)	Higher Secondary Level (Grade 11-12)	Secondary Level (Grade 9-12)
2213	2077	1681	2091	1360	438	*1479*

Source: MoF, 2014

Security

As large number of people migrate from rural and other urban areas to Kathmandu valley for different reasons, it has led to unmanaged urban sprawl. The data obtained from police headquarters suggest a growing a trend of criminal activities. Inadequate resources and opportunities within the valley could be blamed for the growing crimes.

Cultivation

The land of Kathmandu valley is very fertile and most suitable for agriculture yet the population explosion has caused rapid transformation of the once prime agricultural lands into built up areas mostly for residential purposes. National Labour force survey, 2008 estimates that there were 55,000 household in Kathmandu valley with agricultural land holdings. According to the records from the Department of Survey, amount of cultivated land Bhaktapur, Lalitpur and Kathmandu districts are 14437 Ha, 8612 Ha and 23703 Ha respectively. There are still large population who practice agriculture as their primary occupation but it is slowly declining as settlement areas are extending away from the ring road.

Food Security

The concern for food security is an important topic that needs immediate discussion as Kathmandu valley faces food deficit every year and has been increasing year after year. The growing population and limited resources has given rise to this food deficit. On top of that, the rapid change of agricultural lands into built-up areas for residential settlements has proved as another major problem towards food security.

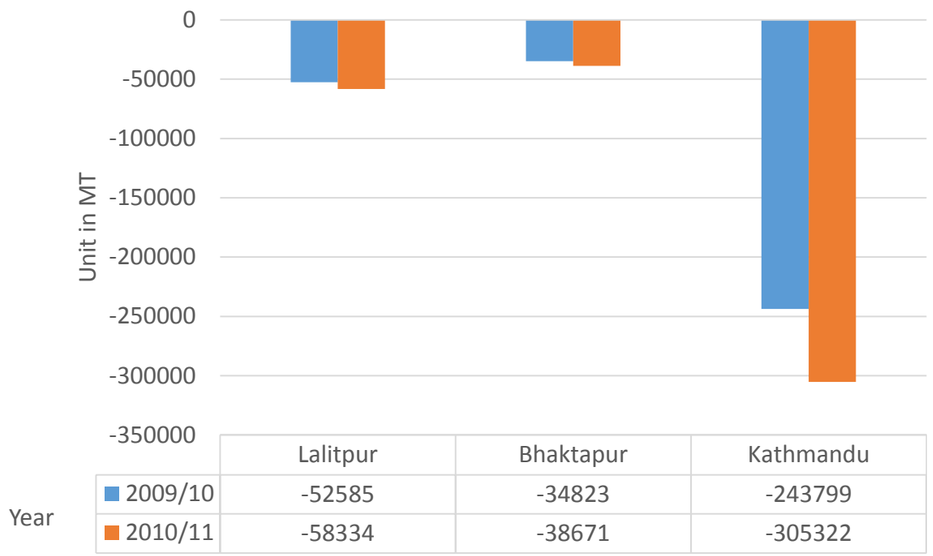

Figure 9 Food availability and requirement (MoAC)

Migration

Migration of people from one region to another has existed for centuries and may continue for centuries to come but during and post conflict decade long revolution, a large influx of population was recorded in the Kathmandu valley. People migrated from rural and urban areas likewise for security concerns and better urban facilities and opportunities.

According to National labour force survey 2008, out of total migrants (all ages) in the Kathmandu valley urban, 19 % are from other urban areas, 77 % are form rural areas and 5% are from abroad.

Vulnerable Population

During the 2007-2008 period, two large slum neighborhoods appeared, comprised of 300 and 500 households at Thapathali and Balkhu, respectively (Tiffon, 2010). Since then, the slums have increased in number and locations along the main river corridors. The attempts to resettlement of the squatters have been going on yet large number of squatter settlements still reside near the floodplains of major rivers.

Monuments/ Heritage

Kathmandu Valley is a city of temples, monuments and stupas. Religious and spiritual traditions and customs oozes from every corner of the valley. It is said that once there used to be more number of temples than the residential buildings. But with growing urbanization, excessive pressure of commercial activities along with unplanned and haphazard growth of the city, the cultural heritage of Kathmandu valley is gradually eroding. It has become utmost important to conserve these monuments/ cultural heritages from privatizations and commercialization.

United Nations Educational, Scientific and Cultural Organization (UNESCO) has designated 7 world heritage sites within the Kathmandu valley. The cultural heritage; seven groups of monuments and buildings which display the full range of historic and artistic achievements are the Durbar Squares of Hanuman Dhoka (Kathmandu), Patan and Bhaktapur, the Buddhist stupas of Swayambhu and Bauddhanath and the Hindu temples of Pashupati and Changu Narayan.

3.6.5. Economy

According to the survey by Nepal Rastra Bank in 2012, it estimates that the total value of economic activities (consumption, gross capital formation and net exports) in the Valley is Rs. 316 billion, which accounts for 23 percent of GDP under reference scenario. It estimates the Valley's total consumption of Rs. 328 billion, which is 26% of the national level consumption and 24 percent of GDP. Though Nepal is often quoted as an agricultural country, the highest share of GDP is obtained from service sectors.

The survey estimates the total value of exports (domestic and abroad) of goods and services (excluding other services except tourism) from the Valley at Rs. 43 billion. The Valley exports 26 % and 47 % of goods and tourism services to abroad respectively. Likewise, the total imports (domestic and abroad) of the Valley are estimated at Rs.118 billion. Of the total imports from abroad, the share of Kathmandu Valley is 19 percent.

The overall survey findings suggest that about one-third of the total economic activities of the country are concentrated in Kathmandu Valley

Employment

According to the National Labour force survey in 2008, there are about 54000 economically active population who are unemployed. The Kathmandu Valley has the highest unemployment rate at almost 11%. Labour force participation rate is also found to be low at only 58%. The disparities on labour force participation rate across sexes seems higher in the Kathmandu valley urban than other areas.

The number of Nepalese going abroad as migrant workers has increased drastically in these last few years. The trend of labour migrants to foreign country has been continuously increasing. Internal decade long conflict triggered the sudden rise in labour migrants to foreign countries and it has reached about 385000 population in the year 2011/12. This labour force has helped country through the remittance that has been backbone for sustaining national economy.

The survey estimates that for households in urban areas, 24.5% received a remittance. The average amount received by urban households in the last 12 months was Rs. 107,234 and the average remittance in Kathmandu valley is even higher (Rs. 161,082).

Industry

Industries are necessity for the development but the current energy crisis from constant load shedding and petroleum shortages has halted the growth of these industries. According to the data from Department of Industry and Department of Cottage and Small Industry, almost 60% of the industries of Nepal are located within the Lalitpur, Bhaktapur and Kathmandu districts. This has provided about 22776 population with employment opportunities which is about 55% of the total industrial workforce in Nepal.

Prosperity

According to UN-Habitat's analysis, following are the different dimensions of City Prosperity Indexes of Kathmandu Valley:

Table 6 City prosperity indices of KV

Productivity Index	: 0.385	Environment Index	: 0.704
Quality of Life Index	: 0.621	Equity Index	: 0.617
Infrastructure Index	: 0.740	City Prosperity Index	: 0.598

UN-Habitat has developed an index that measures the current status of cities, vis-à-vis the five dimensions of prosperity: productivity, urban infrastructure, quality of life, equity and environmental sustainability. In their own words,

"Prosperity implies success, wealth, thriving conditions, and well-being as well as confidence and opportunity. In general terms, a prosperous city offers a profusion of public goods and develops policies and actions for sustainable use, and allows equitable access to 'commons'."

As per the report, Kathmandu is considered as one of the cities with weak prosperity factors and shows following traits:

- Production of goods and services is still too low
- Historic structural problems, chronic inequality of opportunities and widespread poverty
- Inadequate capital investment in public goods
- Lack of pro-poor social programmes

3.6.6. *Infrastructure, Utilities:*

Water Supply

In Kathmandu Valley, the demand for water is around 360 million liters per day (mld) however, the supply from KUKL is only around 110 mld (154 mld during wet season and 95 mld during dry season). The Central Bureau of Statistics study carried out in the valley showed that 59% of the surveyed households did not have adequate water supply from the piped water line and on average. In addition, the water table is decreasing at the rate of 4 meters per year due to excessive ground water extraction (around 800 mld), which requires greater attention at present. The Melamchi water supply project, which started in 2000 with an aim to supply 170 mld of water supply to the valley by 2007, has been a major component to fulfill the water demand of the valley.

Road

Road network in Kathmandu Valley is classified into two groups:

- Strategic Road Network comprising of Highways, Feeder Roads (both major and minor) and Strategic Urban roads are the responsibility of the Department of Roads
- Local Road Network comprising of District, Urban and Village roads are the responsibility of the respective local institutions

The growth of the road network in valley in 70s and 80s was 62% and 50%. The growth phenomenally picked up in 90s with a record of 154% and it slowed down in between 2001 to 2012 with a decade average of 31 %.

The planned Outer Ring Road and the proposed Fast Track, will likely influence the growth trend within their corridors.

Mode of Transportation

Motorization in the Valley has been increasing by 13% every year. There are approximately 600,000 vehicles registered in the Bagmati Zone which is almost half of the total vehicles registered in Nepal. The share of motorcycle has increased at an alarming rate of more than 20% in the past five years. With the rapidly increasing population and economic development, there are more than 600 thousand vehicles registered in the Bagmati Zone until 2012/ 2013, which is almost half of the total.

Public transport vehicle represents less than 3% of total registered vehicle fleet in Kathmandu but their travel mode share is almost equal to that of private vehicles, which constitute 93% of total vehicle fleet. The motorcycle now constitutes around 74% of the total vehicle fleet in Nepal and in absence of effective public transport system; it is bound to grow more in future.

Kathmandu Valley sees 3.4 million person/trips a day, nearly half the people commute on foot, there are 5,300 public transport vehicles such as buses, mini buses, micro buses, and tempos owned by 1,000 private operators plying on 200 routes.

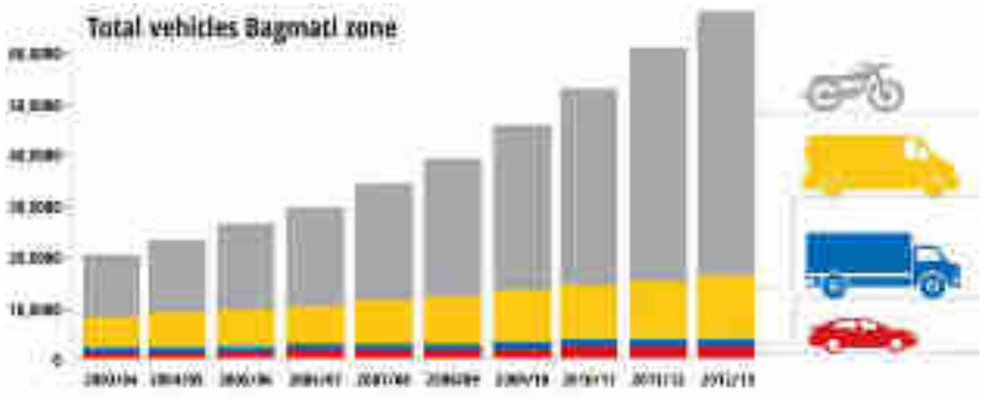

Figure 10 Current condition of Transportation in KV

Telephone

The access to communication facilities bridges the gap between boundaries for easy transfer, receiving and sharing information. The access to communication facilities represents the level of technological development in the country and the national and global outreach of the community.

Telecom data shows that half the number of telephone lines are connected in the country in ratio of total households in the Kathmandu and Lalitpur district while less proportion are connected in Bhaktapur district.

Table 7 Telephone lines and households connected

District	Total Household (HH)	No. of Telephone Lines connected
Kathmandu	436344	231662
Bhaktapur	68636	21494
Lalitpur	109797	56256

Source: NTC

Comparing the access to number of communication facilities, only about 28% of the households have telephone facilities while more than 89% of the households have mobile facilities.

Electricity

Urban facilities within the Kathmandu valley is not well distributed as all of the administrative and political functions are concentrated within the circle of ring road. Urban facilities are minimal as we move farther from the ring road circle.

The access to electricity in all three districts; Kathmandu, Bhaktapur and Lalitpur are about 98%. The 2% households still don not have access to electricity.

3.6.7. Environment

Air Pollution

Studies show that the concentration of particulate matter less than 10 microns (PM10) in the Valley's ambient air is already several times higher than WHO safer limit and Kathmandu is one of the most polluted cities in Asia with regards to PM10 and PM2.5 level.

Black smoke plumes from brick kilns, refuse burning, increasing use of diesel generators due to regular power cut etc. are additional sources of air pollution in the Valley (CANN/ CEN & UN-Habitat, 2014b).

Sanitation

Sanitation is measured in terms of availability of toilets and sewerage facilities (ICIMOD, 2007). According to NLFS (2008), 99.5% of total households have toilet facilities out of which 54.8% are connected to public sewage and 13.5% are connected to septic tank. In addition, a study highlights that more than 400 surface drainage channels with direct connection to river, have been used for transferring sewage. The recent 2011 CBS data shows that there are still 9875 households without toilet within the three districts of Kathmandu Valley. The launch of Open Defecation Free (ODF) Campaign in various regions within the country is slowly trying to solve this problem by making toilet for each house a compulsion.

Solid Waste Management

According to an estimate, around 1225.4 tons of solid waste is generated in Kathmandu Valley out of which only 40% of the waste is directed to Okharpauwa landfill site (Livable Kathmandu, 2014).

The weight of materials collected for recycling is less than one-fourth of the total waste generated in the Kathmandu Valley, which is about 450 tons. In view of this, the government has implemented law banning use of plastic bags for shopping starting from year 2072.

Only one wastewater treatment plant, with a capacity of 16.4 MLD, uses mechanized treatment, while the other four use waste stabilization pond systems. Moreover, the disposal of untreated sewage in rivers is affecting the quality of surface and groundwater, increasing the incidence of disease, and imposing associated economic burdens.

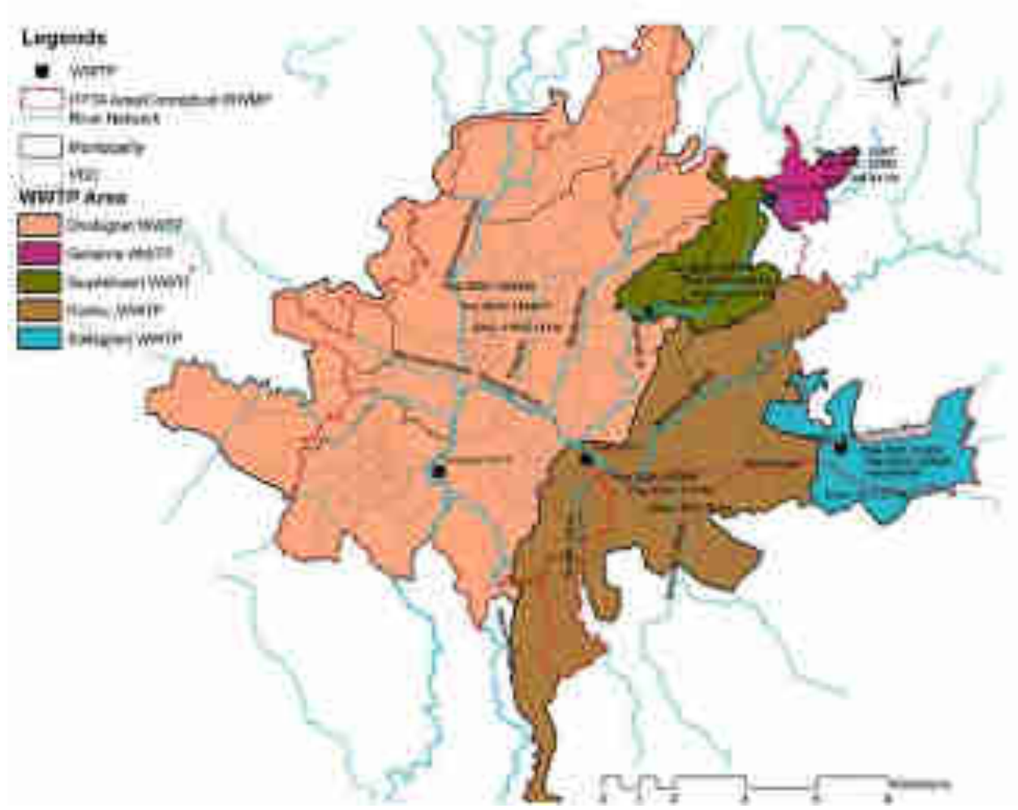

Figure 12 Service area of Waste water treatment plant in KV

Protected Areas

Kathmandu Valley has 34.78% of its area covered by forest. These forest have wide biodiversity of flora and fauna which demand to be protected. In view of the need for protection of forest rea and its biodiversity, Shivapuri National Park was gazetted initially covering 144 sq. km which was later extended by the Nagarjun Forest Reserve covering 15 sq. km in 2009.

The protection area is also important because of the water catchment area that lies within it. This catchment area is important for the continuous supply of water to the lower region of Kathmandu Valley.

Environmental and Industrial Hazards

Anthropogenic influences on environment for the development activities have caused imbalance in the environment. The technological innovation for development have added to the degradation of the environment.

The environmental hazards arising from the quarry and brick kilns are some of the primary concerns as thy directly impact the health and degrade the environment. Most of the quarries are located at the southern part within the Kathmandu Valley. The river Nakhu Khola has turned into a canal due to illegal stone quarries operated in Nallu, Lele and Chapagaon of Lalitpur district. Brick kilns are located at the outskirts of ring road and concentrated mainly in Bhaktapur and Madhyapur Municipality in the East, Lalitpur Municipality in the South and Thankot in the West.

Being ranked as 11th most risky country to earthquake and learning from what occurred in Kobe, if so happens in Nepal, the combined impact of earthquake and consequent fire could trigger the BLEVE in gas stations and LPG tanks distribution centers. Little more than 29 gas stations are spread all over the Kathmandu Valley with high concentration near the settlement areas.

3.6.8. Housing and High Rise

3.7. *H*ousing

Comparing the NLSS 2004 and NLSS 2010, it can be observed that the owner households have declined from 62.5% to 48.1% while rental households have increased from 33.1% to 49.5%. This depicts an increasing trend of renting households in the present context. According to the NLSS 2010/11, the average dwelling size in Kathmandu Valley is 555 sq. ft. The poor population is estimated to be 15.1% of the total population, according to the Willingness-to-Pay Survey (Lumanti, 2002).

The housing and high rise buildings trend has slowly started to grow post decade long conflict and is rising in number. The CDRMP study in 213 identified 72 housing and high rise projects within the Kathmandu Valley, 2 in Bhaktapur, 25 in Lalitpur and 45 in Kathmandu district.

Land Pooling Schemes

Land readjustment tools like land pooling has been very successful in context of Nepal especially Kathmandu Valley. Large areas of land have been acquired and redistributed in a planned manner in 12 cases within Kathmandu. Land pooling has been completed in total 29.37 Ha area of land.

10 new land pooling projects are ongoing which covers an area of 405.69 Ha. This type of land pooling not only promotes planned development but helps to acquire large areas of land for different development purposes.

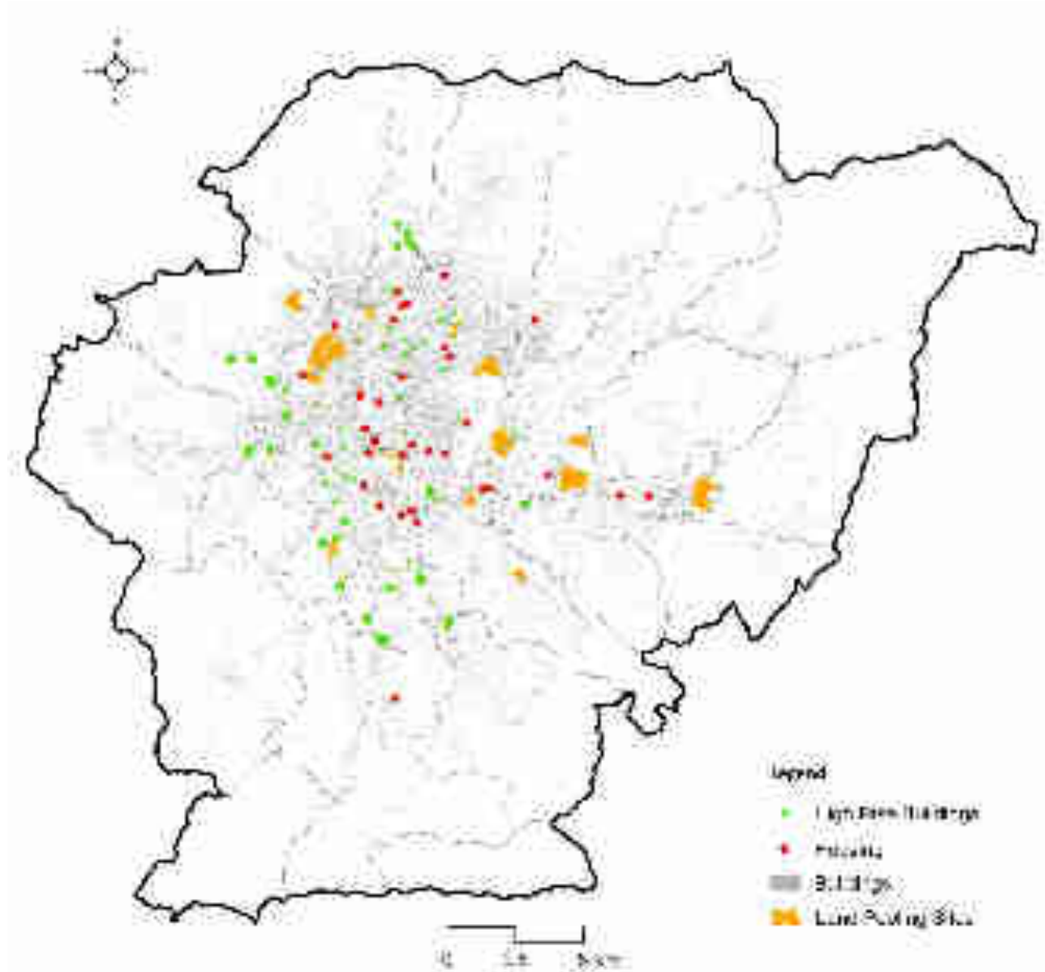

Figure 13 Locations of housing, high rise apartments and land pooling sites in KV

4. MULTI-HAZARDS SCENARIO IN KV[1]

4.1. Seismic Hazard and Vulnerability

Historical records show that Nepal has experienced numbers of large earthquakes in the past centuries. The most devastating earthquakes had been recorded in 1255, 1408, 1681, 1803, 1810, 1833, 1866, and 1934 (Chitrakar and Pandey 1986, Pandey et al. 2002, Pandey and Molnar 1988).

The 1934 Nepal-Bihar earthquake (Mw = 8.3) is thought to be a repetition of 1833 Rasuwa-Sindhupalchok earthquake, which had a magnitude of 7.8 (Bilham 1995). National Seismological Center (NSC) has been continuously monitoring the earthquake events since 1978; however the seismic data are available only after 1994.

There are several small to medium earthquakes by magnitudes that have been occurred with their epicenters near to Kathmandu Valley that have caused relatively less to no damage in the valley. The locations of past earthquakes is presented in the following figure.

The 25th April 2015 earthquake, epicentered in Barpak of Gorkha district, just 80 km NW of Kathmandu Valley brought massive destructions in 14 districts of the country, including in the KV. The characteristics of this earthquake and post-earthquake analysis is presented separately in Chapter 5 of this document.

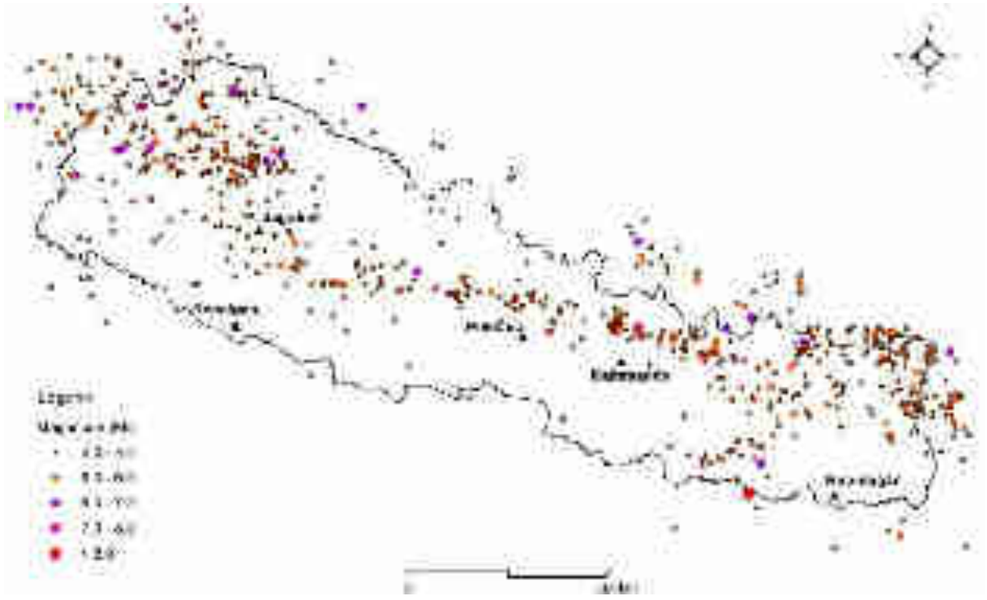

Figure 14 Seismic catalogue map of Nepal (earthquakes (> 4.0 ML) recorded between 1994 and August 2013 by NSC)

[1] The chapter Multi-Hazards Scenario in KV is a synopsis of key outputs of the previous study by the study team for UNDP/CDRMP and KVDA (KVDA and UNDP/CDRMP 2014).

4.2. Scenario Earthquake Model

In the Kathmandu Valley, the last devastating earthquake was in the year 1934, which epicentered in the east Nepal. That earthquake severely affected eastern and central Nepal including many parts of north-east India. If we go more past, 100 years ago that that earthquake there was another huge earthquake hit central Nepal in 1833 having epicenter at Sindhupalchok, very close to Kathmandu Valley. Those two earthquakes show that one area is silent since about 200 years and another since 100 years. Long seismic gap indicates that there is a possibility of occurring earthquake in near future. In the earlier UNDP/CDRMP (KVDA and UNDP/CDRMP 2014) study, the seismicity of the Kathmandu Valley is modeled by taking the epicenters of those two earthquakes assuming the re-occurrence of earthquakes of similar magnitudes. Besides those sources, two active thrust/faults are also taken to model the seismicity of valley. In which, one is Main Boundary Thrust (MBT), a regional thrust, that passes through the south of Kathmandu Valley; and the second is a local normal fault that passes through northern foothill of Chobhar within the valley.

Table 8 Scenario Earthquakes in KV

Scenarios	Earthquake	Description
Scenario I	1833 Sindhupalchok Earthquake	The magnitude of this historical earthquake was 7.8. Reoccurrence of 1833 Sindhupalchok earthquake is taken as first scenario earthquake, whose epicenter was about 40 km far from the Kathmandu valley.
Scenario II	1934 Nepal-Bihar Earthquake	– It is one of the largest earthquake occurred in the Himalayan region. The epicenter of this earthquake was near to Nepal-India boarder, eastern Terai. The recorded magnitude of this earthquake was 8.4. In this study, the re-occurrence of the 1934 Bihar-Nepal earthquake is modeled. The epicenter of the 1934 NB earthquake is 175 km from the Kathmandu valley.
Scenario III	Main Boundary Thrust (MBT)	It is an active thrust in the Nepal Himalaya. It is assumed that an earthquake would be possible from the thrust zone of MBT. In this study, a regional earthquake with magnitude 8.0 is considered, whose epicenter will be hypothetically located at about 20 to 35 km south from the Kathmandu valley.
Scenario IV	Chobhar Local Earthquake	Locally, the Chobhar Fault, located on the foothill of Chobhar and Kirtipur hillocks, is taken as a possible seismic source of local earthquake within the Kathmandu valley. Since it is an active fault (Sakai, 2001), occurrence of an earthquake with magnitude of 6.5 is considered with an epicentric distance of 1 to 15 km. Since the Kathmandu valley is large, the distance to the epicenter is varied for different location points.

4.2.1. Scenario Earthquake PGA, Vs, and TG in the Kathmandu Valley

The spatial distribution of shear wave velocity *(Figure 15),* predominant period of earthquake *(Figure 16)* and the peak ground acceleration for four scenario earthquakes *(Figure 17)* are modelled for the scenario earthquakes. The shear wave velocity and predominant period of earthquake were calculated only in soft sedimentary deposits of the valley because there were no borehole data information in the bedrocks and alluvial fan deposits. The variation of shear wave velocity in the valley sediments ranges from 154 m/s to

300 m/s, while it increases in alluvial soil and bedrocks *(Figure 15)*. The longest predominant period of earthquake in the valley sediments ranges from 0.4 to 0.8 second (*Figure 16)*. It implies that the buildings from 4 to 8 storeys, are more likely to be affected during the earthquake.

The PGA distribution map *(Figure 17)* for the 1833 Sindhupalchok earthquake scenario shows the KV sediments would experience PGA range of 342–497 gal (i.e., 0.35g–0.51g). The Kalimati, Balkhu and Suryabinayak areas would experience maximum horizontal acceleration *(a)*. The reoccurrence of 1934 Nepal-Bihar earthquake would create the PGA ranging from 142gal to 206gal in the Kathmandu Valley. Likewise the 1833 Sindhupalchok earthquake, Kalimati, Kuleshwor, and Suryabinayak area would experience the maximum ground acceleration *(b)*. The PGA distribution map for the MBT scenario earthquake shows the PGA values ranges from 380gal to 703gal in the valley sediments. The maximum ground acceleration would be experienced in Kalimati, Balkhu, Bungmati, Suryabinayak, and neighbouring regions *(c)*. The local earthquake scenario would experience PGA of 354–929gal. The maximum ground acceleration would be experienced in Kalimati, Balkhu, and Sanepa area *(d)*. From all four scenario earthquakes, the regions in the vicinity of Kalimati and Suryabinayak are highly hazardous in terms of seismicity.

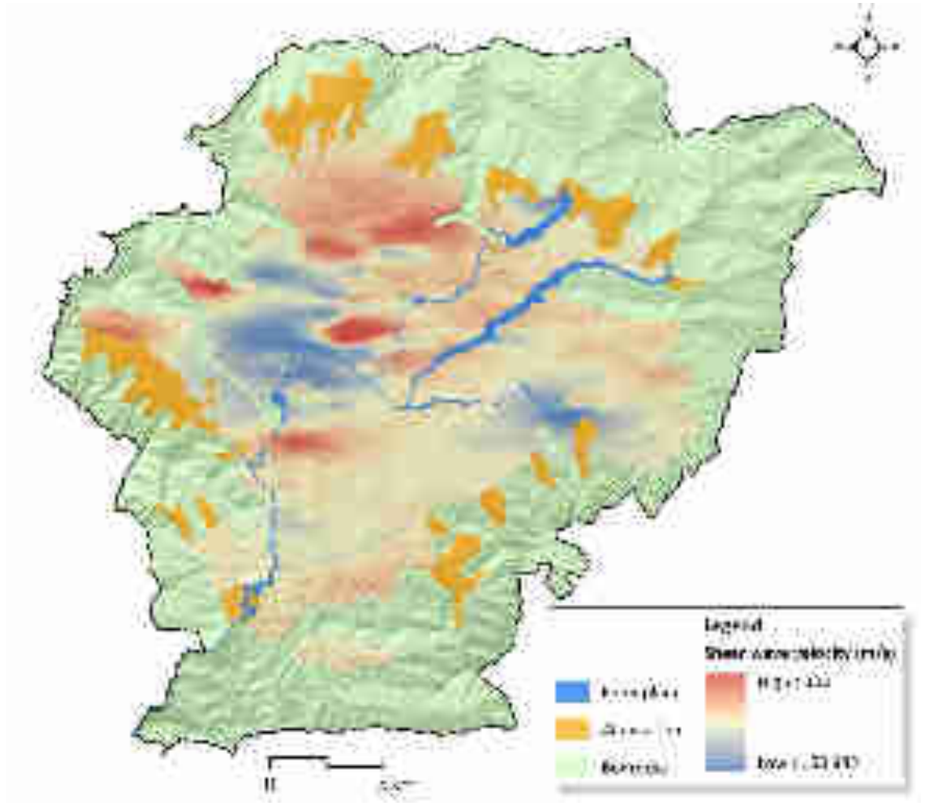

Figure 15 Shear wave velocity (Vs) in KV

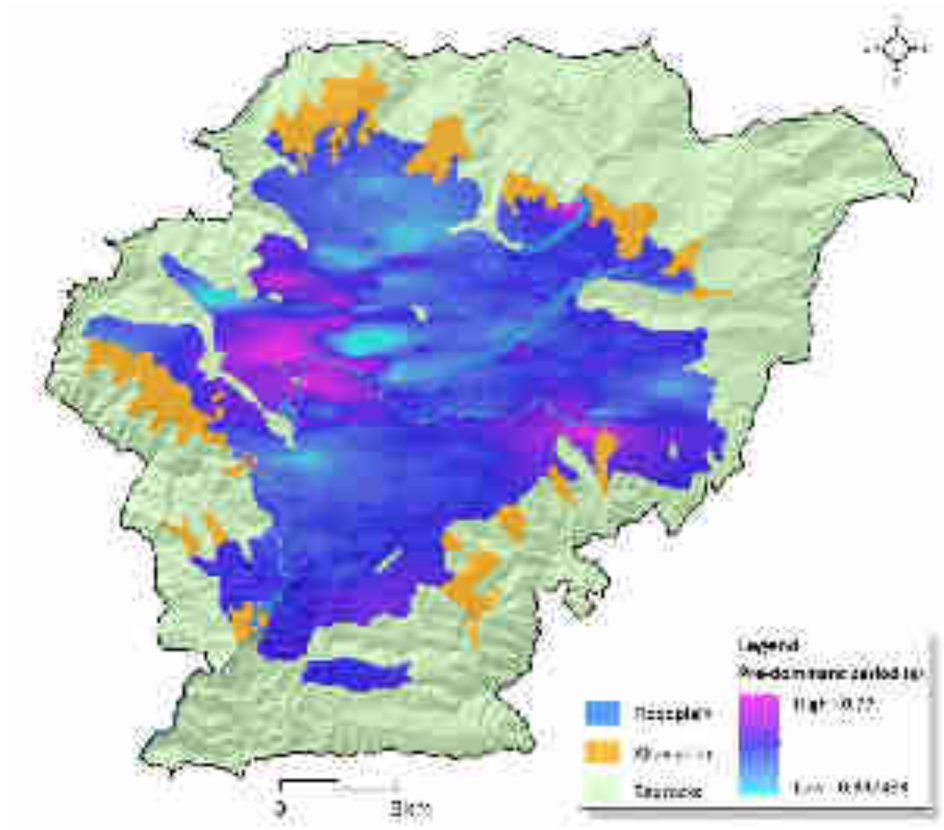

Figure 16 Predominant period of earthquake (TG) in the KV

4.3. Seismic Intensity

The seismic intensity distribution for the probable intensity of the scenario earthquakes in terms of Modified Mercalli Intensity (MMI) scale was computed at each grid cell from the PGA distribution map using PGA-MMI relationship (Trifunac and Brady 1975)

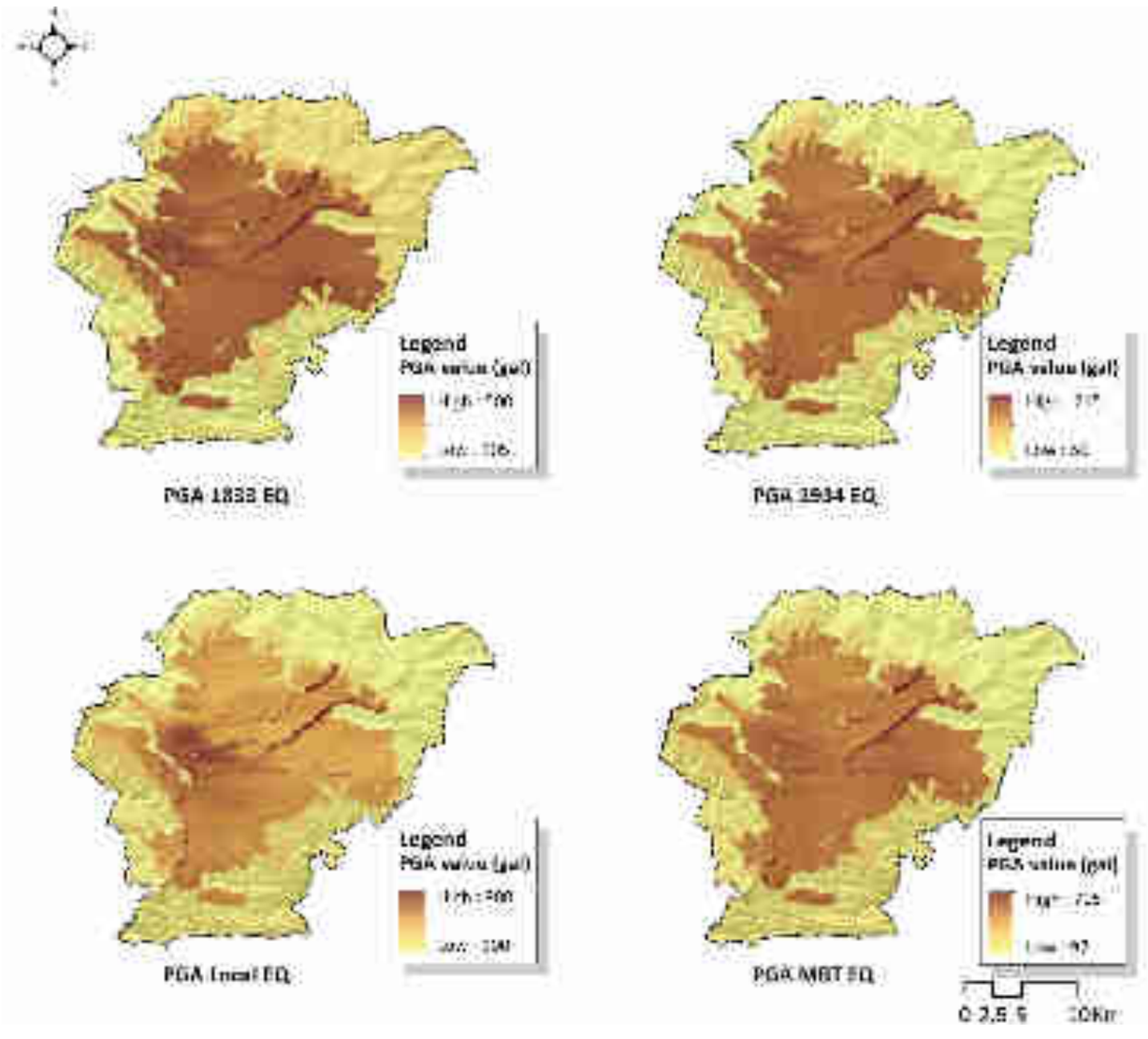

Figure 17 Peak ground acceleration in different scenario EQs in KV

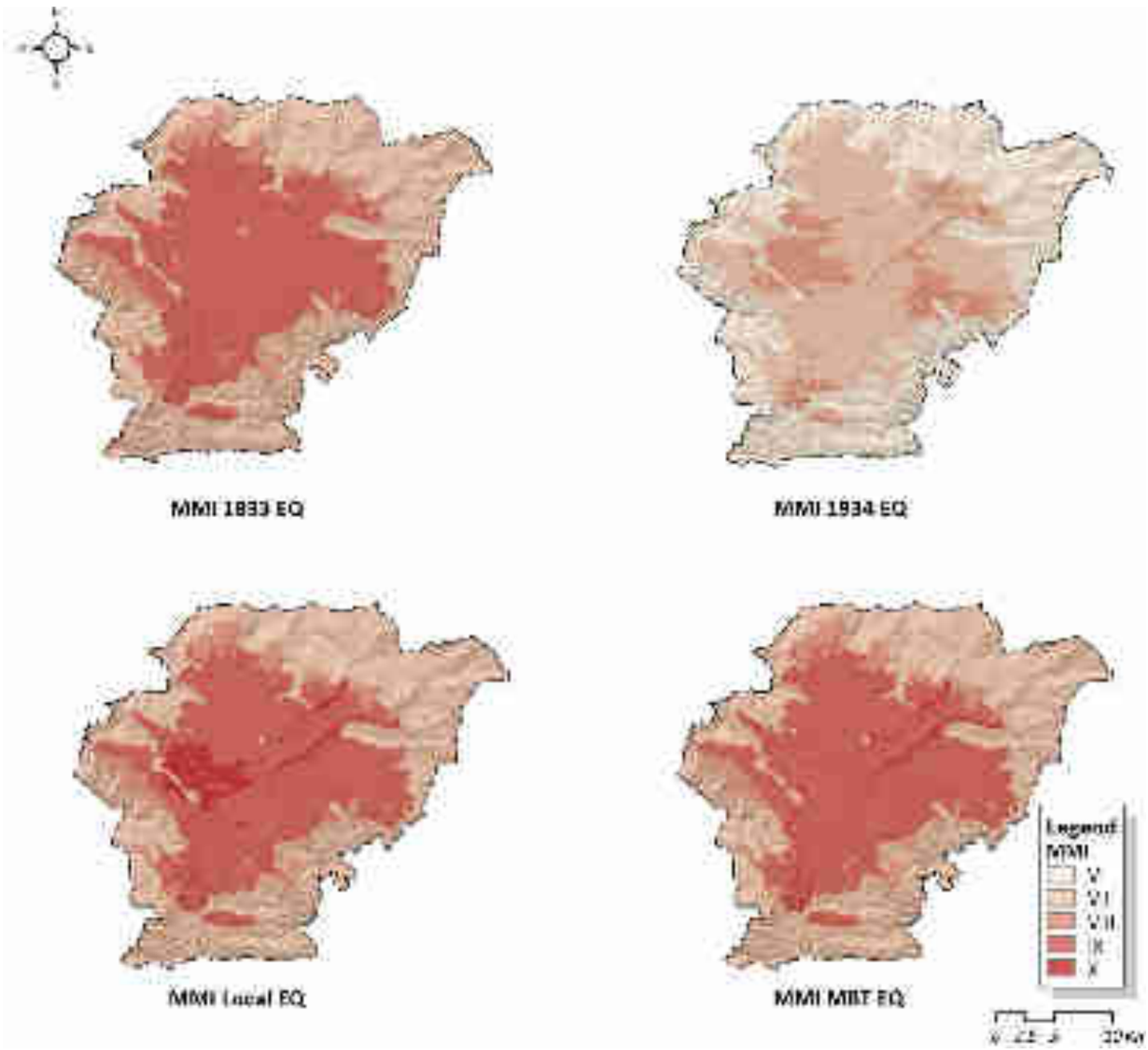

Figure 18 MMI in different EQ scenario in the KV

4.4. Liquefaction Susceptibility

The value of liquefaction potential at a location is different for different earthquake scenarios. Stochastic simulation was performed to generate the spatial distribution of liquefaction potential values in the soft sedimentary deposits of the KV for four different liquefaction susceptibility scenarios for each scenario of earthquake as shown in maps in *Figure 19*.

The liquefaction susceptibility map generated for the 1833 Sindhupalchok earthquake shows that the areas in the vicinity of Kalimati, Nakhu, Suryabinayak, Thimi, Lazimpat, and Tokha would experience high to liquefaction if the similar earthquake reoccurred *Figure 19 a*. Most of the valley sediments would be moderately liquefied due to such earthquake.

The liquefaction susceptibility map for 1934 Nepal-Bihar earthquake *Figure 19 b* shows that Rabibhavan, Kalimati, and Teku area including Thamel and Gyaneshwor area would experience moderate to high liquefaction. Most of valley sediments lie under low susceptibility zone showing that the valley might face mild liquefaction if the 1934 earthquake reoccurred.

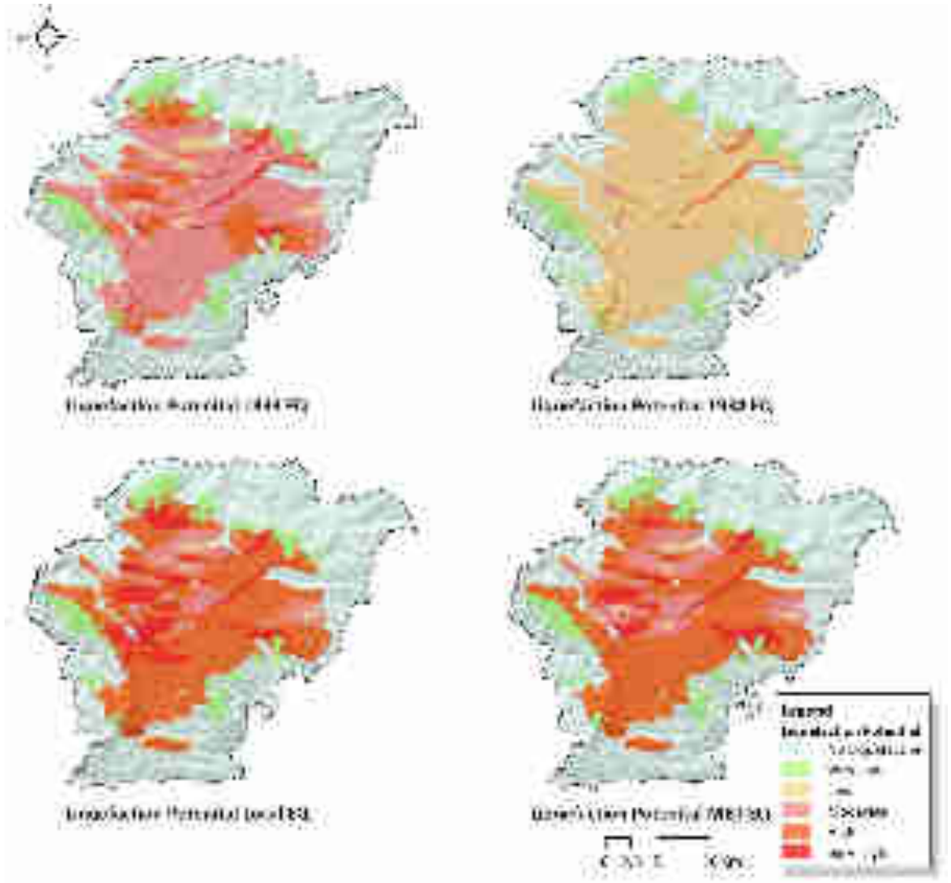

Figure 19 Liquefaction susceptibility (a) Scenario I (b) Scenario II, (c) Scenario III &(d) Scenario IV

Most of the valley sediments would be affected by high liquefaction if an earthquake (ML=8.0) occurred in the MBT *(Figure 19 c)*. Some areas in the vicinity of Soaltimod, Kalimati, Teku, Lainchaur, Tokha in Kathmandu, Dhobighat, and Nakhhu in Lalitpur, and Thimi, and Suryabinayak area of Bhaktapur would face very high degree of liquefaction. Tribhuvan International Airport (TIA) lies under moderate susceptible zone.

Based on the above prepared liquefaction susceptibility/potential maps and mapped buildings, assessment of buildings susceptible to various liquefactions zones are assessed. Following are the assessment observations for buildings susceptible to liquefaction hazard for different scenario earthquakes:

- For the liquefaction susceptibility of scenario earthquake of 1833 Sindhupalchowk EQ, total of 10,051 buildings are in very high liquefaction potential zones. This is 3 percent of the total mapped buildings in the KV. Similarly, 61,312 buildings are in high liquefaction zone (17 percent); 193,302 (54 percent) in moderate liquefaction zone; 26,123 (7 percent) in low and 23,524 buildings (6.5 percent) are in very low liquefaction zones. Of the total buildings in very high liquefaction zone, 75 percent are in municipalities, 9 percent in rural VDCs and 16 percent buildings in urbanizing VDCs.
- For the scenario 1934 Nepal-Bihar earthquake, which has lesser effect (in terms of PGA and resulting MMI), total of 969 buildings are in high liquefaction zone (0.3 percent of the total). However, in this earthquake scenario, about 79 percent buildings in KV are exposed to low liquefaction potential.
- For the local scenario earthquake, total of 60,183 (17 percent) buildings are vulnerable to very high liquefaction susceptibility; 168,428 buildings (47 percent) are vulnerable to high liquefaction; 55,383 (15 percent) to moderate; 6,794 (2 percent) to low and 23,524 (12 percent) to very low liquefaction hazard.
- For the scenario earthquake at MBT, 38,202 buildings (11 percent) are in very high liquefaction zone; 165,320 (46 percent) are in high; 77,296 (22 percent) in moderate; 9,970 (3 percent) in low and 23,524 (12 percent) in very low liquefaction potential zones.
- For the local earthquake scenario, high and very high liquefaction susceptible zones are dominant in the soft sediments of the Kathmandu Valley (Figure 19 *d).* The areas having bedrocks and alluvial fan deposits on the basement could only be safe if such earthquake occurred in the valley.

4.5. Flood Scenario in KV

Flood inundation modelling and mapping using GeoRAS and GIS tools. Hydro-meteorological study of the Bagmati watershed by analysis of daily rainfall data of past 30 years for stations No 1022 in Godavari, Maharajgunj 1039, Bhaktapur 1052, Chapagaun 1060, Khokana 1073, Thankot 1015, Khumaltar 1029, KTM Airport 1030, Nagarkot 1043 from DHM.

Delineation of the flood plain boundary, River Stream line, River bank and General Land Cover.

Flow discharge measurement using dilution method (Tracer techniques) and current meter method near at Khokana in downstream of Bagmati River, Slope Area and Float Method was applied to measure discharge in upstream of Mahadev khola at Jarakuin Bishnumati Khola at Budanilkantha , in Nakhu Khola at Tika Bhairav ,in Bagmati Rive at Gokarneswar and Sundarijal, in Manohara Riber at Karki Gaun, in Hanumante khola at Mohan Pokhari.

For flood prediction analysis HEC-HMS model and Tank model were used. Besides, for better and reliable resulted extreme flood data from gauging station were used for flood frequency analysis. Gumbel method is applied for prediction of rainfall and flood peaks in different return period.

Flood flow modelling using through calibration of Manning's coefficient for various land cover classes, hydraulic analysis and modelling of river X-section, simulation of profile for given return period and discharge, simulation of the profile in steady state flow method (in HecRAS).

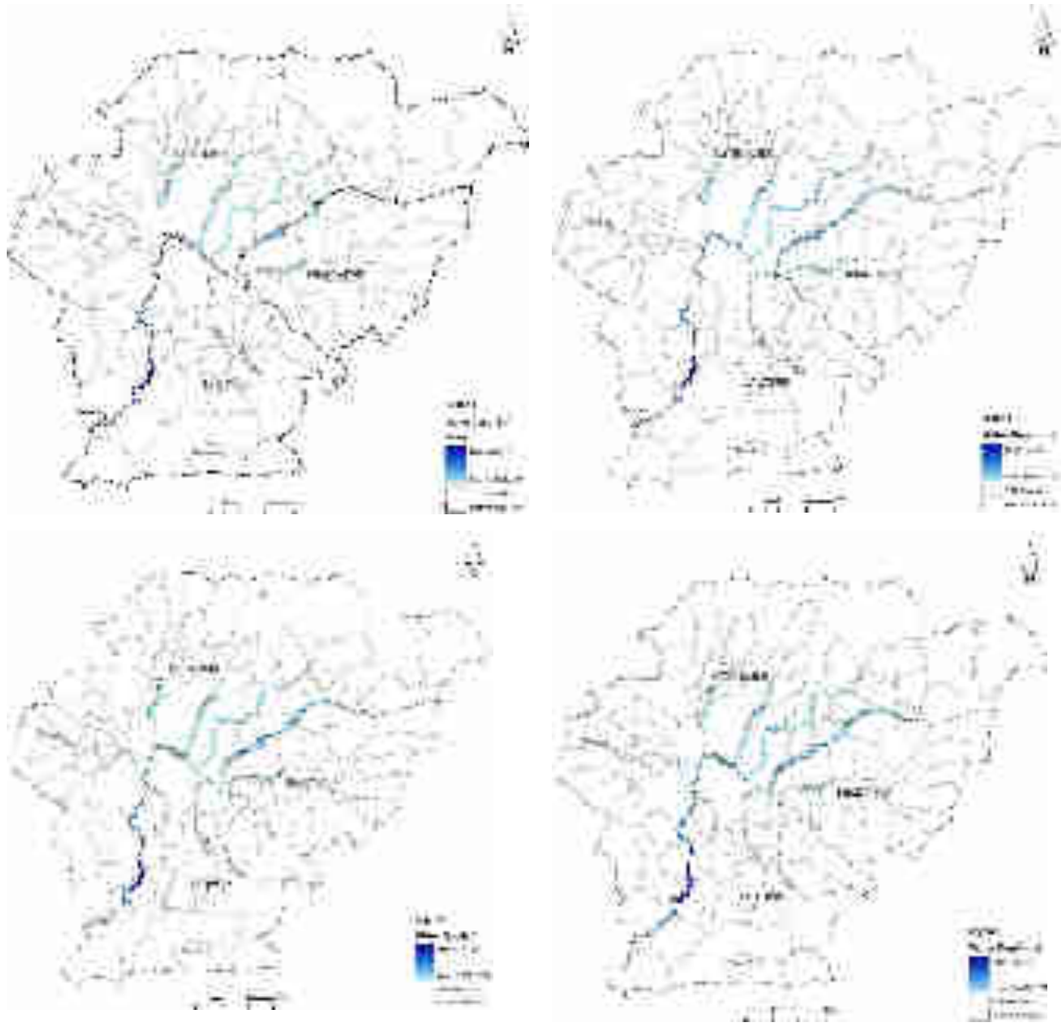

Figure 20 Simulated Flood Inundation Map at (a) 2 yrs., (b) 50 yrs., (c) 500 yrs. &(d) 1000 yrs. return period

Mapped buildings *(n=353,630)* were assessed for possible inundation by different rivers for flood scenarios in different return periods. Following vulnerability scenario is observed based on flood simulation and inundation mapping:

- For 50 years return period, total of 14,329 buildings are likely to be inundated with 13,956 buildings in depths upto 2m, 340 buildings in depth 2-5m, and at least 33 building in depth 5-10m. Major flooding is foreseen in Dhobi Khola with estimated 5,312 buildings affected by inundation with at least 5 buildings up to 5 m depth. Bagmati and Bishnumati rivers are also likely to cause submergence of 3,806 and 2,2295 buildings respectively.
- For 100 years return period, total of 14,593 buildings are likely to be inundated. Among these, 14,169 number of buildings will be submerged up 2m water, 399 buildings 2-5m and 25 buildings 5-10m of water. Flood in Dhobi Khola, is likely to affect 5,425 buildings, Bagmati River flood is likely to affect 4,153 buildings and the Bishnumati flooding is likely to affect 2,313 buildings. *(Refer Table 9)*
- The total number of buildings likely to be inundated in the event of 200 years return period flooding is 14,945 throughout the KV. Among these buildings 14,918 buildings will be submerged 2-5m, and 27 buildings are likely to get submerged in 5-10m water. Dhobi Khola, Bagmati and Bishnumati Khola are likely to affect more buildings than other smaller rivers in the KV. *(Refer Table 10)*
- In 500 years return period flooding event, total of 15,319 buildings in KV are likely to be affected. Among these, 15,286 buildings are likely to be submerged in waters 2-5m and 33 buildings are likely to be submerged in 5-10m waters. *(*Refer *Table 11*).

Table 9 Affected buildings in 100 years return period flood

	100 years			
Rivers	**<=2m**	**2m - 5m**	**5m - 10m**	**Total**
Bagmati	3,900	230	23	4,153
Balkhu	392	80		472
Bishnumati	2,313			2,313
Dhobi	5,346	79		5,425
Godavari	41			41
Hanumante	349			349
Kodku	266			266
Mahadev	488			488
Manohara	600			600
Nakhu	205	1	2	208
Sangle	269	9		278
Total	**14,169**	**399**	**25**	**14,593**

Table 10 Affected buildings in 100 years return period flood

Rivers	**<=2m**	**2m - 5m**	**5m - 10m**	**Total**
Bagmati		4,325	25	4,350
Balkhu		483		483
Bishnumati		2,341		2,341
Dhobi		5,461		5,461
Godavari		41		41
Hanumante		359		359
Kodku		268		268
Mahadev		495		495
Manohara		643		643
Nakhu		222	2	224
Sangle		280		280
Total		**14,918**	**27**	**14,945**

Analysis of flood simulations in different return periods and the extent of the inundation areas clearly shows that the buildings presented in the adjoining tables are located in the old flood plains of these rivers predominantly Dhobi Khola, Bagmati River and Bishnumati Khola, which traverses through the core densely built areas of the KMC. Buildings built in the flood plains of Dhobi Khola, in Kapan VDC and KMC are effected. Similarly, Bagmati River inundates the buildings in Jorpati and KMC, Bishnumati Khola floods effect the buildings in rivers in Khadka Bhadrakali, Tokha Saraswoti, Dhapasi, Gongabu, Manamiaju and KMC. Buildings in Imadol, Harisiddhi, LSMC and Dhapakhel are likely to be affected by the floods in Kodhku Khola. Certain areas along the Bagmati are also affected within LSMC. *(Refer Figure 21 and Figure 22)*

Table 11 Affected buildings in 500 years return period flood

Rivers	<=2m	2m - 5m	5m - 10m	Total
Bagmati		4,529	31	4,560
Balkhu		503		503
Bishnumati		2,360		2,360
Dhobi		5,510		5,510
Godavari		43		43
Hanumante		367		367
Kodku		272		272
Mahadev		505		505
Manohara		680		680
Nakhu		233	2	235
Sangle		284		284
Total		**15,286**	**33**	**15,319**

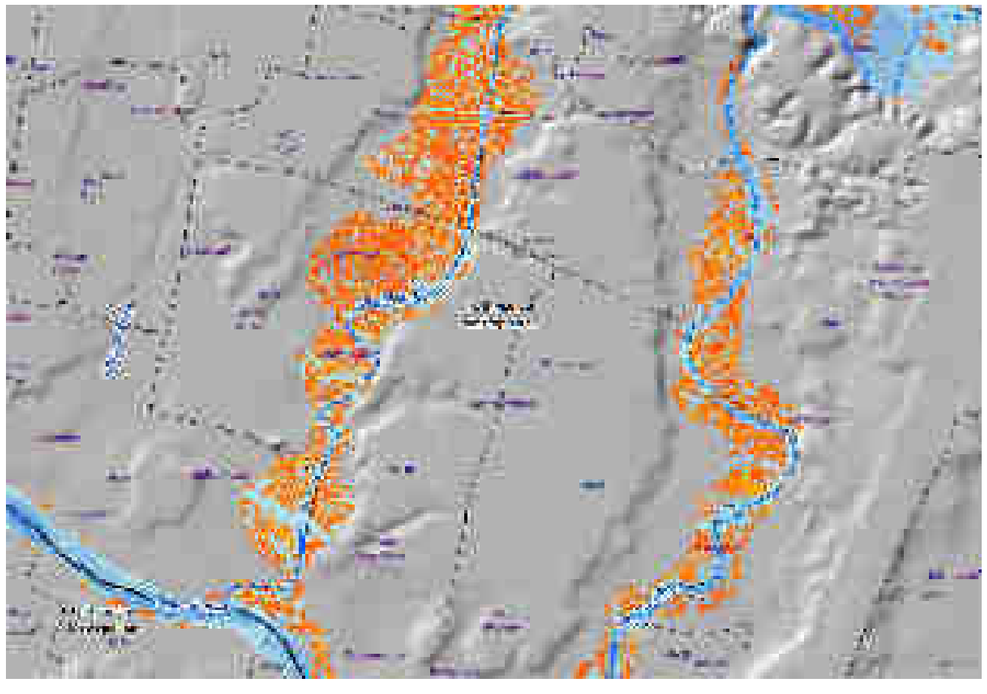

Figure 22 Buildings constructed in the old flood plains of Dhobi Khola and Bagmati River in KMC.

Figure 21 Inundated buildings by Dhobi Khola, Bagmati and Bishnumati Rivers for 100 years return period flood

4.6. Landslide Hazard and Vulnerability

Several factors may be responsible for the occurrence of landslides. With regards to landslide events in Kathmandu valley majority of the cases of landslides were linked with prolong heavy rainfall. However there are other triggering factor like earthquake, Slope and the internal parameter of soil for slope instability. Changes in land use, urbanization and other physical development activities such as road construction, land cutting further add disturbance in the hill slopes leading to landslide. It is therefore necessary to know the landslide prone zones and Landslide susceptible area mapping.

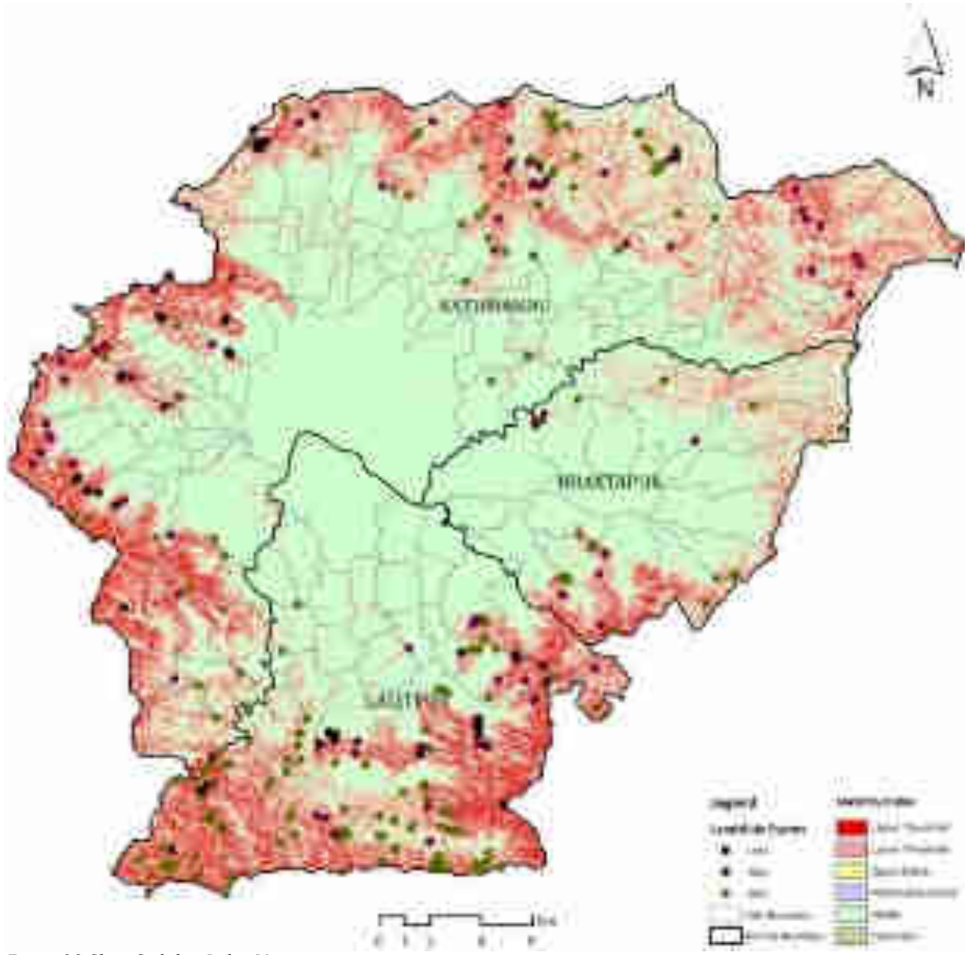

Figure 23 Slope Stability Index Map

Landslide hazard assessment has been done using SINMAP (Stability Index Mapping) method based on the infinite slope stability model (Hammond et al., 1992; Montgomery and Dietrich, 1994). This method balances the destabilizing components of gravity and the restoring components of friction and cohesion on a failure plane parallel to the ground surface. It models the spatial distribution of shallow debris slides combining a mechanistic infinite slope stability model with a steady-state hydrology model. The method derives its terrain stability classification from inputs of topographic slope and specific catchment area and from parameters quantifying material properties (such as strength) and climate (primarily a hydrologic wetness parameter). SINMAP approach applies to shallow translational land sliding phenomena controlled by shallow groundwater flow convergence. It does not apply to deep-seated instability including deep earth flows.

Table 12 Past landslides

Years	Land slides (nos.)
1990	37
2000	96
2012	219

With visual interpretation of high resolution aerial photographs and satellite image of the year 1990, 2000 and 2012, mapping with ground observations, the scenario of landslide in KV is found in an increasing trend. The table below shows the number of events that has occurred in three decades in KV.

With 392 number of landslide inventory points, given Digital elevation model (DEM) and assigned soil parameter, the SINMAP model has derived the topographic Wetness Index that indicates the saturation index in steady state hydrologic condition in the valley and Soil Stability Map in (Figure 23) shows the potential Susceptibility zone of landslides in six range of stability index.

To verify and cross check the results of Stability Index map, different sites were selected based on past landsides hazard records available in database of MoHA and DESINVENTER along with the sample locations designated with Red zone under upper and lower threshold in stability index map *(Figure 23)*.

Figure 24 Figure 5 Landslide in Matatirtha (2002) [Source: Pradeep Poudyal]

From the site verification it found that the results of Stability Index Map approximately tally with the real scenario except in few slope degrees where Rock Outcrops are also shown as susceptible zone in Stability Index Map. However there are also some landmass where subsidence occurred due to existence of excessive springs are demarcated and considered high risk and susceptible to landslide zone.

Figure 25 Landslide revisited in Matatirtha (2015) Houses abandoned after landslide of 2002

The field verification was done at two level of investigation i.e. physical Investigation of landslide area and the other at Disaster Risk Responsive Perspective.

Though the type, intensity and extent of slides are found varied, the cause behind the slides was always associated with continuous and heavy rainfall.

Considering the of Scenario of landslide types and majority of distribution of landslides in certain slope degree (20-40 degree) with additional demarcation of field surveyed data, Stability Index Map is further classified with addition of above mentioned factors into five Susceptible Zones i.e Very High, High, Moderate, Low Very Low Susceptible Zones.

5. POST-EARTHQUAKE SCENARIO

5.1. Gorkha April 25 Earthquake

On April 25th 2015, M7.8 earthquake occurred 11:56 NPT with its epicentre about 80 km west of Kathmandu near Barpak, Gorkha, at the depth of 15 km. This earthquake was the one of the most powerful earthquakes to strike Nepal since the 1934 Nepal-Bihar earthquake (ML8.4). The Gorkha earthquake of 2015 occurred about 200 km west of the 1934 earthquake. Nepal, which constitutes a part of Himalaya region, was also hit by other earthquakes occurred in 1964, 1988 during the instrumental period. The region belongs to Himalaya Arc, which was suffered very large earthquakes with a moment magnitude of 7.5 or more in 1100, 1505, 1555, 1724, 1803, 1833, 1897, 2005, 1947, 1950, 2005, 1833 during the instrumental period and historical period, respectively (Bilham, 2004, 2009; Bilham et al., 2001).

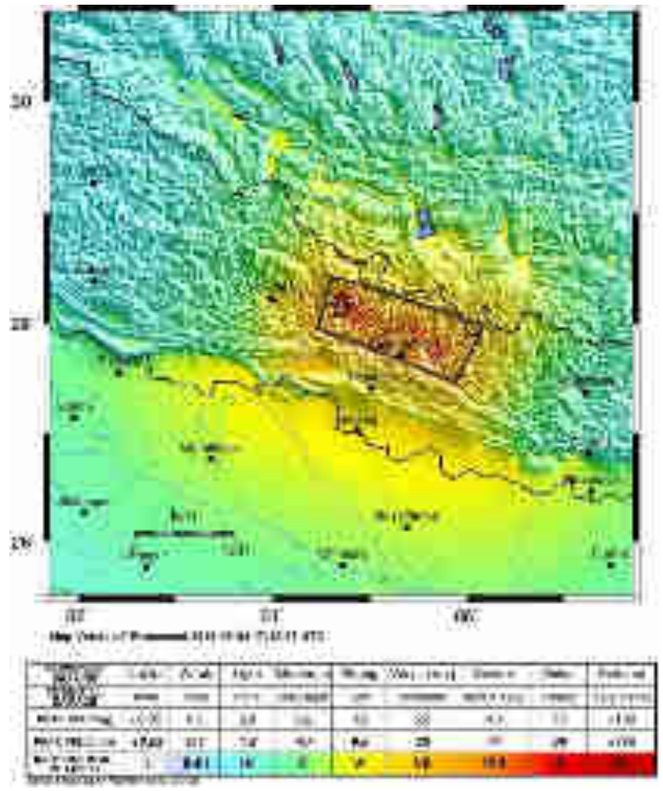

Figure 26 Intensity map of M7.8 Gorkha earthquake. (Source: USGS)

According to USGS, the earthquake was occurred as a result of thrust faulting near the Main Frontal Thrust between the Indian and Eurasian plate. As the Indian plate is converging with Eurasian plate at the rate of 45 mm/yr., a fraction of which, (~18 mm/yr) is driving the uplift of the Himalayan mountain range, and this region has experienced several strong to the great earthquakes over the past history. The rupture plane strikes parallel to the Himalayan Belt west-north-west to east-south-east, and dips with 11° to the North. The rupture duration and relative slip range between 45-60 seconds and 4-5 m. The estimated length, slip and rupture duration of the earthquake fault for a moment magnitude of 7.8 are 132 km, 6 m and 67 seconds from the empirical relations developed by Aydan (2007, 2012), respectively. The preliminary location, size and focal mechanism of the April 25 earthquake are consistent with its occurrence on the main subduction thrust interface between the India and Eurasia plates (i.e. Bilham et al., 2001; Bilham, 2004, 2009).

The ground movement shown by interferometric SAR data from Sentinel-1a radar spacecraft reveals that an area of 120x50 km around Kathmandu Valley was lifted up with the maximum of 1m just to the north east of Kathmandu Valley. Further to the north of the capital, the interferogram data from Sentinel image indicates that ground has subsided, which could be due to the shallow thrust. The researchers have indicated that the fault has ruptured east from the epicentre and did not break to the surface, which could suggest that all the strain built up in the rocks prior to the earthquake has not been released by the M7.8 earthquake and its subsequent aftershocks.

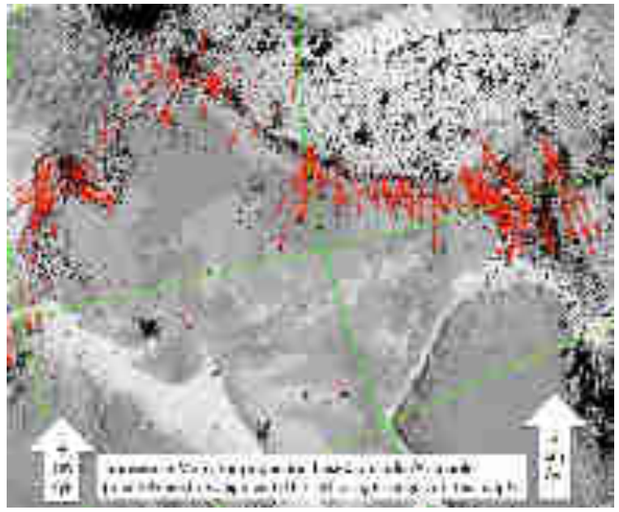

Figure 27 GPS vectors showing Indian pate subduction under Tibetan plateau with the resultant of 4 to 6cm/yr. (Source: Bilham 2015)

The earthquake was felt as far south as Baroda in Gujarat and Hyderabad in Telangana; Tibet in the north; Myanmar in the east and Srinagar, Kashmir in the west. The highest intensity was IX on MMI scale spread over an area cantered in north Kathmandu affecting approximately 700,000 people. The areas of intensity VIII were spread over rest of Kathmandu, Patan, and several other major cities of Nepal affecting some 1,010,000 people. The highest rates of destruction and damage to housing are reported in Sindhupalchowk, Gorkha, Nuwakot, Ramechhap and Dhading districts of Nepal. 39 out of 75 districts were affected. The most affected areas were Makawanpur, Sindhuli, Bhaktapur, Dhading, Dolakha, Gorkha, Kathmandu, Lalitpur, Lamjung, Rasuwa, Ramechhap, Nuwakot, and Sindulpalchowk. About 3,737,000 people experienced intensity VII. There are over 300 aftershocks of M>4 including 26 aftershocks of M≥5. The largest aftershock of Mw 7.3 occurred on 12 May 2015. The events of size of M 7.8 earthquake had approximate dimensions of 120x80 km, directed from its hypocentre eastwards, and towards Kathmandu, while the M7.3 earthquake was located just beyond the eastern end of that rupture. The other two strong aftershocks of M 6.6 and 6.7 occurred on 25th and 26th April.

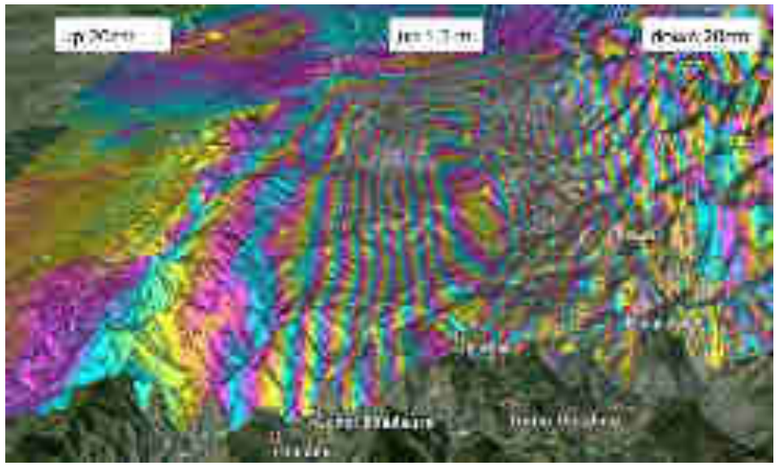

Figure 28 Sentinel1 interferogram image showing the uplift of Kathmandu valley of up to 1.5 m while subsidence of the peripheral areas. (Source Bilham 2015, BBC)

The strong motion network of Nepal is limited and there are only two stations in Kathmandu valley. The Kanti-Path (KATNP station) recorded the maximum ground acceleration of 0.164 g. It was noted that the record was dominated by the long-period components of acceleration, which may be affected by the soft sedimentary basin effects on the duration and amplification of shaking in Kathmandu Valley. The USGS preliminary estimation of the maximum ground acceleration (PGA) in the epicentral area was about 0.35g and 0.1-0.15g for Kathmandu valley. Piya (2004) stated that, The Kathmandu valley comprises of thick semi-consolidated fluvio-lacustrine Quaternary sediments on the top of basement rocks and the maximum thickness of the valley sediments reaches up to 550 m at the central part of the valley and the basement rocks composed of Precambrian to Devonian rocks, such as limestone, dolomite, slate, marble, schist, meta-sandstone, phylitte, quartzite. According to Gautam and Chamlagain (2015), the shear wave velocity of the soft sedimentary deposits ranges between 167 m/s and 297 m/s and ground amplification may be ranging between 1.9 and 7.9.

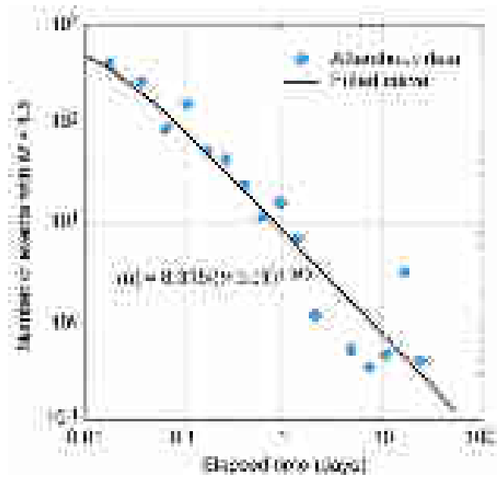

Figure 29 fitting of aftershock conforming to the modified Omori's Law with P value of 1.049 (Source: Goda et al. 2015)

From the trench excavation, French Scientist Laurent Bollinger and his colleagues had uncovered the historical pattern of earthquakes during the fieldwork in Nepal just one month prior to the earthquake and anticipated a major earthquake in the same location where the M7.8 earthquake occurred. Bollinger's team dug trenches across the country's main earthquake fault, which runs for more than 1,000 km from west to east, at the place where the fault meets the surface. The team used the fragments of carbon buried within the fault to carbon-date when the fault had last moved. His group showed that the fault has not moved since the year 1344 and could cause major earthquake. The findings were presented to the Nepal Geological Society just two weeks prior to the earthquake. The team suggested that, when a large earthquake occurs, it is common for the movement to transfer strain further along the earthquake fault, and this seems to be what happened in the year 1255. Over the following 89 years, strain accumulated in the neighbouring westerly segment of fault, finally rupturing in 1344. The history has repeated itself, with the 1934 fault transferring strain westwards along the fault, which has finally been released 81 years later on 25th April 2015. Also the Bollinger's team has suggested that M7.8 earthquake is probably not big enough to rupture all the way to the surface, so there is still likely to be more strain stored, and another big earthquake could be expected to the west and south of this one in the coming decades.

5.2. Aftershocks

Generally, a strong earthquake is followed by number of aftershocks. The aftershock data obtained from the USGS earthquake catalogue reveals that moderate aftershock of (M6.6) occurred immediately after the main shock and majority of aftershocks took pace in Kodari region of north east of Kathmandu Valley.

The aftershock of 12th May was recorded M7.3 and caused additional damage and fatalities. Comparison of the aftershock distribution with respect to slip distribution of main shock indicates that the major aftershock of M7.3 occurred far off in the surrounding areas of the main shock asperity, which may be because the spatial and temporal characteristics of the aftershocks are a manifestation of internal crustal dynamics involving the redistribution of the stress and displacement fields (Stern 2002). The statistical analysis of the aftershock data reveals that, while fitting the aftershock data to the Gutenberg-Richter relationship, the slope parameter was observed to be -0.862, which is slightly gentler than the typical b-value for global Interplate subduction earthquakes but within the expected range. Also the aftershock data conforms to the modified Omori's law which suggests the temporal decay parameter p-value is 1.049, which is close to the global average of about 1.2. The above results support the applicability of the established empirical laws for characterizing the 2015 Nepal earthquake data.

The aftershocks have been continuous with changing intensity. It has spread all over Nepal moving to west towards Gorkha and Okhaldhunga to the east as shown in *Figure 30.*

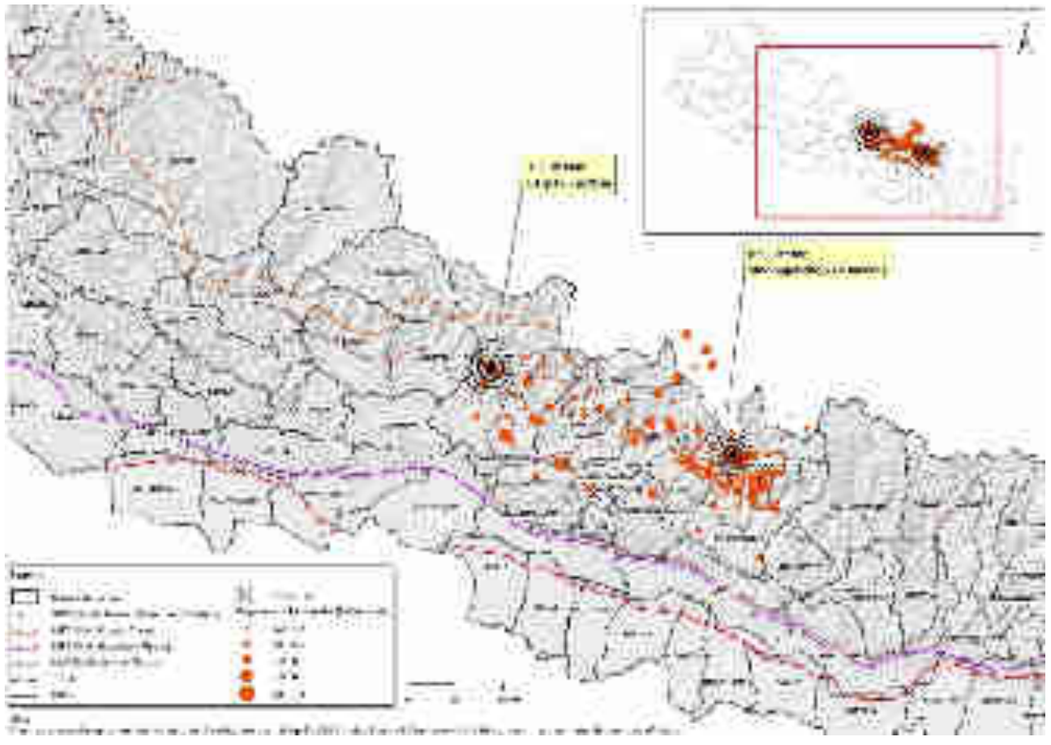

Figure 30 Distribution of aftershocks (DMG/GoN, DoS/GoN, National Seismological Centre Nepal, GENESIS)

5.3. Fatalities and Causalities

In Nepal, 8,781 people died, among which 3932 were male and 4847 were female also 22,303 people were injured due to the earthquake. The earthquake caused 2,649 government houses totally damaged and 3,617 houses partially damaged, also 509,727 public buildings were fully damaged and 289,170 buildings were partially damaged throughout the country. Also the assessment report from Nepal police reveals that 3,534 schools, 673 archaeological structures and temples, 277 health centres and 710 police units were damaged due to the earthquake. In Kathmandu Valley alone, 1,735 people died and 13,102 people were injured (DRR Portal, 21/6/2015). Similarly inside the KV, 73,624 buildings were completely damaged beyond repair, while 68,937 buildings were suffered from partial damage.

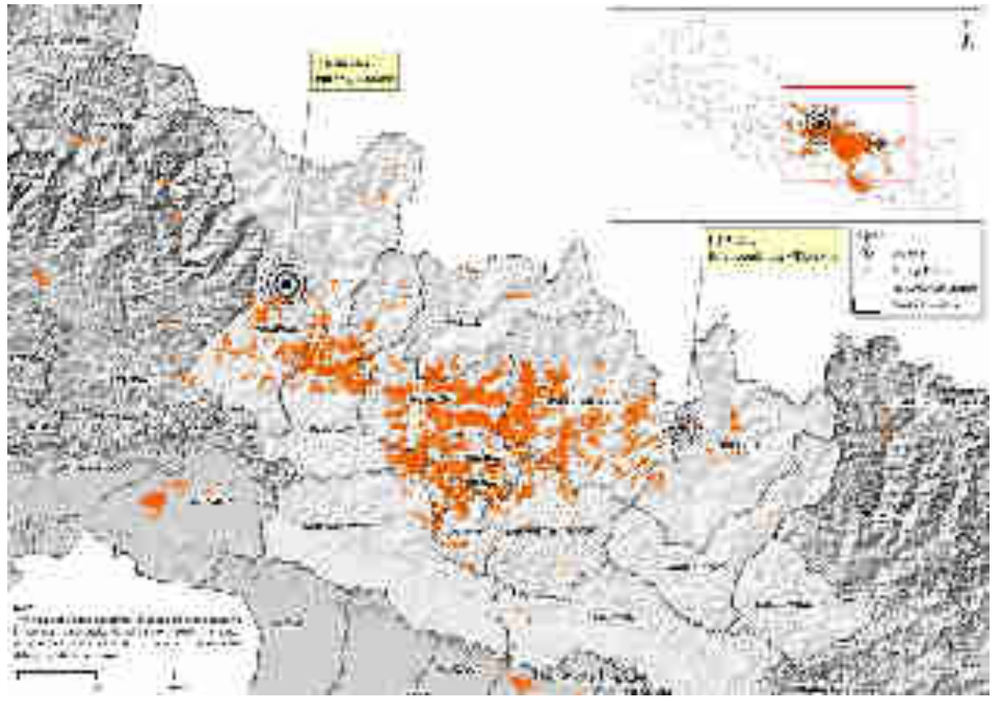

Figure 31 Locations of damage buildings/infrastructures [Source NGA, UNOSAT and Tomnod]

The shallow depth of the quake and the nature of Kathmandu Valley have contributed to the high losses in the capital of Nepal. However, it should be noted that the quality of construction and materials of buildings is very poor. Many recently built reinforced concrete structures failed in a pan-cake mode due to improper column-beam connections. Furthermore, many brick structures collapsed or heavily damaged due to the use of poor mortar material and tie-beams and slabs within the walls. The walls of houses were built as dry-masonry and their resistances are mainly due to frictional forces. In addition, plastic deformation of their foundation on sloping ground due to ground shaking was another cause of collapse and heavy damage.

This earthquake induced many mass movements in mountainous areas and resulted in landslide lakes, which could be another cause of secondary disasters. The mass movements and deformation of weathered soft soil cover are the main causes of the collapse or heavy damage to buildings and heavy casualties in mountainous areas. In addition, the earthquake also triggered a major avalanche on the south slopes of Mt. Everest, located approximately 160 km east-northeast of the epicentre. According to different media reports, the avalanche killed at least 17 people and injured 61 others.

In KV, traditionally built mud-mortar buildings were the most affected in traditional settlements Bungmati, Lubhu, Sankhu, Bhaktapur, Chapagaon and parts of Kathmandu and Lalitpur. Poorly built and non-engineered buildings were also mostly damaged. Heavy damages and fatalities occurred in and around Gongabu, Sitapailam Machapokhari, Kapan areas. The newly built road that connects Bhaktapur to

Koteshwor was also heavily damaged near Kaushaltar with large cracks on the road surface and subsidence. Engineered buildings that collapsed around Gongabu and Sitapaila are said to have been due to geological formation of those areas. These areas have been identified as high liquefaction susceptible areas. Other areas in KV also reported oozing out of water and sand, indicating the potential of liquefaction in these areas. According to DMG officials, the topography, soil and geological formation have also shown very close correlation with the pattern of building damage. The surface and ground water sources have depleted in some areas while in some areas dry sources have been replenished with water. Many are reasoning the shift in surface of the earth as the cause to these events.

5.4. Damage to Cultural Heritage

The reports reveal that there is a substantial damage to the built heritage sites across Kathmandu valley and some parts of the western regions of Nepal. The mostly the traditional settlements with unreinforced brick masonry structures were severely damaged including traditional palaces, squares, stupas and temples. In a report by ICORP/ICCROM which was based on crowd sourcing of the damaged monuments and cultural sites, out of 141 entries 68 were mentioned to have completely collapsed. In historic sites of such as Durbar Squares in Kathmandu, Bhaktapur an Patan and temple complex of Swayambhu, some structures were completely damaged while some are standing but structurally unsound.

Figure 32 The military assist in cleaning and salvage in Swayambhunath (Source: Tapas Paul and Drik/ ICCROM/ICORP 2015)

Many of the temples and religious structures feature elaborately carved wooden elements as well as stone sculptures dating very ancient times which ended up in the heap of rubble. Also the National museums in Kathmandu suffered damage, which includes Chhauni museum, Gorkha Museum, museums in Changunarayan, Patan palace museum, Sankhu library and Kaiser Library in Kathmandu. The damaged monuments inside Kathmandu valley includes Dharahara tower, around the periphery of Kathmandu Durbar square, Hanuman Dhoka palace, Bishnu temple, Maju Deval Temple, Krishna temple, Dus Mahadhar Temple, statue of King Pratap Malla, Shikhar style Mahadev temple, Kageshwori temple, Jagannath temple premise, Kasthamandap temple and small temple at the north side of kasthamandap and Jaishidewal temple. Similarly the Taleju temple was partly damaged and also the Shiva temple at Ranipokhari was damaged. At Changunarayan world heritage site premise, white Gumba, Kileshwor temple and Amatya Sattal suffered major damage and Chhinnamasta temple had partial damage. At Swoyambhu, Anantapur, Shantipur and Devdharma Mahavihar was totally collapsed. At Tripureshwor, Kalmochan temple, HemHiranya Temple and Sattal were destroyed. At Pashupatinath periphery, Guheshwori temple, Kirateshwor temple, Panchadewal, Shankaracharya Temple, Bishworup Temple, Mrityanjaya Mahadev Temple, Chandreshwor sattal, Ram temple, Gorakhnath temple and Sattals were damaged, the spire and top portion of Jaybageshwori temple was destroyed. At Lalitpur, Char Narayan and Harishankar temple collapsed, Sundari Chowk and Taleju temple inside Moolchowk suffered damage. Also the Jagatnarayan temple at Sankhamul and Red Machhindranath temple at Bungamati was collapsed. At Bhaktapur, Vatsala temple, Fasidewal, Harishankar Sattal, Kedarnath temple, Laal Baithak and small temples around Nyatapola was damaged and the top part of Nyatapola has cracks.

Figure 33 Before and After image of Kasthamandap temple, which was said to be built by one Tree and Name of Kathmandu was taken from this temple's Name.(Source: Instragram/Sabinji)

5.5. Post-Earthquake Disasters

Though Gorkha EQ and its aftershocks had toll on human lives and damage to buildings, it was of extreme luck that no major damages occurred to the infrastructure and critical lifelines. Other post-earthquake disasters such as fire, epidemics etc. was reported. Earthquake triggered landslides was of major concern and have occurred throughout the central and western hilly regions. These landslides and dry mass wasting have been major hazards and have resulted in further toll of lives and assets. Potential landslides during the ensuing monsoon season is of further concern adding woes to the lives of already displaced population. The frequently occurring aftershocks, especially epicentered in and around Dolakha and Sindhupalchowk districts have rendered fear and misery to the general public in the region.

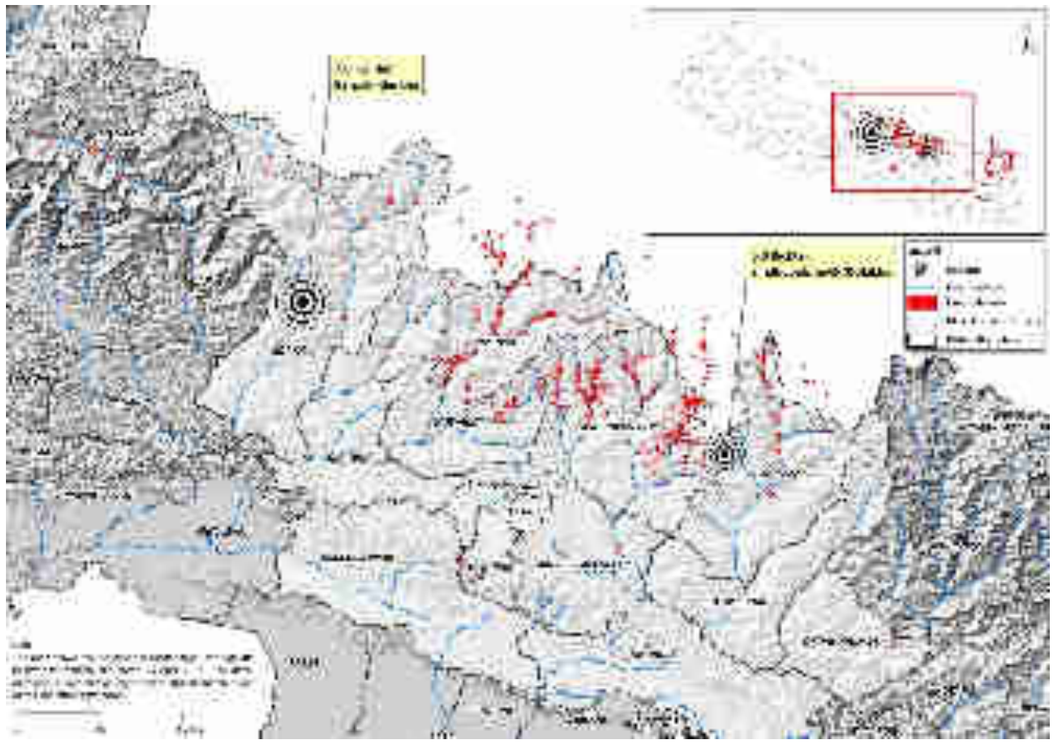

Figure 34 Locations of post-earthquake landslides

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SECTION 2 RISK SENSITIVE LAND USE PLAN IN KATHMANDU VALLEY

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6. RISK SENSITIVE LAND USE PLANNING

6.1. Risk Sensitive Land Use Planning

Land is a resource and a base for development activities. In an urban context, lack of land for development and lack of integrated land use management policy are major challenges, which further lead to haphazard urbanization and socio-economic consequences. Land Use Planning is undertaken to specify acceptable usage of the available land for development, while considering local situation analysis in relation to long term socio-economic and environmental factors. It involves multiple choices and decisions made by community in reaction to multiple and economic forces that interplay within society and often the component of risk and hazard are overlooked or given less priority. In the present context, considering the increasing vulnerability of communities to natural hazards and climate change stimuli, there is an urgent need to develop land use plan that focuses on mitigating the potential disaster risks and build resiliency of the communities to cope with such risks. Encouraging such an approach is urgent considering the fragmented approach to Disaster Risk Reduction (DRR) practices that are still dominated by a post-disaster focused approach rather than emphasizing on preventive measures through spatial planning and long term investments in DRR (Johnson 2011). There are opportunities and limitations of spatial planning as a policy instrument for efficient and balanced development that includes long term planning required for effective disaster risk reduction. Thus, the concept of Risk Sensitive Land Use Planning (RSLUP) is evolving as a mechanism that integrates the factors related to DRR into land use planning. Adding to this concept, the role of ecosystem management in risk reduction, also referred to as 'natural or ecological infrastructure' or 'green solutions' for DRR

Risk sensitive land use planning identifies the safest areas in order to prioritize immediate investments in urban development and infrastructure projects (Jha, Miner, and Stanton-Geddes 2013). Risk Sensitive Land Use Planning is a participatory approach that utilizes information related to potential hazard risks and resource constraints within the area to develop a more risk resilient settlement that has the right mix of both development and risk reduction (Burby et al. 1999). In urban RSLUP, the urban planning is used as a mechanism through which disaster risk reduction and climate change adaptation can be mainstreamed and institutionalized, when practiced by national and local government as regular management functions with the broader goal of sustainability of the cities for future generations. As the plan is prepared for the community, involvement of stakeholders within the community is quintessential from the early phase of risk sensitive planning (World Bank and EMI 2014). Participatory approach helps to develop shared understanding of disaster risks within the community and facilitates the stakeholders to prioritize potential risks and provide inputs related to risk mitigation strategies within the plan. This further sets the stage for productive collaboration and the timely implementation of the proposed plan while ensuring support from all stakeholders throughout the planning process. The approved RSLUP is practiced by national and local government as regular management functions with the broader goal of sustainability of the cities for future generations.

In summary, risk-sensitive land use planning intends to: [adopted from (Jha, Miner, and Stanton-Geddes 2013)]

a. Identify and mitigate the disaster risks embedded in the current land use and development practices through building bye-laws are regulatory ordinances for use of land in hazard prone areas;
b. Reduce losses by facilitating faster responses by providing open spaces, well planned evacuation road networks for rescue operations;
c. Promote controlled urban growth without generating new risks through rebuilding and upgrading infrastructure – "building back better" using hazard resistant construction

6.2. Process of RSLUP

Risk sensitive adds two new considerations in the conventional land use planning approaches (World Bank and EMI 2014):

- Disaster Risk Reduction (DRR) goals and objectives are formulated and integrated in the conventional land use planning approaches based on the information related to hazard, vulnerability, risk and capacity parameters together with the disaster/emergency management requirements.
- Integration and mainstreaming in formal government activities by undertaking measures to ensure understanding, acceptance, ownership and support for the plan through improving competency and knowledge about the risk-sensitive land use planning among the policy makers, planners, development professionals and through raising awareness and fostering support of all the stakeholders.

These additional considerations require scientific and evidence based assessment of hazards, vulnerability and risk along with coping and adaptive capacities of the communities including the governance system; review of information, aspirations, perceptions of the targeted communities and stakeholders; assessment of the legislative framework and institutional capacities of the government and implementing authority and supporting agencies; assessment of non-government organizations and private sectors to support implementation of the tools and business models of the plan for successful and sustainable implementation.

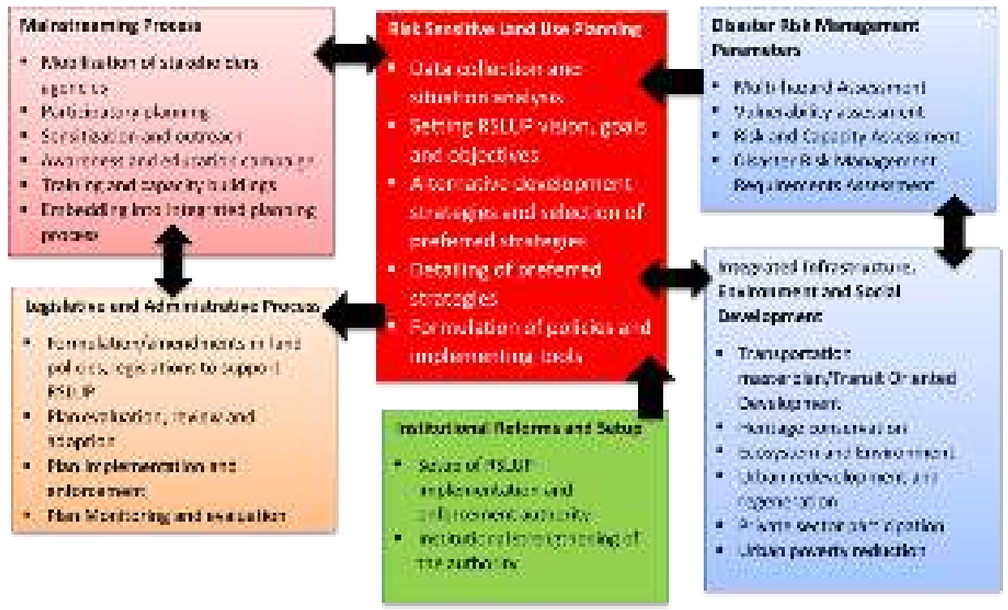

Figure 1 Framework and process of RSLUP [Adapted from Bendimerad, F. (2012)]

6.3. Rational for RSLUP

More often disaster occur suddenly or with very little warning, catching communities, local government and states lacking proper early warning system completely off-guard. Lack of preparedness makes the post disaster management a difficult task especially after very a major natural disaster. This situation was evident after the Haiti Earthquake in 2010 and recent Nepal Earthquake in 25 April 2015, where the states failed to respond immediately with their administrative set up and limited funds and resources. The key barriers to risk sensitive land use planning can be summed up by the institutional capacities to carry forward plans and enforce them, the amount of public participation in planning and the amount of political leverage to support the planning process (Sudmeier-Rieux et al. 2013).

The urban areas in Nepal are proliferating with haphazardly constructed and substandard buildings, non-engineered dwellings as well as uncontrolled land use. The haphazard urbanization has led to the resource depletion, degradation of the urban environment, unsustainable and unhealthy living conditions and more importantly vulnerability and exposure to multiple hazards. Most urban areas of Nepal face the growing problems of urban sprawl, loss of natural vegetation and open space, and infrastructure deficiency. The current rate of urban growth and the consequent land use change if left unabated will surely lead to the major complexities for the future generations.

Haphazard Land-use change has a direct impact on regional climate change and influence on water and energy balance. The conversion of natural systems to agriculture and other urban land use has resulted in a net release of carbon dioxide to the atmosphere. This has a negative impact on the regional climatology and hydrology and results in the loss of bio-diversity and fragmentation of the landscape. Biodiversity loss takes place at multiple levels -landscape, ecosystems, species and gene and in multiple dimensions-structure, function and process.

Environmental degradation, urban poverty and increasing vulnerability towards natural calamities due to urban expansion in high earthquake prone areas, floods and landslide prone areas and others has exacerbated the existing urban areas. The urban vulnerability is largely a consequence of improper urban management, inadequate land use planning, ill-regulated population density, poor construction practices, ecological imbalance, infrastructure dependency, and inadequate provision of open spaces. The worsening vulnerable situation of the urban areas is one of the primary reasons for rising disaster losses. The urban disasters occur as an outcome of the interaction of a natural hazard, and vulnerable conditions of people exposed to such hazards.

Land-use planning is the systematic assessment of land and resource potential, alternatives for land use and economic and social conditions in order to select and adopt the best land-use options. Its purpose is to select and put into practice those land uses that will best meet the needs of the people while safeguarding resources for the future. The utility of land use planning has immense possibility in an effective disaster risk reduction in Nepalese context and it is a high time to methodologically integrate risk reduction in land use planning. Reducing the urban disaster risk is a systematic development and application of policies, strategies, and practices to enhance resilience throughout the society, by limiting or avoiding the hazard exposure, within the broad context of sustainable development, which in other word can be referred as Risk sensitive land use planning (RSLUP).

Risk sensitive land use planning seeks to adopt the best land-use options and translate the assessment of risks into the appropriate location of land uses, functions, facilities and into land use regulations and policies. It is a potentially powerful mitigation tool as it seeks to mitigate the risks and vulnerability from several geological and other hazards, generally through physical measures such as strengthening structures to withstand earthquakes, limiting development in flood and landslide prone areas, placing development away from geologically unstable areas. RSLUP procedure combines the assessment of hazards, vulnerability and exposure with the standard urban planning processes. This is only possible when the risk assessment procedure has a factual and scientific basis. In order to use land use planning for disaster risk reduction, it is necessary to evaluate the factors contributing to those risks. RSLUP includes hazard identification and evaluation (e.g. Analysis of frequency, severity/magnitude, return period or probability of a hazard), vulnerability assessment (e.g. Potential loss of life, socio-cultural loss, long term economic impacts), and exposure assessment (e.g. Loss estimation of vulnerable population), in broad context of sustainable development and resilience of the urban areas. Applying land use planning techniques with risk assessment includes a comprehensive analysis of the land use behaviours and translation of these risk assessments into location of land uses, functions, facilities and into land use regulations and policies. RSLUP includes some regulatory and non-regulatory planning tools such as land use zoning and building bylaws, design of critical facilities and evacuation routes, building code implementation, building retrofitting and infrastructural strengthening, identification of strategic locations for hospitals and emergency relief materials and stockpiling etc.

6.4. Approach to RSLUP in KV

The development of RSLUP in KV has evolved from generation relevant information, multi-hazard spatial modelling, vulnerability assessment, adaptation of best practices, guided by the provisional planning visions of the KVDA (such as Long Term Development Concept Plan 2035, Strategic Master Plan 2035) and more importantly the post disaster situation from the recent April 25 earthquake experiences. The development of RSLUP has considered four phased approach viz.

- Development of information and knowledge base needed for evidence based decision support in planning
- Development of RSLUP and implementing tools and bye-laws
- Participation of stakeholders and concerned in collaborative decision making; and
- Capacity building and mainstreaming.

The approach is presented in the following schematic diagram.

Figure 2 KV-RSLUP development process

6.5. Result Chain of Kathmandu Valley RSLUP

To institute an increasingly modern and efficient RSLUP Framework that supports economic development with a minimum of negative environmental and social impacts and that adequately considers and protects all population groups from all types of risks including natural and climate change related disasters by increasing their adaptation capacities according to their varying needs while mitigating adverse impacts of climate change

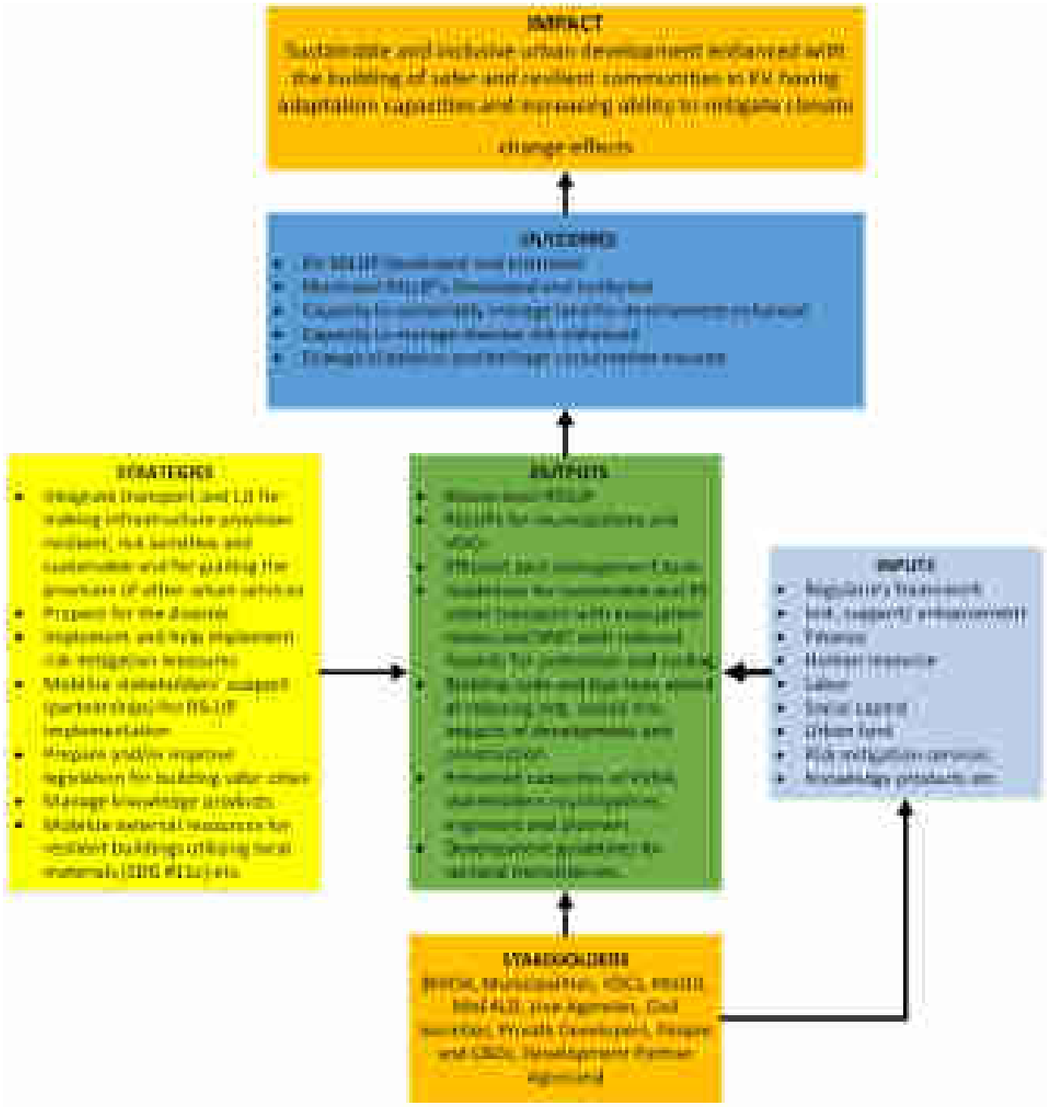

Figure 3 Result chain of implementing RSLUP in KV

The Results Chain shown in the above diagram can be expressed in words as follows:

In order to have sustainable and inclusive urban development enhanced with the building of safer and resilient communities in KV having adaptation capacities and increasing ability to mitigate climate change effects (Impact). The plan aims at instituting and implementing RSLU Framework in KV (Goal) for having capacity to sustainably manage land for development enhanced; capacity to manage disaster risk enhanced; and ecological balance and heritage conservation ensured with inclusive access of all (the poor, children and women, differently abled people and senior citizens in particular) in view of increasing natural disasters and climate change related threats as the result of growth and development of KV (Outcomes).

With the production/provision of

- Macro-level RSLUP
- RSLUPs for municipalities and VDCs
- Efficient land management tools
- Guidelines for sustainable and risk sensitive urban transport plan including evacuation routes with reduced hazards for pedestrians and cycling and expanded and improved service network of urban public transport including non-motorized modes
- Inventory of greenery and open space and heritage sites
- Building code and bye-laws aimed at reducing negative social/ environmental impacts of development and construction
- Development guidelines for sectoral partner ministries
- Training programs and orientations
- Economically efficient and risk sensitive Land Use Plans for urban areas at different levels
- Toolkits and guidelines for preparedness and disaster risk management
- Response mechanisms for availing the emergency needs to the victims
- Designs for more adequate open spaces at several places of the Valley and new development areas to make it easier to build shelter, distribute food, medical care, and temporary health facilities
- Preparedness plans with alternative channels of communication and road access for maintaining contacts outside during disaster
- Local enabling programs for community mobilization and empowerment based on cohesiveness and participatory planning for action etc. (Outputs)

Through the implementation of the following strategies (Strategies)

- Adopt and implement integrated national policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters.
- Provide guidelines for sustainable and risk sensitive transport planning;
- Integrate transport and LU for making infrastructure provision resilient, risk sensitive and sustainable and for guiding the provision of other urban services
- Prepare for the disaster
- Implement and help implement risk mitigation measures
- Mobilize stakeholders' support and form partnerships among spatial entities, sectoral agencies and key players of governance for RSLUP implementation
- Prepare and/or improve legislation for building safer cities

- Manage knowledge products to make "urban areas" inclusive, safe, resilient and sustainable
- Mobilize external resources for resilient buildings utilizing local materials (SDG #11c) etc.

By mobilizing

- Regulatory framework
- Inst. support/ enhancement
- Finance
- Human resource
- Labor
- Social capital
- Urban land, greenery, open space, heritage assets in particular etc.
- Risk mitigation services
- Knowledge products
- Road networks (evacuation routes in particular) etc. (Inputs/Resources)

Owned by

KVDA, Municipalities, VDCs, MoUD, MoFALD, Sectoral Partner Agencies, Private Developers, Civil Societies, People and Community-based organizations (Stakeholders)

7. LEGAL AND INSTITUTIONAL FRAMEWORK

7.1. Legal Mandate for Plan Formulation

In coordination with local municipalities and Village Development Committees (VDCs), the KVDA is responsible for the overall planning and regulation of urban development at the Valley level. Its work includes the formulation and updating of Valley development plans and land use plan for the region. These plans serve to guide the municipalities within the Kathmandu Valley, including DDCS, Municipalities and VDCs in developing their own detailed land use plan.

KVDA exercises land redevelopment through land pooling and guides land development projects in KMC and other municipalities and cities within the Valley. Land pooling is a powerful tool that KVDA is already using, which may be used to integrate DRR in the urban development and land use planning processes of KV.

At the national level, laws and acts of the State are being approved by the Parliament. These legal frameworks and policies may come from various ministries while the Ministry of Laws reviews and consolidates such initiatives. After receiving confirmation from the Cabinet, the legislation enters into force and is implemented by concerned ministries. These national legislations are cascaded down through the bureaucracy in the form of bylaws promulgated by the concerned ministries and other governmental institutions.

Below are highlights from several key policies and development action plans that are relevant to understanding land use planning and local development in Nepal.

7.1.1. The Interim Constitution of Nepal 2063 (2007)

Under this Interim Constitution, provinces are granted autonomy and full authority to plan for their territories. Article 140(1) stipulates the mobilization and allocation of responsibilities and revenues between the Government of Nepal and local authorities as provided by law, in order to make the latter accountable for the identification, formulation and implementation of local level plans, while maintaining equality in the mobilization, appropriation of means and resources, and distribution of development.

7.1.2. Three-Year Interim National Plan (2064-2067) (2007 – 2010)

This plan was prepared with federalism in mind in order to provide a certain level of autonomy to the local government, under the supervision of a Regional/Provincial body. The regional body and the local government units that compose the regional body shall be responsible for the development of the region in accordance with the specific needs of the constituents in order to uplift the present standard of living. Hence, the restructuring process results in a multi-tier government with the national government being called the Federal Government and the regional government as Federal States. The local government is to be given autonomy, but supervised by the State.

7.1.3. *Tenth National Plan (2002-2005)*

Significant issues addressed in this document include Unit 21-Residential Building and Town Development Planning, which covers, inter alia:

- Regulating haphazard construction with proper development controls in town development planning;
- Establishing good partnerships with villages;
- Providing incentives to private sector developers to ensure safe and affordable housing (i.e., with considerations of earthquake safety and promoting local and affordable construction materials);
- Providing guidelines for managing environmental degradation and for orienting people about DRR before the implementation of any project; and
- Preparing and implementing town development policies and regulating city development by local governments. The program and policies will be developed, taking into account the disaster risks in the cities.

7.1.4. *Three-Year National Plan (2009/10 - 2012/13)*

This plan has given the importance to the disaster risk management and set the long term vision for developing the capacity of the country for coping with any type of natural and human-induced disasters. It has clearly mentioned in the policy and actions under the section 6.3 (Disaster Risk Management) that the preparation of risk sensitive land use plan and following the building code will be made compulsory in urban and urbanizing areas. It has also mentioned about the minimization of the impacts of climate change by protecting environment and availing opportunities; increasing the access of people in water induced disaster prevention services; developing safe, low cost and environment friendly housings; developing appropriate settlements and cities from the environmental and social perspective etc in different sections.

7.1.5. *Local Self Governance Act of 1999*

Section 96 of the Local Self Governance Act (LSGA) of 1999 stipulates the functions, duties, and responsibilities of municipalities, including Kathmandu City, to wit:

Section 96. Functions, Duties and Power of Municipality stipulates in addition to executing or causing to be executed, the decisions and directions of the Municipal Council, the functions and duties to be performed by the municipality mandatorily in the municipal area shall be as follows:

Sector	Duties
a. Finance	▪ Prepare annual budget, plans and programmes of the Municipality and submit them to the Municipal Council
b. Physical Development	▪ Frame land-use map of the Municipality area and specify and implement or cause to be implemented, the industrial, residential, agricultural, recreational areas, etc. ▪ Prepare housing plan in the area of Municipality and implement or cause to be implemented the same ▪ Develop, or cause to be developed, green zones, parks and recreational areas in various places in the Municipality area
c. Water Resources, Environment and Sanitation	▪ Conserve rivers, streams, ponds, deep water, wells, lakes, stone water-taps etc. and utilize or cause to be utilized them properly. ▪ Assist or cause to be assisted, in environment protection acts by controlling water, air and noise pollution to be generated in the Municipality area. ▪ Protect or cause to be protected the forests, vegetation and other natural resources within the Municipality area. ▪ Carry out and manage or cause to be carried out and managed the acts of collection, transportation and disposal of garbage and solid wastes.
d. Education and Sports Development	▪ Establish, operate and manage pre-primary schools with own source in the Municipality area and give permission to establish the same. ▪ Open, operate and manage or caused to be opened, operated and managed, libraries and reading halls in the Municipality area. ▪ Prepare and implement or cause to be implemented, sports development programmes.
e. Culture	▪ Prepare an inventory of culturally and religiously important places within the Municipality area and maintain, repair, protect and promote, or cause to be maintained, repaired, protected and promoted the same.
f. Works and Transport	▪ Prepare plans of unsurfaced and surfaced roads, bridges and culverts as needed within the Municipality area, except those roads which are under the responsibility and control of the Government of Nepal (GoN), and construct, maintain and repair or cause to be constructed, maintained and repaired the same. ▪ Arrange or cause to be arranged for bus parks and parking places of rickshaws (three-wheelers), horse-carts, trucks etc. within the Municipality area.
g. Health Services	▪ Open, operate and manage or cause to be operated and managed health posts and sub-health posts within the Municipality area.
h. Industry and Tourism	▪ Act or cause to act as a motivation to the promotion of cottage, small and medium industries in the Municipality area. ▪ Protect, promote, expand and utilize or cause to be protected, promoted, expanded and utilized, natural, cultural, and tourists' heritage within the Municipality area.
i. Miscellaneous	▪ Determine and manage places for keeping pinfolds and animal slaughter house. ▪ Protect barren and government-owned unregistered (Ailani) land in the Municipality area. ▪ Frame by-laws of the Municipality and submit it to the Municipal council. ▪ Carry out necessary functions in managing and responding to natural disasters. ▪ Maintain inventory of population, houses, and land within the Municipality area.

	▪ Update the block numbers of the houses in the Municipality area. ▪ Arrange for animal slaughter houses. ▪ Grant approval to open cinema halls in the Municipality area. ▪ Carry out or cause to be carried out other acts relating to the development of the Municipality area. ▪ Carry-out such other functions as are prescribed under the prevailing law

In addition to the functions and duties referred to in sub-sections, the Municipality may also perform the following optional functions

j. Control unplanned settlement within the Municipality area
k. Make the structure and development of the town well-planned through the functions such as guided land development and land use
l. Launch programmes to control river pollution; and
m. Carry out preventive and relief works to lessen the loss of life and property caused by natural disasters

Further, Section 111 of the LSGA provides the following instructions in the formulation and implementation of municipal plans:

- Each Municipality shall have to formulate periodical and annual development plans for the development of the Municipal area.
- In formulating the plans, the Municipality shall, as per necessity, have to launch plans such as land-use, land-pooling, and guided land development for making the development of the Municipal areas balanced and planned.

7.2. Kathmandu Valley Development Authority Act of 1988

Section 6 pertains to the development of Kathmandu Valley by improving existing town development and identifying new areas for urban expansion. It also highlights the development and implementation of land pooling program and building construction in identified areas.

Section 7 explicitly highlights the need to stop land fragmentation in the identified land use plan area. Land fragmentation is the result of dividing a parcel of land into smaller sizes by the head of the family and distributing the pieces of land to his heir or members of his family. In many cases, the resulting lots become inadequate in size and shape for the construction of a comfortable house or that the building is built higher in order to accommodate the expanding family occupants. However, whenever the original lots are pooled or consolidated into bigger lots or parcels, the resulting area would yield a building structure with adequate amenities and open spaces for air to flow through.

7.3. Building Act of 1999

The Preamble of this Act provides for disaster-resistant building design and construction standards to make buildings safe from natural disasters like earthquake, fire, floods, among others. Section 4 calls for the formulation and adoption of a building code and implementation of the same with the end in view of improving the quality and safety of each building. Section 8 mandates the categorization of buildings into different classes and the issuance of a building permit prior to construction in the municipal areas.

7.4. Local Administration Act of 1971

The Act designates the Chief District Officer to make an inventory of local, unregistered, open government land and protect the government land from private illegal acquisition. If public lands such as parks, ponds, grass field and others are unlawfully registered, this registration will be cancelled.

7.5. 2003 Apartment Ownership Act 1998 Revised Bylaws for Construction

This Act is issued to facilitate apartment ownership by making house ownership affordable to citizens through joint partnerships with housing and land developers. As provided for in the law, housing companies or developers and land owners may enter into agreements regarding development and ownership of apartments. Approval and permits are obtained from the local government. Ownership cannot be transferred without permission from the joint committee.

7.6. 2007 Bylaws for Construction in Kathmandu Valley

With the enactment of Kathmandu Valley Town Development Act of 1976, a building construction bylaws was formulated and implemented to safeguard life, health and public welfare. It was a framework containing minimum standards and requirements to regulate and control the construction of new buildings in the Valley. The building bylaws were updated in 1993 and in 2007.

The current building construction bylaws cover the rules and regulations on building construction in the following cities, municipalities and VDCs:

- KMC,
- Lalitpur Sub-Metropolitan City,
- Bhaktapur Municipality,
- Madhyapur Thimi Municipality,
- Kirtipur Municipality, and
- Adjoining VDCs.

According to the Building Bylaws of 2007, KMC is divided into nine zones, listed as follows:

SN	Zones	Sub Zones
1	Old City zone	▪ Protected Monument sub-zone ▪ Protected sub-zone ▪ Mixed Old Residential sub-zone
2	Residential zone	▪ Business sub-zone ▪ Dense Mixed Residence sub-zone ▪ Other Residential sub-zone ▪ Planned Residential sub-zone

3	Institutional zone	
4	Industrial zone	
5	Protected zone	park, forest, greenery, open space, historical, cultural and religious areas, etc.
6	City expansion zone	
7	Plane transport zone	
8	Airport zone	
9	Sports zone	

Development controls to regulate the areas include the following:

- maximum ground coverage,
- maximum floor area ratio,
- maximum height of the building,
- maximum number of stories, and
- setback to adjacent plot as well as widths to road approach

Provision of basement is classified for different zones. Similarly, types of road within the city are classified as:

- Circumferential (ring road)
- Highways
- Arterial road
- Connector road
- Feeder road
- Special road
- Link road
- River corridor, etc.

Right of ways and setback for different roads are classified accordingly. With the enactment of apartment laws, the Building Bylaws had included the rules and regulations to construct apartment buildings as well as group housing units.

7.7. Local Self-Governance Regulation of 1999

The Local Self-Governance Regulation (LSGR) 1999 Municipal planning process highlights the following:

Each Municipality should prepare a fiscal year plan for development.

While preparing the plan, there should be balanced city development strategy; to regulate urban development, it should be based on land use plan, land pooling, and guided land development programs.

Municipalities can take in consultants for the preparation of the plan.

Municipalities should concentrate on priority areas while taking into consideration the following:

- Productive and results-oriented;
- Improvement in citizens" standard of living;
- Low-cost and engaging people's participation
- The use of local resources;
- Technology-oriented
- Women and children
- Environmental sustainability

Additionally, plan preparation should consider the following elements:

- City's geophysical situation, economic activities, and state of natural resources
- Different sectors balanced estimate and feasibility analysis
- Indigenous or ethnic groups
- Plans should be prepared by local people and should concentrate on local resources

Each municipality should prepare a base map with city level statistics. Each municipality should prepare feasibility study for the project on the basis of:

- Project objective;
- Project beneficiaries and type;
- Type of project and alternatives;
- Cost of project;
- Participation and contribution by users;
- Environmental considerations;
- People's participation coordination with government and non-government organization.

City level planning can make use of various fund sources such as:

- Cities own resources
- Grant from district development committee
- Grant from the national government
- Grant/loan from different nongovernment organizations and international development organizations.

7.8. National Urban Policy 2064 (2007)

The National Urban Policy has been formulated for integration of all the issues of urban development and to clarify the role of implementing institution for addressing those issues. This includes giving clear information on how to mobilize necessary resources and public and private investment for implementation of working policy set in the policy document. The long term goal of the policy is to contribute in poverty alleviation through sustainable urbanization of the development regions. It addresses this through appropriate planning urbanization activities, reversing the deteriorating urban environment, and providing clearer roles of central and local bodies in urban development. Hence, the three main objectives set by the policy were:

Objectives	Working Policies
Balanced National Urban Structure	▪ North-south corridor (ex. Terai region to Valley) shall be developed for equal distribution of facilities to all regional development centre; ▪ Develop trade linkage between Mountain-Terai region and boosting tourism; ▪ Develop at least one large urban economic centre; ▪ Develop inter-linkage of other small urban centre to it and each other through physical facilities; ▪ Give priority to large industrial activities in regional urban centre and small and medium industrial activities in medium urban centre; ▪ Encourage government and private investment for fulfilment of these policies and special encouragement to private investment.
Clean and developed urban environment	▪ Clean and developed urban environment ▪ Working policies proposed were the following: ▪ Give priority to conservation of cultural and natural resources; ▪ Give due consideration to urban sanitation and public health; ▪ Minimize of natural disaster; ▪ Encourage and formulate environment friendly vehicles and transportation system ▪ Promote various economic activities based on local resources and opportunities; ▪ Increase access of low income group to urban infrastructure facilities; and opportunities and management economic activities in unorganized and informal sectors
Effective urban management.	▪ Ensure that the Proposed Physical Planning Act shall address the following: ▪ Identify of concerned agencies and their responsibility and by bringing physical development plan preparation, approval and implementation in the legal framework of law. ▪ Strengthen capacity of local body accordingly by making urban development planning compulsory under it; ▪ Separate unit within the central and regional body for physical development planning, approval and implementation; ▪ Declare only those urban centres as municipality which have developed required level of physical facilities and urban characters and transforming municipality into main responsible body for urban development activities.

Source: National Urban Policy 2064, Unofficial Translation, Nepal Government Ministry of Physical Planning and Works, Department of Urban Development and Building Construction, Babar Mahal)

7.9. National Adaptation Programme of Action (NAPA)

NAPA is a strategic tool which assesses vulnerability to climate change and variability, provides for the process and framework for developing adaptation measures. When related to environmental hazards, in these adaptation measures may fall within the risk reduction themes of disaster mitigation, prevention and preparedness. NAPA is mainly cored on six basic themes which fall within the national and local development sectors (see item 5 above on Section 96 of the Local Self Governance Act (LSGA) of 1999). At the local level, implementation of the adaptation measures within these development sectors are critical and is within the purview of the Municipal functions, duties, and responsibilities of municipalities, including Kathmandu City. With coordination and technical support from the Ministries and Districts, implementation of adaptation measures at VDC/Municipal level, are hopefully ensured.

The suggested focus of planning and action for adaptation are briefly described below:

a. Agriculture and Food Security–adaptation priorities in agriculture have been set at sustainable agricultural land use system, agro-biodiversity management and favourable and conducive governance mechanism
b. Forests and Biodiversity-adaptation measures set on sustainable forest management, improved governance and capacity at the local level.
c. Water resources and Energy- adaptation priorities set on better and more accessible information and technology, stronger and more adaptable institutions, and natural and human-made infrastructure to store water, transport and treat water, and to maintain energy production base, and expand and integrate transmission and distribution networks.
d. Climate Change Induced Disasters- relevant to adaptation, the disaster risk reduction practices (DRR) include strengthening resilience, diversifying livelihood, planning, providing insurance and developing and early warning system, and community based approaches for DRR.
e. Public Health-adaptation strategies focus largely on awareness raising and public health initiatives at local level. Carry out research, formulate appropriate strategies and conduct IEC on health related issues caused by climate change.
f. Urban Settlements and Infrastructure- adaptation measures are cored at the following:

Settlements

- Improving effective and pro-poor structures of governance
- Reduce the threat through prevention
- Improve coping capacity of vulnerable communities

Infrastructures

- Formulate and implement sound climate change adaptation measures
- Providing enabling conditions to ensure resilient infrastructures

Source: National Adaptation Programme of Action (NAPA) to Climate Change, Ministry of Environment, 2010

7.10. National Strategy for Disaster Risk Management (NSDRM-2009)

National Strategy for Disaster Risk Management is a National Framework with commitment of the Government of Nepal for protection, growth, and promotion of national heritages and physical infrastructures. It provides for a course of action to address the loss of physical properties and human lives, destructions of basic infrastructures. This is done by proposing an organizational structure for DRM in Nepal and by mainstreaming disaster reduction in the development process.

Similar to the NAPA, the NSDRM is an inseparable component of all other sector strategies contributing to sustainable development of Nepal. Inherent objective of this Strategy is to guide towards reducing disasters in the process of formulation and execution of development programs for national development.

The NSDRM follows a paradigm shift from merely responding to post disaster situations to disaster prevention through development. Its main vision is to have disaster resilient communities in Nepal. To do this, the long term strategies include:

- Development and restructuring of institutional structures;
- Strengthen policy-wide and legal arrangements to ensure stakeholders' participation while adhering to integrated policy and decentralized implementation process.
- Create enabling environment from the central to household level within the State to prepare and implement disaster risk reduction and preparedness plans.
- Ensure mainstreaming disaster reduction into overall development process along with sectoral development and poverty reduction plans.

The GoN realizing that the disasters are triggered and aggravated by inappropriate development, has set up priorities based on sector-wide activities by assessing the nature of potential disaster. This may be seen in Nepal's need-based development agenda with HFA 2005-2015. This NSDRM then becomes an inseparable and important component of this over-all strategy for attaining sustainability and disaster resiliency. (Source: NSDRM, 2009)

The NSDRM follows five priorities in the implementation process:

a. Put up an institutional framework in place for its implementation by prioritizing DRR at both the national and local levels.
b. Strengthen assessment, identification, monitoring, and early warning system on potential disaster;
c. Make use of knowledge, new ideas, and education for the development of safety and disaster resilient culture at all levels;
d. Minimize existing risk factors; and
e. Make Disaster Preparedness strong enough for effective response.

Mainstreaming of DRR in the various development sectors become imperative to ensure that preparedness, mitigation or response arrangements are in place and that damages, losses are reduced, thereby bringing sustainability of development. In the same sense, the GoN has identified the following sectors as targets for risk reduction efforts:

- Agriculture and Food security
- Health
- Education
- Shelter, Infrastructure and Physical Planning
- Livelihood Protection
- Water and Sanitation
- Information, Communication, Coordination and Logistics
- Search and Rescue, and Damage and Needs Assessment
- Institutional Framework for Planning

7.11. The Social Welfare Act, 2049 (1992)

Under this Act, the Social Welfare Council is a statutory authority mandated to coordinate non-government organizations working in social welfare roles (section 5), and to liaise with foreign governments and organizations conducting such activities (section 9). It issues certificates to INGOs to work in Nepal.

The Council also approves and monitors community-based social welfare projects that involve resources from international NGOs, including DRR projects, which require its prior approval (except in an emergency context).

7.12. Nepal Risk Reduction Consortium (NRRC)

The Nepal Risk Reduction Consortium (NRRC) was launched by the Government of Nepal and a group of international organizations working to promote the UN International Strategy for Disaster Reduction (ISDR) in 2009.

The Nepal Risk Reduction Consortium (NRRC) is a unique arrangement that unites humanitarian and development partners with financial institutions in partnership with the Government of Nepal in order to reduce Nepal's vulnerability to natural disasters. Based on the Hyogo Framework and Nepal's National Strategy for Disaster Risk Management (NSDRM), the NRRC has identified 5 flagship priorities for sustainable disaster risk management, which are:

School and Hospital Safety	Flagship 1
Emergency Preparedness and Response	Flagship 2
Flood Risk Management	Flagship 3
Community Based Disaster Risk Management	Flagship 4
Policy/Institutional Strengthening	Flagship 5

8. STRATEGIC URBAN PLANNING IN KV

8.1. Strategic Planning Initiatives for KV

Several parallel and complimenting initiatives were being undertaken by the KVDA and other authorities for improved planning and disaster risk reductions including the post disaster needs assessment after the 25th April earthquake. Among them the twenty years Strategic Development Master Plan of KV SDMP (2015-2035), which is the road map for the sustainable and resilient development of KV has clearly mandated two levels of RSLUP as it's first two strategies. The KV Urban Transport Improvement project, which closely coordinated their works with the development of KV-RSLUP has integrated multi-hazard risk factors in their transportation planning. The following sub-sections briefly discusses on these initiatives which provides a firm ground for full implementation of the KV-RSLUP as a major component of KV integrated development announced by the GoN in its F/Y 71/72 and F/Y 72/73 budget speeches.

8.1.1. Strategic Development Master Plan for Kathmandu Valley (2015 – 2035)

Vision: To promote Kathmandu Valley as a Livable City by enhancing the interdependence of Nature, Culture and Society by establishing Kathmandu Valley as a Safe, Clean, Organized, Prosperous and Elegant National Capital

Kathmandu Valley is regarded as a major urbanizing region of Asia with an annual population growth rate of 4.3% in the past decade. The rapid urbanization has further led to major consequences such as rapid land use change, lesser constraint free area for development, increasing gap between demand-supply of urban services and increasing vulnerability to disasters. With the current growth rate, the total population in the Valley is estimated to be 2.54 million (CBS 2011), with an estimated projection of 4 million and 6.7 million in the years 2020 and 2030 respectively.

Although Long Term development Plan of Kathmandu Valley 2020 was prepared in 2002 for sustainable development of Kathmandu Valley, it could not be implemented mainly due to rapid urbanization, political instability, overlapping of the jurisdictions of sectoral authorities, lack of coordination between stakeholders and lack of detailed implementation plan. Hence, considering the existing and emerging trends of urbanization, environment, socio-political and economic situations, KVDA has developed the 20 years Strategic Development Master Plan (2015- 2035) to address the current and future needs of the Kathmandu Valley. The plan has been envisaged utilizing the studies of Urban Growth Trend, Multi-Hazard Risk Assessment and development constraint analysis in addition to the recommendations obtained from a series of interactive programs with major stakeholders concerned with sustainable urban development of Kathmandu Valley. Strategic plan developed with this basis would not only help to understand the major underlying issues, but also lead to develop major plan, policies and program that address the current as well as future growth of the Kathmandu Valley.

The 20 years Strategic Development Master Plan (2015- 2035) has emphasized on 8 major strategies to address the major planning issues in context of Kathmandu Valley. Each strategy further includes specific objectives along with short term and long term action plans to be implemented by KVDA in coordination with related agencies.

Table 1 Major Strategies of SDMP (2015 – 2035)

Issues	Major Strategy
▪ **Distant, Dispersed, and Disconnected Settlements (High population concentration in city core areas and Low density of urban expansion)** ▪ **Lack of consolidated laws to manage and control land use**	1. Undertake Planning at two Levels: Macro (Valley Level) and Micro (Municipal Level)
▪ **Unprecedented change in land use** ▪ **Lesser Constraint Free Area in KV (34.8%) due to Land use restrictions, physical constraints and environmental constraints** ▪ **Need to move from 3D to 3C through linking of infrastructure, land use and transport**	2. Analyze constraints and sensitivity based zoning to guide urban expansion and RSLUP of Kathmandu Valley
▪ **Inequitable urban infrastructure and services to accommodate the increasing population** ▪ **Need to link coordinated investment in infrastructure development and urban planning**	3. Develop Urban Pressure and Risk Resilient Urban Infrastructure
▪ **Increased vulnerability of earthquake, flood, landslide, fire** ▪ **Need to integrate disaster risk mitigation approach and preservation of natural environment from planning**	4. Environmental Friendly and Resilient Planning Approach
▪ **Need to preserve historic, cultural and social assets of historic city core areas and heritage sites** ▪ **Structural problems, high occupancy resulting in lesser access to critical facilities in settlements of city core areas**	5. Urban Regeneration of Historic City Core and Traditional Settlements
▪ **Inequality of economic opportunities to promote local economy** ▪ **Inadequate capital investment in public goods and services**	6. Promotion of Economic Opportunities through identified growth areas
▪ **Need to mainstream gender equity and social inclusion in all decision making and activities**	7. Promotion of Gender Equity and Social Inclusion
▪ **Inadequate emphasis on safety, security and risk resilience in urban development**	8. Promote Safety and Security in urban development
▪ **Inadequate effort to ensure private sector participation as key stakeholder in comprehensive and planned urban development**	9. Promote Private Sector Participation in urban development activities
▪ **Need to establish and accountability of KVDA's actions**	10. Emphasize on Information, Communication and Advocacy
▪ **Need to involve youth in urban development activities and decision making process**	11. Youth mobilization and participation in urban decision making processes and development activities

Source: SDMP (2015-2035) Draft, KVDA 2015

The plan further stresses on the need of preparing and implementing the Kathmandu Valley Risk Sensitive Land Use Plan together with transportation and other sectoral plans, while focusing on three major aspects:

- Compact rather than dispersed settlement
- Preservation of Agricultural land within the valley
- Devise major programs and policies to develop an planned urban expansion within the valley

The master plan is intended to be followed till 2035 with proper revision and updating at needed intervals.

8.1.2. Urban Transport Improvement for KV

Vision: "Establishment of sustainable transport with high mobility, safety and comfort"

KVDA and Ministry of Physical Infrastructure & Transport, in collaboration with JICA, are in the process of preparing the project on The Project on Urban Transport Improvement for Kathmandu Valley. It builds upon the backdrop of Transport Master Plan (1993), Data Collection Survey on Traffic Improvement in Kathmandu Valley (2012) and Detailed Planning Survey (2013) conducted by JICA in coordination with the Government of Nepal. The surveys mainly highlighted the urgent need to prepare a plan for urban transport improvement for Kathmandu Valley to be implemented for the development of valley wide transport and urban mobility.

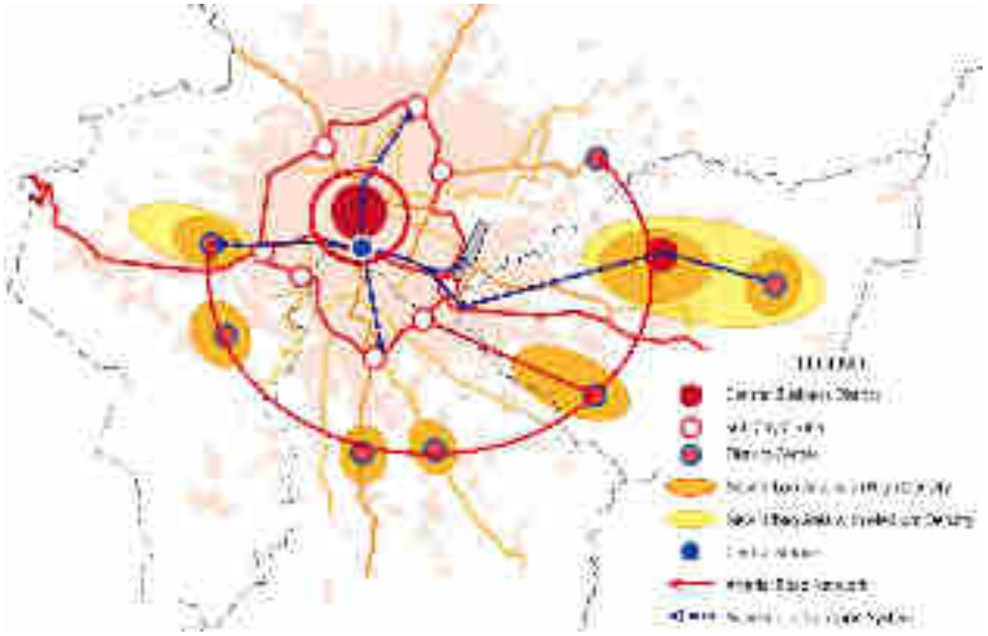

Figure 5 Conceptual Urban Structure and mobility plan [Source: JICA]

Four different working groups (Land use & Urban Development; Transport; Traffic Management; Environment) have been developed to establish a comprehensive Urban Transport Master Plan for Kathmandu Valley, which includes the development of three major features:

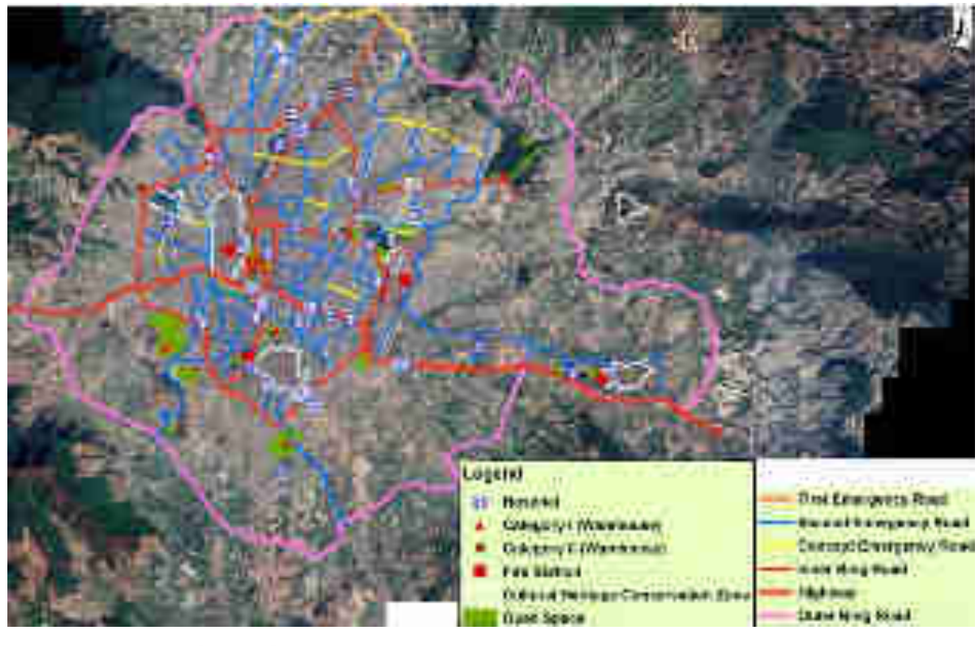

Figure 4 Proposed Classification of Emergency Road Network [Source: JICA]

- **Proposed Urban Structure concept for Kathmandu Valley** [Proposal for the development of new urban centers with medium and high density, connected to the Central Business District by public transport system]
- **Transport Network** [Development of Inner Ring Road; Promotion of mass rapid transit and non-motorized transport in less risk sensitive areas]
- **Emergency Road Network** to perform smooth emergency transport in case of disaster *(Figure 8).*

The project further includes implementation of a pilot project along with capacity development programs for relevant agencies to monitor, maintain and alter the Master Plan.

Table 2 Proposed Classification of Emergency Road Network

	National Emergency Road (NER)	First Emergency Road (FER)	Second Emergency Road (SER)	Concept Emergency Road
Road width	Over 20m	Over 12 m	Over 5 m	No existing road network but necessary to connect to either FER or SER using land pooling
Connection to	Large open spaces	Critical facilities, open spaces, NER		
No. of lanes for ambulance or heavy equipment traffic in case of emergency	more than 2 lanes	At least 1 lane		
No of floors in roadside bldgs		Under 6 floors		

Block point for building demolition	None	Some	many	
	Connected to city core area		Arterial road network located at 1km sq interval	

Source: JICA

8.1.3. *Regional Technical Assistance for Addressing Disaster Risk through Improved Indicators and Land Use Management*

The Regional Technical Assistance for addressing Disaster Risk through Improved Indicators and Land Use Management was approved on 24 November, 2011. The Technical Assistance (TA) aims to strengthen access to tools and guidance on disaster risk-sensitive spatial planning and urban development processes in Asia and the Pacific. It further intends to document innovative urban disaster risk management practice through a detailed study of selected Asian that are at high disaster risk: Kathmandu Valley (Nepal), Da Nang City (Vietnam), Ho Chi Minh City (Vietnam), Naga City (the Philippines) and Wuzhou City (People's Republic of China).

The major features of the TA include the following:

- Development of guide and sector notes integrating risk-sensitive land use management into sector development projects, including urban development, transport and water
- Case studies of incentives for DRR and how it has been used to align decision making among various sets of urban stakeholders
- Development of a set of urban risk indicators to track progress in implementing urban risk reduction measures

Kathmandu Valley selected as one of the case study cities for the TA. Hence, as a part of the study, the TA has been providing support in designing, planning and development of the case study on Risk Sensitive Land Use Plan in Kathmandu Valley. It has been conducting background research and interviews with a range of city stakeholders involved in risk sensitive land use planning. The TA has also been exploring various incentive mechanisms for implementing risk-sensitive land use planning.

8.1.4. *Post Disaster Needs Assessment (PDNA) Housing Sector Summary for KV*

The 2015 Nepal earthquake caused widespread destruction of housing and human settlements. A large-scale impact survey was conducted by the Ministry of Home Affairs (MoHA) during the month following the earthquake. The earthquake has impacted the housing and human settlements sector the most all over the country. Results show that a total of nearly 500,000 houses were destroyed and another 250,000 partially damaged. Among the 31 earthquake affected districts all the three districts of Kathmandu Valley (KV) are identified as crisis hit districts by the Government of Nepal (GoN). The total of 72,394 houses have fully collapsed or are damaged beyond repair, and 65,694 have been partly damaged.

Based on (i) damage data collected by the Ministry of Home Affairs (MoHA), (ii) the district-level distribution of building types defined in the 2011 National Census, and (iii) differential fragility of buildings assessed by the National Society of Earthquake Technology (NSET), the distribution of damage can be divided as below:

Table 3 Damage to Buildings

Damage	Low Strength Masonry	Cement Mortared Masonry	RC	Total
Fully Damaged	59,473	8,954	3,972	72,394
Partially Damaged	16,022	40,485	9,186	65,694

Source PDNA Assessment

In case of Kathmandu Valley the total effect (damage and loss) in the housing sector is valued at NPRs 104,697 million, with total damage valued at NPRs 76,402 million and total loss at NPRs 28,295 million. The damage accounts for physical housing damage and damage to household goods, the loss for demolition and debris clearance, transitional shelters, rental loss and the damage and loss for the real estate sector.

The large-scale destruction of housing is primarily the result of the seismic vulnerability of unreinforced masonry homes predominant throughout the country. Most homes are low strength masonry stone or brick masonry with mud mortar (24% of all homes) and without seismic resilient features. These intrinsically weak and brittle buildings suffered widespread damage and collapse throughout the 31 districts that experienced earthquake shaking. Other common building types such as cement-mortared masonry and reinforced concrete (RC) frame buildings behaved better, but still suffered significantly due to material, design, detailing and deficiency in workmanship.

Based on the damage and loss, recovery and reconstruction needs were calculated as NPRs 83,720 million for Kathmandu Valley including i) transitional sheltering, ii) permanent housing reconstruction with structural resilience, iii) demolition and debris clearance, iv) Repairs and retrofitting, v) clustering of dwellings to safe locations, vi) Training and facilitation and vii) Urban Planning including heritage settlement planning.

Table 4 Total Damage and Loss in Kathmandu Valley

Details			Number of Houses	Damage and Loss (NRS in million)	
Damage	Collapsed houses	Low Strength Masonry	59,473	24,979	
		Cement based Masonry	8,954	9,670	58,483
		RC Frame	3,972	23,834	
	Damaged houses	Low Strength Masonry	16,022	673	10,557
		Cement based Masonry	40,485	4,372	
		RC Frame	9,185	5,512	
	HH goods				3,152
	Real estate sector				4,210

	Total Damage		**76,402**
Loss	Demolition and debris clearance		3,044
	Transitional shelters		3,405
	Rental Loss		1,846
	Real estate		20,000
	Total Loss		28,295
		Total Effect (Damage and Loss)	**104,697**

Source PDNA Assessment

Table 5 Total Recovery Needs of Kathmandu Valley

Details	Amount (NPRs millions)
Demolition and debris clearance	3,044
Cost of Equipment for demolition and debris removal	160
Temporary shelter provision	3,405
New House Reconstruction (450 sq.ft/ unit)	64,184
Repairs and Retrofitting	7,982
Subtotal	78,775
Training, facilitation and quality assurance costs	3,532
Urban Planning (including heritage settlement planning)	1,413
Total	**83,720**

Source PDNA Assessment

Reconstruction Principles and Strategy by the PDNAare as hereunder:

While a detailed recovery strategy is in process of development, some key principles have been identified in PDNA report as listed below

- Reconstruction should empower communities through facilitated owner-driven reconstruction.
- Reconstruction should apply "safer settlement" principles.
- Reconstruction should be a vehicle to build long-term community resilience.
- Reconstruction should strengthen the local economy, through processes supportive to the poor, marginalized and informal sector by provide an opportunity for the poor to upgrade their overall living and economic conditions.
- Reconstruction should ensure environmental sustainability.
- Reconstruction should be equitable and inclusive.

The report also speaks on Land use and Clustering of Housing, Settlement Planning Approach for Rural Housing, Risk Sensitive Planning for Urban Area, Strategy for Transition and Reconstruction Phase.

9. INTEGRATED URBAN DEVELOPMENT FOR RSLUP

9.1. Land Management and Reforms

The Lands Act-1964 (Fifth Amendment-2001) envisages the importance of proper land use planning and its implementation. It also demonstrates awareness about the consequences of farmland fragmentation and positive implications of land consolidation for farm productivity improvement.

The fifth amendment of the Act-2001 adds a separate section with the provisions for land use planning, land fragmentation control and land consolidation. Clause 51 (e) of the Act states that the government can implement proper land use programme in certain portion of the country or over the nation by issuing a notice in the gazette. The land use program should be implemented based on the nature of the land, physiographic characteristics of the land, soil fertility, climate and other environmental factors (Clause 51 e, sub-clause 2). The land use programme would be implemented as per the policies developed by Land Use Council (Sub-clause 3), which is provisioned by the clause 51 (f) of the Act. The council have been formulated consisting of nine members from different ministries (Chairperson- Vice Chair of National Planning Commission, Members- Secretaries from Ministry of Defense, Forest, Agriculture, Physical Planning, Land Use Specialists- 3 persons and Member Secretary- Secretary, Ministry of Land Reform and Management).

The Act prohibits the use of land in any other uses in the areas where land use programme is implemented except with the permission of the committee (Clause 51). Similarly, there is also land fragmentation control, land consolidation and co-operative farming that the government could implement for the purpose of improving productivity of agricultural land (Clause 51 h). Similarly, there is also provision for concessions to the farmers practicing collective farming in a group of 10 or more farmers for buying different farm inputs (Clause 51 i). In addition, there is also provision where the government can shift any settlements deemed unsafe to safe places by issuing notice in the Nepal Gazette or it can declare any area risk sensitive for settlements and prohibit construction of housing in such areas (Clause 51 j).

Unfortunately, none of these provisions is mandatory. Government can do is it wishes, otherwise not. It has turned true that all of these provisions have turned like a mere wish list. Rampant settlements, huge cities in the fertile agriculture land, cities and towns emerging on the land most suitable for agriculture and increasing number of parcels (fragmentation) per holding are the bitter realities of not implementing land use policy.

9.1.1. Land Policy, Regulations and Management for RSLUP

In the context of above mentioned amendments of Acts and Regulations time and often relating to the land use and land classification of the nation and Kathmandu Valley, the government formulated a 'National Land Use Policy-2012.' Before finalizing the national policy, much consultations were held with the related experts, institutions and organizations; and many seminars and symposiums were organized to know their views, comments and suggestions related to prepare risk free land use and its classification.

Ministry of Land Reform and Management (MoLRM) initiated to amend Lands Act-1964 to incorporate the land use policy. It was also added to the related articles which was concerned with the national policy addressing present conditions of risk sensitiveness and its challenges. The MoLRM presented to the Constituent Assembly to amend the Land Act 1964. The Constituent Assembly sent this draft amendment to its parliamentary 'Agriculture and Water Resources Committee' on 18 November 2014. The committee discussed in detail, clause by clause on the proposed Amendment Act. After refining some

clauses and sub-clauses, the parliamentary committee finalized the draft and submitted to the Constituent Assembly as a Bill on 2 July 2015.

With a view to use the land in a most appropriate way, the committee has passed and presented to classify the whole land of the nation into 12 different zones. They are: Agriculture, Residential, Commercial, Industrial, Mining, Quarries for construction, Forest, Public use/open space, River stream and pond and lake, Cultural and archaeological importance, Risk sensitive zone and others as envisaged necessary. The Constituent Assembly Parliament is yet to pass the Bill.

After the approval of the amendment of Lands Act-1965, a particular piece of land of designated zone should be used only for that very purpose. For example, buildings must be constructed only in the residential zone. It is restricted to construct a building wherever the land owner wishes. If it is constructed illegally in the other zone, he may be penalized. Most importantly, he will not be entitled to get minimum basic facilities; and compensation and other facilities during calamities like earthquake, land slide, flood, fire hazard etc.

9.1.2. Recommendation of Land Reforms for the support of RSLUP

Attraction of people towards the urban area is high and the ratio of land use and land cover change is increasing every day. Increasing population caused the spatial pattern of urbanization to be highly dynamic in Kathmandu city. The city is capital of the country with a high concentration of administrative facilities and subsidiaries of multi-national corporations. This unique political and geographic situation has greatly facilitated the outward expansion of urban land use in a speed and scale more significant. Landsat image of 1976 clearly showed rich cultivated land and water resources in Kathmandu, but this land use classes rapidly has transformed into urban area. The urban/built-up areas in the Kathmandu Valley had a noticeable enlargement.

The core city area is going to be the dense jungle of concrete in no year. Due to the unplanned settlement and the unmanaged urbanization, life in the city area is appearing down. Because of the overflow of the mass in the city and the nearby areas, huge cultivated lands, water body, open fields and forest areas have been turning into settlement areas. It creates risk sensitiveness which also refers to the imbalance in the ratio of the land use and land cover categories. The fraction of urban rises very high in comparison to the other land use classes namely forest, water cover area, open area, cultivated land and the sandy area.

The locations of agriculture lands have changed significantly in urban rural fringe areas because of urbanization process within Kathmandu Valley. After 1978, much of the shrubs and forest lands in rural areas have been used for agriculture purposes. Sprawling trend has been found mostly in the urban/built-up and agricultural land uses. In the valley floor, the agricultural land was changed to urban/built-up lands whereas in urban-fringe areas much of the shrubs and forest lands were transformed to agricultural uses.

In fact, the landscapes in Kathmandu valley experienced rapid changes since the 1970s due to urbanization process. This predominantly rural agriculture landscape gradually changed to urban landscape with increasing human settlement in the 1970s and 1980s. Urban/built-up space can be seen to have spread outward from city core and the main roads. Lands abutting on the ring road were by 2000 almost all occupied by housing units.

Due to population pressure, most of the agriculture lands in the valley floor transformed into urban/built-up surface whereas fallow land areas mostly changed into agricultural uses. Such urbanization process and new individual development created new patches in the landscapes that eventually helped to fragment and create more heterogeneity in the landscape. It is mostly observed in city fringes and nearby emerging towns and dense villages in the valley.

Now, one of the most important points is not to let use the land of risk sensitive zone. For example, double of the width of a river on both the sides should be regarded and maintained as a risk sensitive area. This should be utilized for none other purposes than open spaces. Similarly, the potential agricultural zone should be always maintained not to let it be encroached by built-up elements. If the national land use categorization is violated, that should be penalized utmost as a criminal activity.

In connection to the implementation of Lands Act (upcoming Sixth Amendment-2015), concerned institution under the Ministry of Land Reform and Management must delineate and fix the different zones and implement accordingly. The most important part is the implementation. The laws and regulations are there, but land holders and tenants may ignore it knowingly and unknowingly. It needs people participation to make them understandable. Presently, there are not elected local authorities in the municipalities (16 new and 5 old municipalities) of Kathmandu Valley, including Kathmandu Metropolitan City. So it needs some mechanism to disseminate the information on the categorization of land use in the grass root level. At present there is a unit of National Land Use Project. It is a felt need to convert this unit into an integrated institution as 'Land Use Department' to implement and monitor the land use policy of the government.

It is the high time that the concerned authorities should be conscious. The government should immediately pass the Lands Act (Sixth Amendment-2015) and bring it in action. The land plotting system and its market should either be discouraged or should be hold by the government itself. The urban development facilities should be scattered on the lap of surrounded mountains, adjoined with the flat areas of Kathmandu Valley through the decentralization process. Due to the urbanization of these areas, the flow of the migrants towards the city core areas can be lowered down.

Specific and appropriate management of land use plans, keeping in mind the risk sensitiveness to Kathmandu Valley, should be brought into action. For the better and fruitful urbanization, the unproductive barren lands of the mountain foothills should be chosen for the residential purposes, whereas the fertile land should be used for the cultivation and environmental protection.

10. VISION, MISSION AND STRATEGIES FOR RISK SENSITIVE LAND USE PLANNING IN KATHMANDU VALLEY

10.1. Vision and Mission

KVDA's revised Long Term Development Concept Plan 2035 (KVDA 2014a) and the following 20 years Strategic Development Master Plan (SDMP) (KVDA 2015) has defined their vision statement as **"To Promote Kathmandu Valley as a Livable City by Enhancing the Interdependence of Nature, Lives and Culture"**. With this vision, the KVDA has defined its mission *"To Establish Kathmandu as a Safe, Clean, Organized, Prosperous and Elegant (SCOPE) National Capital Region"*, so as to foster the global image of Kathmandu Valley as a *"liveable city with the synergy and harmonization of nature, society and culture"* (KVDA 2014b). The underlined mission SCOPE translates to the definition

SAFE	Safety of peoples' lives including poor and vulnerable from multi hazards
CLEAN	Free from noise, air, water, wastes and industrial pollution
ORGANIZED	Systematic approach to land use, transportation urban infrastructure planning and housing development
PROSPEROUS	Economic development through the promotion of tourism and service industries
ELEGANT	Beautiful through the conservation of historic, religious, cultural and social assets, both tangible and intangible

With this vision statement and its mission, the KVDA SDMP has formulated following strategies:

Strategy 1	Institutional Development and Capacity Building
Strategy 2	Two Levels of Planning- Macro Level and Micro Level
Strategy 3	Risk Sensitive Colour Zones to guide urban expansion and Risk Sensitive Land Use Plan of Kathmandu Valley
Strategy 4	Urban Pressure, Climate Change and Risk Resilient Urban Infrastructure: Water Supply, Sanitation, Waste management, Road Network, Traffic management, Housing
Strategy 5	Environmental Friendly Planning Approach
Strategy 6	Urban Regeneration of Historic City Core
Strategy 7	Promotion of Tourism, Service related industries
Strategy 8	Promotion of Gender Equality and Social Inclusion

With this overarching vision, mission of KVDA and its strategies, the RSLUP vision and mission are defined to compliment it, emphasizing on *building resiliency of the communities*. The RSLUP strategies are formulated towards implementing Risk Sensitive Land Use Plan through *Sustainable Land Use Management* addressing the needs for sustainable ecology, conservation, economic growth and social inclusion.

The RSLUP vision statement takes due consideration of the Policies and Programs of the Government of Nepal (for F/Y 2071-72), National Land Use Policy 2069, National Urban Policy 2064 and the recent Nation Urban Development Strategy 2015 such that the RSLUP vision and mission are streamlined towards supporting the national policy and strategies.

The RSLUP Vision

"Building Resilient Communities through Integrated Development of Kathmandu Valley"

With the mission

"Fostering Sustainable Land Use Management for Heritage Conservation, Social Inclusion and Ecological Balance"

दूरदृष्टि

"उत्थानशील समुदाय निर्माणकोलागी काठमाडौं उपत्यकाको एकीकृत विकास"

परिदृष्य

संम्पदा संरक्षण, सामाजिक समावेशीकरण तथा पर्यावरणिय सन्तुलन को लागी दीगो भू-उपयोग व्यवस्थापन

The above stated RUSLP Vision is defined to accentuate building of resilient communities in the face of disaster and climate change stimuli through risk sensitive land use planning. An *integrated development* approach is perceived as stated in the Clause 43 of the Policies and Programs of the GoN (Box 1) to build resilience of the communities through conservation of heritage, sustainability of ecology and ensuring social equity. This vision statement attempts to capture the essence of the UN's Sustainable Development Goal 7: Empower Inclusive, Productive and Resilient Cities, by highlighting on building resilient communities through integrated and inclusive development.

The mission statement has highlighted three elements viz. cultural heritage, social fabric and ecology, the three key resources of the communities of Kathmandu Valley, which can enable them to resist, absorb, accommodate and recover from the effects of potential hazards and climate change stimuli, thus building their resilience. The mission statement therefore, emphasizes on *heritage conservation, social inclusion and ecological balance* through *sustainable land use management* with due consideration to the risk factors.

Box 1 Excerpts from the Policies and Programs of the GoN for F/Y 2071-72

Clause 43:

In order to support urban development of the Kathmandu valley, both immediate and long term policies of physical development and management will be formulated and an integrated Kathmandu Development Programme will be implemented.

सहरी विकासलाई टेवा पुऱ्याउ काठमाडौं उपत्यकाको भौतिक विकास र व्यवस्थापनको तत्कालीन र दीर्घकालीन योजना तर्जुमा गरी एकीकृत काठमाडौं उपत्यका विकास कार्यक्रम लागू गरिनेछ ।

Policies and Programs of the GoN for F/Y 2071-72. Presented by Rt. Honourable President, Dr. Ram Baran Yadav at the Meeting of the Legislature Parliament of the Constituent Assembly

10.1.1. Description of the Vision

The vision of KV RSLUP is to build the communities more resilient and responsive to risks due to disasters and climate change stimuli through mainstreaming development activities collectively and integrally to address heritage conservation, social inclusion and ecological balance. These tri-factors namely heritage (both tangible and intangible), social fabric, and ecological balance are the three principle elements that have identified Kathmandu Valley and its people since centuries. These three elements are intertwined with our philosophy of life, spiritualism and religion. Further, these three factors have enabled Kathmandu Valley and its people to bounce back from adverse environments brought upon by natural calamities, wars, famines since many centuries. Therefore, it is imperative to revive, preserve and nurture these three elements to enable our communities to be more resilient.

Different facets of *cultural capital* of KV such as archaeological and architectural heritages, festivities, traditions and customs are the major attraction of tourism in the country that contributes 8.2% of the GDP and more than 7% of the total employment in the country. Undoubtedly, conservation of the cultural heritage of KV will ensure economic prosperity and help build economic resilience of the communities and the KV as a whole.

KV is endowed with seven designated UNESCO Heritage Sites and numerous other heritages that have withstood tests of time and numerous disasters including a devastating earthquakes in 1833 and 1934. It was primarily the cultural capital manifested in the form of bonding, bridging and linking *social capital* and traditional social networks which has largely contributed to the relief, recovery, long term survival and community revitalization after the 1934 earthquake even during the oppressive Rana regime in the country (Bhandari 2014). This cultural capital now face increasing risks from unprecedented land use changes and haphazard development attributed to the rapid urbanization of the valley that has threaten to undermine the cultural systems and practices that prepared the community to adapt to natural hazards over generations. Furthermore, vulnerability of population to disasters and hazards, both natural (earthquake, flood etc.) and man-made (industrial and environmental hazards) has increased as our cities and authorities are not adequately prepared to mitigate and reduce the exposures to such natural and human induces hazards.

On the other hand, the strong cultural background in terms of cultural values, cultural bonds, customs and norms in these communities can also overcome adversities, provided "culturally-focused resilient adaptation" (Clauss-Ehlers 2015) concept is implemented which can have an effect on resilient outcomes. This concept considers larger environmental variables that help communities and individuals overcome the obstacles they face, and these environmental variables pertain to communities' cultural traits, cultural background, values and supportive aspects of the sociocultural environment. Socio-cultural aspect which is intertwined with the social fabric of the communities in KV, their livelihoods, social bonds, cultural identity and heritage, religious and ethnic practices, can support a key element of resilience in the KV.

10.1.2. Implications on the Vision

The designation of additional sixteen new municipalities in the valley totalling to 21 municipal regions and remaining VDC cluster in the southern region of Lalitpur has made in necessary to reorganize land base resources. Strength, opportunities and constraints of the land available in the municipal regions will guide the optimum use of land due considering the risk management strategies. Risk mitigation capacities of each of the administrative units will be guided by the valley wide strategies in the macro level KV-RSLUP. There may be some conflict between LSGA and RSLUP implementation, which need to be resolved through partnership amongst the local administrative bodies in optimal resources sharing and implementing collaborative risk reductions strategies.

As some municipalities specialize in a certain functional area due to their comparative advantages in terms of land resources, there is a tendency for others to show competitive attitude trying to do the same. This may accentuate risks and makes it necessary not to allow them to create negative externalities on others. It is thus necessary to delineate land use zones for different purposes at the Valley level itself which need to be linked with investment priorities: which parts of the Valley should be for intensive tourism activities/ which for educational and so on? Some more discussions and studies are required to answer:

- To what extent is it possible to reconcile the vision of Kathmandu Valley with the vision of the stakeholders (municipalities as well as sectoral/ line agencies affecting the land use changes in Kathmandu Valley?
- How does KVDA perceive the challenges ahead and how does it set its own vision and mission?
- Does it adequately understand that it needs full support from all the areal jurisdictions? It has a role to play and educate the new municipalities, in particular, and makes all realize that in isolation no part of the valley can be risk sensitive in a sustainable way due to externalities as well as environmental and risk mitigation services coming from other parts. Recognizing this, we need to have a general approach for defining the vision of RSLUP-Kathmandu Valley, which ought to be respected mandatorily by all the areal jurisdictions and sectoral agencies responsible for the Valley development.
- There is a need to disseminate knowledge and its plan of action to all the constituent municipalities and align them to its mission and vision.
- The government should commit to make the necessary institutional reform to this end and make KVDA more assertive in mobilizing all the stakeholders.

The utilization of risk reduction capacity of constituent municipalities will largely determine the success as well as the effectiveness of the valley level RSLUP.

Risk mitigation services that any area or sector can provide needs to be considered and accounted for. This will ensure the sustainability of any partnerships to be formed. Just like eco-services these services are also costly services. Giving access to open space during emergencies, giving alternatives in the provision of services, making social services available opting for earthquake resistant school building are examples of contributions to this end. Policies should be so formulated as to reward actors contributing to risk sensitivity and penalize free-riders who exploit the potentials created through others' contribution.

10.1.3. Implementation of RSLUP - Kathmandu Metropolitan City

Few years ago, RSLUP (EMI 2010) was prepared for Kathmandu Metropolitan City (KMC) under certain assumptions. The Plan has highlighted the need for the preparation of a valley-wide RSLUP. The Plan also implies the metropolis' access to risk mitigation resources outside its boundary. In this context the feedback from and evaluation of RSLUP of KMC was relevant in developing the vision for Kathmandu Valley. These also led to some institutional changes required in preparing the KV-RSLUP more implementable based on the institutional implications of implementing KMC's RSLUP. It needs to be noted at the outset that since KMC is now adjoined by newly formed municipalities, the implementation process is likely to be affected.

Ecological footprints of Kathmandu metropolis may have to be addressed more seriously when it is surrounded by municipal areas. Does that mean we should revisit its vision that was so deeply worked on and well prepared just a couple of years ago? Or can we establish spatial collaboration and make all the

constituent municipalities strive towards making the Valley as a whole a more resilient and risk-mitigated region? For instance, the current vision implies an ambitious target for tourism, which if carried on by the new municipalities as well will require a more sustainable approach for tourism development. KDVA needs to analyze risk implications due to such type of policy shifts. We should revisit the vision of Kathmandu Metropolis RSLUP in the context of new municipalities and re-define the role of KVDA in the changed context.

10.1.4. Significance of Valley wide RSLUP on municipal RSLUPs

The RSLUP for the Valley will provide a guiding principle for the municipalities to prepare and implement their respective RSLUPs. The general premise of KV's RSLUP could be as follows:

- Valley wide RSLUP need to be respected by the constituent municipalities as well as sectoral ministries; it needs to be formulated with all of them as stakeholders. Valley wide actions by sectoral ministries and constituent municipalities should be guided by the principles embodied in the plan. This also implies that what they are going to do and how they are going to do will have implications on the preparation and implementation of the proposed RSLUP. This is more critical in the context of infrastructure development and in the provision of social services such as education, health and open spaces.
- Municipalities should form collaborative arrangements in optimizing their resources for risk management; they should develop adaptation strategies and risk mitigation measures. They should collaborate and not compete even in risk aspects as the extent of valley wide risk mitigation need not necessarily increase if all the constituent municipalities exert on the limited resources required for risk mitigation and adaptation strategies.
- Areas of intensive development and management in relatively sparse settlements with green areas need to be decided upon considering the ecology of the entire valley rather than by towns.

It should be recognized at the outset that some municipalities will be more vulnerable than others and some will have more resource potentials to deal with risks. As the relative access to resources outside their boundary is going to be limited due to increased territorial rights of areas just being declared as municipalities. It is unlikely that KVDA will be able to control the development of any municipalities at the cost of their present development activities. KVDA should be strengthened to help municipalities to collaborate among themselves to enhance the risk sensitivity of the Valley as a whole and make the municipalities understand that the sustainability of their development requires their joint management of the Valley bound eco-resources. We should understand that in view of realistic implementation, RSLUPs for the five old municipalities are being influenced due to the formation of new municipalities. It is unlikely that the demarcation of the municipalities could be changed for optimizing risk sensitivity aspects; which implies that some municipalities should be encouraged to conserve their risk mitigation potentials through providing incentives. The required open space management plan proposed may restrict some of the new municipalities to encourage population growth or launch development projects. On the whole the Valley should not have more than 20 percent of its total area urbanized. This means some of the municipalities will have just 15 percent of its areas for urban use. The total public space within the urban areas should be more than 50 percent of the total area. This may not be possible for Kathmandu; the municipalities surrounding it should contribute their public space.

Required Institutional changes for Implementation

The purpose of preparing and implementing RSLUP for Kathmandu Valley is to help KVDA guide the constituent municipalities and VDCs to prepare and implement their respective RSLUPs in order to make the entire valley more risk resistant. The mission of KVDA in this regard is to develop its RSLUP as an effective tool to mobilize its constituent areal jurisdiction strives for the development of Kathmandu Valley while making the Valley risk sensitive. The above leads to the concept of KV metro region under the direct rule of the central government. RSLUP will be the guiding principle for each of them. The plan needs to be regularly improved and updated based on its risk and resource implications on the constituent municipalities and VDCs as well as on the consultations of the stakeholders. Institutional arrangement should be so evolved and changes should be so managed as to make KVDA capable of facilitating its constituent areal/ spatial entities to strive for the common goal while implementing their own RSLUPs effectively. It should allow for consultations for making trade-off between the development needs of the constituent parts and the sustainability vis a vis risks at the valley level.

- It is necessary to clearly designate which agencies of the government should be responsible to which category of land resources related to risk sensitivity. In absence of a clear regulatory framework, KVDA will have to assume the role to ensure that land resources are properly utilized for risk sensitivity wherever an agency is not designated to take care of it.
- It is necessary to align all the constituent municipalities and VDCs towards the formulation and implementation of a Valley-wide RSLUP. Since this will have to be followed by them in their RSLUPs and since these when summed up will lead to the Valley wide plan, it is necessary to make it clear how RSLUP is going to be developed as an effective tool for guiding development with risk sensitivity and how the risks are reduced and mitigated.
- The training component of this project will also focus on orienting municipalities on the implementation of the RSLUP. It needs to be participatory and all the stakeholders will be aligned towards the targeted outputs of RSLUP.
- Each neighbourhood (tole) committee should have some sort of plan for risk reduction; these should be guided by the vision at a higher level. The valley-wide provision should help and promote action at lower levels. In doing so the impact and externalities on others should be considered and through participation and partnership forms, synergy in facing the challenges of risk reduction should be pursued. Institutional changes should be geared to this approach. Integration and harmony is the key to success and conflicts of interest by sectors or areal units should be sorted out or minimized.
- A process of reiteration will be used to ensure the realization of the vision. RSLUPs of constituent spatial entities will be prepared based on the guidelines of the valley wide and their compatibility will be tested. The valley level vision will guide the actions.

The foregoing shows clearly that the government of Nepal should recognize effective governance at the valley level. KVDA needs to be further strengthened and should have its mandate extended to regulate the activities of all the sectoral ministries on Kathmandu Valley. The government may agree to it but bureaucratic resistance to change especially the Kathmandu metropolis the way it developed will not yield to any rulings of KVDA. We may wait for some time to see the status of Kathmandu Valley Metropolitan region under the federal structure. We must recognize the inherent conflict between development ministries and Kathmandu's sustainability.

KVDA should ask all the line agencies to prepare their sectoral plans and make them more risk sensitive and direct the municipalities to prepare their spatial plans to incorporate them.

It is necessary to revisit the metropolis' RSLUP in view of the new municipalities. One implication is more effective governance at the valley level. Cooperation of surrounding new municipalities is a must for implementing this RSLUP.

If the government agencies comply with the plan, it will not be difficult to align families and private sector to help implement the plan. The road widening and the concern of KVDA to synchronize land use with transport plan shows this clearly. The main objective is to prepare RSLUP that will guide the preparation and implementation of physical development plan of KV to make it risk sensitive and safer. The major components of the RSLUP are:

- Physical/spatial land use plan considering the risks and addressing them identifying risk prone areas and strategies to deal with the resource constraints, hazard mapping, seismic zones, flood prone areas and all other spatial physical aspects. This will also include spatial strategies in delineating land use that ensure adequate mobility, places for rehabilitation, transport networks, open spaces.
- Implementing tools of land use plan including bye-laws, building codes
- Strategies for the use of the built environment for addressing risks and threats during hazards and disasters
- Orientation and training and participation for the use and implementation of the built environment

The major components of the RSLUP are:

- The disaster prone areas being shown clearly in KV Plans;
- Planning Physical infrastructure to mitigate the effect of disasters;
- identification and protection of Areas for rescue and relief;
- Designation of Areas for future expansion of infrastructure;
- Open spaces defined protected;
- Conflicts in sensitive areas (ex. encroachment in sensitive areas) identified and addressed;
- Integration of KV Plan with Local Periodic Plans;

The vision of local plans should be compatible with the vision of KV plan. No municipality should frame their vision that causes risk related externalities on the rest of the Valley. The plan of the metropolis needs to be revisited to check whether it is eroding the risk related competence of other municipalities.

Principles: Risk Sensitive Land Use Planning will aim to make Kathmandu Valley a safer region. It will consider the risks and threats due to probable natural disasters like earthquake and floods. It recognizes that provision of urban goods and services during and after disaster is more problematic as the pressure on urban goods and services increases. Risk Sensitive Land Use Planning will make it easier to be serviced even at the time of crisis. Through the implementation of the Plan the following outcomes are expected:

- Ability to deal with disasters will be enhanced
- Ability to respond to the emergency needs quickly and make them accessible to the victims will be enhanced
- More adequate open spaces at several places of the city and new
- Development areas will be provided to make it easier to build shelter, distribute food, medical care, and temporary hospitals
- Alternative channels of communication and road access will maintain
- Contacts outside
- Community cohesiveness and participatory planning will help to reduce crimes
- Alternative sources of life systems will be provided locally to reduce dependence on city-wide infrastructure networks -- electricity, water.

It is thus clear that the relationship between and significance of RSLUPs at different levels is critical for the success of implementation towards the realization of the vision. All players from households to community to municipalities to valley level need to be aligned to the realization of the vision ensuring there should be concerted efforts towards making the whole region more risk sensitive. It is necessary to consider the fragile ecosystem of the Valley; risk mitigation potentials of each of the constituent municipalities need to be ascertained. Their preparedness and capacity to adapt to risk consequences depend on the impact of activities on land use changes.

Interpreted in a different style, each of the municipalities will be providing risk mitigation services for the safety of the Valley as such. Such services should be judged on the basis of the valley wide need. These may vary from open space utilization to providing access for emergency relief to possibilities of high rises. While each should be allowed their own safety the externalities caused at the valley level needs to be assessed. Different types of risk mitigation services can be:

- wider roads
- alternate access
- open space made accessible
- building system with low density
- provision of infrastructure and services ensuring alternate channels of service delivery
- conservation of fragile ecosystem
- soil condition stabilization etc.

It is necessary to prepare these for each of the municipalities/VDCs and sum them up to arrive at the valley level. As there will be difference between this and the Valley level requirements, adjustments need to be worked out.

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11 FUTURE GROWTH SCENARIO AND PREFFERED PLANNING APPROACH

11.1. New Urban Boundaries of Kathmandu Valley

In December 2014, the Government of Nepal has merged existing 91 VDCs of Kathmandu Valley to form 16 new municipalities[1]. In September 2015, GoN further declared Bajrabarahi Municipality merging Techo, Jharuwarasi, Chapagaun and Lele VDCs. With this Kathmandu Valley now has 22 municipalities[2] and remaining 4 VDCs in Lalitpur district. Municipality offices in the respective municipality were established shortly after the declaration and have started functioning. In the past couple of decades, there has been significant growth in these new designated municipal regions as bye-laws and building codes were not developed and implemented due to their VDC status then, as well as land value was relatively lower in these regions in compare to the land in municipal areas. The growth, most of which were unplanned and have resulted from the sprawl. Further, these VDCs had limited capacity to prepare the plans and implement them. The declaration of new municipalities is considered as an attempt to address urban development issues; though it has brought different criticism since the areas, especially the regions in the foothills, still lacked basic requirements for being designated as the municipality. The list of the municipalities and their corresponding old VDCs is presented in Annex 1, with the summary given hereunder:

Figure 1 New municipal boundaries and corresponding old VDCs in KV

Table 1 List of municipalities and former VDCs in KV

District	Municipality	Municipality/VDCs Merged	Pop 2011	Area (Ha)	Density (ppha)
Kathmandu	Budhanilkantha Municipality	Budhanilkantha, Chapali Bhadrakali, Chunikhel, Kapan, Khadka Bhadrakali, Mahankal	107,918	3,499	31
	Chandragiri Municipality	Badbhanjyang, Balambu, Dahachok, Machhegaun, Mahadevsthan, Matatirtha, Naikap Naya Bhanjyang, Naikap Purano Bhanjyang, Satungal, Thankot, Tinthana	85,198	4,391	19
	Dakshinkali Municipality	Chalnakhel, Chhaimale, Dakshinkali, Saukhel Satidevi, Sheshnarayan, Talkudunde Chaur	24,297	4,267	6
	Gokarneshwar Municipality	Baluwa, Gokarneshwar, Jorpati, Nayapati, Sundarijal	107,351	5,846	18
	Kageshwori Manohara Municipality	Aalapot, Bhadrabas, Gagal Phedi, Gothatar, Mulpani, Thali Danchhi	60,237	2,736	22
	Kathmandu Metropolitan	Kathmandu Metropolitan	975,453	4,944	197
	Kirtipur Municipality	Kirtipur Municipality	65,602	1,476	44
	Nagarjuna Municipality	Bhimdhunga, Ichangu Narayan, Ramkot, Sitapaila, Syuchatar	67,420	2,984	23

[1] Published in 25th Baishak 2071 in Nepal Rajpatra, Part 5

[2] Bajrabarahi Municipality was declared after the draft KV-RSLUP document, therefore has not been incorporated exclusively in the process of development of RSLUPs. The former VDCs Techo, Jharuwarasi, Chapagaun and Lele are hoever included as VDCs.

District	Municipality	Municipality/VDCs Merged	Pop 2011	Area (Ha)	Density (ppha)
Lalitpur	Shankharapur Municipality	Indrayani, Lapsiphedi, Nanglebhare, Pukhulachhi, Sangkhu Bajrayogini, Sangkhu Suntol	25,338	6,019	4
	Tarkeshwar Municipality	Dharmasthali, Goldhunga, Jitpur Phedi, Kabhresthali, Manmaiju, Phutung, Sangla	81,443	3,494	23
	Tokha Municipality	Dhapasi, Gongabu, Jhor Mahankal, Tokha Chandeshwari, Tokha Saraswati	99,032	1,690	59
	Godawari Municipality	Badikhel, Bisangkhunarayan, Godamchaur, Godawari, Thaiba	28,793	3,473	8
	Karyabinayak Municipality	Bungmati, Chhampi, Dukuchhap, Khokana, Sainbu Bhaisepati	38,036	2,160	18
	Lalitpur Sub Metropolitan	Lalitpur Sub Metropolitan, Sunakothi, Dhapakhel, Harisiddhi	254,308	2,493	102
	Mahalaxmi Municipality	Imadol, Lamatar, Lubhu, Siddhipur, Tikathali, Balkot, Dadhikot, Gundu, Sirutar	62,172	2,649	23
Bhaktapur	Anantalingeshwar Municipality	Balkot, Dhadhikot, Gundu, Sirutar	37,989	1,813	21
	Bhaktapur Municipality	Bhaktapur Municipality	81,748	655	125
	Changunarayan Municipality	Changunarayan, Chhaling, Duwakot, Jhaukhel	32,522	2,791	12
	Madhyapur Thimi Municipality	Madhyapur Thimi Municipality	83,036	1,111	75
	Mahamanjushree Nagarkot Municipality	Bageswori, Nagarkot, Sudal, Tathali	22,908	3,504	7
	Suryabinayak Municipality	Chitapol, Katunje, Nangkhel, Sipadol	40,501	2,431	17
Total Municipalities			**2,381,302**	**64,426**	**37**

Source: Population data based on CBS 2011, area based on Survey Dept. 2011, new municipal boundaries delineated based on Nepal Rajpatra, Part 5, published 25 Baishak 2071

Population densities in these new declared municipalities varies from 59 ppha in Tokha Municipality to minimum of 4 ppha in Shankharapur Municipality. Kathmandu Metropolitan is the most densely populated city with the density of 197 ppha followed by Bhaktapur Municipality with 125 ppha and Lalitpur Sub-Metropolitan with 102 ppha. All other municipalities have density less than 100 ppha. Few municipalities have even less than 10 ppha which did not seem to be qualified for becoming the town; as described by National Urban Policy 2007. Habitation in new municipal area contiguous to old municipalities has increased tremendously after the year 2000. The peri-urban areas, relatively far from city central and near the foothills, have not developed much and still possess rural character. Based on the existing population density, the new municipalities can be grouped into two categories as below:

Table 2 Municipalities based on population density grouping

Population Density Groups	Municipality	Area (ha)	Population		Population Growth
			2001	2011	
Old Municipality	Kathmandu, Lalitpur, Bhaktapur, Kirtipur, Madhyapur Thimi	10,679	1,014,449	1,460,147	3.7%
New Municipality - Group 1 (> 20 ppha)	Anantalingeshwor, Budhanilkantha, Kageshwori, Mahalaxmi, Nagarjuna, Tarkeshwar, Tokha	18,866	252,242	516,211	7.4%
New Municipality - Group 2 (< 20 ppha)	Chandragiri, Changunarayan, Dakshinkali, Godawari, Gokarneshwa, Karyabinayak, Mahamanjushree Nagarkot, Shankharapur, Suryabinayak,	34,882	288,910	404,944	3.4%
VDC	Bhardeo, Chapagaon, Devichaur, Ghusel, Jharuwarasi, Lele, Nallu, Thecho	7,761	40,607	47,977	1.7%
Total		**72,187**	**1,596,208**	**2,429,279**	**4.3%**

Source: Population data based on CBS 2001

As apparent from the table, the population growth in new municipalities Group 1 in last decade was observed 7.4%. The same in other group of municipalities was slightly below the growth in old five municipalities. This pattern shows, people migrating various parts of the country opted to live in the former VDCs than in municipalities; because of the availability of cheap land and having modest road connection to the city centres in the old municipal regions where the economic activities occurred.

Figure 2 Municipal regions grouped based on population densities

11.2. Land Use in New Municipalities

Recent land use mapping showed the forested area constitutes about 35% of the area in the valley, located mostly in the hills around the valley. Some patches of forests can be seen in the plain but the number of such patches and the area is not significant. About 47% of the area consists of agricultural and the built up area is about 16%. The situation of open space and water body is not very encouraging. The most alarming is the status of open space in newly declared municipalities, where it's less than 1%. Following table shows the land cover status in municipalities and VDCs.

Table 3 Land use in municipal groups

Districts		Land Use 2012 (Area in ha)						
		Agri	Built-up	Forest	Open Space	Others	Water Body	Grand Total
Old Municipality	Area	3,323	6,599	401	131	150	76	10,679
	Percent	31%	62%	4%	1%	1%	1%	100%
New Municipality - Group 1 (> 20 ppha)	Area	9,987	2,951	5,639	40	213	36	18,866
	Percent	53%	16%	30%	0%	1%	0%	100%
New Municipality - Group 2 (< 20 ppha)	Area	18,083	2,086	14,469	30	148	65	34,882
	Percent	52%	6%	41%	0%	0%	0%	100%
VDC	Area	2,811	226	4,599	1	104	20	7,761
	Percent	36%	3%	59%	0%	1%	0%	100%
Total	Area	**34,204**	**11,862**	**25,108**	**201**	**615**	**198**	**72,187**
	Percent	**47%**	**16%**	**35%**	**0%**	**1%**	**0%**	**100%**

Source: Land Use map of 2012

11.3. Future Growth Scenario of Kathmandu Valley

Various recent studies have carried out their own population projections for various development planning. Review of these recent population projections is done hereunder and considered accordingly for this study.

11.3.1. Population Projection by SDMP, 2015

According to the population census 2011, the population of the valley was 2.43 million. The population growth as compared to census 2001 was observed at 4.5% per annum. The decade of 2001-2011 was exceptional chiefly because of the insurgency in the country and the urban areas experienced phenomenal in-migration trend in the period due to internal conflict. If the same growth trend continues, the population of Kathmandu valley would 7.8 million, more than three folds than that of 2011; which is most unlikely to happen. SDMP projects the population to the tune of 6.0 million; with 4.5% of annual growth rate till 2015 and decrease by 0.5% in each five year till it reaches 3.5% in 2035.

11.3.2. Population Projection by CBS, 2014

A more scientific projection has been carried out by CBS using Cohort Component Population Projection Method based on the levels of fertility, mortality and migration. Seven types of input data namely smoothed age-sex distribution of base year population, sex ratio at birth, age-specific fertility, total fertility rate, life expectancy at birth, model life table pattern and net migration available from National Population and Housing Survey (NPHS) 2011 were used to project the population of Nepal. According to which, the population of the valley, including institutional population, with medium variant is expected reach about 3.85 million by the year 2031. The projection was made for the year 2016 and subsequent interval of five years afterwards with annual average growth of 3.7% to 1.5%. In order to make the

projection comparable, the estimation made by CBS has been rounded up and extrapolated to arrive at the figure for the years 2015 to 2035, as shown in the Table 4 below.

11.3.3. Population Projection by RSLUP

As the population change in Kathmandu in future is dependent on a number of factors relating to government policies and infrastructure investment which is not very explicit at this moment, it's difficult to assess the future growth pattern. However, it would be fair to assume the annual average growth between 2.8% to 3.3% since Kathmandu will continue to be the national capital and largest economic region of Nepal and as a result significant increase of internal migration can be expected in future. The valley should be prepared for some additional population that might be attracted with the increased economic activities after promulgation of constitution followed by economic transformation.

The three population projections cited above are high, low and medium and our planning is based on the projection which is pessimistic to SDMP and optimistic to CBS. Comparative figures of these projections are shown in the table below:

Table 4 Population projection of KV

Year	Population Projection By			Growth		
	Low (CBS)	Medium (RSLUP)	High (SDMP)	Low (CBS)	Medium (RSLUP)	High (SDMP)
2015	2,726,000	2,768,000	2,897,000	2.9%	3.3%	4.5%
2020	3,078,000	3,243,000	3,535,000	2.5%	3.2%	4.1%
2025	3,387,000	3,773,000	4,288,000	1.9%	3.1%	3.9%
2030	3,661,000	4,359,000	5,093,000	1.6%	2.9%	3.5%
2035	3,949,000	5,000,000	6,049,000	1.5%	2.8%	3.5%

Note: CBS Projection: Adjusted and extrapolated figure from population projection by CBS in Population Monograph (Volume I), 2014

For the purpose of preparation of RSLUP, a medium growth is adopted; with an expectation that the population of the valley might reach up to 5 million in next 20 years which is two folds of the population that existed in 2011. Kathmandu Valley should, therefore be prepared to accommodate almost double the present population which would roughly be the increment of 95,000 to 128,000 annually. The pertinent question now arises where and how they're going to be accommodated considering the risks and sensitivity in the valley and availability of limited constraint free land.

The following sub-sections analyse the existing situation of the constraints and availability of land. Provision of infrastructure and other major issues has been dealt separately.

11.4. Risks Sensitivity and Growth Constraints

The analysis of risks and constraints were carried out in 2012/13 under the preceding study "Comprehensive Study of Urban Growth Trend and Forecasting of Land Use in the Kathmandu Valley" by UNDP/CDRMP and KVDA(KVDA and UNDP/CDRMP 2014). Three types of constraints[1] to growth were defined viz. land use restrictions, physical constraints and environmental constraints. Under these broader categories, further specific constraints and restriction were defined by the study as illustrated and briefly discussed hereunder.

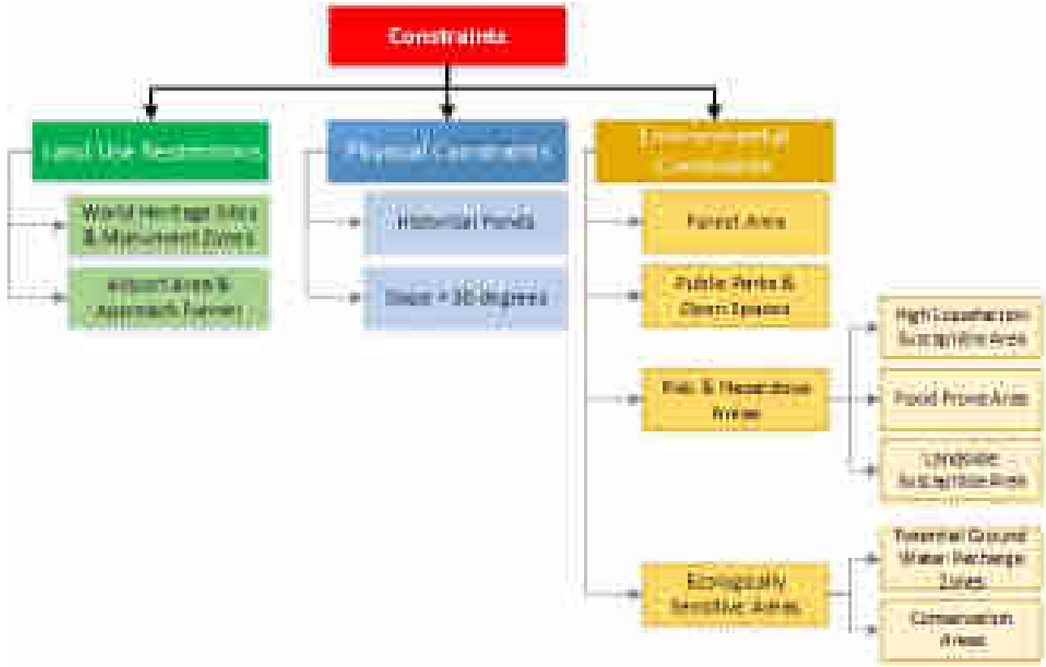


Figure 3 Constraints for development in KV

These constraints are generalized into five restrictions namely open spaces, world heritage sites, airport area, forest area and existing built-up area; and four types of risk zones pertaining to slope (>30°), flood prone areas, high liquefaction susceptible areas and high intensity earthquake zone for this study. The rationale for this generalization is to aid zoning of these restrictions areas and associated hazard-risks for the development of RSLUP. Brief descriptions of these generalized restrictions and risk zones are presented hereunder:

Restrictions

Designated Open Spaces: Under the leadership of Ministry of Home Affairs (MoHA), the International Organization for Migration (IOM) has identified open spaces within Kathmandu valley which could be used for humanitarian purposes in the event an earthquake occurs. Highest percentage of open spaces have been designated within four major municipalities; LSMC, Kirtipur Municipality, KMC and Bhaktapur Municipality while other municipalities have open spaces less than 1 percentage. Under the changed scenario of post 25th April 2015 earthquake and its aftershocks, the MoHA/IOM designated open spaces have been only partially used as the internally displaced and affected preferred to stay near to their damaged buildings and closer to their communities in any open spaces available. Therefore, any open spaces (publicly or privately owned land) could potentially be used as open space for evacuation and rescue-relief during such events.

[1] For clarity to the readers, 'constraints' are defined as the existing/imposed 'restrictions' for urban/built-up development

Restrictions

Built-Up Area: Built Up areas are those areas where anthropogenic influence is observed and infrastructures such as road, house, statues, and monuments have been built. Built Up areas is extracted from recent land use map of the year 2012 and updated for the year 2015 with appropriate projection. Newly formed municipalities and remaining VDCs within KV have least built up areas (<20%) while KMC, LSMC, Bhaktapur Municipality, Madhyapur Thimi Municipality, Tokha Municipality, Kirtipur Municipality and Budhanilkantha are densely builtup areas (>20%).

Airport Area: Tribhuvan International Airport (TIA) is only a sole international airport in Nepal. Urban development is not permitted inside and in the periphery of the airport. The TIA is located in the centre of the KV and has been undergoing expansion since its establishment. At present, it covers an area of 304 ha. The Approach Funnel area of the runway extends to 6 km in both the directions of the runway and covers an area of 1440 ha (projected area of Approach Funnel). This approach funnel area is considered as the take-off and approach limits and as such vertical development needs to be strictly controlled to enable aircrafts to maintain their Glide Path during landing and take-off. TIA area covers 6.1% of total area of KMC.

Forest Area: Forest area is taken as restrictions or development constraint for future urban development so that valley can maintain its greenery for long term. Forest area is extracted from land use map of 2015 that was prepared from geo-eye image of 0.5m resolution.
Almost all municipalities have more than 10% of forest area while municipalities namely Changunarayan, Karyabinayak, Madhyapur Thimi, Bhaktapur, KMC, LSMC and VDCs namely Thecho and Jharuwarasi have coverage of less than 10% forest area.

World Heritage Sites: The seven monument zones of Kathmandu valley which were inscribed as World Heritage Sites in early 1979 by UNESCO is taken as restrictions or development constrains for future urban expansion. The sites consist of three ancient royal palaces (Hanumandhoka Durbar square, Patan Durbar square and Bhaktapur Durbar square) and four religious complexes (Pashupatinath, Swayambhunath, Baudhanath and Changu Narayan). The designated area of WHS is referred from Department of Archaeology, Kathmandu. WHS covers an area of about 3.6% of KMC, 1.7% of Bhaktapur Municipality, 1.2% of Changunarayan Municipality and 0.6% of LSMC.

Historical Ponds: Historical ponds were built to maintain water flow even during dry season to recharge the aquifers. They can serve as water reservoirs, open spaces and attraction for tourism. They are prominently found in traditional cities of KMC, LSMC, Bhaktapur Municipality and Madhyapur Thimi Muncipality as well as other traditional Newari Townships in the valley.

Ground Water Recharge Area: A recharge area is a place where water is able to penetrate into ground and refill aquifers. Shallow aquifers can be locally recharged and are distributed throughout the valley but deep aquifers are confined into foothills on the north and south part of the valley
The potential water recharge zones for deep aquifers are prominent in Tarkeshwor Muncipality, Tokha Municipality, Budhanilkantha Municipality, Chandragiri Municipality, Godawari Municipality, Gokarneshwar Municipality and Kageshwori Municipality.

Risks

Slope: Development on steep slopes (slope greater than 33 % i.e. 30 degrees) poses a high risk of erosion as well as it helps to increase risk of landslides both during and after construction (County 2013). Most of the VDCs and Municipalities lying at the boundary of the KV at all four directions have higher percentages of steep sloping areas. Tarkeshwor and Tokha Municipality have more than 50% steep sloping areas.

Flood Prone Area: All the areas that are expected to inundate by 100 years return period flood are considered as risk areas and are thus restricted for future urban development. These areas are in close proximity to the major river banks that flows within the Kathmandu valley. While they cover major area of southern parts of KV, frequent flooding has been a major problem along the major river corridors like Dhobikhola where only 2hrs of heavy rainfall caused heavy damages along river banks on September 19, 2015.

Liquefaction Area: Liquefaction is caused by earthquake shaking in the loose non-consolidated sediments dominant of sand and silt. Such areas and areas close to river banks have high liquefaction potentiality. Madhyapur Thimi Municipality, KMC, Karyabinayak Municipality, Kageshwori Municipality, LSMC and Changunaryan Municipality have more than 5% area with high liquefaction potentiality.

High Earthquake Risk: The ground motion is represented by the Peak Ground Acceleration (PGA), which defines the maximum acceleration experienced by the soil during the scenario earthquake. Seismic intensity in modified Mercalli scale (MMI) is computed from the obtained PGA values at corresponding site to show the earthquake hazard for a particular scenario earthquake. Bhaktapur Municipality and Madhyapur Thimi Municipality has highest percentage of hazardous seismic zones covering over 40% of its area.

Of total area of 72,187 ha, the area with restrictions in KV is 59% and the area with risks is 38%. Several risks and restrictions overlap with one another and hence the total constraints sum up to 65%; inferring constraint free non-built up areas of 35% remaining in the KV. The following table shows types of risks and restrictions that prevail in different municipality and VDC category. Details are given in Annex 2 (A) and map presented in *Figure 4*.

Table 5 Municipality / VDC Level Risks and Restrictions

	Constraints	Old Municipality	New Municipality 1	New Municipality 2	VDC	Total (area in ha)	Total (%)
	Total Area	**11,492**	**17,818**	**21,628**	**21,249**	**72,187**	**100%**
Restrictions	Designated Open Space	49	310	158	15	532	1%
	World Heritage Site	11	178	50	0	240	0%
	Airport Area	0	304	0	0	304	0%
	Forest Area	5,163	3,749	7,927	6,164	23,004	32%
	Built-up 2012	1,892	5,749	2,375	1,815	11,832	16%
	High Water Recharge Area	247	4,272	2,324	0	6,843	9%
	Total	**7,363**	**14,562**	**12,834**	**7,994**	**42,754**	**59%**
Risks	Slope > 30deg	1,115	1,250	1,109	3,369	6,843	9%
	Flood Prone Area	842	2,006	5,347	2,903	11,098	15%
	Liquefaction Risk	442	875	607	215	2,139	3%
	High Earthquake Risk	1,305	2,546	1,461	2,324	7,636	11%
	Total	**3,703**	**6,677**	**8,524**	**8,811**	**27,715**	**38%**

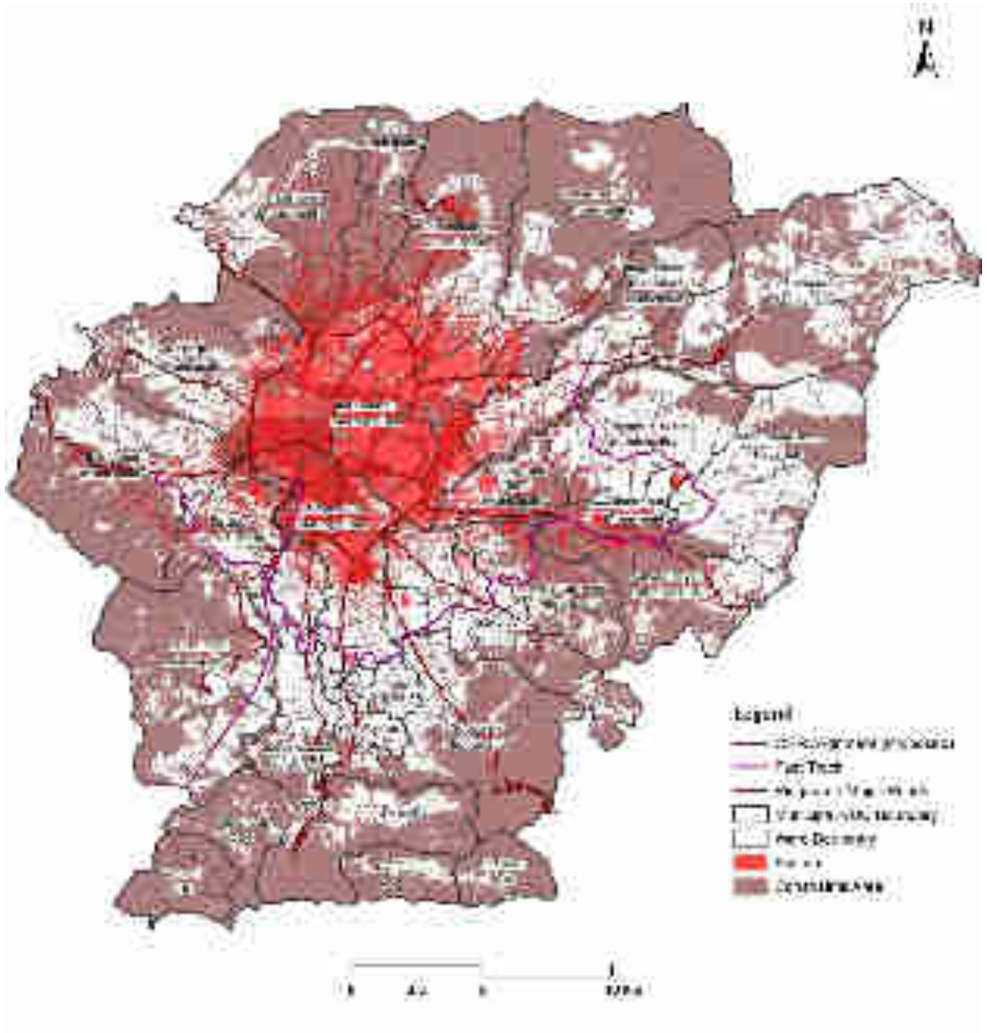


Figure 4 Development constraints map of KV

11.5. Analysis of Composite Risks and Restrictions

Risks and restrictions are spatially analysed to assess the total constraint areas in each wards of the municipalities and VDCs. It is observed that Kathmandu Municipality has the least constraint free non-built up area with only 5% of its municipal area and Changunarayan has the highest with 71%. Among VDCs, Ghusel has about only 6% of constraint free area and Jharuwarasi has the largest constraint free space remained with 85%. The municipalities/ VDC have been grouped into three categories on the basis of their availability of non-built up constraint free area. Those municipalities/ VDC having less than 30% of non-built up constraint free area are put in RED category, 30% to less than 60% in YELLOW category and more than 60% in GREEN category. The detail assessment is given in Annex - 2(B) and the summary is presented below:

Table 6 Colour zones and constraints

Colour Zone	Area in Ha (2015)							
	Built-up on Constraint	Non-Built-up on Constraint	Total Constraint Area	Built-up on Constraint Free	Non Built-up on Constraint Free	Total Constraint Free Area	Grand Total	Non- Built up Constraint Free Area Percent
Red	4,116	20,612	24,728	4,746	8,017	12,763	37,491	21.4%
Yellow	800	12,334	13,134	1,549	10,852	12,401	25,535	42.5%
Green	59	2,287	2,347	561	6,253	6,815	9,162	68.3%
Total	**4,975**	**35,234**	**40,209**	**6,856**	**25,122**	**31,979**	**72,187**	**34.8%**

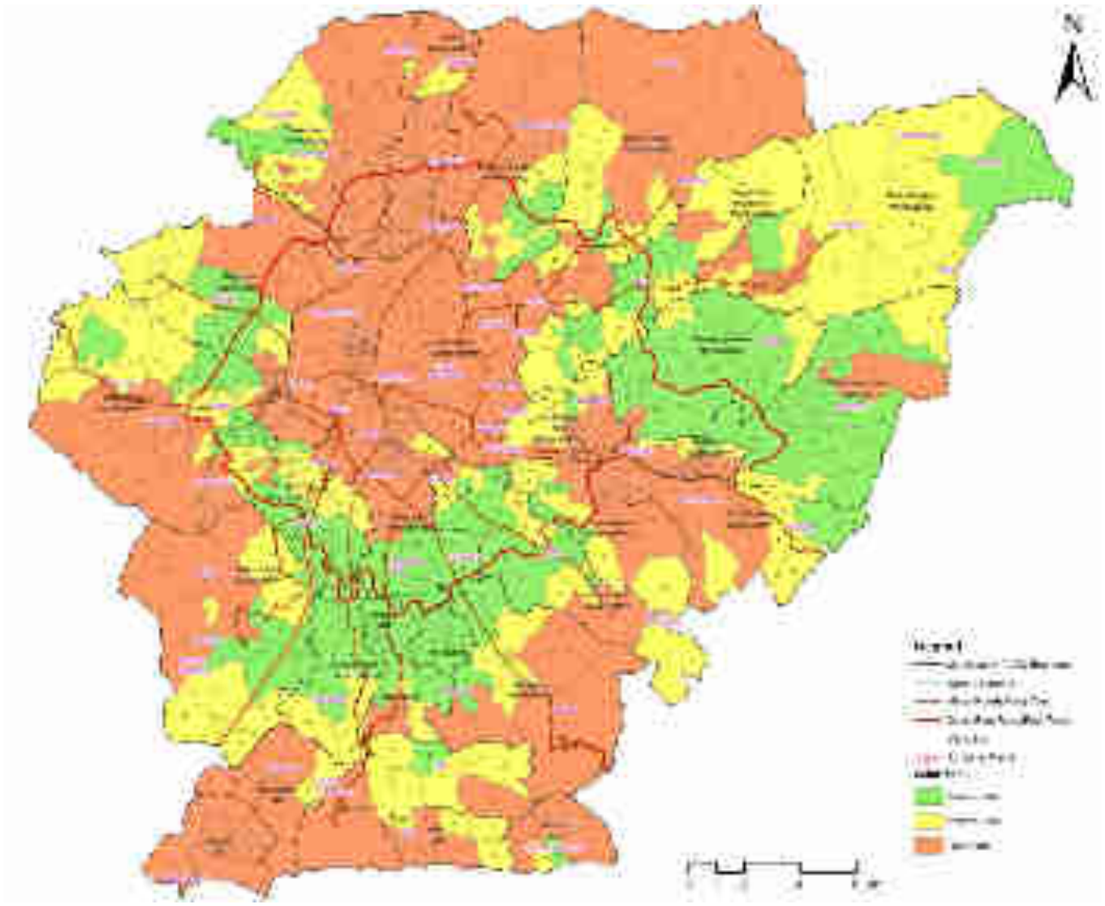


Figure 5 Colour zones at municipal/VDC ward levels

About 60% of the population in KV reside in five old municipalities which constitute about 15% of area. Around 38% of the people live in 74% of land space of new municipalities. The eight VDCs which cover 11% of land accommodate only 2% of population. Several wards of core areas of Kathmandu, Lalitpur and Bhaktapur are so compact that there is less possibility of further development without planned redevelopment initiatives. Some area may hence need to be de-densified to reduce the risk. Following table shows different non-built up constraint free area available in the municipalities and VDCs (Refer Annex - 2C. Ward level colour zone matrix is given in Annex - 2D.

Table 7 Available non-built up on constraint free areas in KV 2015

Districts	Total Area	Constraint Area	Non Built-up Constraint Free Area			
			Red	Yellow	Green	Total
Old Municipality	10,679	8,416	567	452	1,244	2,263
	100%	79%	5%	4%	12%	21%
New Municipality -1	18,866	12,778	951	2,642	2,495	6,088
	100%	68%	5%	14%	13%	32%
New Municipality -2	34,882	20,537	1,522	5,454	7,369	14,344
	100%	59%	4%	16%	21%	41%
VDC	7,761	5,334	636	813	978	2,428
	100%	69%	8%	10%	13%	31%
Total	**72,187**	**47,065**	**3,676**	**9,361**	**12,085**	**25,122**
	100%	**65%**	**5%**	**13%**	**17%**	**35%**

** New Municipality – 1, New-Municipality-2*

11.6. Colour Zones and its Parameters

The **RED** Colour zone is designated as the **High Alert Zone** which has limited constraint free space available for further development. It requires managing the activities that may potentially escalate risks and prevent development to avoid exposure of lives and assets. The area may not be suitable for high rise apartments or large scale industries. The average density in the wards falling into RED category is 145 ppha. However, there's huge gap between minimum and maximum densities. The lower density means that the area is not yet built up but significant portion of which has other risks and constraints.

The **YELLOW** Colour zone is designated **Medium Alert Zone** and represents the area which is lesser sensitive than the Red Zone, but has high potentiality to becoming the Red Zone if not planned appropriately. Few high rise buildings could be permitted and large scale industries should be restricted. The land transaction and permit fee should be lower than the Red Zone.

The **GREEN** Colour zone or **Residential Area Promotion Zone**, mostly on the south of the valley, is the most potential residential area. Organize housing and land pooling schemes should be introduced in this zone. More than 60% of the existing area in this zone is constraint free. High rise buildings, medium and large scale industries are suited to be should be promoted in this zone.

11.7. Population Allocation and Constraints

According to earlier discussion, the valley should preferably be planned for 5 million people in next 20 years. The additional 2.57 million people will tend to live in the area which is close to the city and where they get better urban and social facilities. In other words, the historic trend of development will follow unless some planned intervention is introduced. In case of business as usual model, with 5 million of target population, the likelihood of concentration after 20 years may be as below (refer Annex - 3A for detail).

Table 8 Expected population in municipalities and VDC of KV by 2035

Districts	Population		Population Projection - Estimated				
	2001	2011	2015	2020	2025	2030	2035
Old Municipality	1,014,449	1,460,147	1,641,028	1,886,236	2,148,398	2,424,693	2,711,492
New Municipality-1	252,242	516,211	622,007	780,305	970,448	1,196,444	1,462,176
New Municipality-2	288,910	404,944	453,600	520,718	594,287	674,326	760,729
VDC	40,607	47,977	51,269	55,311	59,108	62,567	65,603
Total	**1,596,208**	**2,429,279**	**2,767,904**	**3,242,570**	**3,772,240**	**4,358,030**	**5,000,000**

Due to non-availability of constraint free built-up space in the city centre and periphery, the development has to shift to other areas where the constraint free land is available. Current phenomena of infrastructure following sprawl has to be stopped or reduced significantly so that people start building their houses only in the developed plots where adequate provision of urban infrastructure has been made. Reversing this trend is a huge challenge to KVDA. Moreover, some areas need to be protected or controlled for development that would further reduce the amount of developable land.

In order to reduce the sprawl and make KV conducive to disaster risk reduction approaches, some areas need to be **de-densified** and some has to be **densified** gradually. The densification and de-densification is proposed as hereunder:

Table 9 Densification and De-densification

	Population		Pop as per Constraints	Densify or De-densify	Additional Population	Annual Additional Population
	2011	2035				
Old Municipality	1,460,147	2,711,492	2,316,573	(394,919)	856,426	35,684
New Municipality-1	516,211	1,462,176	1,263,518	(198,658)	747,307	31,138
New Municipality-2	404,944	760,729	1,283,734	523,006	878,790	36,616
VDC	47,977	65,603	136,174	70,571	88,197	3,675
Total	**2,429,279**	**5,000,000**	**5,000,000**	**0**	**2,570,721**	**107,113**

Above estimation is the aggregated data based on the ward level information on availability of risks and constraints free land. Among old municipalities, Kathmandu, Lalitpur and Madhyapur need to get de-densified, whereas Bhaktapur and Kirtipur still have space to accommodate 51,000 and 95,000 population respectively. Few newly declared municipalities; Budhanilkantha, Gokarneshwor, Tarkeshwor and Tokha municipalities; should also get de-densified. All other remaining municipalities have potential to densify as shown below. The ward wise detail of those areas is given in Annex - 3B.

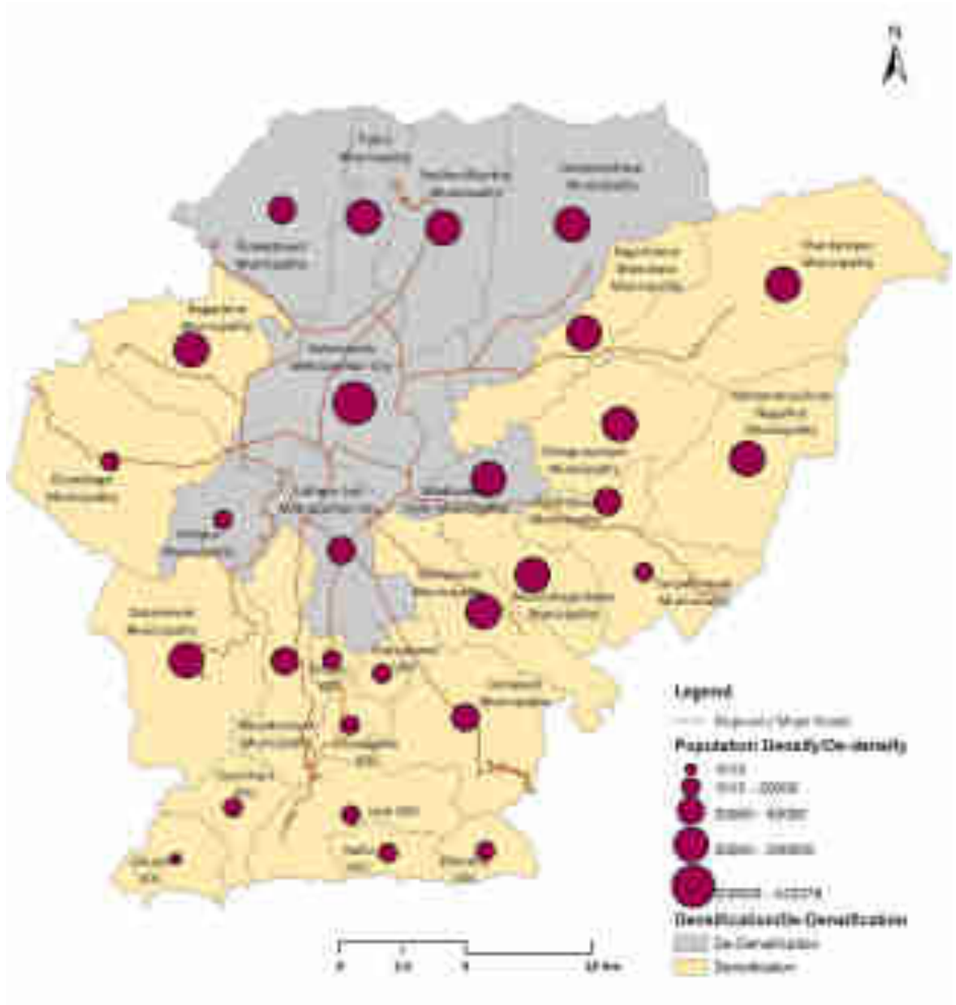


Figure 7 Proposed densification/de-densification of population in municipalities/VDCs

Following assumptions were made while estimating the population to be allocated in the particular ward of the municipality/ VDC:

- Average density in RED area would be the highest; followed by YELLOW and GREEN
- Average density in old municipalities would be the highest and would be followed by New Municipality 1, New Municipality 2 and VDC
- The maximum density would be in RED zone of old Municipality (289 ppha) and minimum density would be in GREEN zone of VDC (19 ppha). The density of the valley would reach 69 ppha from existing 34 ppha.
- About 70% of additional population would be living in constraint free area while 30% would still live in constraint area

11.8. Requirement of Area for New Development

The requirement of land for each household to attain specified densities would be 2.99 aana[1] (95.24 sq.m) in RED zone of old municipality and 5.39 aana (171.44 sq.m) in GREEN zone of New Municipality 1. The estimation has been made on the basis of 10,000 population (assumed number for one developed unit), family size, requirement of area for various infrastructure, social and agricultural use (specified below as requirement other than residential) as shown in table below. Elaborate illustration of which is given in Annex - 4. The minimum plot size in old municipality should therefore be 4 aana (127 sq.m) and the same in New Municipality 1 should be 6 aana (191 sq.m). Similarly, the density in RED zone of New Municipality 2 would be 115 ppha and GREEN zone of VDC would be 19 ppha. The requirement of land in RED zone of New Municipality 2 would be 5.31 aana (168.84 sq.m) and GREEN zone of VDC would be 26 aana (831.22 sq.m). The preferred minimum plot size would therefore be 6 aana in New Municipality 2 and 16 aana (509 sq.m) in VDCs.

Table 10 Requirement of area for new development in Old Municipalities and New Municipality-1

Particulars	Basis	Old Municipality			New Municipality-1		
		RED	YELLOW	GREEN	RED	YELLOW	GREEN
Density	ppha	289	144	96	192	96	64
Population to be accommodated	persons	10,000	10,000	10,000	10,000	10,000	10,000
Family Size	persons	5.00	5.00	5.00	4.00	4.00	4.00
Household	nos	2,000	2,000	2,000	2,000	2,000	2,000
Total Area Required	ha	34.63	69.27	103.90	51.95	103.90	155.85
Total Area Required	Ropani	680	1,361	2,041	1,021	2,041	3,062
Requirement other than residential	%	45%	56%	67%	56%	67%	78%
Area other than Residential	ha	15.59	38.79	69.61	29.09	69.61	121.57
Area for One Household	sq.m	95.24	152.39	171.44	114.29	171.44	171.44
Area for One Household	Aana	2.99	4.79	5.39	3.59	5.39	5.39
Minimum Plot Size	Aana	4.00			6.00		

Table 11 Requirement of area for new development in New Municipality-2 and VDCs

Particulars	Basis	New Municipality-2			VDCs		
		RED	YELLOW	GREEN	RED	YELLOW	GREEN
Density	ppha	115	58	38	58	29	19
Population to be accommodated	persons	10,000	10,000	10,000	10,000	10,000	10,000
Family Size	persons	4.00	4.00	4.00	5.00	5.00	5.00
Household	nos	2,000	2,000	2,000	2,000	2,000	2,000
Total Area Required	ha	86.59	173.17	259.76	173.17	346.34	519.51
Total Area Required	Ropani	1,701	3,402	5,103	3,402	6,804	10,207
Requirement other than residential	%	52.82	124.68	215.60	79.66	197.41	353.27
Area other than Residential	ha	33.77	48.49	44.16	93.51	148.93	166.24
Area for One Household	sq.m	168.84	242.44	220.79	467.56	744.64	831.22
Area for One Household	Aana	5.31	7.62	6.94	14.70	23.41	26.13
Minimum Plot Size	Aana	6.00			16.00		

[1] 1 aana = 31.81 sq.m

As apparent from above that the individual plot size has bearing to the provision of area other than residential, which is proposed minimum 45% in RED zone of old municipality and maximum 83% in GREEN zone of New Municipality 2; indicating more open space and agricultural land in latter.

12 DEVELOPMENT OF PLANNING ZONES FOR KATHMANDU VALLEY

Under this chapter, existing development zones, land use and constraints zones are discussed along with the regulatory framework for theses; and preferred planning zones proposed as a guideline for the RSLUP.

12.1. Planning Hierarchy

The planning hierarchy is the linkages between regulatory framework of the development zones, Colour zones and land use zones. Following planning hierarchy is proposed to link macro level planning with constraints based Colour zones and subsequent micro level implementation planning.

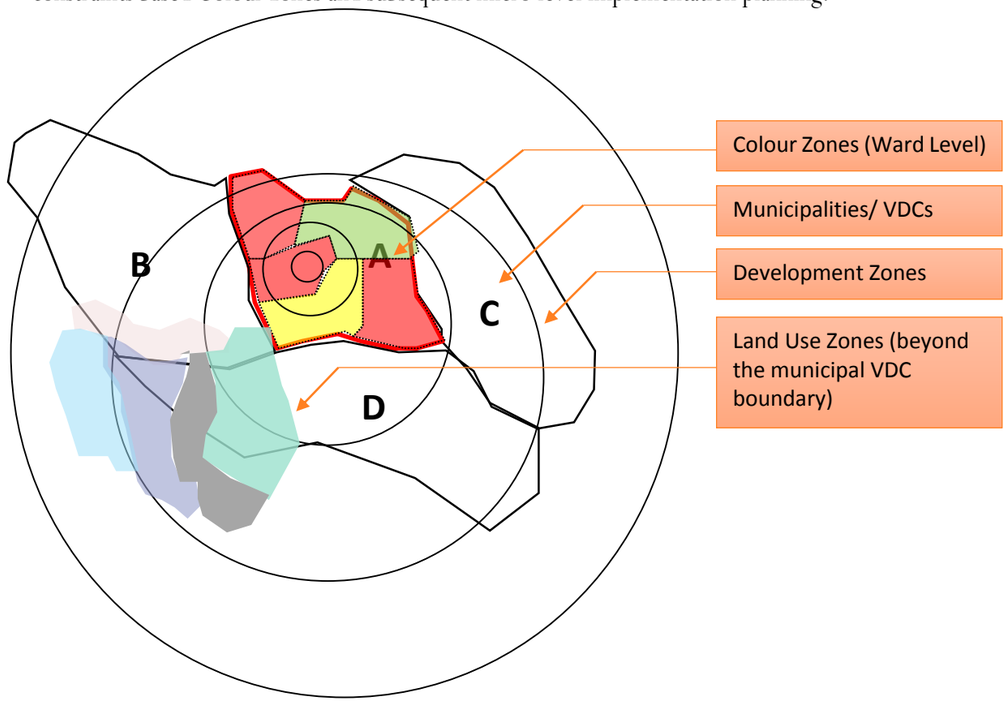


Figure 8 Schematic diagram of planning hierarchy

Figure 9 Linkages between different levels of planning regulations for KV

12.2. Regulations for Development Zones in KV

The boundaries of sub-zones in the above mentioned development zone have been delineated on the basis of their characteristics of density and building typology. This zone indicates the development of Kathmandu Valley over different time frame. Each municipality may have its own inner core and outer core within its boundary limit. However, the periphery to outer core may extend beyond the municipality boundary encompassing adjoining municipalities. KVDA should be authorized to delineate the development zone. Long term strategic planning relating to transportation, water supply, electricity, telecommunication, sewerage, solid management and land and housing development should be based on the development zone. The boundary of Periphery to city core should preferably be the proposed outer ring road or other road for circular movement of traffic.

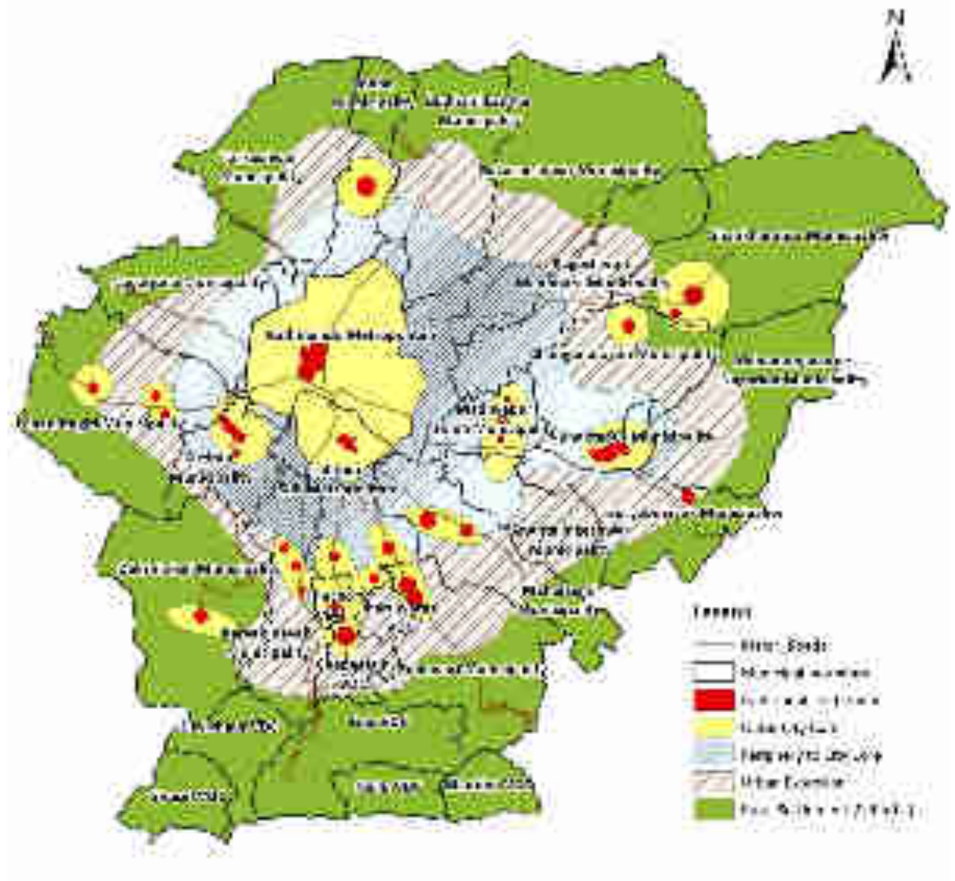


Figure 10 Schematic diagram of development zones in KV

The following sub-sections define each development zones and proposed regulation to support the development and implementation of RSLUP.

12.2.1. Old Settlements – Inner City Core

The settlements that existed from centuries possess typical characteristics of temples, monuments, squares, community space, water spouts and built structures exhibiting local arts and architecture. Such settlements exist in the core city centre of Kathmandu, Lalitpur and Bhaktapur, Thimi and Kirtipur. Few more settlements exist in the periphery of these cities in the areas; namely called Tokha, Sankhu, Changu on the north and Chapagaun, Khokana, Bungmati, Harisiddhi, Thaiba, Sanagaun, etc. on the south. Buildings in these settlements, except the temples and monuments, are gradually being pulled down and new buildings defying local architecture are being constructed. Moreover, vertical splitting of the buildings, as a result of distribution of property, has further deteriorated the city fabric and also increased the vulnerability as the new buildings are made excessively tall. The people in these settlements are predominated by Newar community. Inner city cores, in several patches, cover an area of 440 ha (0.6% of total area of KV). The inner city cores are the most compact and dense settlement and have no infill space unless redeveloped.

Figure 12 Satellite image view of inner city core in Kathmandu (GeoEye-1 Image of 2012)

12.2.2. Outer City Core

Outer city cores are the area around inner city that were started to develop mostly after '60s with the construction of ring road. These areas include Baneshwor, Pulchowk, Kalanki, Nayabazar, Maharajgunj, Bishalnagar, Sinamangal, Gwarko, Nakkhu, Balkhu, Jagati, Kamalvinayak, Gurjudhara etc. The buildings in these areas are mostly up to three storeys made of bricks and cement mortar with RBC or RCC roofs. Some areas along the highway and major inner roads have started to develop as commercial strips where RCC buildings of more than five storeys. With the widening of inner streets which started some three years ago, the area along these roads are gradually shifting from residential to commercial or mixed use.

All five old municipalities possess these characteristics. About 10,182 ha (14.1%) of the area of KV has been covered by outer city core. There is a limited infill space in this zone.

Figure 11 Satellite image view of outer city core in Kathmandu (GeoEye -1 Image of 2012)

12.2.3. Urban Periphery (Periphery to City Core)

Urban Periphery are the area adjoined to the municipalities and lied in VDCs until they were declared to include in the municipalities last year. Most of the areas in this development zone started to develop after 90's. In fact, these are the most haphazardly developed area in the valley and constitute about 9,981 ha (13.8%) of total area of valley. Mahankal, Kapan, Dhapasi, Sitapaila, Naikap, Sainbu, Imadol, Balkot, Duwakot, jhaukhel, Gothatar and Mulpani are the most prominent places which lie outside the existing ring road and within the proposed outer ring road. These areas lack any particular urban form and one can see various types and uses of buildings all around; from group housing to apartment to hospitals to colleges and many more. Narrow and substandard roads, absence of parks or open spaces are the typical characteristics of these areas. Some infill areas have still remained in this zone.

Figure 13 Satellite image view of urban periphery in Kathmandu, (GeoEye-1 Image of 2012)

12.2.4. Urban Extension

Urban extension, the areas located around 5-7 km. outside of ring road, has still significant agriculture land. However, the agricultural land has gradually been converting into residential use. The land sub-division is on rise and there's a danger of complete loss of agricultural land and open spaces if some planning intervention is not applied. Small old settlements, predominantly rural, exist in many places. These areas include Chapagaun, Jharuwarasi, Godamchaur, Dadhikot, Sipadol, Nangkhle, Tathali, Sudal, Chhaling, Changunaryan, Daanchhi, Bhadrabs, Nayapati, Baluwa, Chapali Bhadrakali, Chunikhle, Futung, Dharmasthali, Ichangunarayan, Ramkot, Chalnakhel, Chhampi and Dukuchhap. Most of them have now been included in the municipalities. Urban Periphery and Urban Extension Zones appear to be most sensitive at the moment areas in terms of planning. This zone has about 21,208 ha (29.2%) of land of KV.

12.2.5. Urban Suburbs or Rural Settlements

This is the zone which extends beyond the boundary of urban extension to the ridge of the valley. The area, mostly covered by forest, has thin sporadic rural settlements on the foot hill and slopes. Few of these areas are vulnerable to landslides. These areas include Chhaimale, Ghusel, Devichaur, Godawari, Nallu, Lele, Bhardeu, Lamatar, Nangkhel, Nagarkot, Nanglebhare, Lapsiphedi, Gagalphedi, Sundarijal, Jhor Mahankal, Sangla, Jitpurphedi, Goldhunga, Bhimdhunga, Dahachowk, Baadbhanjyang, Matatirtha and Machhegaun. They are either included in the municipality or still in VDCs. This zone covers an area of about 30,477 ha (42.2%).

Figure 14 Satellite image view of urban extension area in Kathmandu (Geo Eye-1 Image of 2012)

Figure 15 Satellite image view of rural settlement area in Kathmandu (GeoEye-1 Image of 2012)

12.3. Regulations for Colour Zone

Colour Zones primarily reflect the availability of risks and constraint free non-built up area in the particular ward of municipalities or VDCs. KVDA should be authorized to prepare Colour zone map and update it. Each land use zone may have policies or bye laws to **Avoid** or **Contro**l or **Promote** uses based on the risks and constraints as mentioned below.

12.3.1. Red Zone

- Allowing only the permitted uses as specified in zoning regulation and all construction shall conform to the existing building code.
- KVDA's prior approval is required for the construction of building more than 3 storey.
- No vertical subdivision of existing building is permitted. The height of the building shall be governed by its width.
- No land fragmentation lesser than 3 aana in old municipality, 4 aana in new municipality - 1, 5 aana in new municipality - 2 and 8 aana in VDCs is permitted.
- Open space is restricted to a set of allowable uses such as agriculture, park and pedestrian facilities etc.
- No building construction allowed in agricultural land. Provision of penalties in restricted areas.
- Hazardous land acquisition by government and provide alternative location.
- Revealing the information to the owner related to hazards in their property.

12.3.2. Yellow Zone

- All new construction shall conform to the existing building code.
- Retrofitting for strengthening identified hazardous building stocks.
- Provision of emergency services and access.
- No land fragmentation lesser than 4 aana in old municipality, 5 aana in new municipality - 1, 8 aana in new municipality - 2 and 12 aana in VDCs is permitted.
- Identification/Allocation of alternative routes into and out of hazard susceptible areas.
- Identification/Allocation of open space for humanitarian purpose.
- Restrict high rises and high occupancy residential buildings and offices in high risk areas.
- Relocation of vulnerable population and public facilities to reduce damage to infrastructure.
- Creation of buffer zone in flood plains allowing only recreational activities like parks, gardens, play areas (also act as green cover of the city).
- Sufficient land shall be kept unpaved or sufficient opening shall be provided in the land to allow percolation of rain water in the plot itself and rain water from a plot shall be connected with public drainage system only in case of plots with impermeable soil.
- All community facilities/centres/halls to be on high plinth or on upper floors (with open staircases) so that they can serve as emergency shelters during floods.
- Minimum use of timber in construction as they tend to rot.
- Emergency shut down and evacuation mechanism in every building (especially for lift /escalators).
- High voltage installations strictly not allowed in the flood prone zone

12.3.3. Green Zone

- Affordable housing scheme for low to middle income household
- Subsidies/incentives for agriculture use
- No land fragmentation lesser than 5 aana in old municipality, 6 aana in new municipality - 1, 8 aana in new municipality - 2 and 16 aana in VDCs is permitted.
- Municipal tax rebates in areas targeted for higher density development
- Design and implementation of new developments at high densities in identified new growth areas.

12.4. Regulations for Land Use Zone

Land Use Zones are micro level of planning which has to be prepared mandatorily by each municipality or VDC through community participation. A broad outline of the bye laws shall be released by KVDA and based on which the municipality or VDC can prepare their own bye laws and get approval from KVDA prior to implementation. They cannot, however, create their own land use zone type besides those specified without obtaining due approval from KVDA. Land use zones may not confine to the municipal boundary and may go beyond. Adjoining municipalities must be consulted while preparing the land use zone map.

The types of land use zone are prescribed as below which also commensurate to the land use classification prescribed by National Land Use Policy 2012 (GoN 2012).

- Agricultural (A)
- Residential (R)
- Mixed (M)
- Commercial (C)
- Forest (F)
- Public Utility (PU)
- Public and Semi Public (P & SP)
- Transport and Communication (T & C)
- Protected Area (P)
- Others (O)

The definitions of these land use zones and proposed regulations are presented in the following sub-section.

12.4.1. Agriculture Zone (A)

Agricultural Land may be defined broadly as land used primarily for production of food and fibre. Agricultural zoning is generally used by communities that are concerned about maintaining the economic viability of their agricultural industry. Agricultural zoning typically limits the density of development and non-farm uses of the land are restricted. The density is controlled by setting a large minimum lot size for a residential structure. Densities may vary depending upon the type of agricultural operation. By agricultural zoning, farming communities can be protected from becoming fragmented by residential development. Agriculture zone provides both market and non-market benefits to society e.g., crop production and open space.

Two components are important for designation of Agriculture zone; land evaluation and area review.

- Land Evaluation measures the importance of the property's soil resources in terms of their use for agriculture. The soil capability for agriculture is evaluated according to the most recent soil capability information, one of the most important factors in evaluating the agricultural potential of a property. A good soil base is critical for long term agriculture use. The land evaluation is given a weight of 70 %.

- Area Review identifies other important factors such as land use, parcel size and adjacent land uses that contribute to the suitability of a property for agricultural activities. The area review is given a weight of 30%.

The degree of agricultural use of a property indicates the property's ability to sustain farm operations. Agricultural use includes areas that have been under active cultivation, pasture. The size of the property influences potential for agriculture. Larger farm parcel sizes assist in maintaining the flexibility to accommodate a range of agricultural activities and ensure long term viability. Conversely smaller parcels are less attractive for long term agriculture.

12.4.2. Residential Zone(R)

Residential zone is intended for residential uses with high concentration of residential activities. The Residential land use designations provide for housing and other land uses that are integral to, and supportive of, a residential environment. Housing may take many forms ranging in density and scale from detached homes to high-rise apartment structures. To provide opportunities for the development of a broad range of residential uses that will satisfy housing requirements, and to provide for compatibility issues to be suitably addressed, different categories of residential land use have been identified. Areas designated Low Density Residential (Traditional and Modern Residential); Medium Density Residential (Paying Accommodations and care centres); and, High Density Residential (Group Housing and Apartments).

A residential zone provides a supply of residential land that is sufficient to accommodate the anticipated demand for broad range of new dwelling types over the planning period. It also supports the provision of a choice of dwelling types according to location, size, affordability, tenure, design, and accessibility so that the broad range of housing requirement are satisfied. Within the residential zone building with architecturally and/or historically are encouraged for preservation and maintenance.

12.4.3. Mixed Zone (M)

Mixed use zone is the area in any municipality or VDCs where a single building blends a combination of residential, commercial, cultural, institutional or industrial uses; where those functions are physically and functionally integrated. Many part of Kathmandu Valley is predominantly mixed use.

12.4.4. Commercial Zone (C)

A commercial zone is any part of a city or town in which the primary land use is commercial activities. These activities include the buying and selling of goods and services in retail businesses, wholesale buying and selling, financial establishments, and wide variety of services that are broadly classified as "business". Commercial zone in a city can take up about 5% of a city's land. Even though these commercial activities use only a small amount of land, they are extremely important to a community's economy. They provide jobs and bring money into the community.

Depending upon the nature of business, it could be neighbourhood commercial (C1), small (C2), medium (C3) and large (C4) commercial congregational units or hazardous and polluting commercial units (C5).

A convenient commercial zone encourages the growth of residential population in new development areas.

12.4.5. Industrial Zone (I)

In order to recognize the needs of existing and future industry and to address concerns over land use compatibility, industrial land uses are separated into six categories: Household Industries (I1), Service Industries (I2), Small (I3), Medium (I4), and Large industries (I5) and Hazardous/Heavy Industries (I6). These categories are differentiated on the basis of the range of main permitted uses or industrial processes, the potential impacts of such uses or processes would have on adjacent areas, and the scale and intensity of development allowed. The intent of this categorization is to group industrial uses so as to maximize their compatibility and minimize any negative impacts on nearby residential or other sensitive land uses.

12.4.6. Forest (F)

This zone encloses all areas covered by Forests, shrubs, bushes, grasses and uncultivated areas. Forest zoning limits development that could conflict with forestry practices. It keeps forest lands from being divided into small plots for purposes other than forestry. Forest has to be preserved and shall be developed into eco parks without disturbing the natural features. These areas shall not be changed to any other land uses and should be retained as it is.

12.4.7. Public Utilities (PU)

The purpose of this zone is to provide for a system or works that is used to provide for public consumption, benefit, convenience or use such as water supply, sewage disposal, public transportation, irrigation, drainage, fuel, electric power, heat, waste management, and telecommunications.

The property on which the public utility facility is located shall be appropriately buffered or screened with fencing or landscaping to screen it from neighbouring zone or within a particular zone. Such screening and buffering shall be approved by concerned authority and such plan shall be submitted prior to the construction or installation of any such facility by a public utility. In case of new developments, these shall remain as non-buildable areas and remain as reservations and marked for the purpose intended. They may be considered for calculation of open spaces within the schemes while approving building/development and layout plans.

12.4.8. Public and Semi Public (P & SP)

This zone includes Government owned complexes and civic amenities and large infrastructure facilities of health, education, sports, cultural and social institutions. This zone intends to provide non-residential uses of a public or quasi-public nature to be located in or near residential areas and to establish standards which will minimize the impact of the non-residential uses on nearby properties. It promotes combined public facilities such as school/community centers, police/fire stations, or library/community centers in several locations throughout the city to improve accessibility and promote efficient delivery of services.

12.4.9. Parks and Open space (P)

The natural and manmade features for environmental conservation and preservation, including water bodies, parks, playgrounds, burial and crematoria that contributes to recreational and social needs of the community. The purpose of this zone is to preserve open space for the conservation of natural resources as well as to maintain the natural character of the land while providing access to the public use. Only those uses are permitted that are complimentary to, and can exist in harmony with open space. Public use ancillary to park and open space shall not exceed 5%.

12.4.10. Transport and Communication (T & C)

Transportation zones are reserved for Transport and Transport related activities such bus stands, bus shelters, road & transport depots, parking areas, airport, special warehousing, cargo terminals and transfer of cargo between different types of transport (road, air). Ancillary land uses permissible subject to a condition that the built up area shall not exceed 5%.

Permissible use in each land use zone in different Colour zone is given in detail in the following chapter.

12.5. Regulations Related to Safety in Hazard Prone Areas

Earthquake, flood, landslides and liquefaction are four major hazards in Kathmandu Valley that potentially pose threat to safety of population and property. These hazards may potentially occur in any zone. Colour zone is essential for macro level of planning whereas the hazard map is useful for building control regulation in particular area. The specific provisions are given in the table below:

Risks	Specific Provisions to be made for Red Zone
Slope / Landslide	▪ Apartments, hotels, shopping complex, schools, hostels should not be more than 3 storeys ▪ Private residential buildings to be limited to 2 storeys ▪ Petrol pumps, gas storage depots not allowed ▪ Small commercial congregation units (up to 50 persons) allowed ▪ Small and medium scale industries may be allowed ▪ Relocation of vulnerable communities
Liquefaction	▪ Encouraged for agricultural use (incentive to be provided) ▪ Government may purchase land for open space and playground ▪ Light structures of single storey allowed in 50% of plot size ▪ Detailed soil investigation required for construction of more than two storeys
Flood Prone Area	▪ Squatter settlements to be re-allocated phase wise with specific plans for resettlement ▪ Define right of way of river according to 50 years of return period ▪ Define plinth level of buildings according to 10 years of return period ▪ River bank protection through tree planting and preserve the river side heritage and historical amenities. ▪ Upgrading and construction of drainage system to prevent water logging
High Earthquake Risk	▪ Retrofitting of public buildings and historic, cultural or religious monuments ▪ Demolition of public structures posing threats ▪ Encourage private owners to retrofit their buildings; provide discounts on loan ▪ Certify buildings that are earthquake resilient ▪ Restrict high occupancy buildings ▪ Deconcentration of population to low risk area ▪ Discouraging land sub-division into small parcel

Risks	Major Provisions to be made for Yellow Zone
Slope / Landslide	▪ No construction is allowed in slope greater than 45 degree ▪ Medium commercial congregation units (up to 200 persons) ▪ Medium scale industries ▪ Medium scale construction of public and semi-public category allowed
Liquefaction	▪ Agriculture promotion
Flood Prone Area	▪ Redevelopment of river bank into open spaces, parks etc. ▪ Define right of way of river according to 50 years of return period ▪ Building should be above a level corresponding to 50 year return period or 10 year rainfall ▪ Identification and protection of natural waterways
High Earthquake Risk	▪ Low density residential development ▪ All the new construction shall conform to existing building code ▪ Retrofitting of public buildings and historic, cultural or religious monuments ▪ Demolition of public structures posing threats ▪ Encourage private owners to retrofit their buildings; provide discounts on loan

Risks	Major Provisions to be made for Green Zone
Slope / Landslide	▪ Apartments, hotels, shopping complex, schools, hostels should not be more than 3 storeys ▪ Private residential buildings to be limited to 2 storeys
Liquefaction	▪ Agriculture promotion ▪ Simple, low occupancy commercial and industrial structures ▪ Detailed soil investigation required for construction of more than two storeys ▪ Ground improvement
Flood Prone Area	▪ Define right of way of river according to 100 years of return period ▪ Building should be located in such a way that they are above level corresponding to a 100 year frequency or the maximum observed flood levels and should be also above the levels corresponding to 50 year rainfall and the likely submersion due to drainage congestion. ▪ Building should be double or multiple storeys so the shelter can be taken on upper floor during danger on account of flood.
High Earthquake Risk	▪ Residential building, group housing/accommodation, apartments constructed should comply with appropriate building codes and regulation. ▪ All the new construction shall conform to existing building code

13.RSLUP IMPLEMENTATION GUIDELINES

13.1. Permissible Use in Colour Zones

Colour zones in each categorical land use zones are defined with their permissible uses regulated as hereunder:

Land Use Zones	Colour Zones		
	Red Zone (AVOID)	**Yellow Zone (CONTROL)**	**Green Zone (PROMOTE)**
Agriculture (A)	▪ Urban farming, nurseries, horticulture, children's play land, parks and open spaces, public and semi-public recreational uses not conducted for profit ▪ Hospitals, libraries, sports clubs & stadiums, playgrounds ▪ places of worship ▪ cultural buildings, places of worship ▪ gardens, orchards, nurseries, agricultural supplies centres ▪ Seminar hall, party palaces not exceeding 20% of the plot - single storey, light roof	▪ Residential building not exceeding 2,000 sq.ft inclusive of ground and first floor only ▪ Hospitals, libraries, sports clubs & stadiums, playgrounds, water sports, golf centres ▪ processing & sale of farm products on the property where they are produced ▪ mills for grinding, hulling, etc of cereals, pulses, food grains and oil seeds ▪ gardens, orchards, nurseries, agricultural supplies centres ▪ cultural buildings, places of worship ▪ Seminar hall, party palaces not exceeding 20% of the plot - single storey, light roof ▪ Veterinary hospital	▪ cold storage ▪ processing & sale of farm products on the property where they are produced, slaughter house ▪ mills for grinding, hulling, etc. of cereals, pulses, food grains and oil seeds ▪ farm houses and their accessory buildings and uses not exceeding the ground coverage of 10% of 5 ropani or above. ▪ quarrying, removal of clay upto 3.0m depth ▪ gardens, orchards, nurseries, agricultural supplies centres ▪ dairy and poultry farming, decorticators and any ancillary activities to agriculture not transgressing any pollution norms and only which are suitable to the neighbourhood. ▪ Hospitals, libraries, sports clubs & stadiums, playgrounds, water sports, golf centres ▪ amusement theme parks, toy trains ▪ cultural buildings, places of worship ▪ exhibition centres not exceeding ground coverage of 10% ▪ institutions relating to agriculture- like vocational training centre, research centres, educational institutions not exceeding ground coverage of 20% ▪ resorts and other tourism (eco tourism, agri-tourism) development projects, single storey, not exceeding ground coverage of 20% ▪ floor plus first floor only, orphanages and old age homes not exceeding ground coverage of 20% ▪ Residential building not exceeding 1,500 sft inclusive of ground and first floor only ▪ Shelters for urban poor not exceeding 2 floors ▪ Seminar hall, party palaces not exceeding 20% of the plot - single storey, light roof ▪ brick kiln and clay tile manufacturing (permission from concerned authority required) ▪ highway amenities viz.,filling station, weigh bridges and check posts ▪ Veterinary hospital
Residential (R)	*Detailed Structural Design and Soil Investigation are required for more than two storey*		
R1 A : Private Residential Buildings (Traditional)	up to 3 storey	up to 3 storey	up to 3 storey
R1 B : Private Residential Buildings (Modern)	up to 5 storey or Frontage to Height Ratio of 3.0 whichever is lower	up to 7 storey or Frontage to Height Ratio of 2.5 whichever is lower	up to 3 storey or Frontage to Height Ratio of 2.0 whichever is lower

Land Use Zones	Colour Zones		
	Red Zone (AVOID)	**Yellow Zone (CONTROL)**	**Green Zone (PROMOTE)**
R 2 : Group Housing (Detached, Row Housing, Semi Detached)	up to 3 storey (detached, row, semi detached)	up to 5 storey (detached, row, semi detached)	▪ Only detached houses allowed ▪ Min. Plot Size : 6 aana ▪ Max. Ground Coverage : 50% ▪ Min. Usable Open Space : 5% ▪ Min. Road Width : 8m ▪ Min. Community, Parking, Public Utilities Space : 5%
R3 : Apartments	up to 7 storey	up to 10 storey	up to 5 storey
R4 : Hostels, paying guest accommodation	up to 3 storey	up to 5 storey	up to 3 storey
R5 : Orphanages and Old age homes	up to 3 storeys	up to 3 storeys	up to 3 storeys
Mixed (M)	up to 3 storey	up to 5 storey	up to 3 storey
Commercial (C)			
C1 : Essential neighbourhood shops and offices	Allowed	All categories allowed	All categories allowed
C2 : Small commercial congregation units (up to 50 persons)	Permission Required	All categories allowed	All categories allowed
C3 : Medium commercial congregation units (up to 200 persons)	Permission Required	All categories allowed	Permission Required
C4 : Large commercial congregation units (up to 500 persons)	Allowed only in designated area	Permission Required	Allowed only in designated area
C5 : Hazardous and polluting commercial units	Allowed only in designated area	Allowed only in designated area	Allowed only in designated area
Industrial (I)			
I1 : Household (cottage) industries : Please refer the list	Intimation	Intimation	Intimation
I2 : Service Industries	Intimation	Intimation	Intimation
I3 : Small/ non-polluting Industries	Intimation	Intimation	Intimation
I4: Medium/ non-polluting Industries	Permission Required	Intimation	Permission Required
I5 : Large/ non-polluting industries	Permission Required	Permission Required	Not allowed
I6 : Hazardous/ Heavy manufacturing/ polluting industries	Not Allowed	Special Permission Required	Not allowed
Forest (F)	All community, public forests to be properly delineated, fenced and protected by local community and may be allowed general public for social, recreational or religious purpose; the maximum coverage of structures (both permanent and temporary) should not exceed 10% of the total area and the structures should be single storey only.		
Public Utility (PU)	Water supply system, treatment plants, gas storage, electric sub-stations, transformers, towers, solid waste management facilities, landfill site : Environmental and Social Safeguards required		
Public and Semi Public (P & SP)	Permission from KVDA and respective authority required		
Parks and Open Space (P)	Sports grounds, stadium, playgrounds, parks, swimming pool, cremation place		
Transport and Communication (T & C)	T & C 1 and T & C 2 are allowed	All facilities allowed	T & C 1 and T & C 2 are allowed
Conservation	Conservation of historical, religious, cultural, social or environmental sites to be promoted		

13.2. Permissible Land Uses in Public and Semi Public Category

P&SP 1	P&SP 2	P&SP 3	P&SP 4
Sub Offices of utilities	Police Stations, Post offices, Ward offices	Parks, Play Grounds, Stadiums	Airport related ancillary uses
Telecommunication Towers	Public Utility Service Centers/ Ticket Counters	Middle schools, High schools, Residential Schools	
Public Toilets	Traffic and Transport related facilities	Research Institutions	
Temples, Stupas, Mosques, Churches,	Primary Schools and Hostels	Public Offices, auditoriums, cultural complexes	
Montessory, Play Schools		Higher Educational Institutions, Colleges	
		Fire Stations	
		Media (Audio/ Visual/ Print/ online) Institutions	

13.3. Permissible Land Uses in Transport and Communication Category

Sub Group	Group			
	T&C1	T&C2	T&C3	T&C4
A	Bus/ micro bus bays, taxi stand, bus stands, transport information	Transport offices	Godowns	Ware houses, storage depots
B	Parking Areas	Automobile spares and services	Loading and unloading platforms/ weigh bridges	Airport
C	Multi level car parking	Bus Depots	Bus Terminals	Truck terminals
D	Workshop and garages for taxi and micro buses	Workshops and garages for minibus and buses	Workshops and garages for long route buses	Dry ports/ Cargo Terminals

13.4. Set Back, Ground Coverage and Building Height

Zones/ Sub-Zones	Frontal Road	Set Back	Ground Coverage	Max Building Height	Special Considerations	Remarks
Agriculture (A)	<4m	3m	20%	10m		
	4-<8m	2m	20%	10m		
	8-12m	1m	20%	10m		
	12-16m	1m	20%	10m		
	>16m	1m	20%	10m		
Residential (R)						
R1 A : Private Residential Buildings (Traditional)	6m	1.5m	70%	10m		
R1 B : Private Residential Buildings (Modern)	8m	1.5m	60%	15m	Frontage to height ratio whichever is lower	
R 2 : Group Housing (Detached, Row Housing, Semi Detached)	>8m	3m	50%	10m	For detached housing minimum distance between the building is 3m Minimum usable open space is 10%	
R3 : Apartments	12m	6m	40%	18m	For every increase in height of 6m or thereof above 30m, minimum extent of setback space to be left additionally shall be one meter	
R4 : Hostels, paying guest accommodation	8m	1.5	50%	15m		
R5 : Orphanages and Old age homes	8m	1.5	50%	10m		
Mixed Use (M)						
Commercial (C)						
C1 : Essential neighbourhood shops and offices	8m	2m	50%	15m		
C2 : Small commercial congregation units (up to 50 persons)	12m	3m	50%	As per the light plane or frontage to height ratio????		

Zones/ Sub-Zones	Frontal Road	Set Back	Ground Coverage	Max Building Height	Special Considerations	Remarks
C3 : Medium commercial congregation units (up to 200 persons)	12m	4m	50%			
C4 : Large commercial congregation units (up to 500 persons)	14m	5m	40%			
C5 : Hazardous and polluting commercial units						
Industrial (I)						
I1 : Household (cottage) industries : Please refer the list	8m	3m	60%	15m	Maximum height of industrial shed/building shall be 15.0 m or depending upon the nature of requirements of particular industry. In case of roof trusses the height of shed/building may be adjusted or relaxed	
I2 : Service Industries	>8m	5m	60%	15m		
I3 : Small/ non-polluting Industries						
I4: Medium/ non-polluting Industries	>12m	10m	50%	15m		
I5 : Large/ non-polluting industries	>12m	15m	50%	15m		
I6 : Hazardous/ Heavy manufacturing/ polluting industries						
Forest (F)		1m	10%	3m	Activities promoting afforestation, wild life, picnic and tourism shall be permissible.	Under tourism only tented, temporary, small and make shift accommodations are proposed with prior permission of concerned authority Felling of trees shall not be allowed for any of the activities mentioned above.
Public Utility (PU)	Buffer should be created for accommodating the utilities as dictated by technical standard specified by the competent authority.					
Public and Semi Public (P & SP)	12m	6m	40%			
Parks and Open Space (P)				6m	Public use ancillary to park and open space shall not exceed 5% of total area.	
Transport and Communication (T & C)	18m	6m	70%		Design consideration for specially abled	

13.5. Development Control Regulations in Hazard Prone Areas

Development regulations in the designated hazard prone areas needs special provisions and special enforcement/enactment regulations. Following regulatory mechanisms is proposed to be considered strictly in hazard prone areas.

I. General Requirements for Development	
Requirements of Site	No land shall be used as a site for the construction of building: ▪ If the site is found to be/designated as susceptible to liquefaction by the Regulatory Authority under the certain earthquake intensity in the area, except where appropriate protection measures are taken. ▪ If the Regulatory Authority finds that the proposed development falls in the area liable to storm surge during cyclone, except where protection measures are adopted to prevent storm surge damage.
Requirements of Site Plan	▪ In hilly terrain, the site plan should include location of land slide prone areas, if any, on or near the site, detected during reconnaissance. The Authority in such case shall cause to ensure that the site is away from such land slide prone areas. ▪ The site plan on a sloping site may also include proposals for diversion of the natural flow of water coming from uphill side of the building away from the foundation.
II. Provisions in Building Regulations/ Bye-laws for Structural Safety in Hazard Prone Areas	
Structural Design	All the construction should conform to the provision made under National building code. ▪ For general safety ▪ For cyclone/windstorm protection ▪ For earthquake protection ▪ For protection of landslide hazard *Note: Whenever standards are referred, the latest version shall be followed. Codal revision/ guidelines pertaining to protection for any specific hazard can be omitted wherever not applicable.*
III Regulations for Land Use Zoning for Hazard Prone Areas	
Land Use Zoning	▪ The objective of land use zoning is to regulate land use in hazard prone areas to minimize the damage caused to the habitat, as a result of natural hazards viz. earthquakes, cyclonic storms and floods which recur from time to time. Land

	Use Zoning, therefore, also aims at determining the locations and the extent of areas likely to be adversely affected by the hazards of different intensities and frequencies, and to develop such areas in a manner that the loss to the development is reduced to the minimum. ▪ Land Use Zoning envisages certain restrictions on the indiscriminate development of the "unprotected" hazard prone areas and to specify conditions for safer development by protecting the area from severe losses. In the former case, boundaries of different zones are to be established to prevent unrestricted growth there. ▪ Another objective of Land Use Zoning in the hill areas will be to ensure the forest cover and to preserve the green areas for environment protection.
Earthquake Prone Area Designation	▪ Intensities of VII or more on Modified Mercalli Intensity (MMI) or MSK intensity scale are considered moderate to high. Therefore, all areas in these three zones will be considered prone to earthquake hazards. ▪ In these zones the areas which have soil conditions and the level of water table favourable for liquefaction or settlements under earthquake vibrations will have greater risk to buildings and structures which will be of special consideration under Land Use Zoning. ▪ Under these zones, those hilly areas which are identified to have poor slope stability conditions and where landslides could be triggered by earthquake or where due to prior saturated conditions, mud flow could be initiated by earthquakes and where avalanches could be triggered by earthquake will be specially risk prone. ▪ Whereas, earthquake hazard prone areas identified have to be determined specifically for the planning area under consideration through special studies to be carried out by geologists and geo-technical engineers. ▪ If an active fault trace is identified by Geological Survey, a structure for human occupancy should not be placed over the fault trace and must be set back by a minimum of 15 m on either side of fault trace.
Improving Resistant of Sites to Earthquake	▪ In those areas where there are no dangers of soil liquefaction or settlements or landslides, all building structures and infrastructures should be designed using the relevant Indian Standards as provided in the Building Regulations and the National Building Code ▪ Soils subjected to liquefaction potential under earthquake shaking can be improved by compaction to desired relative densities, so as to prevent the possibility of liquefaction. ▪ Buildings and structures could be founded on deep bearing piles going to non-liquefiable dense layers. ▪ Steep slopes can be made more stable by terracing and construction of retaining walls and breast walls, and by ensuring good drainage of water so that the saturation of the hill-slope is avoided. ▪ Any other appropriate engineering intervention to save the building structures or infrastructure from the fury of the earthquake. ***Note:*** *The protective action given under (ii) to (v) will usually involve large amount of costs and should only be considered in the case of large and costly structures. For ordinary buildings the cost of improvement of the site will usually be uneconomical, hence bad sites should be excluded by Land Use Zoning.*
Flood Prone Areas	▪ Besides the flood prone areas in river plains (unprotected and protected by bunds) , other areas can be flooded under conditions of heavy intensity rains, inundation in depressions, backflow in drains, inadequate drainage, failure of protection works, etc.

	▪ Whereas, the flood prone areas are identified on the available maps other areas have to be identified through local contour survey and study of the flood history of the planning area.
Regulation for Land Use Zoning for Flood Protections	▪ Installations and Buildings of Priority 1 should be located in such a fashion that the area is above the levels corresponding to a 100 year flood or the maximum observed flood levels whichever higher. Similarly they should also be above the levels corresponding to a 50year rainfall flooding and the likely submersion due to drainage congestion; ▪ Buildings of Priority 2 should be located outside the 25 year flood or a 10 year rainfall contour, provided that the buildings if constructed between the 10 and 25 year contours should have either high plinth level above 25 year flood mark or constructed on columns or stilts, with ground area left for the unimportant uses; ▪ Activities of Priority 3 viz. play grounds, gardens and parks etc. can be located in areas vulnerable to frequent floods. ***Note:*** *In natural hazard prone areas identified under the land use zoning regulations, structures buildings and installations which cannot be avoided, protective measures for such construction/ development should be properly safeguarded based on the given suggestion*
Protecting areas from flood	This may require one or more of the following actions. ▪ Construction of embankments against the water spills from the source of flooding like rivers, large drain etc. ▪ Construction of high enough embankments/bund around the planning area. ▪ Raising the planning area above the high flood level. ▪ Construction/improvement of drainage paths to effectively drain the water from the planning area. ▪ Construction of buildings and structures on deep foundations going below the depth of scour or on stilts with deep enough foundations under water. Flood proofing works such as providing quick drainage facility consisting of Revitalization of secondary and primary drainage channels after establishing the drainage blockage points; Provision of additional waterways; Clearing of clogged cross drainage works; Providing Human and Animal Shelters for population living within embankments in the form of raised platform or use of available high ground. ▪ Anti-erosion actions in affected areas ▪ Any other suitable measure ***Note:*** *The concept of land zoning should be kept in mind for areas where protection works are taken up to decide inter-se priority for location of structures considering possibility of failure of protection works during extreme disaster events.*
Planning in Hilly Areas	In order to ensure environmentally sound development of hill towns, the following restrictions and conditions may be proposed for future activities. ▪ An integrated development plan should be prepared taking into consideration environmental and other relevant factors including ecologically sensitive areas, hazard prone areas, drainage channels, steep slopes and fertile land. ▪ Water bodies including underground water bodies in water scares areas should be protected. ▪ Where cutting of hill slope in an area causes ecological damage and slope instability in adjacent areas, such cuttings shall not be undertaken unless appropriate measures are taken to avoid or prevent such damages. ▪ No construction should be ordinarily undertaken in areas having slope above 30^0 or areas which fall in landslide hazard zones or areas falling on the spring line sand first order streams identified by the State Government on the basis of available scientific evidence.

- Construction may be permitted in areas with slope between 10° to 30° or spring recharge areas or old landslide zones with such restrictions as the competent authority may decide.

13.5.1. Land Use Conversions

The following matrix details on the provisions of regulations for land use conversions from one designated to the others.

	Agr	Residential						Commercial					Industrial						F	PU	P&SP				T&C			
		R1A	R1B	R2	R3	R4	R5	C1	C2	C3	C4	C5	I1	I2	I3	I4	I5	I6			1	2	3	4	1	2	3	4
Agr	NA	D	D	D	E	D	D	D	D	E	E	E	D	D	D	E	E	E	A	B	A	A	A	A	B	B	B	B
R1A	A	NA	B	D	E	D	D	C	C	E	E	E	D	D	D	E	E	E	E	E	C	C	C	E	D	E	E	E
R1B	A	E	NA	B	B	B	B	C	C	D	D	E	D	D	D	E	E	E	E	E	C	C	C	E	D	E	E	E
R2	A	E	E	NA	B	C	C	D	D	D	D	E	D	D	D	E	E	E	E	E	D	D	D	E	D	E	E	E
R3	A	B	B	B	NA	B	D	B	C	C	D	E	D	D	D	E	E	E	E	E	D	D	D	E	D	E	E	E
R4	A	B	B	B	B	NA	D	B	B	C	D	E	D	D	D	E	E	E	E	E	D	D	D	E	D	D	E	E
R5	A	B	B	B	D	D	NA	B	D	C	E	E	D	D	D	E	E	E	E	E	D	D	D	E	E	E	E	E
C1	A	B	B	B	B	B	B	NA	B	B	D	E	C	C	D	E	E	E	E	E	B	B	B	E	B	B	B	E
C2	A	c	B	D	D	B	B	B	NA	B	C	E	B	B	C	E	E	E	E	E	B	B	B	E	C	E	E	E
C3	A	E	C	C	C	B	C	B	B	NA	B	C	B	B	D	D	D	E	E	E	B	C	B	E	E	D	D	E
C4	A	E	E	E	E	D	E	B	B	B	NA	E	B	D	D	D	D	E	E	D	B	D	C	E	D	D	D	E
C5	A	E	E	D	E	E	E	E	D	E	E	NA	E	E	E	E	E	B	E	D	E	E	E	E	E	E	E	E
I1	A	C	C	C	C	D	D	B	B	D	D	E	NA	B	B	D	E	E	E	E	D	D	D	E	E	E	E	E
I2	A	D	D	D	D	B	D	D	B	B	B	E	D	NA	C	C	C	E	E	E	C	C	C	E	D	D	D	E
I3	A	E	E	E	E	E	E	E	D	D	D	E	E	D	NA	D	D	E	E	D	E	E	E	E	D	D	D	E
I4	A	E	E	E	E	E	E	E	E	D	D	E	E	D	E	NA	D	E	E	D	E	E	E	E	E	E	E	E
I5	A	E	E	E	E	E	E	E	E	E	E	E	E	D	E	E	NA	D	E	D	E	E	E	E	E	E	E	E
I6	A	E	E	E	E	E	E	E	E	E	E	D	E	E	E	E	E	NA	E	D	E	E	E	E	E	E	E	E
F	A	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	NA	D	E	E	E	E	E	E	E	E
PU	A	E	E	E	E	E	E	E	E	E	D	D	E	E	E	D	D	D	E	NA	D	D	D	E	D	D	D	E
P&SP1	A	D	D	D	D	D	D	C	C	C	C	E	D	D	D	D	D	E	E	D	NA	C	D	E	D	D	D	E
P&SP2	A	D	C	C	C	C	C	C	C	C	C	E	C	C	C	C	C	E	E	D	C	NA	C	E	D	D	D	E
P&SP3	A	D	D	C	C	C	C	E	E	B	B	E	E	C	D	D	D	E	E	D	D	C	NA	E	D	E	E	E
P&SP4	A	E	E	E	E	E	E	E	E	E	E	D	E	E	E	E	E	E	E	E	E	E	E	NA	E	E	E	B
T&C1	A	D	B	B	B	B	B	E	B	B	B	D	D	B	B	B	D	E	E	E	C	C	B	E	NA	C	C	E
T&C2	A	E	E	E	E	E	E	E	E	E	D	E	E	E	E	E	D	E	E	D	E	D	E	E	C	NA	C	E
T&C3	A	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	D	E	E	E	E	D	E	E	D	D	NA	E
T&C4	A	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	D	D	E	E	E	E	E	E	E	E	E	NA

Note: A : Allowed - Incentives Given, B : Allowed- Permission Required, C : Allowed - Permitted on Conversion Charge, D : Allowed on Special Condition and Conversion Charge, E : Not Allowed, NA : Not Applicable

14 IMPLEMENTING TOOLS FOR RSLUP

This chapter discusses on various implementing tools that could be adopted/adapted for effectively implementing the RSLUP in the KV. Case studies of these tools implemented elsewhere internationally are presented to learn of the best practices.

14.1. Easement

In order to protect communities from impact of hazards and capitalize on planning efforts to the greatest capacity, mitigation efforts should be incorporated into local land use decisions, policies and codes. Working to achieve land use and hazard mitigation goals not only reduces community's vulnerability, it is also a more cost effective in the event of a crisis (APA, 1998).

Easements are highly effective means of protecting land, and have the benefit of being permanent, while land use regulation may change. When a certain activities on private land such as commercial development or residential sub-division have to be excluded, conservation easement is designed. The primary purpose is to conserve natural or manmade resources on the land. It makes the holder responsible for monitoring and enforcing the property restriction imposed by the easement for as long as it is designed to run but it does neither grant ownership nor it absolve the property owner from traditional responsibilities, such as property tax, upkeep, maintenance, or improvements.

14.2. Transfer of Development Rights

While not as common as zoning or subdivision regulations, transfer of development rights or TDRs can be used to protect certain lands from development. A local government identifies an area it wants to protect, say, undeveloped property in a hazard prone area. This area becomes the sending area from which TDRs can be purchased from willing landowners. Property owners in the sending area are awarded a set of development rights based on the value or acreage of land. The government then identifies an area, usually where it would like growth to occur, as a receiving area for these development rights. By purchasing TDRs from landowners in sending areas, developers typically can build at higher densities in the receiving areas than would otherwise be allowed by zoning. Landowners who sell TDRs in sending areas typically are prohibited from developing their land. Transfer of development rights can be used as a relatively low cost means of protecting sensitive lands. It is designed to steer growth and not to limit or stop development.

TDR could be used to direct development in specific zones while preserving agricultural areas, forested area, heritage areas etc. by allowing its owner to give up their rights to develop these lands. Consequently, agriculture and environmentally sensitive areas are protected, and development occurs in suitable areas. Monetary compensation or certain amount of additional built up area are made available to landowners in lieu of the area relinquished or surrendered by the owner of the land, so that he can use the extra built up area either for himself or transfer it to an area where development is permitted. For effective execution of TDR programs, it must be implemented synchronously with sound urban planning and zoning regulations, with streamlined land title registration.

While the strength of TDR lies in its ability to allow density to be shifted to areas best able to accommodate it protecting sensitive lands, it is a complex system. It is always easy to identify "transfer out" zones of sensitive or hazardous areas, but harder to identify "transfer in" zones for the shifted density. Perhaps most importantly, without strong development pressure in the receiving areas, there may be no market for the development rights. There are also government costs and administrative burdens in tracking and monitoring the development rights sales and transfers, to ensure proper densities are achieved in the transfer-in and transfer-out zones.

Implementation Mechanism	Actors
▪ An appropriate legislative and planning framework needs to be in place to facilitate the process	▪ Ministry of Land Reform and Management, MoFALD, DUDBC, Communities
▪ Identification of sending and receiving zone	▪ DUDBC, Municipality
▪ Determining incentives and selecting a transaction mechanism.	▪ MoLRM, DUDBC, Municipality
▪ Capacity building of stakeholders	▪ DUDBC, Municipality

Transfer of Development Rights: Curitiba, Brazil

Curitiba is internationally acclaimed as an environmentally- friendly city. The local government applied the Transfer of development rights in order to preserve buildings of architectural and historical value and to achieve inner city revitalization. Development rights were transferred from the original sites to elsewhere in the city, provided that infrastructure and services were in place to absorb the increase of densities and the FAR in the receiving land parcels. Decisions to increase FAR were based on a careful study of impacts of densification, e.g. absorption capacity of infrastructure, impact on transit and public service provision.

Source: Compact Cities: Sustainable Urban Forms for Developing Countries,

14.3. Relocation of Vulnerable Groups

Relocation, either temporarily or permanently is the process to physically move people to a different locations. To protect vulnerable residents from future disasters, it is one of the decisions that national and local government can pursue. Sometimes relocation are perceived to be the best option in a situation when people have already been displaced by disaster but it can be undertaken as preventive measure, before a disaster occurs to avoid the adverse effect of natural hazards such as landslides, flooding and liquefaction as a result of seismic tremors. In fact, relocation may be appropriate when disaster is the result of site specific vulnerabilities. With more people living and working in areas exposed to disasters- total or partial relocation of vulnerable communities at risk might become increasingly necessary.

Well managed planned relocation is a measure for building resilience and saving life of vulnerable people at risk. For improved land use and living condition of targeted communities, planned relocation can be a tool to manage people's movement. However, decision to relocate as a strategy for disaster risk reduction must be based on vulnerability and risk assessment.

Although relocation can be effective to reduce the exposure of vulnerable population and assets to disasters, it is a costly and complex process. It entails enormous challenge of finding adequate and appropriate sites for relocating vulnerable communities. The new site if unsuitable might lead to loss of livelihood, lost sense of community and social capital, cultural alienation and poverty. As a consequence, there are examples of relocation that have failed to sustainably reduce the vulnerability of population at risk. Relocated people abandoned the new sites and returned to their area of origin. Often it might be that people relocated to protect them from one risk may find themselves exposed to new ones. These challenges could be addressed through planned relocation consideration by incorporating it within DRR

strategies such that it would reduce hazard exposure and strengthen resilience of relocated people. The location of vulnerable communities are observed in ward 1 and 2 of Gokarneshwor Municipality, where there is a patch of settlements living amidst the forest area designated as Natural reserve. The people residing there are willing to be relocated to safer locations if government provides them with proper relocation options. KVDA and local government should prioritize the relocation of these settlements with proper relocation plan.

Implementation mechanism	Actors
▪ An appropriate legislative and planning framework needs to be in place to facilitate the process	▪ Ministry of Land Reform and Management, KVDA, DUDBC, Local Government, Communities
▪ Identification of relocation site not exposed to hazards	▪ Ministry of Land Reform and Management
▪ Developing a relocation plan which upholds the rights and enhances, or at least restores, the living standards of those who must be relocated because of the effects of disasters.	▪ DUDBC, Local Government, Communities
▪ Addressing land and tenure rights as well as shelter and livelihoods	▪ Ministry of Land Reform and Management

Relocating vulnerable population with risk management and land use planning approach in Nueva Esperanza, Columbia

The Nueva Esperanza in the southeast of Bogota, capital city of Columbia where 9,154 families were identified at high risk from landslide. Land use and geological studies determined that neighbourhood was invading a natural park and creeks' buffer, one of the Bogota's natural reserves and declared an environmentally fragile zone. The structural assessment of houses demanded 662 households for immediate evacuation. They were temporarily relocated to rental houses until more permanent solutions were sought. Support were provided to find a replacement housing option , Transfer the land rights of their original house to the city, and move to a new house. Based on the supply of house and population's expectation, four options were identified: i) Acquiring a new house on the real estate market ii) Acquiring a pre-existing house on the real estate market iii) Constructing houses iv) Moving to the household's place of origin. To help households chose replacement houses; housing fair was organized of both new and pre-existing homes.

Once the resettled families turned over their original properties and signed document, the existing houses were demolished (1,170 houses demolished) and the land was restored. Other activities carried out were fencing off the area, collecting debris (1,014 tons of solid waste were collected), preparing the soil for planting trees and shrubs, restoring the surface soil on slopes and recovering 5,583 meters of rain water and sewage.

Source: Gomez, Narzha Poveda, 2011, GFDRR

14.4. Building Code and Retrofitting

To reduce adverse impact of hazard, structures with highest exposure and largest risk of collapse should be targeted through retrofitting and building codes. Building codes help communities establish common standards for proper construction. They address appropriate construction method and type of materials to be used for building construction. Most of the earthquake related deaths are caused by collapsing building. Enforcement of building code can significantly reduce the number of deaths caused by earthquakes.

Similarly, retrofitting of existing construction enhances building resilience against seismic activity. Most often cost is perceived as obstacle to retrofitting and for developing countries retrofitting is not financially viable for individual households. Masonary buildings are both highly susceptible to risk and more expensive to retrofit than concrete (UNEP, 2014). Where all vulnerable buildings could not be retrofitted, target should be directed towards critical infrastructure that needs to be functional even after the disaster.

The earthquake risk of urban settlement was evident in earthquake of April 25, 2015. The huge loss of life and building damage due to recent earthquake of 7.9 magnitude may be the result of accumulated risk which people were neglecting. Analyzing the damages the quake made to the type of houses, it is apparent that masonry houses suffered at its worst due to their age. However, most of the RCC building survived, the only reason was that the intensity and duration of the earthquake was not as big as predicted. With a rapid rate of urbanization and a corresponding high demand for housing, the building industry and many valley citizens do not prioritize earthquake safety in housing.

The recent earthquake can be taken as an eye-opener how our urban environment is unsafe. To address this huge risk, intervention on safer construction is urgently required such as strict implementation of the building code. Also, retrofitting is one of the most effective ways to address the risk of existing construction. Build on NSDRM, Nepal Risk Reduction Consortium has identified five flagship areas for disaster risk reduction in which Flagship 1 acts for earthquake resiliency of school and hospital safety through retrofitting, training and awareness raising. Till date many public schools and hospitals are retrofitted and they have withstood recent earthquake without undergoing any damage. This can be taken as a commendable step towards reducing vulnerability that might arise due to the collapse of these structures.

Kathmandu already has a strict urban building code prepared in 1993. It has specific guidelines for the design, construction and mandatory rule of thumb (MRT) for buildings up to three floors, but the code has to be revised and enforced.

Implementation mechanism	Actors
▪ An appropriate legislative and planning framework needs to be in place to facilitate the process	▪ MoFALD, MoUD, KVDA, DUIDBC, MoPPW, Local Government, Municipalities
▪ Drafting of building code and retrofitting guidelines	▪ DUIDBC
▪ Capacity building of national and local government official and implementing bodies	▪ DUIDBC
▪ Inclusion of building code in building permit system	▪ Municipality
▪ Monitoring and evaluation of code implementation	▪ DUIDBC, Municipality

Retrofitting practices in Mexico City

The Mexican government used targeted approach to identify the most vulnerable 1%, 5% and 10% of buildings by potential death tolls. It was found that the worst 5% of building in the city could reduce deaths from severe earthquake by 50%. Similarly, a retrofit of worst 10% of buildings could reduce fatalities from severe earthquake by 80%. It is obvious that death would be very high if a strong earthquake

strikes without appropriate retrofitting. Nevertheless, the cost of retrofitting would be the same if a less severe earthquake strikes with fewer deaths. Therefore, the cost of retrofit correlates with the anticipated strength of earthquake. Retrofitting worst building was an applaudable effort by Mexican government to save lives as is evident by 2012 earthquake of 7.4 magnitude in which only three deaths were attributed to this event versus at least 10,000 deaths in 1985 earthquakes. Although various factors played a part in reducing death toll, targeted retrofitting and updated building codes were major contributors.

(Source: Cobum, Spence, 2006, Earthquake Protection: Second Edition)

14.5. Resilient Infrastructure Development

Urban populations heavily rely upon the proper functioning of infrastructure system. This reliance is normally invisible but is evident when the system fails in disaster event. Moreover, due to their network properties, service could be disrupted over an extensive geographic area even if there is infrastructure damage in one location. As a result, resilient infrastructure is prerequisite for an effective disaster response and fast reconstruction activities after an event and also for the fast recovery of the economy. The development of the whole country can be set back for years leading to further social and political problems. Disaster resilient infrastructure therefore is an important issue of the overall sustainable development process of a country.

Natural disasters will inevitably continue to occur, however by understanding the concept of resilience and the factors that lead to it, vulnerabilities could be minimized and resilience could be increased. Safe roads, schools and hospitals become critical infrastructure immediately aftermath of disasters. Accordingly critical facilities and infrastructure systems need to be operational and functional during and after the hazard event (McAllister, 2013). Investment in resilient infrastructure is a key to disaster preparedness. As such it is important to design, develop, operate and maintain in such a way that it can withstand at a time of a disaster and be able to protect the functioning of the city. It is important to reduce the risk by use of hazard resilient designs, specifications, construction methods, materials and technologies; and construction of protective infrastructure and also by protecting existing critical infrastructure (Haigh and Amaratunga, 2011).

Implementation mechanism	Actors
▪ An appropriate legislative and planning framework needs to be in place to facilitate the process	▪ MoFALD, MoPIT,, KVDA, DUDBC, Municipality
▪ Improving the resilience of civil infrastructure and life line system to all hazards.	▪ MoFALD, DUDBC, MoPIT
▪ Investment in resilient infrastructure	▪ MoFALD, DUDBC, Municipality and related line ministry
▪ Risk transfer mechanism such as insurance	▪ MoF, Insurance Company

Resilient Infrastructure Development in Sendai, Japan following 2011 earthquake

An earthquake of 9.0 magnitude struck northeastern Japan's Tohoko region on March 2011 causing a Tsunami killing 600 resident of Sendai, a major city close to earthquake's epicenter. Some 200 people were reported missing and nearly 7000 homes were completely destroyed. Though Japan has a reputation for attention to disaster preparedness; the economic losses amounted to the equivalent of 4% of GDP. Realizing the importance of resilient infrastructure, it invested in elevated roads and added special tsunami evacuation roadways and facilities. It also imposed on the location of housing and installed solar powered generators so that the citizens will have an emergency energy during a disaster. The old pipe carrying the natural gas was replaced with highly elastic ones such that they bend and stay intact without breaking when hit by an earthquake. In the past, focus was always directed towards roads, sewage, water and fuel that made the lifeline of the city but the serious problem faced by poor telecommunication in 2011 reflected the importance of communication without which disaster could not be responded.

Source: PWC, Rebuilding for resilience, 2013

14.6. Densification/De-densification

The density of city have significant effect cost of infrastructure. Studies have found that per capita spending on infrastructure tends to decline with increased density, due to economies of scale, especially for capital facilities and social services (Carruthers & Ulfarsson, 2003). However, very high density can also be difficult to manage resulting in more investment requirement (for example, traffic congestion and crime). Therefore, the manageable density should be maintained for economic investment in infrastructure. In addition, to sustain commercial activities too, the city should be of desirable density.

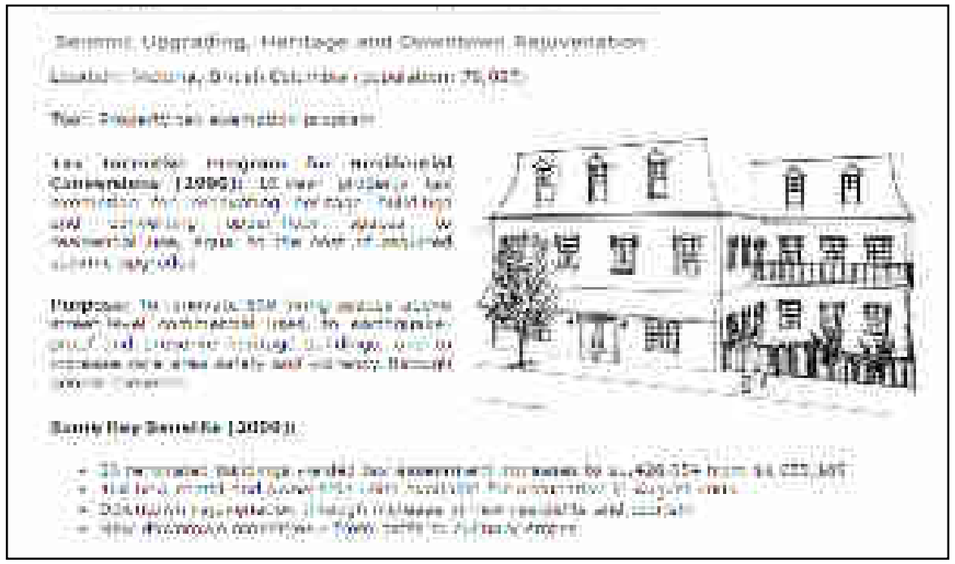
The emerging market centers of the municipalities will be promoted for high density mix use development facilitated with proper transit system to reduce sprawl development in urban fringes.

The areas with high density in the hazard prone areas will be relocated to safer places with similar opportunities as far as possible.

Implementation Mechanism	Actors
▪ An appropriate legislative and planning framework needs to be in place to facilitate the process	▪ Government: MoUD, KVDA, MoLRM, municipality
▪ Clear land sub division rules necessary for densification of existing urban areas.	▪ MoLRM, KVDA
▪ Participatory planning with local stakeholders for proper implementation regarding the selection of place to move the excess population	▪ Municipality, local community
▪ There should be clear regulation on financial incentives ▪ Coordinate with departments like finance, land reforms etc	▪ Municipality and MoLRM
▪ Proper identification of areas for densifying or de-densifying based on specific criteria and scientific analysis	▪ KVDA and Municipality

14.7. Urban Upgrading, Urban Renewal

Urban redevelopment is an important process for improving living environment in changing land use of old cities. Urban redevelopment refers to physical redevelopment in a confined areas. The priority is often given to physical and aesthetic improvement. Urban restructuring refers to a deliberate effort to change the urban environment through planned, large-scale adjustment of existing city areas to present and future requirements for urban living and working. Urban rehabilitation/conservation is even more confined to specific sites which are to be preserved because of their historical, cultural and archaeological significance. Urban regeneration aims at rejuvenating the core historic city through the preservation of the social assets. Urban upgrading refers to the process of upgrading social, economic and physical aspects through an outcome of economic and social forces upon an area.



Source: www.mha.gov.on.ca

Since Kathmandu Valley consists of lots of traditional settlements with more than century old buildings, the city redevelopment should be done to conserve those cities' identity as well as to make the older buildings and infrastructure resilient to natural disaster like earthquake. Cities are not only the physical construct, but also social and cultural construct. Therefore, urban redevelopment is incomplete without preserving intangible heritage related to it. While redeveloping all these aspects should be taken care.

Urban regeneration or renewal tool can be used with other financial tool like tax incentive tool for better implementation.

Implementation Mechanism	Actors
▪ An appropriate legislative and planning framework needs to be in place to facilitate the process.	▪ Government: MoUD, KVDA, Department of Archaeology and Municipality
▪ There should be clear regulation on financial incentives in conjunction with other planning regulation	▪ MoLRM, Ministry of Culture, tourism and civil aviation and Municipality
▪ Clear mechanism for involving local community in planning for urban renewal	▪ Local Community, Municipality
▪ Resettlement policies, Regulations for Transfer of development rights should be clear	▪ KVDA, DUDBC, DoA and Municipality

14.8. Land Consolidation Processes

14.8.1. Land Consolidation

Land consolidation is the method for reversing the action of fragmentation of land. It is considered as a way of distributing the land more equitably and to increase the economic returns per unit of land (Bullard, 2007). Land consolidation has successfully done in lots of countries like France, Italy, Netherlands, Spain, Cyprus, Turkey, India, Zimbabwe etc.

A well-planned and well-implemented consolidation scheme can greatly improve the yields and economics of agriculture in an area, in addition to providing the major new structure. Intensive cooperation and consensus building is needed between political, administrative, technical institution and land owners/farmers. To save remaining and fragmented agricultural land in Kathmandu, land consolidation can be applied, which will also create economic benefit to those working in agriculture.

14.8.2. Land pooling

Land pooling is consolidation of land for urban development. It consists of 3 steps: land consolidation, development and redistribution. The irregular plots will be made regular and is plot is made accessible by road construction and open space are provided with contribution of land from all land owners. Other infrastructure includes drainage, water supply, electricity and communication. Land-pooling scheme is most widely used land readjustment technique for planned provision of urban infrastructures and supply of urban land without external investment.

The study has shown that the land pooled areas have domination of residential use, with few supporting functions and poor socio-cultural amenities which has made planned neighbourhoods monotonous, sterile and without community life (Shrestha, 2010). Therefore, new land pooling areas will be planned as mixed land use zones for creating vibrant urban spaces. Open spaces will be created as community spaces which can also be used for rehabilitation in disaster.

Implementation Mechanism	Actors
▪ An appropriate legislative and planning framework needs to be in place to facilitate the process.	▪ Government: MoUD, KVDA, MoLRM, and Municipality
▪ Provision for transparency and accountability in the process	▪ MoLRM, KVDA and Municipality
▪ Cooperation and consensus between political, administrative, technical institution and land owners/farmers	▪ Land owner, farmers, local leaders, KVDA, MoLRM and Municipality
▪ Clear mechanism for involving local community in planning for land consolidation and land pooling	▪ Local Community, Municipality
▪ Standards and regulations for minimum and maximum plot size, road width, contribution of land etc.	▪ DUDBC, MoLRM and KVDA

15. INCENTIVISING RSLUP

15.1. Incentive Mechanism for Implementing RSLUP

Incentive is one of the tools used for land use planning and DRM. Incentives are most effective when used in conjunction with other types of regulatory instruments. In developing countries, where regulations are difficult to implement, incentives can be used for behavioural change through rewards and penalties. However, the fact is "establishment or strengthening of DRM is not a narrowly 'technical' task that can be left to scientists and emergency managers. Instead it requires the creation of political interest and the design of incentives for multiple stakeholders to engage". (UNDP & BCPR, 2007)

Nowadays this tool is most widely used for disaster risk management. "An Incentive in Disaster Risk Management can be defined as any policy mechanism that induces individuals, businesses or governments to conform to a desired action to reduce disaster risks" (AECOM, 2014). Local governments in developing countries like Nepal have limited experience with incentives for disaster risk management. They should provide right policy mix and balance between incentives targeted at individual and businesses for better achieving disaster risk management goals along with sustainable development of a city.

15.2. Types of Incentives

There are different types of incentives provided for risk sensitive land use planning aimed at reducing the risk by proper land use planning tool for disaster risk management. These incentives can be broadly categorized in three types: (i) Financial and Insurance, (ii) Incentives associated with urban planning and (iii) Incentives associated with training, awareness and public participation. Table 12, Disclosure Laws

The suitability of development of land exposed to natural hazards should be disclosed so that the limitations are understood by property owners and investors. This will ensure that the investors are aware of the risks and ultimately the development will be less in vulnerable locations (AECOM, 2014). To implement this, awareness raising activities need to be put in place. At the same time, there should be another option for land owners of such vulnerable lands for its productive use. For example, providing them incentive in form of tax rebate for keeping it as agricultural land rather than for other development.

Urban Upgrading

The traditional towns or the old market centers are in dilapidated condition which are more vulnerable to disaster. Some of these traditional areas are covered by migrants and urban poor whereas in some cities still indigenous people are staying. In this condition, the investment in urban upgrading or renewal for making these cities resilient to disaster and at the same time conserve it for the future generation would be the best incentive.

Transfer of Development Right

Transfer of development rights or TDRs can be used to protect certain lands from development, direct development in specific zones while preserving agricultural areas, forested area, heritage areas and hazard prone areas etc. by allowing its owner to give up their rights to develop these lands. Consequently, hazardous and environmentally sensitive areas are protected, and development occurs in suitable areas.

and Table 14 below shows incentives under these types with target group and Limitations of each incentive prepared by AECOM, 2014.

15.2.1. Financial and Insurance Incentives

Financial Incentive can be given as tax rebates, grants to individual and businesses, concessional loans, conditional cash transfer etc. The municipality may structure incentives granted to eligible individuals or projects in two ways, as upfront loans or grants or as grants paid after certain conditions are met. The later one is more preferred and easier to structure since compliance with the defined performance standards is verified before payment. Some of the financial and insurance incentives are described below:

Tax Rebate

Low tax rates can be assigned for designated land use to promote proper land use according to zoning. For example, to preserve construction on flood prone areas, these areas can be designated as agricultural zone and low tax should be applied for agricultural land use to motivate land owners or farmers to continue agricultural works.

Idle Land Taxes

Idle land taxes are charged if the land is kept idle for more than a given period of time after purchase. This helps to productive use of land thus prevent speculation.

Insurance

The use of risk transfer mechanisms such as insurance is still very limited in developing countries like Nepal and history too is not so long (First insurance company established only in 2004 B.S.). However, the trend for both life insurance and non-life insurance including insurance against fire and natural hazards are increasing. For promoting constructions only on safe zones, providing discounts on premiums for insurance of the structures in disaster resistant locations can be given as incentive. At the same time not offering property insurance in the hazard prone areas can be used as disincentive to reduce harm due to construction in hazard prone area.

Conditional Cash Transfer

Conditional cash transfer is mostly used with the goal of improving the condition of poor family especially on nutrition, health and educational status. There are evidence of efficiency and effectiveness of these programs in Brazil, Mexico and Nicaragua for promoting human capital accumulation among poor households (Rawlings & Rubio, 2005). This incentive can also be used for disaster risk reduction of vulnerable groups in developing countries like Nepal.

Table 12. Incentives associated with fiscal and insurance

Incentives	Provider	Target group	Preconditions	Limitations
Personal fiscal incentives, tax rebates, grants	Sub-national and local governments	Homeowners	Verification tax base	Verification, tax base

Insurance discounts for disaster resistant locations	Insurance companies	Homeowners, business, public sector	Risk maps, properly insurance markets	Competitive pressures, reinsurance, political pressures
Bonds/ sureties	Private sector finance	Developers, properly buyers	Sophisticated financial sector	Circulation and assumption of risk, reliability of underwriters
Intergovernmental fiscal transfers	National governments	Local governments	Fiscal accountability	Local government action only
Conditional cash transfer		Low income households	Large funding, eligibility criteria	verification

Source: AECOM, 2014

15.2.2. Urban and Land Use Planning

Urban and land use planning incentives intends to invest in DRM through innovative land use planning tools. This includes transfer of development rights, density bonuses, conservation easements resettlement, urban upgrading, disclosure laws etc.

Incentive zoning

Incentive zoning allows developers more density or building height in exchange for amenities for communities such as increased open space, pedestrian paths, affordable housing etc. This helps in cluster development with sustainable population which in turn helps in protecting environmentally sensitive areas as well as hazard prone areas.

Locational incentives

To encourage specific land uses in the designated areas given in form of lower taxes, land costs, import duties or combined incentives. More often it is used for specific land uses like industries, to promote the land use in specific zoning areas only.

Disclosure Laws

The suitability of development of land exposed to natural hazards should be disclosed so that the limitations are understood by property owners and investors. This will ensure that the investors are aware of the risks and ultimately the development will be less in vulnerable locations (AECOM, 2014). To implement this, awareness raising activities need to be put in place. At the same time, there should be another option for land owners of such vulnerable lands for its productive use. For example, providing them incentive in form of tax rebate for keeping it as agricultural land rather than for other development.

Urban Upgrading

The traditional towns or the old market centers are in dilapidated condition which are more vulnerable to disaster. Some of these traditional areas are covered by migrants and urban poor whereas in some cities still indigenous people are staying. In this condition, the investment in urban upgrading or renewal for making these cities resilient to disaster and at the same time conserve it for the future generation would be the best incentive.

Transfer of Development Right

Transfer of development rights or TDRs can be used to protect certain lands from development, direct development in specific zones while preserving agricultural areas, forested area, heritage areas and hazard prone areas etc. by allowing its owner to give up their rights to develop these lands. Consequently, hazardous and environmentally sensitive areas are protected, and development occurs in suitable areas.

Table 13 Incentives associated with urban planning

Incentives	Provider	Target group	Preconditions	Limitations
Urban upgrading/ utility provision	National, sub-national and local governments	Low income communities	Community participation, land tenure	
Resettlement	Local governments	Low income communities	Community participation	Community resistance
Incentives zoning	Local areas, government planning agencies	developers	Planning capacity, judgement calls, land use codes	Planning capacity, judgement calls, land use codes
Transfer of development rights	Developers, local government, planning agencies	Land owners, developers	Planning capacity, land use codes	Planning capacity, land use codes, litigation, political
Conservation easements	Local government, conservation, environmental, NGOs	Land owners	Conservation NGO/ Environmental NGO, legal framework	Negotiations, costs and reliance on NGOs funding
Disclosure laws	National and subnational governments	Land and property owners	Legal framework, former sector and market	Legal uncertainty, risk map, formal sector, buyers, purchase anyway

Source: AECOM, 2014

15.2.3. Public Participation, Awareness and Trainings

Public participation and awareness raising is considered as valuable incentive along with other incentives. When people are aware about the disaster risks, they are more likely to invest in disaster risk management (Sudmeier-Rieux et al., 2013). Awareness raising through campaign, education both formal and non-formal can significantly change landuse outcomes and behaviors prone to unsafe construction.

Participation can be considered as non-monetary type of incentive perhaps powerful as regulatory or financial incentives (Burby, 2003). Public participation in land use planning has been applied in many countries for the successful implementation of the project. By gaining access to information about future development and risk reduction plans, public can participate in decision making, demand greater public accountability and offer local knowledge can be very empowering and provide strong incentives to gain ownership over planning and risk reduction (Burby, 2003).

Construction or low cost materials provision: Technical advises and construction services for those who build their own houses, and supplying low cost materials can be incentive for making the buildings resilient to natural hazards.

Training and knowledge Transfer Incentives: Training for enhancing constructions skills of individual construction worker can be one of the best investment for achieving resilient building structures where the buildings are built by local manpower and local material and technologies. For example, UNDP/CDRMP has been conducting training to masons about earthquake resistant construction in different municipalities.

In Kathmandu Valley, National Society for Earthquake Technology (NSET) raised seismic risk awareness by focusing upon critical and visible community structures i.e. schools and hospitals. Vulnerability assessments and reinforcement of these structures were followed up by emergency planning in schools, regular "duck and cover" drills and the integration of earthquake risk reduction into school curricula. In addition simple, illustrated publications have been disseminated (UNDP/BCPR 2007) which helped in increasing awareness.

Table 14 Incentives associated with training and materials

Incentives	Provider	Target group	Preconditions	Limitations
Low cost construction materials	National/local government, research institute, NGOs	Households, especially low income households	Research, production facilities, marketing	Household, acceptance, affordability
Construction skills development	National & local governments, vocational institutes, donors, NGOs	Construction workers, architects, engineers	Training institutes, community engagement	Home builder affordability, awareness

Source: AECOM, 2014

15.3. Incentive practice in Nepal related to Disaster Risk Management and Land Use Planning

There are few incentive practices in Nepal directly related to Disaster Risk Management and Land Use Planning. Some organizations and local government are providing incentives of different types which have possibility to contribute in DRR with some necessary alterations or provisions. Few examples are given below:

15.3.1. Prime Ministers Disaster Relief Fund

The Prime Minister's Disaster Relief Fund set up by the Government of Nepal is a relief fund used for rescue, treatment, relief, rehabilitation of victims and restoration of physical infrastructure damaged by natural disaster and calamities. According to Prime Minister's Disaster Relief Fund Website, money received from the Government of Nepal or from any other national and international sources for the purpose of relief is deposited into this fund. The committee chaired by Vice president of National Planning Commission and secretaries from different ministries as members and the secretary of Prime Minister's Office as executive member.

Out of the money collected from various sources, some percentage shall be directed for Disaster Risk Reduction that includes pre-disaster preparation activities which ultimately reduces the expenditure on relief and rescue operation.

15.3.2. Minimum conditions and Performance measures (MCPM)

Performance based grants system (PBGS) is the incentives to the local government for high performance and promote their accountability. This is measured through a tool called Minimum Conditions Performance Measure (MCPM). It is a system of measuring the performance of local bodies on the basis of certain set standards and tie up the block grants and revenue sharing with their performance result. Government of Nepal started the system since 2004/05 for District Development Committees and from 2007/08 for the municipalities and VDCs in order to make local bodies more transparent, accountable and effective in providing public goods and services at the local level. This on one hand encourages the local bodies to improve their performance by recognizing their good undertakings and on the other helps to tie up grants with their capacity that will enable capable local bodies to acquire additional grants.

For DRM and Land use planning too, if similar kind of grant is provided to local bodies for applying risk sensitive land use planning preparedness and mitigation of disasters, the local bodies will be encouraged for DRR by themselves.

15.3.3. Incentive in registration of land for right of women in land

Government of Nepal legislated for the implementation of joint land ownership certificates in 2010, incentivized by discounts in the registration of land granted to village women living in remote areas. Similar kind of discounts can be applied for land taxes for designated land use in designated zone for some specific years.

15.3.4. Insurance

For approving the loan with house as collateral, the home should be insured for fire and earthquake disaster. People are compelled to do insurance which can be taken as good form of transferring risk. In addition, if buildings constructed in hazard prone areas are not insured, people are encouraged to construct only on safe land and ultimately helps in DRR.

15.3.5. Incentives by municipalities

Incentives are provided by municipality on complying with the rules and regulations. For example, Bhaktapur municipality is providing technical and financial support for renovation and reconstruction of architecturally important buildings in monument zone and sub-monument zone and traditional settlement zone. This is to conserve traditional setting in Bhaktapur. In the other hand, most municipalities are providing discount upon timely payment of property tax.

Such types of incentives can also be provided for DRR to the households for constructing earthquake resisting houses, conserving urbanscapes etc.

15.4. Incentives/Disincentives applicable for Kathmandu Valley

I Financial Incentive
▪ Tax rebate at agricultural zone, disaster prone area to keep the land as agricultural land use ▪ Higher taxes for land use conversion ▪ No insurance of buildings constructed at hazard prone areas ▪ Low premiums for insuring buildings constructed following building code ▪ Tax rebate in traditional core area for building in historic way to conserve the identity of the place
II Land use planning, Building codes and By laws
▪ Completion certificate of the house is compulsory if one wants to rent it to government office. This can be taken as ▪ No service provision by government beyond growth boundary area to avoid leapfrogging ▪ Locational incentives in form of Low tax for certain years for commercial, industrial development in the designated places ▪ Material and technical support by local government for rebuilding or restoration of historic buildings ▪ Without completion certificate no one can sell or rent their properties to promote construct according to building code and by laws ▪ In commercial zone, density bonus can be given for providing open space for community
III Training and Public Awareness as Incentive
▪ Trainings of local masons on safer building construction ▪ Including disaster risk reduction knowledge in the coursework from school level ▪ Participation of public in planning process and disaster risk management

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SECTION 4 INTERNALIZING, INSTITUTIONALIZING AND IMPLEMENTING RSLUP

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16. STRATEGIES FOR INTERNALIZING, INSTITUTIONALIZING AND IMPLEMENTING RSLUP

16.1. Identification of Gaps in Policy and Implementation Guidelines

Although there are several legal and institutional arrangements (as elaborated earlier in this report) related with the policy and implementation guidelines, the findings based on the analysis of the damage due to recent earthquakes revealed the gaps and shortcomings in the overall process of implementation and development. The major gap should be seen as the absence of any clear direction on how the municipalities should have been issuing building permits. This is found to be inadequate since the conditions for issuing building permit are not well defined. Interpretation of the overall planning framework is too complex a process for municipalities to take right decisions. At the end of the day, important risk-related planning prerequisites are left out while devoting more time and money on less important easy-to-implement planning aspects and tools. It must be recognized that municipalities just beginning to implement land use planning will face problems and difficulties in implementing RSLUP. With the need for implementing additional bye-laws in terms of RSLU, it will be more difficult to exercise land use controls and there is need for better understanding of the overall planning framework and its implementation. It may be inferred that RSLUP aspects have not been systematically integrated with the land use requirements and this should be recognized as the major gap that is being addressed through this work.

16.2. Review of Policy Gaps

Land use planning is not adequately linked with risk reduction. Despite the need for avoiding disaster-prone areas for intensive development, there is no explicit and effective policy to restrict development in such areas. As a result most of the floodplains and fragile sloped areas of the Valley had been used for housing. Areas susceptible to earthquake hazards due to possible liquefaction were found to have been used for intensive development. How to make the existing policy-related documents effective in addressing RSLUP issues adequately is the main policy gap. There are either conflicting policy statements or too many of them that confuse municipalities for making concrete decisions on the development that is taking place. As a result, the ongoing development pattern can hardly be said to be risk sensitive. Undesirable developments are thus found to have been allowed under political pressure or market forces.

There is policy gap also on the systematic application of related IEC materials. Implementers willing to comply with the risk sensitive provisions are found to be unclear in ascertaining conditions on which any developments will be risk sensitive. Duplication and confusing extent of overlaps of different guidelines issued by different government bodies have made the policy gap more pronounced. The prevailing conflicts among such bodies have also worsened the situation.

Except where the provisions are crystal clear, permits are issued under pressure. After the recent earthquakes, where the guidelines are clear-cut, cases of deviations from the requirements have not been reported. This trend should be continued to develop the culture of compliance. In fact this is a good opportunity to carry on with the demonstrated after-earthquake priority on risk related aspects.

16.3. Policy Reform and Implementation Guidelines

The inadequate response during the recent earthquakes clearly showed that the policies in place are not effectively implemented. Policy reform is required for the optimum use of the open space within the Valley. Policy needs to be clear enough without any ambiguity for municipalities to act on whether to issue a building permit for a proposed development or not. Policy reforms are thus necessary to make municipalities clear on the actions they should take up in granting building permits. Policy should also be directed towards sustainable financing for risk management and risk reduction. Although compliance with RSLUP may mean more cost in the short run, it will lead to more savings on the whole as has been evident from the lessons learnt from the recent earthquakes.

There is a need for developing IEC materials through their use and application with feedback on their effectiveness as well as the impact on the built environment. Training and orientation programs should be run on a regular basis in order to link them with implementation. These should produce municipal staff dedicated to the implementation of RSLUP. Only through this approach, a culture of compliance vital for reducing the policy gap can be developed at the action level. Policy should be construed to provide incentives for complying with the provisions of RSLUP, which will develop the culture of compliance. It should make all the implementing agencies responsible for risk sensitive land use planning. Land use is viewed as a critical element in making the Valley safer. Culture of compliance should start with the government agencies first. Policy reform is necessary for creating an environment where all can work together in an integrated manner with concerted efforts.

In order to ensure that implementers cooperate fully in the application of RSLUP principles, implementation guidelines should be prepared and executed with a view to directing and channelling different implementers towards risk sensitive sustainable development. Due to lack of institutional arrangements and cohesiveness, these need to be prepared holistically as well as by each and every implementer/sector.

Since KVDA is the focal agency, "Implementation Guidelines" embodied in this report is deemed to be comprehensive and holistic; and for its execution KVDA will be designated as the responsible agency. The institutional implication of this arrangement is that higher authorities including Rebuilding Authority/National Planning Commission, MoFALD and MoUD should recognize this role of KVDA and help strengthening it. Similarly KVDA in agreement with MoFALD and MoUD are jointly required to help and facilitate municipalities in the preparation of municipal level guidelines. With the transformation to a federal government system, KVDA needs to be recognized as a federal/ regional agency in charge of the entire province. This is necessary as the sustainable development of the Valley already categorized as fully municipal area will depend on the surrounding rural areas as well. Kathmandu Valley no more has VDCs. The Valley is surrounded by the following districts: Dhading, Makwanpur, Sindhuli, Kabhre and Chitwan. The other districts in the Province are Dolkha, Rasuwa, Ramechap, Chitwan, and Sindhupalchowk. Policy on the limit to growth is required. This aspect will have to be looked with respect to the economy of the rest of the Province. Policy reform is necessary for developing an urban system within the province. KVDA needs to be concerned with the surrounding areas as well, since its ecological footprints due to rapid urbanization will sharply increase over time affecting the development of the entire province.

KVDA will support each and every municipality in the Valley to prepare their individual implementation guidelines. These for the municipalities should be comprehensive enough to help municipalities in taking a decision on cases that building permit must be granted and cases where such permits must not be granted.

For the remaining cases, it should have the procedure to analyse case- by- case whether to grant the permit or not.

Development ministries should be provided with RSLU policy for them to promote their own sectors while complying with the guidelines. The outputs and the production of their development projects will be affected only slightly as they make the implementation more risk sensitive without additional cost.

16.4. Review of Existing Policy and Implementation Guidelines Governing the Building Bye-Laws

After the Earthquake, different ministries have issued conflicting guidelines. There is no policy on the procedure for issuing guidelines to local bodies, which has made the latter weak in implementation. Jurisdiction of different ministries is not clear. Specific to the projects of development ministries, consensus decision on the type of guidelines for the municipalities decided jointly by MoUD, MoFALD and the related Ministry and in big Projects environment, or even forest needs to be involved in issuing guidelines. Although KVDA is entrusted to prepare guidelines for its constituent municipalities on different types of development, municipalities are governed by MoFALD. Confusions and duplications make municipalities unable to implement bye-laws in a proper systematic manner. In a similar way, sectorial ministries have limited awareness and technical competence to ensure compliance with the building bye-laws and give priority to their sectorial achievements ignoring these.

16.5. Tax Reform policy

Before advocating tax reform, the mechanism to invest the revenue back for sustainable development becomes a matter of utmost importance. Taxes related with risk sensitiveness will be used for instituting RSLUP that means safety and security, people may pay more if they become safer and the risk due to unsafe practices will be minimized. Implementation of green taxes in the context of enforcing climate change related environmental laws. Tax incentives, and reduced building permit fee for risk sensitive development need to be encouraged. A detailed study on how to encourage risk sensitive designs through fiscal and banking policies need to be carried out and the policy impact needs to be monitored.

The guiding principle will be to relate additional tax revenue with the production of risk mitigation services as well as adaptation capacity of the urban community. The production will mainly take place at the municipal level and the municipality will generate additional tax revenue from this service. People will be made more willing to appreciate such services and would pay for better security due to RSLUP. RSLUP will be the main tool/ strategy for generating such services. These will be available as economic commodities. It is becoming less and less cost effective for the national government to implement local projects. This sort of need in the context of RSLUP is relatively new and less tangible and not easily understood for the central government to cascade down to the local level. Given the complex situations and many national priorities, it may not be desirable to overload the central government with more technicalities. All that can be done is to integrate the concept within the Minimum Condition Performance Monitoring System based on info from the divisional offices of DUDBC. The link to the municipal level will be through KVDA. KVDA will implement it and monitor it, which will be taken up by MoFALD.

It is necessary to strengthen municipal revenue base for implementing RSLUP. Most resources collected at the municipal level should be invested locally. Gradually the central grant to municipal level should be reduced, since centralized revenue administration has proved to be more costly. Locally it needs to be managed and implemented. The immediate product will be the risk sensitive services which need to be paid by the beneficiaries and it includes awareness as well as implementation; and most importantly; culture of compliance needs to be instituted.

16.6. Implication of Climate Change impact in the Policy reform requirements

Awareness on the threats of climate change is growing at a rapid pace. However, this is a relatively new area for Nepal and policy adjustments are required for addressing CC impact. Cities are the centers of high consumption and the primary source of GHG emission. It has become necessary to find land use strategies that will allow our cities develop with potential for mitigation while reducing the cost of adaptation in the future. The terms “adaptation” and “mitigation” are the key to policy reforms in responding to climate change issues. They should be made to complement each other in an overall strategy to reduce GHG emissions. Mitigation measures ought to be taken to minimize climate change and hence its effects. The goal of adaptation is to enhance the ability of the city to face the threats of climate change. It should adjust to climate change including variability and extremes to curb potential damage; to take advantage of opportunities; or to cope with the consequences. While mitigation deals with the causes of climate change, adaptation is concerned with its effects. The adaptive capacity of a city increases as it builds resilience to deal with the negative impact and use benefits that may occur from CC. It means adjusting the ways of living to the consequences of climate change. This requires the organization and sustainable utilization of the urban space through RSLUP.

If cities are not well managed, there will be congestion and overcrowding that affect human health as well as economy. The consumption of energy can be very high due to traffic congestion; and cities will be less sustainable. Understanding of cities’ impacts on climate change will make land use responsive to CC related risks and make cities able to reduce anthropogenic CC. In a similar way understanding of the implications of climate change on cities will make cities able to adapt to CC related disasters and consequences. Cities themselves do not cause climate change but they provide sites for human settlements and for locating economic activities that influence CC. People and their activities in a city are responsible for CC. Municipalities will be able to regulate these only with the help of a collectively owned RSLUP since they do not have the sole authority to control. Failure to adapt to and cope with climate change disasters lead to environmental deterioration in cities. CC affects the poor more. It will lead to social disruption with relocation of affected people. Infrastructure will be increasingly deficient and costly. Increasing urbanization places greater demand on ecosystem services. The poorest and most vulnerable people are most directly reliant on these services in order to meet their basic needs. They lose the most from the damage of ecosystem goods and services in the context of climate change conditions. Urban form and density are associated with a range of social and environmental consequences. High densities of informal settlements and slums result in increased health risks, and high levels of vulnerability to climate change and extreme events. Urban form and the urban economy are key factors influencing emissions at the city level.

Climate change disasters are increasing. Low-income settlements are located in disaster-prone areas. Since non-climate stresses such as poverty and incidence of diseases can increase their vulnerability to CC by reducing resilience and hence their adaptive capacity, it is necessary to avoid the formation of any type of human settlements in flood and disaster-prone areas.

Environmental degradation in some areas of the valley may force some people to migrate to other parts. Kathmandu Valley as a whole has shown the potential to absorb migrants affected by CC in the outlying areas; but failure in managing the growing population through land use planning has deteriorated its

environment in general. Through planning and community building, resilience of cities should be enhanced to make them able to deal with CC issues. The Consultant strongly suggests for carrying out an in-depth study for a comprehensive policy adjustment particularly addressing the following:

- How to provide housing, infrastructure and services to the growing population while reducing per capita GHG emissions?
- How to address CC imperatives while coping with growing economic activities?
- How to carry out land use planning and building designs in new development areas of the valley to reduce environmental load and energy use?
- How to intensify development in old settlements of the Valley to encourage densification and mixed-use development to reduce energy use in the city?
- Renewal of existing housing stock and urban layout and design at a neighbourhood scale to reduce energy use in the city.
- Improved quality of local governance with strong institutional networks to provide assistance to residents in order to enable cities to prepare and respond to CC.
- Improved resilience to climate change impacts through targeted financing of adaptation, broad institutional strengthening and minimizing the drivers of vulnerability.
- Engagement of civil societies for reducing vulnerability by helping populations copes with and adapts to CC.

16.7. Proposal for Policy Reform and Implementation Guidelines

Policy reforms are required for integrated action on development by the stakeholders. Policy should be directed to enabling municipalities to take decisions on conditions case by case for rejecting or approving for issuing development/ building permit. Due to the time constraint and other limitations of this study, it is not possible to arrive at conclusive intervention for policy reform. Whatever is proposed here needs to be tested through actual implementation by KVDA. We propose that KVDA be engaged in furthering interactive programs with stakeholder agencies with a view to mobilizing them for an integrated and concerted effort on RSLUP. Despite many hurdles such as the impact of earthquakes, disturbances in the transport and supply conditions of essential goods and services with very difficult mobility situation, and constraints in interactions, we have developed an action plan for KVDA to pursue further. Our conclusion is that KVDA should work forward as a pioneer agency of Nepal to implement RSLUP and achieve more concrete results. Changes in the overall policy framework need to be advocated ony when stakeholders commit to cooperate in the implementation process. The problems and concerns of the stakeholders need to be addressed locally and by sector/project recognizing the conflict and trade-offs between short term production and sustainability. KVDA through the proposed experimental project should be enabled and strengthened to develop and carry out consultative processes and training programs. The selected trainers should be deployed for continuing the interactive processes. KVDA on an experimental basis should start facilitating the stakeholder implementers to consider risk sensitive aspects for making their business sustainable. The finding of the experimental project should be disseminated to the key players of the government including the Rebuilding Authority and National Planning Commission and urge all to consider these. The ability to address issues in a situation specific way, project wise or space wise needs to be enhanced. Training should be directed towards building capacity in the trainees to scan THE OVERALL POLICY CONTEXT AND MAKING IMPROVEMENTS.

16.8. Prepare Approach for Reform of Policy and Implementation Guidelines

As of today, most municipalities do not have adequate competence in the preparation and implementation of land use plans and related bye- laws. It may be too ambitious in this context, to expect them to implement RSLUP as a separate scheme, something different and distinct from the usual land use plan. Hence the right approach will be to institute land use planning first and then gradually integrate risk sensitive aspects into it according to the situation-specific needs of the municipalities and their vulnerabilities to risks. Instead of treating these as separate tasks to be accomplished, it is better to extend the scope of land use planning with adequate care for and attention to risk sensitivity. So the approach that will be followed is seriousness in land use plan implementation addressing risk sensitive aspects comprehensively. Implementation guidelines should be prepared and implemented with support and commitment of stakeholder agencies. KVDA needs to be designated as focal point for risk sensitive land use and DRR. An experimental project is proposed to be launched for initiating a learning- by- doing process. This is the only available option for the time being since there are many issues unresolved for the purpose of implementing guidelines. One year period of this study is too short for making adequate and radical institutional changes warranted by such a complex issue. Nevertheless it has paved the way forward for KVDA to initiate the necessary changes.

16.9. Institutional Set up

According to the Work Division Regulation of the Government of Nepal 2069, MoFALD is responsible for local governance and hence for strengthening municipalities and VDCs. All the local bodies are directly controlled by the ministry. It is responsible for policy, plan and program formulation, as well as implementation, monitoring, regulation and evaluation related to urban development and urban infrastructure. It does the monitoring and evaluation of the performance of the local bodies.. MoUD, on the other hand, has the mandate to develop sustainable and planned urban centres and cities through provision of infrastructures, services and safe housing. KVDA, an apex planning, developing, monitoring and regulating agency for urban development in the Kathmandu Valley is under the MoUD, and is mandated to assume the authority of MoUD for sustainable and planned development of KV including all the municipalities in the valley. As such, there are certain overlapping in the influences of these two ministries as well as the MoPIT and line agencies/authorities under these three ministries in the planning and development of KV. Other central agencies such as MoLRM has mandate over land administration, transactions and management; and has mandate over regularization of land use polices. Utility providers Nepal Telecom, Nepal Electricity Authority, Kathmandu Upatyaka Khanepani Limited and others exercise their respective mandates, which in one way or the other influences land use and development in the KV. Conflicting mandates, conflict in implementing overlapping programs, lack of coordination and conflict of interests have largely attributed to the current state of haphazard development activities in the KV.

It is necessary to clarify the role of MoFALD vis-a-vis MoUD and other line ministries and agencies to avoid confusions and conflicts. Whatever option the government chooses, greater coherence between the two ministries MoFALD and MoUD and coordination with other line ministries MoLRM, MoPIT and their agencies is a prerequisite for effective implementation of RSLUP guidelines.

KVDA will formulate RSLU Policy for new development areas and develop RSLUP strategies for urban upgrading and house pooling projects through the improvement of existing street network, road junctions. It will undertake Human Resources and Capacity Enhancement Planning and conduct training in RSLUP for the municipalities and line agencies. It will help sectoral ministries to incorporate RSLUP aspects into

their projects and mandates. This is necessary to enable the concerned ministries to direct their respective agencies at the local level for integrated response on risk mitigation at the municipal level through implementing RSLUP programs and guidelines. In order to make the risk mitigation services effective, to carry out or to get it carried out studies and consultations of other ministries. It needs to be gradually upgraded to the Provincial/Federal Level agency. KVDA should assume a much bigger role for integrated response to risk reduction through planning because of the following reasons:

- For urbanized municipalities entirely surrounded by municipal areas, it will be necessary to form some sort of partnership arrangement among the associated municipalities to respond to risks by jointly providing risk mitigation measures. KVDA needs to undertake this task through the Valley wide RSLUP and also responding to the fulfilment of the needs of individual municipalities to the extent that their actions have externalities on the adjoining municipalities and that such actions also depend on the cooperation of other municipalities. KVDA thus needs to implement its valley wide RSLUP, but not in isolation. It has to mobilize and support the constituent municipalities to prepare and implement individual RSLUPs based on synergy and concerted effort and ensure that there will be minimum conflict of interests among the constituent municipalities.
- Since KVDA is under MoUD and municipalities are under MoFALD, KVDA should not control municipalities but work together for solving the common problem of risk mitigation. As an alternative, it may be given the power to control municipalities. But this is not sufficient as the development ministries are also independent and they may exert more pressure on municipalities by by-passing KVDA. In such cases it will be extremely difficult for KVDA to exercise such power. However, KVDA, as an apex planning, developing, monitoring and regulating agency for urban development in the Kathmandu Valley; can take an advisory and technical assistance roles to the municipalities in the valley to implement the RSLUP. Further KVDA in coordination with DUDBC can enhance the capacities of the municipalities in implementing the RSLUP and building-bye laws. MoFALD can play significant role in policy guidance and formulation, coordination with other line ministries (MoLRM, MoPIT etc.) to facilitate and support the municipalities to implement the RSLUP and the building bye-laws.
- Since the RLSLUP implementation at the ground level requires zonation of individual land parcel, the role of MoLRM and its departments along with the district level Survey Offices are very important. The current revised National Land Use Policy and Land Act 2021 (6th Amendment), 2072 makes a provision of delineation of hazard-risk zone and prohibition of development in such zones. However, the zoning of such land and designation of the zone in the land ownership record/title deed needs to be done in the coordination with the MoLRM.
- After the formation of federated states and local elected bodies, the elected municipal representatives will be more answerable to the municipalities. The municipalities will likely rely on KVDA's expertise for implementing land use plans in their municipalities. It will be prudent to think of an institutional set-up and strengthening the same to meet the demand of the municipalities on technical expertise in this regard.

Considering above context and issues, an organizational setup framework is envisaged and proposed hereunder.

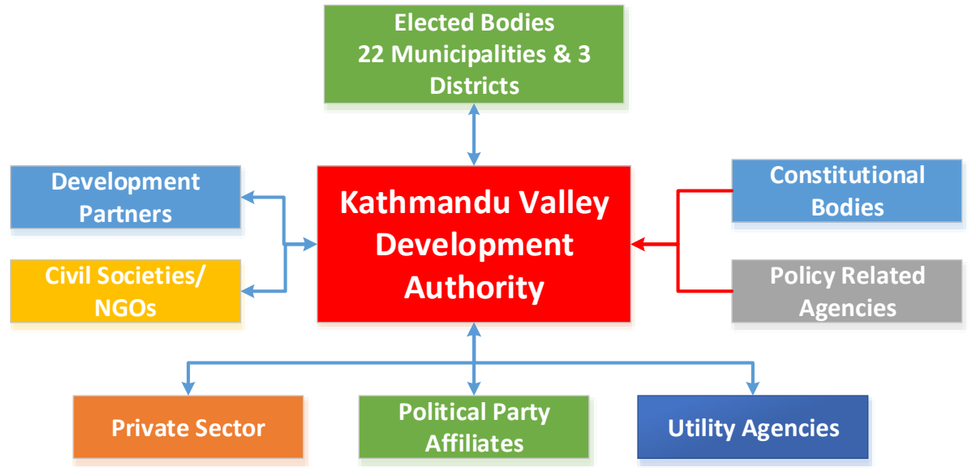

Figure 1Organizational setup framework for RSLUP implementation

- Policy matters related to the land policy, inter-organizational mandates, physical infrastructure, environment, conservation and co-financing will be addressed by the policy related organizations including the Parliament Committees, National Planning Commission, MoUD, MoFALD, MoLRM, MoPIT, MoPE, MoF, MoFSC etc. This includes review and amendment of existing polices and laws and policies, formulation and enactment of new ones as necessary to facilitate implementation of the RSLUP at the KV level and the municipal levels.
- Constitutional Bodies Judicial Institution, National Human Rights Commission, CIAA, Office of Auditor general and others will enact their respective roles to ensure legality, transparency, constitutional rights and abidance to the rule of law in every aspect of RSLUP implementation.
- District Development Committees and Municipalities in the KV play a key implementation role of RSLUP. Coordination between KVDA and MoFLAD at the top level and co-implementation of the RSLUP programs between the KVDA and municipalities at the ground levels is mandatory for success of the RSLUP.
- Infrastructure agency such as DoR and utility agencies such as Nepal Electricity Authority, Nepal Telecom, KUKL, DWSS, solid waste management as well as private/commercial providers of mobile, cable television and others needs to coordinate and regulate their works with the KVDA's plan and RSLUP guidelines.
- Development partners play a key role in financing and technical assistance for the implementation of RSLUP and its programs. Further key support is needed to enhance the capacities of the KVDA and municipalities as well as the stakeholder departments to successfully implement the RSLUP and its program. Further assistance will be needed to engage the public and private sector in participatory RSLUP implementation.
- Private sector including business communities, Federation of Nepalese Chamber of Commerce and Industries (FNCCI), Confederation of Nepalese Industries (CNI), Nepal Land and Housing Developer's Association (NLHDA), Banks and Financial Institutions etc. can play role in co-financing

the RSLUP implementation through various mechanisms including in the land pooling, house pooling, incentivising, insurance, transfer of development rights, land banking and various other mechanism to implement the RSLUP through Public Private Partnership (PPP) modality.

- Civil societies, NGOs, professional societies will need to engage in participatory planning and implementation of the RSLUP and its programs.
- Political party affiliates will need to come up with common consensus and political will to support and see successful implementation of RSLUP for safer communities in the KV.

The KVDA, as an implementing agency for the RSLUP will need to have appropriate organizational setup to develop/prepare/update the RSLUP, formulate programs and projects for implementation of RSLUP and lead RSLUP implementation in coordination with other stakeholders. KVDA, under Strategic Development Master Plan (2015-2013) has proposed an organizational setup. The same setup can

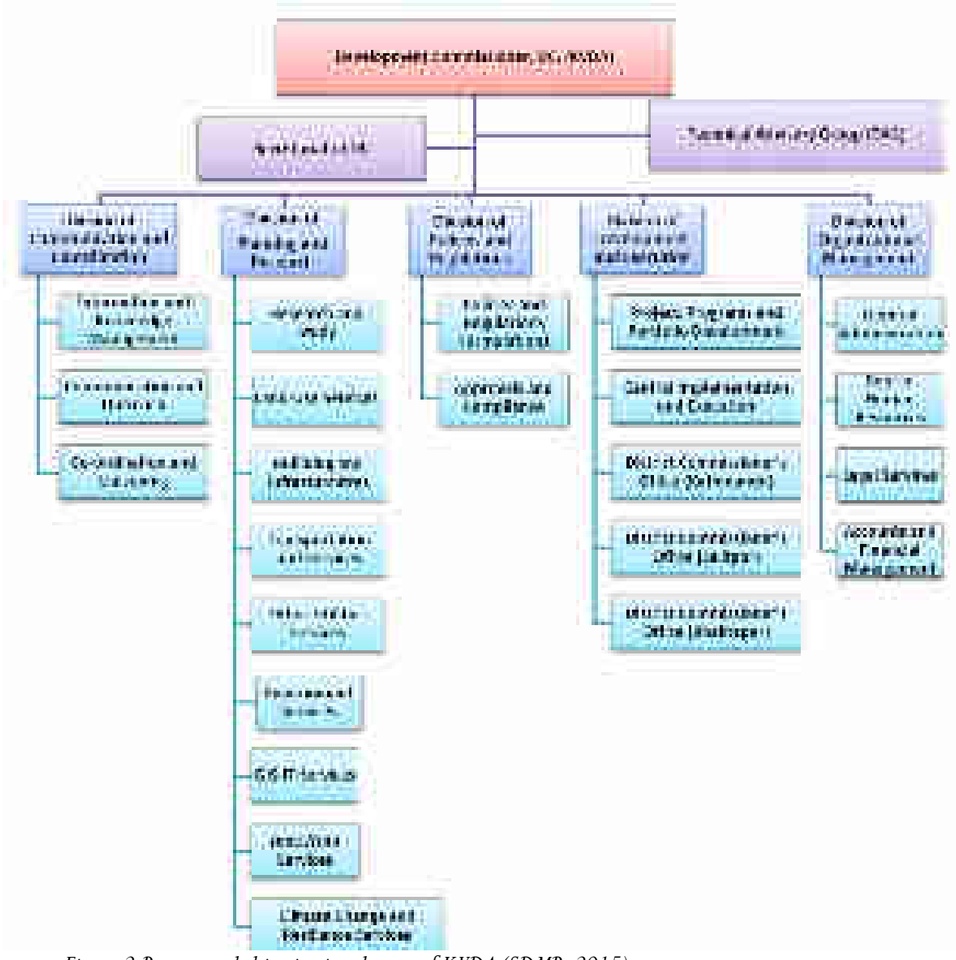

Figure 2 Recommended institutional setup of KVDA (SDMP, 2015)

implement the RSLUP with clear definition of the roles and mandates specifically addressing the RSLUP implementation requirements. From the proposed organizational setup, the RSLUP program formulation and implementation will involve all the units/section of Division of Planning and Research in coordination with each other and the other divisions. The Policies and Regulations Decision formulates policies and regulation in collaboration and coordination with other line ministries and stakeholder departments. Communication and Co-ordination Division will coordinate with coordinate with the line ministries and stakeholders as well as the municipalities and also will be responsible for technical capacity enhancement of the municipalities for undertaking the RSLUP. The Development and Execution Division will be responsible for implementing the RSLUP and will monitor the implementations its execution.

16.10. Proposal for Institutional Arrangements and Organizational Changes

In order to enable KVDA to perform the role outlined above, a permanent apex-level advisory/steering council involving all the implementers relating to RSLUP needs to be constituted. Under this, action level steering committees, sectoral as well as spatial, need to be instituted for ensuring the compliance with RSLUP.

The commitment of the concerned ministries will thus be ensured through their participation in the high-level council under the Prime Minister and for the proper implementation. Each sector will have its own sector-specific committee represented by all the stakeholders who will decide the trade-off between land use optimization and their own production targets. Based on this, the suitability of land use bye-laws and standards for each of the sectors including tourism (hotels), education (schools), and health (hospitals) and so on will be ascertained. The role of KVDA as a facilitator will be pivotal. Based on the land use policy decided by the sectoral committee, municipalities will make an analysis of detailed land use implications before issuing development permits. This may not be necessary where there is clear land use policy. In other cases, this will help evolve strategies for land use with respect to different uses. It is necessary to develop policies for using land for each of these activities case by case and the change in land use after the construction should be closely monitored and duly reported.

The available information about the ministries and agencies related with DRR, their jurisdictions and their role in facilitating local bodies are clear indications that some institutional changes are required in the national government to build capacity to help manage urban development with due attention to climate change effects and disaster related risks especially in the context of implementation. The existing arrangement is not adequate to address the complexities of issues as is evident from our overall performance and response in the context of recent earthquakes. Provincial support through KVDA is required for instituting RSLUP at municipal levels.

KVDA will help form sector-wise committees as explained earlier and take up the RSLUP provisions specific to each sector and work closely to sort out their land related problems in achieving their sectoral achievements.

KVDA will give priority on utilizing the available costly built space and oversee that land use changes in the built-up areas are based on sustainable productivity. This will ultimately reduce the pressure and demand on limited and scarce urbanized land.

The concerned KVDA officials will be oriented and sensitized with the RSLUP document and they will own the document, will disseminate the provisions among the stakeholders, act as trainers for municipal officials working on RSLUP and get info from the municipalities on their RSLUP related needs and will

be engaged in the process of instituting RSLUP and updating the plan every two years. Will help them to prepare the municipal level RSLUP.

16.11. Develop Various Institutional Models capable to undertake the Building Bye Laws Implementation

As indicated earlier, the central level mechanism in place needs to play more effective roles with coordinated efforts between MoFALD and MoUD. There is, in fact, a lack of a coordinating agency with urban-specific focus. A global approach dilutes the critical needs of ever growing urban centres. These two ministries should therefore work closely in order to provide guidelines and directives to the municipalities in particular. A joint permanent committee jointly headed by the two secretaries should meet regularly for conflict resolution and provide guidelines in concrete terms for the related implementers. In order that MoFALD assume an effective role to guide all the municipalities to implement RSLUP, it along with MoUD/KVDA and DUDBC should create an institutional mechanism to provide legal, financial, organizational, technical and institutional support to municipalities. Accordingly, each of the municipalities should have at least one designated and dedicated staff to address and mitigate risks in the overall process of urban development. The desired institutional enhancement will be facilitated through a creation of a section within MoFALD to address RSLUP issues of all the municipalities by responding to the following:

- Help municipalities in creating a mechanism for RSLUP integration into the overall process of urban development with a focus on new developments. MoFALD should make necessary arrangement for deploying a staff in each of the municipalities dedicated solely to RSLUP issues. The person will have the competence to make changes in favor of RSLUP integration and help disseminate the importance of RSLUP.
- Train the above-mentioned municipal staff in the application of RSLUP strategy and for working towards integration of risk sensitive aspects into LU.
- Help Municipalities/trained staff to prepare and implement the municipal RSLUP strategy updates it every three or five years.
- Encourage the application of performance indicators with the establishment of performance monitoring system.
- Respond to issues brought up by RSLUP staff of municipalities and use them in making RSLUP strategies and guidelines more relevant

The main purpose of the suggested changes in the organization for the RSLUP implementation is integrated action through coordination of different agencies working on RSLUP. This report is mainly focused on empowering the focal agencies and making them resilient in dealing with other agencies created politically for helping them but in fact creating problems for them. As the focal agencies are still in their embryonic stage, high level directives will make it difficult to institute the requirements found form this report. In this regard different agencies will have influence on implementation. The proposed Rebuilding Authority will lead to huge investments, with the highest impact on the culture of compliance on RSLUP. This body should before making its policies and plans should help internalize the recommendations of this work. Various agencies including Prime Minister's Office and National Planning Commission have been trying to improve the coordination mechanisms and are responsible for monitoring. However the efforts have been erratic. It has become necessary to institutionalize the coordination mechanism that has universal acceptance. Such an approach should be based on effectuating partnership in the real sense involving the stakeholders of a particular activity or a project.

16.12. Organizational Change in MoFALD

The proposed bye-laws and guidelines are based on the approach of empowering the municipal level. In order to help the municipality do this, MoFALD needs to come forward and facilitate coordination while providing the necessary technical help, finance, or organizational support. In order to enable MoFALD respond to RSLUP in a technically sound way, organizational change is suggested. This is critical that the learnings and achievements gained from this consultancy work as well as from the proposed experimental project needs to be utilized by the government in making appropriate policy and the role of MoFALD being in charge of the local bodies and also federal agencies in the future cannot be ignored or undermined. In order to avoid any possible discord in the future, we have proposed some changes in its organization and also extending its performance monitoring by incorporating RSLUP aspects Joint Secretary of the municipal management division should work as the member secretary of the monitoring committee headed by Hon. Minister MoFALD with representatives from all the stakeholders of the coordinating and monitoring committee.

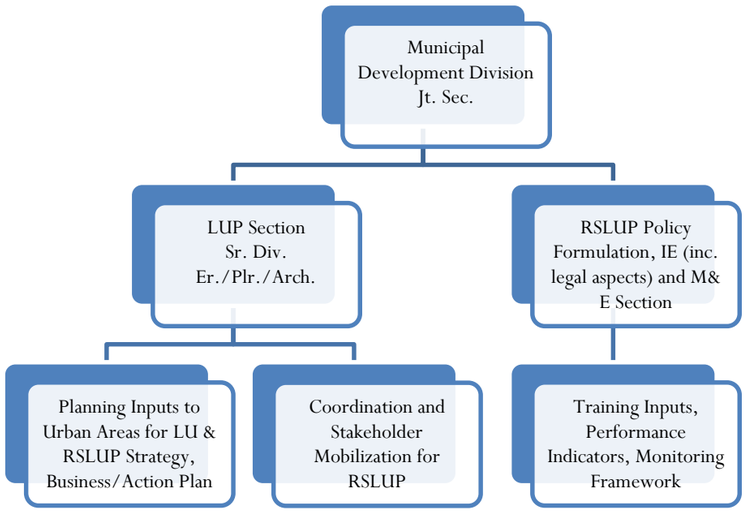

Figure 3Recommended organizational structure of MoFALD for effective implementation of RSLUP

MoFALD will support the municipalities of the Valley for aiming at:

- Integrating risk sensitive aspects into land use planning in order to minimize the risk;
- Preparedness for the inevitable increase in the disaster and climate change related risk as a result of the urban growth and development
- Creating an effective regulatory framework through the development of appropriate coordination mechanisms that will at the same time lead to the best utilization of the investments in urban development;

For playing this role, MoFALD will have to build national competence on RSLUP and integrate LU and DRR processes in shaping an urban development planning framework.

16.13. Monitoring and Evaluation

Performance Indicators for Municipalities: MoFALD already has performance monitoring indicators and it will be necessary to add one more indicator related with risk sensitivity, the level of municipal response to risk sensitive aspects. In order to implement this indicator, monitoring and evaluation committee under the Mayor should prepare situation specific or town specific indicators for enhancing the risk sensitivity of the overall development taking place in the municipality and the monitoring the same.

Performance indicator

- The change in the feeling of safety and preparedness for risk
- Increased willingness to pay for RM services
- By-laws integrating risk sensitive provisions
- % reduction in risks
- Subsidy for risk sensitive designs incentives, bank loans
- Increase in the proportion of earthquake resistant buildings in the municipal area

The expected outcomes are:

- Inclusive access of all to risk mitigation services within the municipality
- Increased awareness and preparedness on disaster and climate change related risks
- Staff in place to respond to risk related aspects and issuing of building permits
- RSLUP guidelines implemented and regularly updated.
- Increased competence of the municipalities to adapt to climate change effects and ability to mitigate climate change effects.
-

16.14. Ministries in charge of sectoral development

Mechanisms for integrating municipal actions and sectoral actions are important, disasters are not confined to municipal boundary; supra local policies are required, each and every sector will be controlled by supra local governance. Therefore RSLUP measures need to be addressed for formulating development plans for each and every development sector including health and education.

Based on the RSLUP, KVDA needs to be strengthened with working teams constituted for each of the development sectors. Such teams should have representation of the concerned development sector, MoUD, MoFALD, and meet every two months to monitor the implementation of RSLUP by the municipalities and suggest action on improvement. An officer should be designated to take charge of RSLUP and coordinate with municipalities and stakeholder. Under the officer, there should be sector wise engineer planner to help sectoral ministries to understand, implement the provisions of RSLUP and making suggestions for policy change.

- Help municipalities to prepare municipal level RSLUPs and update them
- Help the municipal level clearing house with best advice on RSLUP implementation on a project by project basis
- Coordinate with MoFALD and hold team meetings with sake holder ministries
- ToT

- Help institute a dedicated sub section in municipalities that will address the issues of RSLUP

For instituting RSLUP, the bye-laws prepared by the Consultant for MoFALD should be legitimized and used as the guiding principle for integrating RSLUP into municipal development activities. The provisions in the bye-laws should be applied and updated as per need. The document will serve as a guide for municipalities to act in favor of plan implementation. Each of the municipalities should designate an official to act as a clearing house for RSLUP implementation. It is advised at this stage to develop ToR for this work gradually based on learnings from situation-specific response depending on the overall affordability, knowledge and information based resources as well as the development imperatives of the municipality. Based on the available resources and constraints, the staff should have the authority to act on RSLUP to make the best decision without impairing development. In order to minimize irregularities, a single person should be made responsible for RSLUP related implementation, the performance indicator being the incorporation of RSLUP provision in the development process to the maximum possibility without hampering development. This will facilitate allowing building permit based on trade-off between risk sensitivity and economic growth.

For implementation, the municipality will be required to integrate RSLUP bye-laws in the municipal development process. If deemed necessary the Mayor may constitute a team of experts coordinated by the staff mentioned above. The team will have the responsibility to recommend whether to issue a development permit or not. The staff in charge of RSLUP will directly report to the Mayor. In case of any conflict or dispute, the matter needs to be taken up to KVDA for resolution. Each and every municipality will have a unit or a staff dedicated to RSLUP with the following responsibilities:

- Work as a clearing house for issuing building permits
- Hold local level meetings of stakeholders to sensitize and orient and disseminate about RSLUP
- Help prepare and update the municipality RSLUP:
- Provide counseling to perspective developers in implementing RSLUP

The high level steering action committee under the chair of Minister

- Hold meetings every two months to orient the needs of RSLUP
- Constitute sub committees under KVDA chief to align their development with RSLUP implementation and refine the sectoral part of the RSLUP
- Help ministries to Prepare sectoral guidelines on RSLUP
- Make MoFALD guidelines compatible with sectoral guidelines.

High level permanent committee under the MoFALD/MoUD will be constituted to orient the stakeholder ministries to get oriented with the provisions of RSLUP. The concerned KVDA officials will be oriented and sensitized with the RSLUP document and they will own the document, will disseminate the provisions among the stakeholders, act as trainers for municipal officials working on RSLUP and get info from the municipalities on their RSLUP related needs and will be engaged in the process of instituting RSLUP and updating the plan every two years. Will help them to prepare the municipal level RSLUP.

No matter which model we select, it is necessary to develop a system of making municipalities responsible to RSLUP implementation and the central government provide technical support and resources.

16.15. Roles and Responsibilities of stakeholder institutions

a. MoFALD should compete its capacity to help sectoral ministries to get oriented with risk sensitive aspects. The two ministries instead of working in isolation should work jointly as one and help others, development ministries and municipalities in particular to comply with RSLUP requirements.
b. Something like the steering committee headed by the minister at the top with representatives of all the development ministries working groups on different sectors will be formed by this high level committee to help line ministries be as risk sensitive as possible. All the ministries are having hard time to cope with the challenges brought by making a trend off between their sectoral priorities and planning imperatives.
c. Culture of compliance need to be developed by assigning at least one staff with responsibility only for RSLUP and to support her, organizational changes need to be evolved. The Person will (since she has no other duties to perform) have to explore how RSLUP can be instituted in her municipality.
d. KVDA should designate a unit to take care of RSLUP just like a focal point to liaise donors and stakeholders (municipalities under its jurisdiction as well development ministries)that person will do the ongoing research stocking taking whatever is available and development on it with the feedback from the problems and issues being faced by the constituent municipalities within their territories as well as the difficulty facing the development ministries to be risk sensitive in their pursuit for sustainable development.

16.16. Consultation with stakeholders

We have, mainly through trainings, demonstrated mechanisms for consultations and this should be continued after the termination of this study, for making things happen. We suggest that the trainees be given opportunities to make use of the trainings, through regular application of the knowledge acquired. As mentioned earlier, it is necessary to mobilize all of them for concerted efforts towards effective implementation of RSLUP. The role of different stakeholders and players are being defined for the required changes towards the sustainable development model in this report. A long term consultative process for making the policy and institutional changes are being proposed.

16.17. Recommended and preferred approach towards institutional and policy change

In view of technology transfer and in-house domestic capacity building, KVDA is an appropriate agency to internalize the expertise on RSLUP; and the right approach will be to initiate the process of learning-by- doing through a demonstrative action oriented project within KVDA. The project will also have an in-built training and capacity building component. The project will aim at enabling municipalities to understand the overall planning framework in place and developing it at the action level of achieving the planning goals. This is of critical importance and significance as municipalities are somehow lost in identifying and pursuing the long term planning goals for making cites resilient, inclusive, safe and sustainable. The salient features of the recommended approach may be listed as follows:

- KVDA to launch an action-oriented RSLUP implementation project also supported through external funding.
- Ability to analyse and develop the planning framework in place to be enhanced
- Project staff dedicated to RSLUP
- For integrating RSLUP with the conventional approach, stakeholder consultations,

- Changes required as evidenced by the planning process will be the feedback for policy making bodies in the preparation and development of the policy

The project team will be gradually integrated into the structure of KVDA.

- to make the Planning framework explicit
- to understand the planning framework
- to find the gaps in the framework in terms of risk sensitivity
- training and orientation on regular basis
- policy dialogues
- consultative mechanisms to be institutionalized for resolving trade-off and conflicts.

Implementation process will largely depend on promotional approach rather than control based approach. A team of stakeholders will develop a mechanism working as a permanent task force and discuss the trade—offs and reach at the best solution for any conflict that may arise. A clearing house at the municipal level will have the key say. They will be trained to work professionally on RSLUP upholding the professional ethics.

Internalizing is important and KVDA should be made aware of the high value of the knowledge product embodied in this report. For the evolutionary change in the organizational structure required for RSLUP, It is suggested that KVDA will launch such a project as a process of capacity building and institutionalizing, where-by it will bring all the stakeholders together for RSLUP implementation. The achievements of the project will be turned duly into the organizational change permanently. The main purpose of this arrangement is to develop the culture of compliance which is not possible as has become evident from the experience of this work, through enacting laws and rules only in isolation. These has to be instituted gradually as a learning by doing process and capacity building directed to the content of this chapter will be the need. KVDA will be supported by the two ministries and will have adequate staff to run the project. MoFALD, also in view of the transitions to federal system of government, should see KVDA develop as a federal agency and help to enable it to perform its role.

16.18. Financial implication of the recommended proposal

KVDA should start the experimental project in a modest way with a project manager and some core personnel and support staff. With this, it can mobilize other resources from donor community and stake-holder ministries as well as municipalities. MoFALD needs to be provided with more budget in order to compensate municipalities have some fund for undertaking RSLUP related activities.

List of the Municipalities in Kathmandu Valley

Annex - 1

District	New Municipality	Old VDCs	Household and Populaiton - 2011					Municipality Office	No of Wards	Population	Total Area (SQKM)	Type	Area (SQKM)
			Houses	HH	Pop Total	Male	Female						
KATHMANDU	Budhanilkantha Municipality	Budhanilkantha	2,520	3,930	16,443	8,484	7,959	Mahankal	17	118,690	35.0	Urbanizing VDC	14.0
		Chapali Bhadrakali	1,778	2,615	11,337	5,554	5,783					Rural VDC	6.3
		Chunikhel	2,107	3,020	11,859	5,974	5,885					Rural VDC	3.6
		Kapan	6,747	12,412	49,833	25,775	24,058					Urbanizing VDC	4.7
		Khadka Bhadrakali	1,668	2,631	10,998	5,493	5,505					Urbanizing VDC	2.4
		Mahankal	3,222	4,954	18,220	9,265	8,955					Urbanizing VDC	4.1
	Chandragiri Municipality	Badbhanjyang	732	886	3,926	1,985	1,941	Balambu	23	83,295	43.9	Rural VDC	4.8
		Balambu	1,315	1,892	8,621	4,843	3,778					Urbanizing VDC	2.1
		Dahachok	785	873	4,435	2,208	2,227					Rural VDC	6.4
		Machhegaun	667	884	4,048	1,926	2,122					Rural VDC	4.7
		Mahadevsthan	2,660	3,972	16,567	8,321	8,246					Rural VDC	7.0
		Matatirtha	968	1,425	6,286	3,262	3,024					Rural VDC	6.2
		Naikap Naya Bhanjyang	1,335	2,092	8,222	4,230	3,992					Urbanizing VDC	1.3
		Naikap Purano Bhanjyang	975	1,164	4,508	2,265	2,243					Urbanizing VDC	1.7
		Satungal	964	1,165	4,497	2,293	2,204					Urbanizing VDC	2.3
		Thankot	1,844	2,893	12,432	6,399	6,033					Urbanizing VDC	6.1
		Tinthana	1,432	2,600	9,753	4,994	4,759					Urbanizing VDC	1.3
	Dakshinkali Municipality	Chalnakhel	948	1,147	4,406	2,095	2,311	Pharping	15	31,885	42.7	Rural VDC	5.5
		Chhaimale	938	1,091	4,271	2,020	2,251					Rural VDC	9.7
		Dakshinkali	989	1,125	4,900	2,486	2,414					Rural VDC	4.6
		Saukhel Satidevi	1,298	2,723	10,629	5,535	5,094					Rural VDC	5.9
		Sheshnarayan	804	969	4,501	2,330	2,171					Rural VDC	5.1
		Talkudunde Chaur	623	730	3,178	1,696	1,482					Rural VDC	11.9
	Gokarneshwor Municipality	Baluwa	1,097	1,308	5,631	2,823	2,808	Jorpati	16	106,377	58.5	Rural VDC	7.0
		Gokarneshwar	1,303	1,981	7,856	3,983	3,873					Urbanizing VDC	4.7
		Jorpati	8,899	21,535	82,915	41,794	41,121					Urbanizing VDC	4.8
		Nayapati	1,359	1,908	7,344	3,612	3,732					Rural VDC	6.7
		Sundarijal	547	621	2,631	1,324	1,307					Rural VDC	35.2
	Kageshwori-Manohara Municipality	Aalapot	712	759	3,268	1,594	1,674	Danchhi	13	54,455	27.4	Urbanizing VDC	1.5
		Bhadrabas	502	567	2,465	1,227	1,238					Urbanizing VDC	1.7
		Gagal Phedi	1,113	1,169	5,629	2,750	2,879					Rural VDC	10.8
		Gothatar	3,914	6,962	26,830	13,778	13,052					Urbanizing VDC	4.6
		Mulpani	2,024	2,972	12,177	6,168	6,009					Urbanizing VDC	3.9
		Thali Danchhi	879	962	4,086	2,031	2,055					Urbanizing VDC	5.0
	Kathmandu	Kathmandu Metropolitan	130,729	277,789	1,006,656	532,728	473,928	Kathmandu	35	1,006,656	49.4	Metropolitan	49.4
	Kirtipur Municipality	Kirtipur Municipality	10,462	21,854	66,070	36,726	29,344	Kirtipur	19	66,070	14.8	Municipality	14.8
	Nagarjun Municipality	Bhimdhunga	601	664	2,988	1,513	1,475	Sitapaila	14	66,792	29.8	Rural VDC	6.0
		Ichangu Narayan	3,702	6,671	24,072	12,181	11,891					Urbanizing VDC	11.8
		Ramkot	1,574	1,961	8,868	4,483	4,385					Rural VDC	5.8
		Sitapaila	2,817	4,599	17,612	9,024	8,588					Urbanizing VDC	3.5

List of the Municipalities in Kathmandu Valley

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			Houses	HH	Pop Total	Male	Female						
		Syuchatar	1,895	3,500	13,252	6,810	6,442					Urbanizing VDC	2.7
	Shankharapur Municipality	Indrayani	626	714	3,501	1,725	1,776	Pukhulachhi	16	25,541	60.2	Rural VDC	2.8
		Lapsiphedi	1,182	1,234	5,668	2,752	2,916					Rural VDC	17.8
		Nanglebhare	897	931	4,467	2,204	2,263					Rural VDC	20.8
		Pukhulachhi	500	600	2,806	1,365	1,441					Urbanizing VDC	1.4
		Sangkhu Bajrayogini	858	930	4,541	2,208	2,333					Urbanizing VDC	5.2
		Sangkhu Suntol	1,167	1,265	4,558	2,243	2,315					Urbanizing VDC	12.2
	Tarakeshwor Municipality	Dharmasthali	1,310	1,628	6,663	3,364	3,299	Darmasthali	21	80,551	34.9	Urbanizing VDC	1.9
		Goldhunga	2,823	4,028	16,206	8,502	7,704					Urbanizing VDC	5.1
		Jitpur Phedi	1,030	1,130	4,921	2,479	2,442					Rural VDC	8.9
		Kabhresthali	948	1,106	4,996	2,557	2,439					Rural VDC	8.5
		Manmaiju	4,828	11,598	39,185	20,380	18,805					Urbanizing VDC	3.0
		Phutung	1,484	2,052	4,955	2,474	2,481					Rural VDC	1.4
		Sangla	734	802	3,625	1,815	1,810					Rural VDC	6.0
	Tokha Municipality	Dhapasi	3,842	8,478	31,989	16,441	15,548	Greenland	15	100,665	16.9	Urbanizing VDC	2.0
		Gongabu	6,223	14,676	54,722	28,259	26,463					Urbanizing VDC	2.4
		Jhor Mahankal	810	926	4,184	2,079	2,105					Rural VDC	6.2
		Tokha Chandeshwari	724	869	3,959	1,909	2,050					Rural VDC	4.4
		Tokha Saraswati	840	1,203	5,811	3,048	2,763					Rural VDC	1.9
LALITPUR	Godawari Municipality	Badikhel	633	798	3,765	1,895	1,870	Godawari	12	30,312	34.7	Rural VDC	5.8
		Bisangkhunarayan	994	1,051	4,570	2,168	2,402					Rural VDC	7.0
		Godamchaur	955	1,117	5,154	2,541	2,613					Rural VDC	3.1
		Godawari	1,350	1,852	8,317	4,096	4,221					Rural VDC	16.5
		Thaiba	1,318	2,057	8,506	4,257	4,249					Rural VDC	2.3
	Karyabinayak Municipality	Bungmati	1,194	1,401	5,984	2,979	3,005	Chhayasikot	18	40,033	21.6	Urbanizing VDC	3.9
		Chhampi	953	1,072	4,699	2,296	2,403					Rural VDC	5.5
		Dukuchhap	540	554	2,702	1,323	1,379					Rural VDC	4.9
		Khokana	824	1,082	4,942	2,458	2,484					Urbanizing VDC	3.2
		Sainbu Bhaisepati	2,964	5,308	21,706	10,893	10,813					Urbanizing VDC	4.1
	Lalitpur Sub Metropolitan	Lalitpur Sub Metropolitan	31,676	58,127	223,285	116,082	107,203	Pulchowk	30	257,025	24.9	Sub-Metropolitan	15.1
		Sunakothi	1,711	2,561	10,137	5,010	5,127						3.0
		Dhapakhel	1,852	3,091	12,852	6,813	6,039						3.7
		Harisiddhi	1,795	2,842	10,751	5,388	5,363						3.1
	Mahalaxmi Municipality	Imadol	4,264	7,128	27,719	14,066	13,653	Imadol	19	63,702	26.5	Urbanizing VDC	4.0
		Lamatar	1,624	1,742	8,245	4,069	4,176					Rural VDC	11.1
		Lubhu	1,914	2,324	10,452	5,253	5,199					Urbanizing VDC	6.4
		Siddhipur	1,262	1,583	6,160	2,893	3,267					Rural VDC	2.0
		Tikathali	1,593	2,447	11,126	5,587	5,539					Urbanizing VDC	3.0
	Anantalingeshwor	Balkot	2,325	4,022	14,979	7,540	7,439	Gamcha-	15	37,501	18.1	Urbanizing VDC	2.8
		Dadhikot	2,260	3,027	11,685	5,891	5,794					Urbanizing VDC	6.5

List of the Municipalities in Kathmandu Valley

Annex - 1

District	New Municipality	Old VDCs	Household and Populaiton - 2011					Municipality Office	No of Wards	Population	Total Area (SQKM)	Type	Area (SQKM)
			Houses	HH	Pop Total	Male	Female						
BHAKTAPUR	Municipality	Gundu	1,143	1,365	5,745	2,767	2,978	Dadhikot	15	37,561	18.1	Rural VDC	7.4
		Sirutar	982	1,165	5,092	2,441	2,651					Urbanizing VDC	1.4
	Bhaktapur Municipality	Bhaktapur Municipality	12,740	19,273	83,893	42,947	40,946	Bhaktapur	17	83,893	6.6	Municipality	6.6
	Changunarayan Municipality	Changunarayan	1,251	1,429	6,096	2,947	3,149	Narayantar	16	33,439	27.9	Urbanizing VDC	6.8
		Chhaling	1,569	1,790	8,918	4,595	4,323					Rural VDC	9.6
		Duwakot	1,910	2,748	11,188	6,042	5,146					Urbanizing VDC	6.3
		Jhaukhel	1,285	1,516	7,237	3,653	3,584					Urbanizing VDC	5.2
	Madhyapur Thimi Municipality	Madhyapur Thimi Municipality	12,571	21,758	84,259	43,643	40,616	Thimi	17	84,259	11.1	Municipality	11.1
	Mahamanjushree-Nagarkot Municipality	Bageswori	1,076	1,172	5,418	2,627	2,791	Kharipati	13	23,952	35.0	Rural VDC	9.6
		Nagarkot	940	1,001	5,514	3,087	2,427					Rural VDC	9.5
		Sudal	1,624	1,759	7,283	3,382	3,901					Rural VDC	7.3
		Tathali	1,237	1,336	5,737	2,785	2,952					Rural VDC	8.7
	Suryabinayak Municipality	Chitapol	1,161	1,361	5,536	2,719	2,817	Sipadol	14	39,983	24.3	Rural VDC	5.1
		Katunje	2,982	4,839	20,046	9,935	10,111					Urbanizing VDC	4.3
		Nangkhel	998	1,140	4,514	2,152	2,362					Rural VDC	6.8
		Sipadol	2,032	2,383	9,887	4,853	5,034					Rural VDC	8.1

Classification of Rural and Urbanizing VDCs were made some eight years ago by the government. Urbanizing VDCs were those adjoined to the existing municipality and urbanizing rapidly.
No such classification exists at present.

Municipal/ VDC Level Constraints Analysis

Annex - 2(A)

SN	Municipality/VDC	Total Area	Constraints							Risks				
			Designated Open Space	World Heritage Site	Airport Area	Forest Area	Builtup 2012	High Water Recharge Area	Total	Slope > 30deg	Flood Prone Area	Liquefaction Risk	High EQ Risk	Total
1	Anantalingeshwar Municipality	1,813	-	-	-	348	273	91	711	91	218	38	548	895
2	Bhaktapur Municipality	655	25	11	-	4	262	-	302	-	-	20	301	321
3	Bhardeu VDC	3,504	-	-	-	885	144	-	1,028	2	88	-	163	253
4	Budhanilkantha Municipality	727	-	-	-	141	61	863	1,065	-	70	11	93	173
5	Chandragiri Municipality	4,267	-	-	-	2,077	102	894	3,074	208	1,363	64	43	1,678
6	Changunarayan Municipality	783	-	-	-	562	8	6	576	-	374	-	-	374
7	Chapagaun VDC	2,984	7	0	-	1,215	373	-	1,596	-	869	4	220	1,093
8	Dakshinkali Municipality	1,252	-	-	-	819	10	208	1,037	-	641	14	67	723
9	Devichaur VDC	802	-	-	-	473	12	-	485	-	221	-	-	221
10	Ghusel VDC	6,019	-	-	-	1,950	133	-	2,083	335	838	31	143	1,346
11	Godawari Municipality	2,493	158	15	-	-	1,342	469	1,985	-	0	152	454	606
12	Gokarneshwar Municipality	1,084	-	-	-	838	5	252	1,095	-	792	-	38	829
13	Jharuwarasi VDC	2,431	0	-	-	593	256	-	849	157	362	4	868	1,391
14	Kageshwori Manohara Municipality	3,473	-	-	-	2,038	140	289	2,467	469	1,198	28	-	1,696
15	Karyabinayak Municipality	2,407	-	-	-	1,527	57	-	1,583	-	789	-	92	881
16	Kathmandu Metropolitan	5,846	22	-	-	3,719	460	76	4,277	252	410	149	271	1,082
17	Kirtipur Municipality	381	-	-	-	29	21	171	221	-	5	5	-	10
18	Lalitpur Sub Metropolitan	1,111	-	-	-	19	435	-	454	-	0	156	476	632
19	Lele VDC	3,494	-	-	-	719	409	-	1,128	1,888	339	96	457	2,780
20	Madhyapur Thimi Municipality	3,499	2	-	-	1,393	714	-	2,109	863	426	113	256	1,658
21	Mahalaxmi Municipality	2,649	-	-	-	574	341	155	1,070	155	373	84	15	627
22	Mahamanjushree Nagarkot Municipality	4,391	-	-	-	1,673	446	2	2,121	894	1,266	62	57	2,279
23	Nagarjuna Municipality	2,736	4	-	5	396	405	-	810	289	59	184	291	822
24	Nallu VDC	325	-	-	-	-	52	-	52	-	0	9	8	18
25	Shankharapur Municipality	2,160	-	-	-	161	192	335	689	-	98	168	418	684
26	Suryabinayak Municipality	2,791	-	35	-	271	212	157	674	6	24	148	292	470
27	Tarkeshwar Municipality	4,944	231	178	300	92	4,216	1,888	6,904	76	0	493	1,358	1,928
28	Thecho VDC	1,690	7	-	-	328	436	-	771	987	187	72	464	1,709
29	Tokha Municipality	1,476	75	-	-	160	313	987	1,534	171	88	37	240	536
	Total	**72,187**	**532**	**240**	**304**	**23,004**	**11,832**	**6,843**	**42,754**	**6,843**	**11,098**	**2,139**	**7,636**	**27,715**

Municipal/ VDC Level Constraints Analysis

Annex - 2(B)

SN	Municipality/VDC	Old/ New	No. of Wards	Builtup on Constraint	Non-Builtup on Constraint	Total Constraint Area	Builtup on Constraint Free	Non_Builtup on Constraint Free	Total Constraint Free Area	Grand Total	Non- Built up Constraint Free Area Percent	Colour Zone
1	Anantalingeshwar Municipality	New Municipality_1	15	118	945	1,063	155	595	750	1,813	32.8%	YELLOW
2	Bhaktapur Municipality	Old Municipality	17	160	169	328	103	224	327	655	34.2%	YELLOW
3	Bhardeu VDC	VDC	13	1	609	610	6	166	173	783	21.2%	RED
4	Budhanilkantha Municipality	New Municipality_1	9	333	2,047	2,380	381	738	1,119	3,499	21.1%	RED
5	Chandragiri Municipality	New Municipality_2	15	214	2,606	2,820	232	1,338	1,571	4,391	30.5%	YELLOW
6	Changunarayan Municipality	New Municipality_2	9	28	602	631	184	1,976	2,160	2,791	70.8%	GREEN
7	Chapagaun VDC	VDC	14	10	234	244	51	432	483	727	59.4%	YELLOW
8	Dakshinkali Municipality	New Municipality_2	9	24	2,624	2,648	78	1,541	1,619	4,267	36.1%	YELLOW
9	Devichaur VDC	VDC	9	2	1,006	1,008	8	235	243	1,252	18.8%	RED
10	Ghusel VDC	VDC	15	4	1,015	1,020	1	63	64	1,084	5.9%	RED
11	Godawari Municipality	New Municipality_2	30	27	2,454	2,481	113	878	992	3,473	25.3%	RED
12	Gokarneshwar Municipality	New Municipality_2	9	96	4,264	4,361	363	1,122	1,485	5,846	19.2%	RED
13	Jharuwarasi VDC	VDC	14	0	37	37	21	324	344	381	84.9%	GREEN
14	Kageshwori Manohara Municipality	New Municipality_1	12	48	991	1,039	357	1,340	1,697	2,736	49.0%	YELLOW
15	Karyabinayak Municipality	New Municipality_2	9	24	558	582	169	1,410	1,579	2,160	65.3%	GREEN
16	Kathmandu Metropolitan	Old Municipality	16	1,848	478	2,326	2,368	250	2,618	4,944	5.1%	RED
17	Kirtipur Municipality	Old Municipality	9	152	593	745	161	569	730	1,476	38.6%	YELLOW
18	Lalitpur Sub Metropolitan	Old Municipality	22	695	223	918	647	928	1,575	2,493	12.8%	RED
19	Lele VDC	VDC	21	10	1,670	1,680	47	680	727	2,407	28.3%	RED
20	Madhyapur Thimi Municipality	Old Municipality	17	147	385	531	289	291	579	1,111	26.2%	RED
21	Mahalaxmi Municipality	New Municipality_1	19	29	895	924	312	1,414	1,725	2,649	53.4%	YELLOW
22	Mahamanjushree Nagarkot Municipality	New Municipality_2	23	5	1,075	1,081	138	2,285	2,423	3,504	65.2%	GREEN
23	Nagarjuna Municipality	New Municipality_1	1	123	1,525	1,649	250	1,085	1,335	2,984	6.3%	RED
24	Nallu VDC	VDC	9	1	521	522	11	269	280	802	33.5%	YELLOW
25	Shankharapur Municipality	New Municipality_2	18	43	2,757	2,800	90	3,129	3,219	6,019	52.0%	YELLOW
26	Suryabinayak Municipality	New Municipality_2	16	195	1,510	1,706	60	665	725	2,431	27.4%	RED
27	Tarkeshwar Municipality	New Municipality_1	35	352	2,343	2,695	57	742	799	3,494	21.2%	RED
28	Thecho VDC	VDC	15	2	15	17	50	258	308	325	79.3%	GREEN
29	Tokha Municipality	New Municipality_1	19	281	1,081	1,362	155	173	328	1,690	10.2%	RED
	Total			**4,975**	**35,234**	**40,209**	**6,856**	**25,122**	**31,979**	**72,187**	**34.8%**	

Color Zone	Builtup on Constraint	Non-Builtup on Constraint	Total Constraint Area	Builtup on Constraint Free	Non_Builtup on Constraint Free	Total Constraint Free Area	Grand Total	Non- Built up Constraint Free Area Percent
Red	4,116	20,612	24,728	4,746	8,017	12,763	37,491	21.4%
Yellow	800	12,334	13,134	1,549	10,852	12,401	25,535	42.5%
Green	59	2,287	2,347	561	6,253	6,815	9,162	68.3%
Total	**4,975**	**35,234**	**40,209**	**6,856**	**25,122**	**31,979**	**72,187**	**34.8%**

Municipality/ VDC Level Non-Built Up Constraint Free Area

Annex - 2(C)

SN	Municipality/VDC	District	Old/ New	No. of Wards	Total Area	Constraint Area	Non_Builtup on Constraint Free				% Const raints	% (Non-Builtup Constraint Free)			
							Red	Yellow	Green	Total		Red	Yellow	Green	Total
1	Anantalingeshwar Municipality	Bhaktapur	New Municipality_1	15	1,813	1,217	104	363	128	595	67%	6%	20%	7%	33%
2	Bhaktapur Municipality	Bhaktapur	Old Municipality	17	655	431	23	65	137	224	66%	3%	10%	21%	34%
3	Bhardeu VDC	Lalitpur	VDC	13	783	617	109	289	1,886	166	79%	14%	37%	241%	21%
4	Budhanilkantha Municipality	Kathmandu	New Municipality_1	9	3,499	2,761	54	89	289	738	79%	2%	3%	8%	21%
5	Chandragiri Municipality	Kathmandu	New Municipality_2	15	4,391	3,052	296	681	563	1,338	70%	7%	16%	13%	30%
6	Changunarayan Municipality	Bhaktapur	New Municipality_2	9	2,791	815	111	21	34	1,976	29%	4%	1%	1%	71%
7	Chapagaun VDC	Lalitpur	VDC	14	727	295	192	426	467	432	41%	26%	59%	64%	59%
8	Dakshinkali Municipality	Kathmandu	New Municipality_2	9	4,267	2,726	160	75	-	1,541	64%	4%	2%	0%	36%
9	Devichaur VDC	Lalitpur	VDC	9	1,252	1,017	95	174	-	235	81%	8%	14%	0%	19%
10	Ghusel VDC	Lalitpur	VDC	15	1,084	1,021	94	2,160	876	63	94%	9%	199%	81%	6%
11	Godawari Municipality	Lalitpur	New Municipality_2	30	3,473	2,595	144	26	758	878	75%	4%	1%	22%	25%
12	Gokarneshwar Municipality	Kathmandu	New Municipality_2	9	5,846	4,724	63	-	-	1,122	81%	1%	0%	0%	19%
13	Jharuwarasi VDC	Lalitpur	VDC	14	381	57	97	330	238	324	15%	26%	87%	62%	85%
14	Kageshwori Manohara Municipality	Kathmandu	New Municipality_1	12	2,736	1,396	253	251	374	1,340	51%	9%	9%	14%	49%
15	Karyabinayak Municipality	Lalitpur	New Municipality_2	9	2,160	750	153	454	74	1,410	35%	7%	21%	3%	65%
16	Kathmandu Metropolitan	Kathmandu	Old Municipality	16	4,944	4,694	485	564	73	250	95%	10%	11%	1%	5%
17	Kirtipur Municipality	Kathmandu	Old Municipality	9	1,476	906	-	-	324	569	61%	0%	0%	22%	39%
18	Lalitpur Sub Metropolitan	Lalitpur	Old Municipality	22	2,493	1,565	68	198	24	928	63%	3%	8%	1%	37%
19	Lele VDC	Lalitpur	VDC	21	2,407	1,727	163	343	236	680	72%	7%	14%	10%	28%
20	Madhyapur Thimi Municipality	Bhaktapur	Old Municipality	17	1,111	820	274	194	269	291	74%	25%	17%	24%	26%
21	Mahalaxmi Municipality	Lalitpur	New Municipality_1	19	2,649	1,236	68	478	867	1,414	47%	3%	18%	33%	53%
22	Mahamanjushree Nagarkot Municipality	Bhaktapur	New Municipality_2	23	3,504	1,219	179	694	465	2,285	35%	5%	20%	13%	65%
23	Nagarjuna Municipality	Kathmandu	New Municipality_1	1	2,984	1,899	29	784	526	1,085	64%	1%	26%	18%	36%
24	Nallu VDC	Lalitpur	VDC	9	802	533	0	-	258	269	66%	0%	0%	32%	34%
25	Shankharapur Municipality	Kathmandu	New Municipality_2	18	6,019	2,890	-	345	1,065	3,129	48%	0%	6%	18%	52%
26	Suryabinayak Municipality	Bhaktapur	New Municipality_2	16	2,431	1,766	7	141	1,829	665	73%	0%	6%	75%	27%
27	Tarkeshwar Municipality	Kathmandu	New Municipality_1	35	3,494	2,752	250	-	-	742	79%	7%	0%	0%	21%
28	Thecho VDC	Lalitpur	VDC	15	325	67	120	53	-	258	21%	37%	16%	0%	79%
29	Tokha Municipality	Kathmandu	New Municipality_1	19	1,690	1,517	81	164	324	173	90%	5%	10%	19%	10%
	Total				**72,187**	**47,065**	**3,676**	**9,361**	**12,085**	**25,122**	**65%**	**5%**	**13%**	**17%**	**35%**

Municipality/ VDC Level Non-Built Up Constraint Free Area

Annex - 2(C)

Constraint Area and Non-Built up Constraint Free Area - Districtwise

Districts		Total Area	Constraint Area	Non_Builtup on Constraint Free			
				Red	Yellow	Green	Total
Kathmandu	Area	32,291	22,560	1,859	3,135	4,736	9,731
	Percent	100%	70%	6%	10%	15%	30%
Lalitpur	Area	26,595	15,869	1,125	4,748	4,853	10,726
	Percent	100%	60%	4%	18%	18%	40%
Bhaktapur	Area	13,301	8,636	692	1,478	2,496	4,665
	Percent	100%	65%	5%	11%	19%	35%
Total		**72,187**	**47,065**	**3,676**	**9,361**	**12,085**	**25,122**
		100%	**65%**	**5%**	**13%**	**17%**	**35%**

Constraint Area and Non-Built up Constraint Free Area - Old and New Municipalities

Districts		Total Area	Constraint Area	Non_Builtup on Constraint Free			
				Red	Yellow	Green	Total
Old Municipality	Area	10,679	8,416	567	452	1,244	2,263
	Percent	100%	79%	5%	4%	12%	21%
New Municipality_1	Area	18,866	12,778	951	2,642	2,495	6,088
	Percent	100%	68%	5%	14%	13%	32%
New Municipality_2	Area	34,882	20,537	1,522	5,454	7,369	14,344
	Percent	100%	59%	4%	16%	21%	41%
VDC	Area	7,761	5,334	636	813	978	2,428
	Percent	100%	69%	8%	10%	13%	31%
Total		**72,187**	**47,065**	**3,676**	**9,361**	**12,085**	**25,122**
		100%	**65%**	**5%**	**13%**	**17%**	**35%**

Ward Level Color Zoning of Municipality/VDC in Kathmandu Valley

Annex - 2(D)

SN	Municipality/VDC	No. of Wards	Ward No.																																		
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1	Anantalingeshwar Municipality	15																																			
2	Bhaktapur Municipality	17																																			
3	Bhardeu VDC	9																																			
4	Budhanilkantha Municipality	17																																			
5	Chandragiri Municipality	23																																			
6	Changunarayan Municipality	16																																			
7	Chapagaun VDC	9																																			
8	Dakshinkali Municipality	15																																			
9	Devichaur VDC	9																																			
10	Ghusel VDC	9																																			
11	Godawari Municipality	12																																			
12	Gokarneshwar Municipality	16																																			
13	Jharuwarasi VDC	9																																			
14	Kageshwori Manohara Municipality	13																																			
15	Karyabinayak Municipality	18																																			
16	Kathmandu Metropolitan	35																																			
17	Kirtipur Municipality	19																																			
18	Lalitpur Sub Metropolitan	30																																			
19	Lele VDC	9																																			
20	Madhyapur Thimi Municipality	17																																			
21	Mahalaxmi Municipality	19																																			
22	Mahamanjushree Nagarkot Municipality	13																																			
23	Nagarjuna Municipality	14																																			
24	Nallu VDC	9																																			
25	Shankharapur Municipality	15																																			
26	Suryabinayak Municipality	14																																			
27	Tarkeshwar Municipality	21																																			
28	Thecho VDC	9																																			
29	Tokha Municipality	15																																			

Population Projection of Kathmandu Valley (Without considering constraints) - 2035

Annex - 3(A)

S.N.	Municipality/VDC	District	Municipal/VDC Type	Area in Ha	Population		Population Growth	Growth Category	Population Density		Population Projection - Estimated				
					2001	2011			2001	2011	2015	2020	2025	2030	2035
1	Anantalingeshwar Municipality	Bhaktapur	New Municipality_1	1,813	24,987	37,989	4.3%	D	14	21	42,682	49,013	55,739	62,771	70,003
2	Bhaktapur Municipality	Bhaktapur	Old Municipality	655	72,543	81,748	1.2%	F	111	125	85,760	90,380	94,309	97,438	99,675
3	Bhardeu VDC	Lalitpur	VDC	783	2,068	2,210	0.7%	F	3	3	2,318	2,443	2,550	2,634	2,695
4	Budhanilkantha Municipality	Kathmandu	New Municipality_1	3,499	46,745	107,918	8.7%	A	13	31	132,202	169,168	214,419	269,191	334,738
5	Chandragiri Municipality	Kathmandu	New Municipality_2	4,391	55,032	85,198	4.5%	D	13	19	95,723	109,923	125,005	140,777	156,996
6	Changunarayan Municipality	Bhaktapur	New Municipality_2	2,791	26,500	32,522	2.1%	E	9	12	35,141	38,428	41,613	44,619	47,373
7	Chapagaun VDC	Lalitpur	VDC	727	12,448	16,420	2.8%	E	17	23	17,742	19,402	21,010	22,528	23,918
8	Dakshinkali Municipality	Kathmandu	New Municipality_2	4,267	22,697	24,297	0.7%	F	5	6	25,489	26,862	28,031	28,960	29,625
9	Devichaur VDC	Lalitpur	VDC	1,252	2,734	2,883	0.5%	F	2	2	3,024	3,187	3,326	3,436	3,515
10	Ghusel VDC	Lalitpur	VDC	1,084	1,589	1,510	-0.5%	G	1	1	1,553	1,597	1,625	1,638	1,638
11	Godawari Municipality	Lalitpur	New Municipality_2	3,473	24,762	28,793	1.5%	E	7	8	31,111	34,022	36,841	39,503	41,941
12	Gokarneshwar Municipality	Kathmandu	New Municipality_2	5,846	57,698	107,351	6.4%	B	10	18	129,025	161,212	199,508	244,545	296,882
13	Jharuwarasi VDC	Lalitpur	VDC	381	3,662	4,286	1.6%	E	10	11	4,631	5,064	5,484	5,880	6,243
14	Kageshwori Manohara Municipality	Kathmandu	New Municipality_1	2,736	32,077	60,237	6.5%	B	12	22	72,399	90,459	111,948	137,220	166,587
15	Karyabinayak Municipality	Lalitpur	New Municipality_2	2,160	25,239	38,036	4.2%	D	12	18	42,735	49,074	55,808	62,849	70,090
16	Kathmandu Metropolitan	Kathmandu	Old Municipality	4,944	671,846	975,453	3.8%	D	136	197	1,095,959	1,258,530	1,431,213	1,611,788	1,797,491
17	Kirtipur Municipality	Kathmandu	Old Municipality	1,476	40,835	65,602	4.9%	C	28	44	76,612	92,339	110,227	130,315	152,579
18	Lalitpur Sub Metropolitan	Lalitpur	Old Municipality	2,493	181,474	254,308	3.4%	D	73	102	285,725	328,108	373,128	420,205	468,619
19	Lele VDC	Lalitpur	VDC	2,407	7,921	8,411	0.6%	F	3	3	8,824	9,299	9,703	10,025	10,255
20	Madhyapur Thimi Municipality	Bhaktapur	Old Municipality	1,111	47,751	83,036	5.7%	C	43	75	96,972	116,879	139,520	164,946	193,128
21	Mahalaxmi Municipality	Lalitpur	New Municipality_1	2,649	35,802	62,172	5.7%	C	14	23	72,606	87,511	104,464	123,501	144,602
22	Mahamanjushree Nagarkot Municipality	Bhaktapur	New Municipality_2	3,504	21,965	22,908	0.4%	F	6	7	24,032	25,327	26,428	27,305	27,932
23	Nagarjuna Municipality	Kathmandu	New Municipality_1	2,984	33,055	67,420	7.4%	B	11	23	81,032	101,246	125,298	153,583	186,452
24	Nallu VDC	Lalitpur	VDC	802	2,165	2,171	0.0%	F	3	3	2,278	2,400	2,505	2,588	2,647
25	Shankharapur Municipality	Kathmandu	New Municipality_2	6,019	24,260	25,338	0.4%	F	4	4	26,581	28,013	29,231	30,201	30,894
26	Suryabinayak Municipality	Bhaktapur	New Municipality_2	2,431	30,757	40,501	2.8%	E	13	17	43,762	47,857	51,822	55,566	58,995
27	Tarkeshwar Municipality	Kathmandu	New Municipality_1	3,494	37,268	81,443	8.1%	A	11	23	99,769	127,667	161,817	203,152	252,618
28	Thecho VDC	Lalitpur	VDC	325	8,020	10,086	2.3%	E	25	31	10,898	11,918	12,905	13,838	14,692
29	Tokha Municipality	Kathmandu	New Municipality_1	1,690	42,308	99,032	8.9%	A	25	59	121,316	155,239	196,764	247,026	307,176
	Total			**72,187**	**1,596,208**	**2,429,279**	**4.3%**	**D**	**22**	**34**	**2,767,904**	**3,242,570**	**3,772,240**	**4,358,030**	**5,000,000**

Districtwise Population Projection (Without considering constraints) - 2035

SN	Districts	Area in Ha	Population		Population Growth	Growth Category	Population Density		Population Projection - Estimated				
			2001	2011			2001	2011	2015	2020	2025	2030	2035
1	Kathmandu	41,346	1,063,821	1,699,289	4.8%	C	26	41	1,956,109	2,320,660	2,733,460	3,196,758	3,712,039
2	Lalitpur	18,537	307,884	431,286	3.4%	D	17	23	483,446	554,027	629,349	708,626	790,855
3	Bhaktapur	12,304	224,503	298,704	2.9%	E	18	24	328,349	367,884	409,431	452,646	497,106
	Total	**72,187**	**1,596,208**	**2,429,279**	**4.3%**	**D**	**22**	**34**	**2,767,904**	**3,242,570**	**3,772,240**	**4,358,030**	**5,000,000**

Municipality/ VDC wise Popualtion Projection (Without considering constraints) - 2035

SN	Municipality/ VDC	Area in Ha	Population		Population Growth	Growth Category	Population Density		Population Projection - Estimated				
			2001	2011			2001	2011	2015	2020	2025	2030	2035
1	Old Municipality	10,679	1,014,449	1,460,147	3.7%	D	95	137	1,641,028	1,886,236	2,148,398	2,424,693	2,711,492
2	New Municipality_1	18,866	252,242	516,211	7.4%	B	13	27	622,007	780,305	970,448	1,196,444	1,462,176
3	New Municipality_2	34,882	288,910	404,944	3.4%	D	8	12	453,600	520,718	594,287	674,326	760,729
4	VDC	7,761	40,607	47,977	1.7%	E	5	6	51,269	55,311	59,108	62,567	65,603
	Total	**72,187**	**1,596,208**	**2,429,279**	**4.3%**	**D**	**22**	**34**	**2,767,904**	**3,242,570**	**3,772,240**	**4,358,030**	**5,000,000**

Population Projection of Kathmandu Valley (Considering constraints) - 2035

Annex - 3(B)

SN	Names - Municipality/ VDC	District	Municipality/ VDC	Area of Color Zone (Ha)			Constraint Free Total	Population by 2035			Additional Population		Total Population	Growth Rate	Density Envisaged	Decadal Density Increase in	Growth Category	Growth Comparison
				RED	YELLOW	GREEN		RED	YELLOW	GREEN	Constraint Free	Contraint Area						
1	Anantalingeshwar Municipality	Bhaktapur	New Municipality_1	104	363	128	595	20,105	34,894	8,228	63,228	10,438	111,655	4.6%	62	2.94	5	Positive
2	Bhaktapur Municipality	Bhaktapur	Old Municipality	23	65	137	224	6,601	9,358	13,161	29,121	21,991	132,859	2.0%	203	1.63	3	Positive
3	Bhardeu VDC	Lalitpur	VDC	111	21	34	166	6,436	617	646	7,699	712	10,621	6.8%	14	4.81	6	Positive
4	Budhanilkantha Municipality	Kathmandu	New Municipality_1	274	194	269	738	52,771	18,688	17,290	88,749	34,841	231,508	3.2%	66	2.15	4	Negative
5	Chandragiri Municipality	Kathmandu	New Municipality_2	179	694	465	1,338	20,669	40,072	17,917	78,657	24,232	188,087	3.4%	43	2.21	4	Stable
6	Changunarayan Municipality	Bhaktapur	New Municipality_2	7	141	1,829	1,976	825	8,126	70,395	79,346	3,883	115,751	5.4%	41	3.56	5	Positive
7	Chapagaun VDC	Lalitpur	VDC	54	89	289	432	3,118	2,566	5,568	11,253	2,725	30,398	2.6%	42	1.85	3	Stable
8	Dakshinkali Municipality	Kathmandu	New Municipality_2	296	681	563	1,541	34,237	39,330	21,678	95,245	6,351	125,893	7.1%	30	5.18	6	Positive
9	Devichaur VDC	Lalitpur	VDC	160	75	-	235	9,224	2,177	-	11,400	958	15,241	7.2%	12	5.29	6	Positive
10	Ghusel VDC	Lalitpur	VDC	63	-	-	63	3,664	-	-	3,664	582	5,756	5.7%	5	3.81	5	Positive
11	Godawari Municipality	Lalitpur	New Municipality_2	253	251	374	878	29,257	14,491	14,396	58,144	8,801	95,738	5.1%	28	3.33	5	Positive
12	Gokarneshwar Municipality	Kathmandu	New Municipality_2	485	564	73	1,122	56,023	32,553	2,809	91,385	35,491	234,227	3.3%	40	2.18	4	Negative
13	Jharuwarasi VDC	Lalitpur	VDC	-	-	324	324	-	-	6,232	6,232	264	10,781	3.9%	28	2.52	4	Positive
14	Kageshwori Manohara Municipality	Kathmandu	New Municipality_1	29	784	526	1,340	5,664	75,496	33,764	114,924	12,575	187,737	4.9%	69	3.12	5	Negative
15	Karyabinayak Municipality	Lalitpur	New Municipality_2	-	345	1,065	1,410	-	19,943	40,995	60,937	5,404	104,377	4.3%	48	2.74	4	Stable
16	Kathmandu Metropolitan	Kathmandu	Old Municipality	250	-	-	250	72,205	-	-	72,205	378,885	1,426,543	1.6%	289	1.46	3	Negative
17	Kirtipur Municipality	Kathmandu	Old Municipality	81	164	324	569	23,495	23,621	31,223	78,340	16,482	160,424	3.8%	109	2.45	4	Negative
18	Lalitpur Sub Metropolitan	Lalitpur	Old Municipality	144	26	758	928	41,654	3,708	72,961	118,322	65,318	437,949	2.3%	176	1.72	3	Negative
19	Lele VDC	Lalitpur	VDC	153	454	74	680	8,815	13,101	1,417	23,333	2,469	34,213	6.0%	14	4.07	6	Positive
20	Madhyapur Thimi Municipality	Bhaktapur	Old Municipality	68	198	24	291	19,729	28,621	2,336	50,687	25,075	158,798	2.7%	143	1.91	3	Negative
21	Mahalaxmi Municipality	Lalitpur	New Municipality_1	68	478	867	1,414	13,101	46,040	55,647	114,788	11,863	188,824	4.7%	71	3.04	5	Stable
22	Mahamanjushree Nagarkot Municipality	Bhaktapur	New Municipality_2	109	289	1,886	2,285	12,629	16,686	72,622	101,937	3,261	128,106	7.4%	37	5.59	6	Positive
23	Nagarjuna Municipality	Kathmandu	New Municipality_1	192	426	467	1,085	37,043	40,966	29,985	107,994	17,550	192,964	4.5%	65	2.86	4	Negative
24	Nallu VDC	Lalitpur	VDC	95	174	-	269	5,464	5,024	-	10,488	591	13,250	7.8%	17	6.10	7	Positive
25	Shankharapur Municipality	Kathmandu	New Municipality_2	94	2,160	876	3,129	10,860	124,707	33,708	169,274	4,977	199,589	9.0%	33	7.88	7	Positive
26	Suryabinayak Municipality	Bhaktapur	New Municipality_2	97	330	238	665	11,227	19,038	9,162	39,428	12,038	91,967	3.5%	38	2.27	4	Positive
27	Tarkeshwar Municipality	Kathmandu	New Municipality_1	163	343	236	742	31,414	33,008	15,140	79,562	26,242	187,247	3.5%	54	2.30	4	Negative
28	Thecho VDC	Lalitpur	VDC	0	-	258	258	9	-	4,966	4,975	853	15,914	1.9%	49	1.58	3	Stable
29	Tokha Municipality	Kathmandu	New Municipality_1	120	53	-	173	23,043	5,144	-	28,187	36,365	163,584	2.1%	97	1.65	3	Negative
	TOTAl			**3,676**	**9,361**	**12,085**	**25,122**	**559,283**	**657,976**	**582,245**	**1,799,505**	**771,216**	**5,000,000**	**3.1%**	**69**	**2.06**	**4**	**Stable**

Note : Growth Band : <=0% =1,>0% to <=1.5%=2,>1.5% to K7<=3% =3, >3% to <=4.5% =4,>4.5% to K7<=6% =5,>6% to<=7.5%,6,>7.5% =7

Population Projection of Kathmandu Valley (Considering constraints) - 2035

Annex - 3(B)

Districtwise Population Distribution (Considering Constraints)

SN	Districts	Area of Color Zone (Ha)			Constraint Free Total	Population by 2035			Additional Population		Total Population	Growth Rate	Density Envisaged	Decadal Density Increase in	Growth Category	Growth Comparison
		RED	YELLOW	GREEN		RED	YELLOW	GREEN	Constraint Free	Contraint Area						
1	Kathmandu	2,165	6,063	3,800	12,028	367,424	433,585	203,514	1,004,523	593,991	3,297,803	2.8%	80	1.94	3	Negative
2	Lalitpur	1,102	1,914	4,042	7,058	120,742	107,667	202,827	431,236	100,540	963,061	3.4%	52	2.23	4	Stable
3	Bhaktapur	409	1,385	4,242	6,037	71,117	116,724	175,905	363,746	76,686	739,136	3.8%	60	2.47	4	Positive
	Total	**3,676**	**9,361**	**12,085**	**25,122**	**559,283**	**657,976**	**582,245**	**1,799,505**	**771,216**	**5,000,000**	**3.1%**	**69**	**2.06**	**4**	**Stable**

Municipality/ VDC wise Population Distribution (Considering Constraints)

SN	Municipality/ VDC	Area of Color Zone (Ha)			Constraint Free Total	Population by 2035			Additional Population		Total Population	Growth Rate	Density Envisaged	Decadal Density Increase in	Growth Category	Growth Comparison
		RED	YELLOW	GREEN		RED	YELLOW	GREEN	Constraint Free	Contraint Area						
1	Old Municipality	567	452	1,244	2,263	163,685	65,309	119,682	348,676	507,751	2,316,573	1.9%	217	1.59	3	Negative
2	New Municipality_1	951	2,642	2,495	6,088	183,142	254,237	160,054	597,433	149,875	1,263,518	3.8%	67	2.45	4	Negative
3	New Municipality_2	1,522	5,454	7,369	14,344	175,726	314,945	283,682	774,353	104,437	1,283,734	4.9%	37	3.17	5	Positive
4	VDC	636	813	978	2,428	36,730	23,486	18,828	79,044	9,153	136,174	4.4%	18	2.84	4	Positive
	Total	**3,676**	**9,361**	**12,085**	**25,122**	**559,283**	**657,976**	**582,245**	**1,799,505**	**771,216**	**5,000,000**	**3.1%**	**69**	**2.06**	**4**	**Stable**

Densification and De-densification of Municipalities

Annex - 3(C)

S.N.	Municipality/VDC	District	Municipal/VDC Type	Population Projection - Estimated					Pop as per Constraints	Densify or De-densify	Additional Population	Annual Addition
				2015	2020	2025	2030	2035				
1	Anantalingeshwar Municipality	Bhaktapur	New Municipality_1	42,682	49,013	55,739	62,771	70,003	111,655	41,652	73,666	3,069
2	Bhaktapur Municipality	Bhaktapur	Old Municipality	85,760	90,380	94,309	97,438	99,675	132,859	33,184	51,111	2,130
3	Bhardeu VDC	Lalitpur	VDC	2,318	2,443	2,550	2,634	2,695	10,621	7,926	8,411	350
4	Budhanilkantha Municipality	Kathmandu	New Municipality_1	132,202	169,168	214,419	269,191	334,738	231,508	(103,230)	123,590	5,150
5	Chandragiri Municipality	Kathmandu	New Municipality_2	95,723	109,923	125,005	140,777	156,996	188,087	31,090	102,889	4,287
6	Changunarayan Municipality	Bhaktapur	New Municipality_2	35,141	38,428	41,613	44,619	47,373	115,751	68,378	83,229	3,468
7	Chapagaun VDC	Lalitpur	VDC	17,742	19,402	21,010	22,528	23,918	30,398	6,480	13,978	582
8	Dakshinkali Municipality	Kathmandu	New Municipality_2	25,489	26,862	28,031	28,960	29,625	125,893	96,268	101,596	4,233
9	Devichaur VDC	Lalitpur	VDC	3,024	3,187	3,326	3,436	3,515	15,241	11,726	12,358	515
10	Ghusel VDC	Lalitpur	VDC	1,553	1,597	1,625	1,638	1,638	5,756	4,118	4,246	177
11	Godawari Municipality	Lalitpur	New Municipality_2	31,111	34,022	36,841	39,503	41,941	95,738	53,797	66,945	2,789
12	Gokarneshwar Municipality	Kathmandu	New Municipality_2	129,025	161,212	199,508	244,545	296,882	234,227	(62,655)	126,876	5,286
13	Jharuwarasi VDC	Lalitpur	VDC	4,631	5,064	5,484	5,880	6,243	10,781	4,538	6,495	271
14	Kageshwori Manohara Municipality	Kathmandu	New Municipality_1	72,399	90,459	111,948	137,220	166,587	187,737	21,150	127,500	5,312
15	Karyabinayak Municipality	Lalitpur	New Municipality_2	42,735	49,074	55,808	62,849	70,090	104,377	34,287	66,341	2,764
16	Kathmandu Metropolitan	Kathmandu	Old Municipality	1,095,959	1,258,530	1,431,213	1,611,788	1,797,491	1,426,543	(370,948)	451,090	18,795
17	Kirtipur Municipality	Kathmandu	Old Municipality	76,612	92,339	110,227	130,315	152,579	160,424	7,845	94,822	3,951
18	Lalitpur Sub Metropolitan	Lalitpur	Old Municipality	285,725	328,108	373,128	420,205	468,619	437,949	(30,671)	183,641	7,652
19	Lele VDC	Lalitpur	VDC	8,824	9,299	9,703	10,025	10,255	34,213	23,958	25,802	1,075
20	Madhyapur Thimi Municipality	Bhaktapur	Old Municipality	96,972	116,879	139,520	164,946	193,128	158,798	(34,329)	75,762	3,157
21	Mahalaxmi Municipality	Lalitpur	New Municipality_1	72,606	87,511	104,464	123,501	144,602	188,824	44,222	126,652	5,277
22	Mahamanjushree Nagarkot Municipality	Bhaktapur	New Municipality_2	24,032	25,327	26,428	27,305	27,932	128,106	100,174	105,198	4,383
23	Nagarjuna Municipality	Kathmandu	New Municipality_1	81,032	101,246	125,298	153,583	186,452	192,964	6,512	125,544	5,231
24	Nallu VDC	Lalitpur	VDC	2,278	2,400	2,505	2,588	2,647	13,250	10,603	11,079	462
25	Shankharapur Municipality	Kathmandu	New Municipality_2	26,581	28,013	29,231	30,201	30,894	199,589	168,695	174,251	7,260
26	Suryabinayak Municipality	Bhaktapur	New Municipality_2	43,762	47,857	51,822	55,566	58,995	91,967	32,971	51,466	2,144
27	Tarkeshwar Municipality	Kathmandu	New Municipality_1	99,769	127,667	161,817	203,152	252,618	187,247	(65,371)	105,804	4,409
28	Thecho VDC	Lalitpur	VDC	10,898	11,918	12,905	13,838	14,692	15,914	1,222	5,828	243
29	Tokha Municipality	Kathmandu	New Municipality_1	121,316	155,239	196,764	247,026	307,176	163,584	(143,592)	64,552	2,690
	Total			**2,767,904**	**3,242,570**	**3,772,240**	**4,358,030**	**5,000,000**	**5,000,000**	**(0)**	**2,570,721**	**107,113**

Densification and De-densification of Municipalities

Annex - 3(C)

Districtwise Densification & De-densification

SN	Districts	Population Projection - Estimated					Pop as per Constraints	Densify or De-densify	Additional Population	Annual Add Population
		2015	2020	2025	2030	2035				
1	Kathmandu	1,956,109	2,320,660	2,733,460	3,196,758	3,712,039	3,297,803	(414,236)	1,598,514	66,605
2	Lalitpur	483,446	554,027	629,349	708,626	790,855	963,061	172,206	531,775	22,157
3	Bhaktapur	328,349	367,884	409,431	452,646	497,106	739,136	242,030	440,432	18,351
	Total	**2,767,904**	**3,242,570**	**3,772,240**	**4,358,030**	**5,000,000**	**5,000,000**	**(0)**	**2,570,721**	**107,113**

Municipality/ VDC wise Densification & De-densification

SN	Municipality/VDC	Population Projection - Estimated					Pop as per Constraints	Densify or De-densify	Additional Population	Annual Add Population
		2015	2020	2025	2030	2035				
1	Old Municipality	1,641,028	1,886,236	2,148,398	2,424,693	2,711,492	2,316,573	(394,919)	856,426	35,684
2	New Municipality_1	622,007	780,305	970,448	1,196,444	1,462,176	1,263,518	(198,658)	747,307	31,138
3	New Municipality_2	453,600	520,718	594,287	674,326	760,729	1,283,734	523,006	878,790	36,616
4	VDC	51,269	55,311	59,108	62,567	65,603	136,174	70,571	88,197	3,675
	Total	**2,767,904**	**3,242,570**	**3,772,240**	**4,358,030**	**5,000,000**	**5,000,000**	**(0)**	**2,570,721**	**107,113**

Requirement of Space for Residence in Different Color Zones

Annex - 4

	Basis	Old Municipality			New Municipality_1			New Municipality_2			VDC		
		RED	YELLOW	GREEN	RED	YELLOW	GREEN	RED	YELLOW	GREEN	RED	YELLOW	GREEN
Density	ppha	289	144	96	192	96	64	115	58	38	58	29	19
Population to be accommodated	persons	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Family Size	persons	5	5	5	4	4	4	4	4	4	5	5	5
Household	nos	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Total Area Required	ha	35	69	104	52	104	156	87	173	260	173	346	520
	Ropani	680	1,361	2,041	1,021	2,041	3,062	1,701	3,402	5,103	3,402	6,804	10,207
Road Networks	%	15%	18%	21%	18%	21%	24%	18%	21%	24%	15%	18%	21%
Open Space	%	2%	3%	4%	3%	4%	5%	3%	4%	5%	3%	4%	5%
Agricultural Land	%	10%	15%	20%	15%	20%	25%	20%	25%	30%	10%	15%	20%
Utilities	%	3%	5%	7%	5%	7%	9%	5%	7%	9%	3%	5%	7%
Commercial Facilities	%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Social Facilities	%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Requirement other than residential	*%*	*45%*	*56%*	*67%*	*56%*	*67%*	*78%*	*61%*	*72%*	*83%*	*46%*	*57%*	*68%*
Road Networks & Utilities	ha	5.20	12.47	21.82	9.35	21.82	37.40	15.59	36.37	62.34	25.98	62.34	109.10
Open Space	ha	0.69	2.08	4.16	1.56	4.16	7.79	2.60	6.93	12.99	5.20	13.85	25.98
Agricultural Land	ha	3.46	10.39	20.78	7.79	20.78	38.96	17.32	43.29	77.93	17.32	51.95	103.90
Utilities	ha	1.04	3.46	7.27	2.60	7.27	14.03	4.33	12.12	23.38	5.20	17.32	36.37
Commercial Facilities	ha	3.46	6.93	10.39	5.20	10.39	15.59	8.66	17.32	25.98	17.32	34.63	51.95
Social Facilities	ha	1.73	3.46	5.20	2.60	5.20	7.79	4.33	8.66	12.99	8.66	17.32	25.98
Area other than Residential	*ha*	*15.59*	*38.79*	*69.61*	*29.09*	*69.61*	*121.57*	*52.82*	*124.68*	*215.60*	*79.66*	*197.41*	*353.27*
Land Available for Residential Use	ha	19.05	30.48	34.29	22.86	34.29	34.29	33.77	48.49	44.16	93.51	148.93	166.24
Area for One Household	Sqm	95.24	152.39	171.44	114.29	171.44	171.44	168.84	242.44	220.79	467.56	744.64	831.22
	Aana	3.0	4.8	5.4	3.6	5.4	5.4	5.3	7.6	6.9	14.7	23.4	26.1
Minimum Plot Size	Aana	**4**			**6**			**6**			**16**		

1 aana = 31.81