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CDMP

City Disaster Management Plan

Shimla

Shimla Municipal Corporation

CDMP

City Disaster Management Plan

Shimla

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PREFACE

Disaster Risk Governance is integral to the urban development, especially the ones located in the high-risk regions of the world. Being located in a geo-physically vulnerable area known for its unique climatic conditions, Shimla city is one of the major urban settlements located in the mountainous region of India. As the capital of Himachal Pradesh, proper functioning of the systems and services in the city is vital to the safety and well-being of everyone in the state. Recent disasters in the Himalayan region are enough to highlight the need to strengthen disaster risk management at all levels, including the urban local bodies. The Municipal Corporation Shimla recognizes the need, significance and urgency of developing its capacities for disaster risk management and aims to make the risk-informed development of the city a priority.

The Disaster Management Act 2005 mandates the local authorities to ensure proper training of the officers for disaster management, effective management of much-needed resources to deal with disaster situation and adherence to the prescribed standards and specifications for safe construction. Besides this, the Act also entrusts the local bodies with the functions related to relief, rehabilitation and reconstruction activities in accordance with the State Disaster Management Plan and the District Disaster Management Plan. According the Disaster Management Act 2005, every local authority is required to prepare its disaster management plan in the supervision of the District Disaster Management Authority (DDMA). The first Disaster Management Plan of Shimla city was drafted by the Municipal Corporation Shimla in the year 2012. The plan was further reviewed and updated first in 2016 and then in 2019.

I am pleased to note that under the USAID-GoI-UNDP project titled 'Enhancing Institutional and Community Resilience to Disasters and Climate Change', the Municipal Corporation Shimla has revised the City Disaster Management Plan (CDMP) to make it more user-friendly and purposeful for all stakeholders. I believe that the Municipal Corporation Shimla will keep the CDMP updated regularly and will ensure that the information given in the plan is used for improving the disaster preparedness at the city-level. I thank Additional Commissioner, MC Shimla Shri Ajit Bhardwaj for supervising the work related to the updation of the CDMP; Dr. Harkanchan Singh, City Project Coordinator- UNDP India for coordinating the updation process; and the consultant (Doers) for producing a transformed version of the CDMP in a very professional manner. In the end, I would like to stress upon the need to integrate risk-centric planning into day-to-day functioning of the Municipal Corporation Shimla with these words of caution that "failing to plan means planning to fail". I hope that the CDMP (2021) will guide all the concerned stakeholders to strengthen institutional planning and preparedness for disasters.

Ashish Kohli
Commissioner
Municipal Corporation Shimla

FOREWORD

I am delighted to note that the City Disaster Management Plan (CDMP) Shimla has been updated after incorporating some very important aspects of disaster risk management in Shimla city. Ever since the CDMP was prepared for the first time in 2012, the need to make it more risk-informed was always felt. As the Municipal Corporation Shimla received the final report of the Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City in 2016, it became imminent that the MC Shimla will plan for a risk-informed development by incorporating the findings of HRVA in the CDMP. Some of the findings from the HRVA were included in the CDMP in the year 2019 which made the plan more useful for the stakeholders. However, it was realized that the contents of the plan was not very well structured and more efforts were required to make it more user-friendly. Finally, with the support of UNDP India, the MC Shimla initiated the overhauling of the CDMP which has been carried out by Doers- an experienced organization in the field of disaster risk management. This assignment was undertaken under the USAID-GoI-UNDP project titled 'Enhancing Institutional and Community Resilience to Disasters and Climate Change' implemented at Shimla city.

The structure of the CDMP is in line with the SDMP and DDMP while highlighting some of the measures which can build disaster resilience in the city. The CDMP (2021) includes a set of risk reduction measures in accordance with the Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City (2016). The guidelines and protocols related to COVID-19 have also been incorporated in this version of the CDMP. As the CDMP now covers all the key sets of information for disaster risk management at the city-level, I am confident that all concerned stakeholders will utilize the information incorporated in the plan for effective disaster risk management. I express my gratitude to all the line departments which provided the much-needed information in this process and the team of fellows and interns who contributed to the data collection related tasks. I also congratulate Dr. Harkanchan Singh, City Project Coordinator- UNDP India for her painstaking efforts in coordinating the processes related to the updation of CDMP. The responsibility to periodically update the CDMP will be there at the core of the DM interventions in the city and I believe the officers of the MC Shimla will leave no stone unturned in keeping the CDMP up-to-date and relevant to the contemporary situations and context.

Ajit Bhardwaj
Additional Commissioner
Municipal Corporation Shimla

ACKNOWLEDGEMENTS

It has been a great experience for us all to come up with a newly-designed and significantly updated version of the City Disaster Management Plan (CDMP) Shimla (Himachal Pradesh). As the consultant for this assignment, 'Doers' expresses its sincere gratitude to Shri Ashish Kohli, Commissioner, Municipal Corporation Shimla and Shri Ajit Bhardwaj, Additional Commissioner, Municipal Corporation Shimla for their guidance, valuable insights and sustained support during this process.

We are grateful for the significant contribution provided by the departments in Municipal Corporation i.e. Architect Planner, Roads & Buildings, Water Supply & Sewerage, City Disaster Management cell and Shimla Jal Prabandhan Nigam Limited (SJPNL) along with all the key informants/stakeholders who were involved in this assignment despite the multi-faceted challenges posed by the COVID-19 pandemic.

We also thank the Department of Urban Development; District Disaster Management Authority, Shimla; Department of Town and Country Planning, Department of Economics and Statistics and Himachal Pradesh Fire Services for providing timely information and support. The process also involved consultation meetings (online as well as in-person) with various departments and organizations in the Shimla city. The team would like to thank all the stakeholders who attended the consultation meeting.

We offer our special thanks to Dr. Harkanchan Singh, City Project Coordinator, UNDP India for her valuable support in coordinating the relevant activities, facilitating the data collection as well as in organizing the meetings with key stakeholders.

Special Mention: This assignment was carried out as a consultancy contract awarded to 'Doers' by the Municipal Corporation Shimla under the USAID-GoI-UNDP project titled 'Enhancing Institutional and Community Resilience to Disasters and Climate Change'.

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December 2021

ACRONYMS

AC Additional Commissioner

ASHA Accredited Social Health Activist

APA Architect Planner

BUARE Building Urban Actions for Resilience in Emergencies

CASA Church's Auxiliary for Social Action

CBSE Central Board of Secondary Education

CDMP City Disaster Management Plan

CEOC City Emergency Operation Centre

CERT community emergency response team

CHO Corporation Health Officer

DCH Duck – Cover – Hold

DDMP District Disaster Management Plan

DEOC District Emergency Operation Centre

DDP District Domestic Product

DRR Disaster Risk Reduction

DDMA District Disaster Management Authority

EIC Emergency Information Centre

EOC Emergency Operation Centre

EMS Emergency Medical Services

ESF Emergency Support Function

FDMP Fire Disaster Management Plan

GSI Geological Survey of India

HRVA Hazard Risk Vulnerability Analysis

HPU Himachal Pradesh University

HPSDMA Himachal Pradesh State Disaster Management Authority

HPU Himachal Pradesh University

HPUCES Himachal Pradesh University Centre for Evening Studies

HRTC Himachal Pradesh Road Transport Corporation

HIMUDA Himachal Pradesh Housing and Urban Development Authority

IMD India Meteorological Department

IRS Incident Response System

ICSE Indian Certificate of Secondary Education

ICT Information and Communication Technology

IGMCH Indira Gandhi Medical College & Hospital

IIAS Indian Institute of Advanced Study

IMD India Meteorological Department

IAG Inter-Agency Group

JNNURM Jawaharlal Nehru National Urban Renewal Mission

JC Joint Commissioner

LPG Liquefied Petroleum Gas

MBF Main Boundary Fault

MCT Main Central Thrust

MAH Major Accident Hazard

MOEFA Manually Operated Electronic Fire Alarm

MM Modified Mercalli

NBC National Building Code

NDMA National Disaster Management Authority

NDRF National Disaster Response Force

NIMHANS National Institute of Mental Health and Neurosciences

NPDM National Policy on Disaster Management

NERT Neighborhood Emergency Response Team

PRIs Panchayati Raj Institutions

PGA Peak Ground Acceleration

PwD People with Disability

PPP Public Private Partnership

RKMV Rajkiya Kanya Mahavidyalaya

RVS Rapid Visual Screening

SAR Search and Rescue

SDRF State Disaster Response Force

SJPNL Shimla Jal Prabandhan Nigam Limited

SPA Shimla Planning Area

STP Sewage Treatment Plan

SADAs Special Area Development Authorities

SCERT State Council of Education Research and Training

SEOC State Emergency Operation Centre

SOPs Standard Operating Procedures

SDGs Sustainable Development Goals

TCP Town and Country Planning Department

UNDP United Nations Development Programme

UNESCO United Nations Educational, Scientific and Cultural Organization

UNDRR United Nations Office for Disaster Risk Reduction

UNOSSC United Nations Office for South-South Cooperation

ULBs Urban Local Bodies

1 Introduction

Background to the City Disaster Management Plan (CDMP), Shimla

Disasters can have a life-altering impact on the individuals and the families fortunate enough to survive them. But the effect of natural disasters can be felt at the community, city and state level, or at many times can impact an entire country. Disasters can have huge environmental impacts as well, even when human communities are relatively unaffected. How well the impact of a disaster event is absorbed has much to do with the intensity of the impact and the level of preparedness and resilience of the subject impacted. Disaster Management thus requires a multi-disciplinary and proactive approach.

The Section 32 (a) of Chapter IV District Disaster Management Authority in Disaster Management Act 2005 calls for the preparation of Disaster Management Plan by the local authority subject to the supervision of the District Authority. Also in accordance with the Section 32 (b) the coordination of the preparation and implementation of the plan with those of the other organizations at the district level including local authority, communities and other stakeholders. Thus, as per the Section 32 of the DM Act, every office of the Government of India and of the State Government at the district level and the local authorities shall prepare comprehensive DM plans detailing how each of them will contribute to the national efforts in the domains of disaster prevention, mitigation of risks, preparedness, response, and recovery.

The Section 41 of Chapter VI of Local Authorities defines the functions of the local authority clearly under the guidance of the District Authority. In adherence with the DM Act, 2005, CDMP plan was proposed by the Municipal Corporation in the 2012. Several updations and reviews were made in 2016. The final draft of the plan was ready by 2019. The final review of the plan is to be done after the inclusion of COVID-19 guidelines and protocols.

1.1 Objective of the Plan

The shift of focus from Relief Centric to Response centric approach in Disaster Management requires a more pro-active, holistic and integrated plan. The City Disaster Management Plan (CDMP) is desired to serve as a guiding document that would facilitate the City Administration and concerned stakeholders for preparedness, planning and prevention related aspects of disasters, along with relief, rehabilitation and reconstruction at the Urban Level.

The main objectives of the plan are:

(i) To have a strong preparedness focus which aims at reducing our vulnerability to disasters and to plan the action/response mechanism for dealing with earthquakes, floods, epidemics, industrial and chemical accidents, road accidents and fires.

(ii) To mitigate impact of natural and man-made disasters through preparedness at City and Urban Ward level.

(iii) To ensure the participation of and coordination with the Administration, NGOs, Communities, Volunteers in each aspect of the plan.

(iv) To prepare multiple disaster scenarios for the city with an objective to simulate the preparedness and response at the level of Shimla Municipal Corporation.

(v) The plan mainly focuses on inclusion of Disaster Risk Reduction (DRR) strategies like Prime Minister's 10-point Agenda, Sendai Framework for DRR (2015-2030) and the Sustainable Development Goals (SDGs).

(vi) To create awareness among the people about hazard occurrence and increase their participation in preparedness, prevention, development, relief, rehabilitation and reconstruction process.

(vii) To develop the capacities of stakeholders on different aspects of urban resilience and multi-hazard disaster risk management in the city.

1.2 Review and Updation of the Plan

The City Disaster Management Plan (CDMP) 2020 is updated with the inclusion of strategies and guidelines for the COVID-19 pandemic issued by the Ministry of Health & Family Welfare, Government of India, National Disaster Management Authority (NDMA) and the Himachal Pradesh State Disaster Management Authority (HPSDMA). It also incorporates the relevant provisions of latest versions of the National Disaster Management Plan, State Disaster Management Plan, Shimla District Disaster Management Plan, Guidelines related to COVID-19 pandemic, United Nations Sustainable Development Goals (SDGs) and the Prime Minister's Ten-point Agenda for Disaster Risk Reduction. Besides this, the CDMP also contains strategic guidance on resource generation for DRR.

Regularly updating the CDMP is a very important steps that helps in aligning the preparedness and response measures with the existing and changing realities. The plan is to be reviewed annually and all the information is required to be updated in the supervision of the Assistant Commissioner, Disaster Management Cell, Municipal Corporation, Shimla. Some of the key points to be considered for updating the CDMP are-

Tentative Time frame for the updation: Every year between 15 November and 15 December.

Coordinated by: City Project Coordinator, UNDP India

Essential Items to be reviewed and updated: Demographic details related to the city, Ward-level maps with other important attributes; Contact Details of the Office Bearers and the field-staff of the MC Shimla; important Standard Operating Procedures (SOPs) defined by the HPSDMA or other competent authorities and contemporary guidelines to deal with different types of hazards.

Profile of the City

1.3 Location of the City

Shimla is a beautiful hill station in the middle range of Himalayas. In the year 1864, Shimla was declared as the summer capital of the British Raj in India. From 1947 to 1953, it was the headquarters of Punjab state, until the new capital city of Chandigarh was completed. A popular tourist destination, Shimla is often referred to as the "Queen of Hills," a term coined by the British. Located in the north-west Himalayas at an average altitude of 2,205 metres (7,234 ft) above the sea level and lies between 31°4' to 31°10' North and 77°5' to 77°15' East. The total area under the Shimla Municipal Corporation is 35.34 Sq. Km. (Census of India, 2011). Of the total area of 9950 hectares of Shimla Planning Area, about 1475 hectares which accounts for 15% of the total SPA, is under urban use (Rapid Baseline Assessment Shimla City, October 2013).

1.4 Administrative Division

In its 160 years old history, the Municipal Corporation, Shimla came into an autonomous existence with the passing of the Himachal Pradesh Municipal Corporation Act, 1994 and a revised delimitation of wards into 21. With 5 retention policies, the city had 25 wards till 2017. However, in mid-2018 some of the wards have been re-framed and some new have been added into the Municipal Corporation jurisdiction, making the total number of wards to 34 (Annexure 09). Apart from the MC area, the city also has three areas which come under the Special Area Development Authorities (SADAs). The total number of households in Municipal Corporation, Shimla is 46,306 and total population is 169578 (Census 2011), out of which, 93,152 are males and 76,426 are females. The Sex Ratio is 756 females per 1000 males.

Table 1 : Municipal Corporation, Shimla - Wards Names & Numbers

Ward No.	Ward Name	Ward No.	Ward Name
1	Bharari	18	Engine Ghar
2	Ruldu Bhatta	19	Sanjauli Chowk
3	Kaithu	20	Upper Dhalli
4	Annadale	21	Lower Dhalli
5	Summer Hill	22	Shanti Vihar
6	Totu	23	Bhattakufar
7	Majath	24	Sangti
8	Boileauganj	25	Malyana
9	Kachhi Ghati	26	Panthaghati
10	Tutikandi	27	Kasumpti
11	Nabha	28	Chotta Shimla
12	Phagli	29	Vikas Nagar
13	Krishna Nagar	30	Kangna Dhar
14	Rambazar	31	Pateog
15	Lower Bazar	32	New Shimla
16	Jakhoo	33	Khalini
17	Benmore	34	Kanlog

Planning area: The 9950 Hectares of total area as taken into account for revision and formulation of Development Plan, includes, Municipal Corporation, Shimla, Special Area Development Authorities of Kufri, Shoghi and Ghanahatti Special Area which is as under:

Table 2 : Settlements falling within Planning Area

Settlement	Area in Hectare	Percentage
M.C. Shimla	2207	22.18
S.A. Ghanahatti	1647	16.55
S.A. Kufri	3173	31.89
S.A. Shoghi	2923	29.38
Total	**9950**	**100**

Source: Rapid Baseline Assessment Shimla City, October 2013

1.4.1 Administrative Set-up in Shimla City

Shimla city has a rather small administrative set-up which is led by the top elected representatives of the Municipal Corporation Shimla. The Office of the Mayor and Deputy Mayor is located at the Town Hall, Shimla whereas the Commissioner and other key officers of MC Shimla have their offices near the Collectorate (Office of the Deputy Commissioner, Shimla). The administrative set-up of the Municipal Corporation, Shimla has been shown below for a better understanding of the hierarchal order in the city.

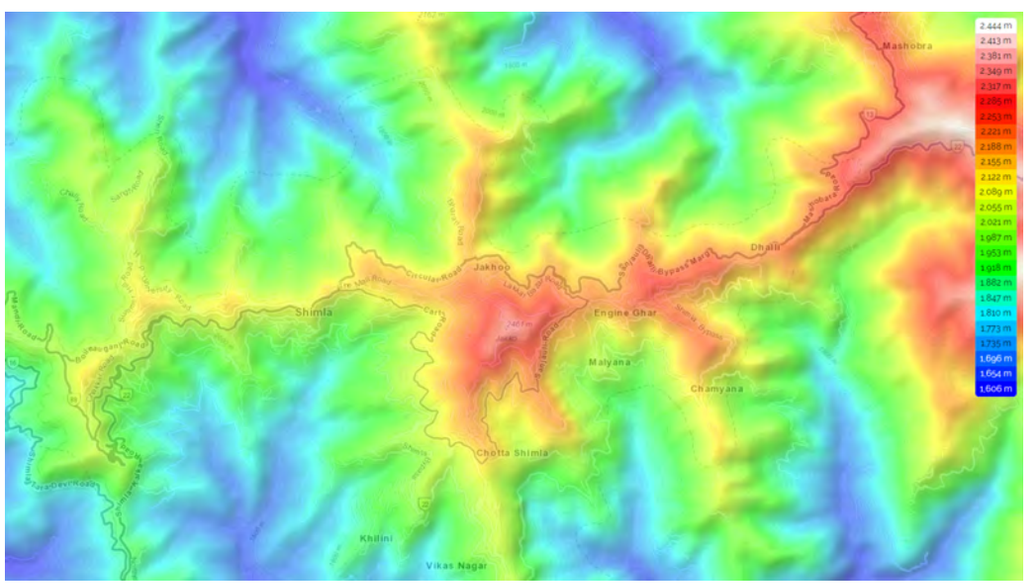
1. **Mayor**
2. **Deputy Mayor**
3. **Commissioner**
4. **MD-cum-CEO SJPNL**
5. **Additional Commissioner/ Joint Commissioner (ADC/JC)**
6. **Additional Commissioner (Legal)**
7. **Executive Engineer –cum- Project Director (PD)**
8. **Architect Planner (AP)**
9. **Corporation Health Officer (CHO)**
10. **Veterinary Public Health Officer (VPHO)**
11. **Executive Engineer, Road and Building (R&B)**
12. **Deputy Controller, Finance and Accounts (F&A)**
13. **Additional General Manager, Water SJPNL (AGM SJPNL Water)**
14. **Additional General Manager, Sewerage SJPNL (AGM SJPNL Sewerage)**

Town Hall, Shimla

1.5 Physical Features

1.5.1 Topography

Approximately 35.34 square kilometres (2019) of the city area does spread over the previous seven hill spurs. The average elevation of these spurs varies from 2073 m to 2454 m from the mean sea level (Picture: Elevation Profile of Shimla City). Jakhoo Hill is the most elevated spur of Shimla. These spurs are inter-connected by roads. The important character of the road network circumscribing these hills is that it is connected to the Mall Road from Boileauganj to Chhota Shimla.



Elevation Profile of Shimla City

Table 3 : Hill Spurs & their Mean Elevation

Hill Spur	Elevation (Mts.)
Jakhu Hill	2454
Elysium Hill	2257
Museum Hill	2201
Prospect Hill	2177
Observatory Hill	2150
Summer Hill	2104
Potters Hill	2073

1.5.2 Soil Type

The soil type of Shimla is mainly grey wooded or podzolic soils.

1.5.3 Existing Land Use Plan

Of the total area of 9950 hectares of Shimla Planning Area (SPA), about 1475 hectares which accounts for 15% of the total SPA is under urban use. The existing land use of urban area is given in Table 4.

The current land use plan of Shimla reflects that there is hardly any open space available in the city. For better response to any emergency situation open spaces help to prevent, organizing community shelters, organizing health and rationing camps, etc. In congested geographical location it is difficult to provide efficient response in any emergency situation.

Table 4 : Land use pattern of Urban and SPA

S. #	Land Use	Area (In Hectare)	% of Urban Area	% of Planning Area
1.	Residential	903.13	61.19	9.07
2.	Commercial	25.22	1.71	0.25
3.	Industrial	9.00	0.62	0.09
4.	Tourism	21.70	1.47	0.22
5.	Public & Semi-Public	138.78	9.40	1.39
6.	Parks & Open Spaces	6.00	0.41	0.06
7.	Traffic and Transportation	371.93	25.20	3.75
8.	**Sub Total**	**1475.76**	**100.00**	
9.	Agriculture	2174.75		21.85
10.	Forest	6080.15		61.12
11.	Water Bodies & Undevelopable Land	219.34		2.20
	Grand Total	**9950.00**		**100.00**

Source: City Development Plan of Shimla

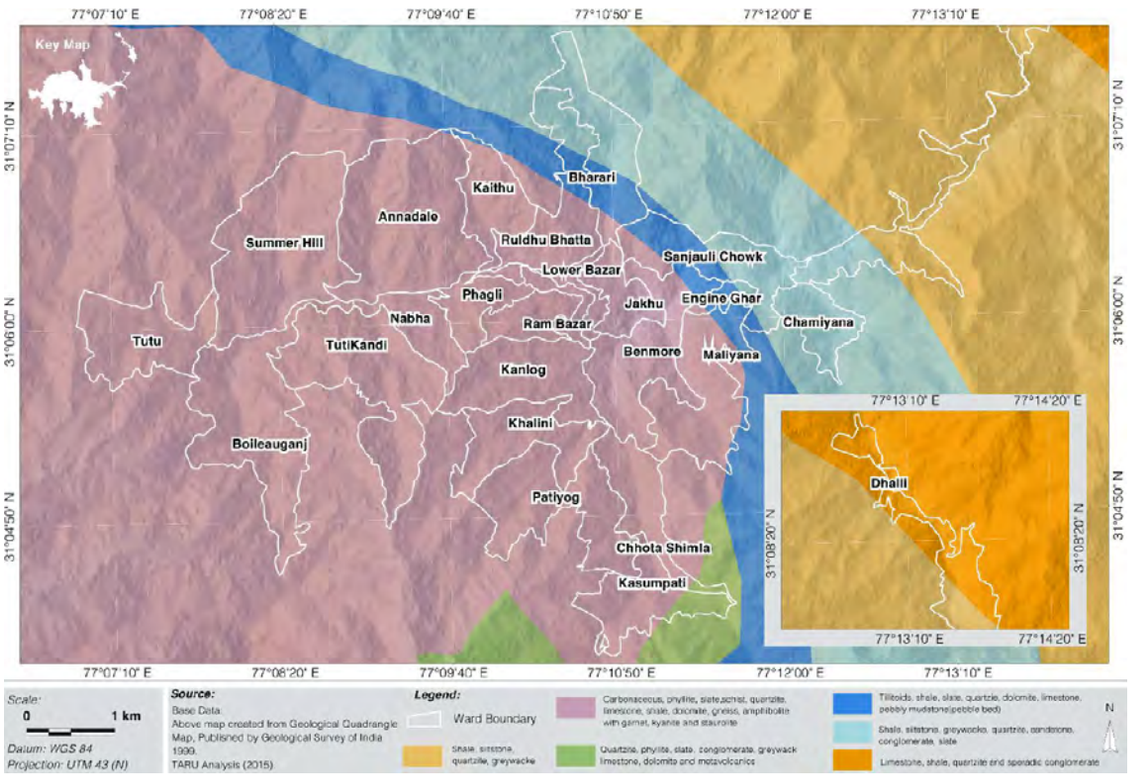
1.6 Geology and Geomorphology

In Shimla, the sediment eroded from the Himalayas 30 million years ago and deposited by ancient rivers. The town is situated on the rocks of Jutogh Group and Shimla Group. Jutogh group occupies main Shimla area and extends from Annadale-Chaura Maidan-Prospect Hill-Jakhoo-US Club and highland area.

Shimla Group comprising of earlier Chail Formation and Shimla Series represented by shale, slate, quartzite greywacke and local conglomerate is well exposed in Sanjauli-Dhalli area. The City is situated at the traverse spur of the Central Himalayas, south of the river Satluj at 31°4' to 31°10' North and 77°5' to 77°15' East at an average altitude of 2,205 metres (7,234 ft) above the sea level.

In shape, it has been described as an irregular crescent. It is 88 kilometres from Kalka having "exquisite" scenery. It is spread over an area of 9950 Hectares along with its commanding position. It has a panoramic view and scenic beauty all around. The city is a unique combination of hills, spurs and valleys. To the north and east, a network of mountain ranges which are crossed at a distance by magnificent crescent of new peaks, the mountains of Kullu & Spiti in the North, the central range of the eastern Himalayas stretching East and South-east. The East-West axis have emerged major axis of development for the city.

Map 1 : Geological Map Showing Soil Formations of Shimla City



Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City

1.7 Climate and Rainfall

Shimla in general has a mild highland climate, with temperature in peak winters, falling below 0°C. Shimla features a subtropical highland climate under the Koppen climate classification. The climate in Shimla is predominantly cool during winters and moderately warm during summers. The temperatures range from -4°C (24.8°F) to 31°C (87.8°F) over the year. The average temperature during summer is between 19°C and 28°C and between -1°C and 10°C in winter. Monthly precipitation varies between 24 mm. in November to 415 mm. in July. It is typically around 45 mm. per month during winter and spring and around 115 mm. in June as the monsoon approaches. The average total annual precipitation is 1520 mm (62 inches). Snowfall in the region, which historically has taken place in the month of December, has lately (over the last fifteen years) been happening in January or early February every year.

Table 5 : Climate Data for Shimla City

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °C (°F)	21.4 (70.5)	22.6 (72.7)	25.8 (78.4)	29.6 (85.3)	32.4 (90.3)	31.5 (88.7)	28.9 (84.0)	27.8 (82.0)	28.6 (83.5)	25.6 (78.1)	23.5 (74.3)	20.5 (68.9)	32.4 (90.3)
Average high °C (°F)	10.9 (51.6)	11.9 (53.4)	15.8 (60.4)	20.5 (68.9)	24.1 (75.4)	24.8 (76.6)	22.6 (72.7)	22.0 (71.6)	22.1 (71.8)	20.3 (68.5)	16.7 (62.1)	13.5 (56.3)	18.8 (65.8)
Average low °C (°F)	2.8 (37.0)	3.7 (38.7)	7.0 (44.6)	11.4 (52.5)	14.6 (58.3)	16.2 (61.2)	15.9 (60.6)	15.5 (59.9)	14.1 (57.4)	11.1 (52.0)	7.8 (46.0)	5.1 (41.2)	10.4 (50.7)
Record low °C (°F)	−10.6 (12.9)	−8.5 (16.7)	−6.1 (21.0)	−1.3 (29.7)	1.4 (34.5)	7.8 (46.0)	9.4 (48.9)	10.6 (51.1)	5.0 (41.0)	0.2 (32.4)	−1.1 (30.0)	−12.2 (10.0)	−12.2 (10.0)
Average rainfall mm (inches)	66.4 (2.61)	75.3 (2.96)	81.2 (3.20)	60.8 (2.39)	90.3 (3.56)	181.9 (7.16)	329.8 (12.98)	320.4 (12.61)	142.3 (5.60)	36.7 (1.44)	18.4 (0.72)	24.2 (0.95)	1,427.7 (56.21)
Average snowfall cm (inches)	42 (17)	43 (17)	7 (2.8)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	7 (2.8)	99 (39.6)
Average rainy days	4.2	5.6	6.1	4.8	7.0	9.6	17.0	15.7	8.2	2.3	1.3	2.0	83.7
Average snowy days	4.2	4.2	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.3	11.2
Average relative humidity (%) (at 17:30 IST)	67	65	57	47	48	62	85	88	79	63	61	60	65

Source: India Meteorological Department (IMD)

1.8 Socio-Economic Features

Employment is largely driven by the government and tourism. Being the administrative capital of the state of Himachal Pradesh, the city houses several central and state government offices. Government jobs account for almost half (47%) of the working population. Direct hospitality industry personnel such as tour guides, hotel and restaurant employees, etc., are few (10%).

Individual crafts and small-scale industries, such as tourist souvenir production and horticultural produce processing, comprise most of the remainder. In addition to being the local hub of transportation and trade, Shimla is the area's healthcare centre, hosting a medical college and four major hospitals: the Indira Gandhi Hospital (formerly known as Snowdon Hospital) Deen Dayal Upadhyay Hospital (formerly called Ripon Hospital,) Kamala Nehru Hospital, and Indus Hospital. The city's development plan aims to make Shimla an attractive health tourism spot. The unemployment rate in the city has come down from 36% in 1992 to 22.6% in 2006. This drop is attributed to recent industrialization, the growth of service industries, and knowledge development.

Indira Gandhi Medical College & Hospital (IGMCH), Shimla

1.9 Demographic Features

Shimla city consists of the Shimla Municipal Corporation and Shimla planning areas (SPA). The SPAs are Dhalli, Tutu, and New Shimla urban agglomerations. In 2011 the total population of District Shimla is 813,384 compared to 722,502 of 2001. Male and female are 424,486 and 388,898 respectively. Population Growth for Shimla District recorded in 2011 for the decade has remained 12.58 percent. Same figure for 1991-2001 decade was 17.02 percent. Total Area of Shimla District was 5,131 with average density of 159 per sq. km. Shimla Population constituted 11.86 percent of total Himachal Pradesh Population. Sex Ratio of Shimla district is now 916, while child sex ratio (0-6) is 922 per 1000 boys. Children below 0-6 age were 80,778 which form 9.93 of total Shimla District population. Average literacy rate for Shimla district is 84.55 percent, a change of from past figure of 79.12 percent. In India, literacy rate is counted only for those above 7 years of age. Child between 0-6 ages are exempted from this.

The population projections have been made for the year 2011 and 2021. It is anticipated that there will be a population of 2,35,970 and 3,18,560 respectively. The increasing trends of migration and decreasing death rate will affect the projected population. Shimla's changing socio-economic conditions and better amenities are now the major pull factors for rural population migrating to the city. If the migration is unchecked, it will have its adverse effect on the growth of population and overall development of Shimla City.

1.10 Culture

1.10.1 Heritage Structures

Perceived and established by the British during colonial period in first half of 19th century as their Summer Capital. It is known to all over the world for its heritage value. Shimla has total 92 identified heritage structures (Source: Single Umbrella Committee).

1.10.2 Religious Centres

The Major religious centres of the city are:

1. Kali Bari Temple
2. Jakhoo Temple
3. Sankat Mochan Temple
4. Tara Devi Temple
5. Kamna Devi Temple (Boileauganj)
6. Dhingu Mata Temple (Sanjauli)
7. Singh Sabha Gurudwara, Bus Stand
8. Christ Church, The Ridge
9. Christ Church, Near Deputy Commissioner's Office
10. Dargah, Kachighatti
11. Eidgah, Middle Bazar
12 Buddhist Monastery, Sanjauli

1.10.3 Tourist Centres

Shimla is a major tourist spot of India. The main tourist centers within city are:

1. The Mall
2. The Ridge
3. Christ Church at the Ridge
4. Jakhoo Hill
5. Indian Institute of Advanced Study (Viceregal Lodge)
6. State Museum
7. Annadale Ground
8. Summer Hill
9. Tara Devi
10. Chadwick Falls
11. Glen Falls

Indian Institute of Advanced Study (Viceregal Lodge), Shimla

1.10.4 Government and Semi-Government Establishments

Shimla is the State capital of Himachal and having all important Government Offices located in Shimla. Many of these offices reside in heritage buildings. The main Government Offices are:

1. Vidhan Sabha of the State of Himachal Pradesh, Secretariat, High Court, HP University, Railway Board, AG Office and ARTRAC.
2. Apart from Government offices many Semi-Government and private agencies have also started their establishment in State Capital. Main Semi Government/private offices include Commercial Banks, Telecom, Insurance Operators etc.

1.10.5 Educational Facilities

Shimla, the Queen of Himalayas is a heart of quality education. Since the British India, Shimla had been the hub of good schools. Almost all the schools are affiliated either with the Indian Certificate of Secondary Education (ICSE), Central Board of Secondary Education (CBSE) and Himachal Pradesh Board of School Education (HPBOSE). The small city also has medical, dental, engineering, ITI, MBA, Hotel Management and Law Colleges. Shimla is home to the Himachal Pradesh University (HPU) and all the degree colleges are affiliated to HPU. Public Schools like Jesus & Mary, Auckland House School, Loreto Convent Tara Hall, St. Edwards, Bishop Cotton School etc. are very old (established during the British Raj) and are known for their high standards of education. Following are the Degree Colleges affiliated to the Himachal Pradesh University, Shimla:

1. St. Bede's College, Nav Bahar
2. Government Degree College, Sanjauli
3. Rajkiya Kanya Maha Vidayaliya (RKMV), Longwood
4. HPU Centre for Evening Studies (HPUCES), The Mall
5. Institute of Vocational Studies, Summer Hill
6. Rajiv Gandhi Government Degree College, Chaura Maidan

Medical & Dental Colleges affiliated to the Himachal Pradesh University, Shimla:

1. Indira Gandhi Medical College & Hospital, Shimla
2. H.P. Government Dental College & Hospital, Shimla

1.10.6 Health Facilities

The city provides very good and effective health services in Shimla. People across from State come here for treatment and health care. The main government hospitals are as follows:

1. Indira Gandhi Medical College & Hospital, Shimla
2. Kamla Nehru Hospital, Shimla
3. DDU Zonal Hospital, Shimla
4. Regional Ayurvedic Hospital, Shimla

The main private hospitals in Shimla are as follows:

1. Indus Hospital
2. Shimla Sanatorium
3. Shri Ram Hospital
4. Tenzin Hospital

1.10.7 Places of Mass Congregation

The main places of mass congregation in the city are as under:

1. The Ridge
2. The Mall Road
3. Lower Bazaar
4. Major Temples during festivals
5. The Ridge during the Summer festival or Special visits
6. Vidhan Sabha Complex during sessions
7. H.P. Secretariat Complex

1.11 Power Stations/Electrical Installations (Receiving Station)

The overall electricity consumption of Shimla city is 11, 46, 94,707 Kw (2010-2011). The total number of consumers in City is 37,805 (April 2011). There is one Grid in Totu and total 6 substations located in Bharari, Idgah, Khalini, Totu, Summer Hill and Sanjauli. The main supply is coming from different Hydro Power Plants- Bhabha, Giri and Nabha.

1.12 Water Supply

The IPH Department is supplying water to Municipal Corporation Shimla in bulk. The Shimla Jal Prabandhan Nigam Limited (SJPNL) does the distribution of water in entire Shimla. There is metric distribution system of water is in place. There are six water stations which provide supply to entire Shimla: Sanjauli, Chhota Shimla, New Shimla, Central Zone, Lakkar Bazar, Chaura Maidan. Besides some smaller water storage tanks in different wards, there are two big water storage tanks at the Ridge and Sanjauli which are used for bulk water storage and supply.

1.13 Sewerage System

The stepping stone to modern sewerage system from dry latrine system took place in 1980s. However, the large scale set-up of Shimla sewerage system came into operation in October 2005 with six numbers of STPs namely Lalpani 19.35 Mld, Malyana 4.44 Mld, Dhalli 0.76 MLd, Snowdon 1.35 MLd, North disposal 5.80 Mld and Summerhill 3.93 Mld. Total sewage treatment capacity of all the Six numbers of STP's is 35.63 MLD and design up to the period of 2016 and total length of sewage network is 308 km. In 2016, the length of sewage network was 189 Km and post 2016, 119 Km of sewage network has laid. Work of up-gradation of 3 Nos. of STP is in progress (STP Lalpani 14.2 Mld, STP Malyana 5.2 Mld and STP Dhalli 1.5 Mld on latest SBR technology). Tentative completion time period is January 2022. Also, the work of retrofitting of remaining 3 Nos. of STP (STP Snowdon, North Disposal and Summerhill) has been awarded in which electro-mechanical modification is required for better efficiency. At present, there are 16586 Nos. of sewage connection which are serving 29580 house hold. Only 1228 Nos. of septic tanks are present in town in the area of Totu and Majiath for which work of laying sewer pipe line is in progress. Also to treat the fecal matter of septic tank FSTP of 2.5 Kld has been constructed at STP Lalpni where septage of septic material can be treated. Construction work of New STP at Ashwani khad namely STP panthaghati 3.1 Mld has been awarded at for which land acquisition and site development work is in progress. Work of laying sewer network for the area of Mehali, Lower panthaghati, Beolia and Gussan has been awarded to various contractor and work has been started.

1.14 Economy and Industrialization

Industries in Shimla are mainly centre around the small-scale industries. Since Shimla is a hill resort, so the construction of big industries is quite impossible in Shimla due to number of valid reasons like the unavailability of adequate human resource and uneven terrain. Shimla being an ideal place for a getaway, the tourism industry in Shimla has emerged as a booming one. The tourism industry has been a major source of income for the people of Shimla. The overall scenic beauty of Shimla with the rolling hills and salubrious climate drags domestic as well as foreign tourists.

The various other industries of Shimla are:

1. Food industry
2. Wood-based industry
3. Fruit processing industry
4. Bakery Products industry
5. Implements of agriculture and horticulture

Table 6 : Settlement-wise Workforce Participation

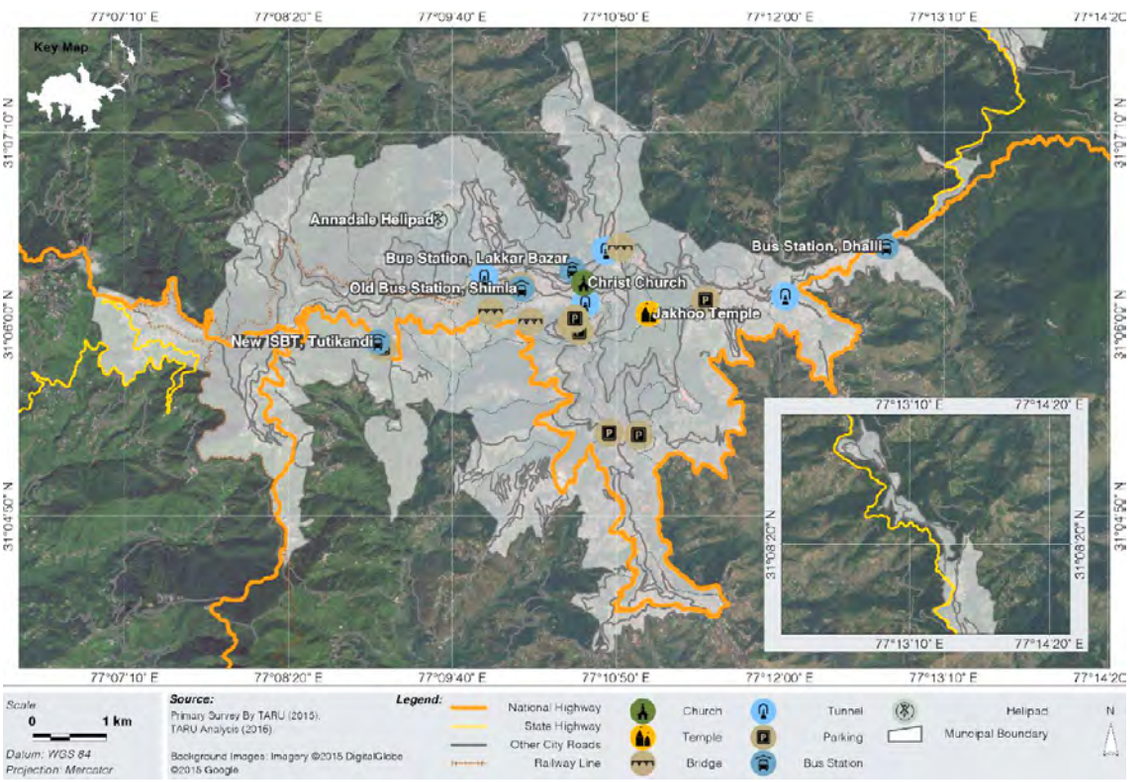
Category	M.C. Area	Ghanahatti SA	Kufri SA	Shoghi SA	Total
Cultivators	439	1199	2384	2474	6496
Agriculturists	149	115	107	172	543
Household Industry	504	52	42	106	704
Others	53312	2839	2914	2389	61454
Total	**54404**	**4205**	**5447**	**5141**	**69197**

Source: Development Plan for Shimla Planning Area, 2015

1.15 Transport and Communication Network

The economy of Shimla is dependent upon tourist activity; Shimla Local Transportation is therefore planned with the tourist as a core customer. Commercial buses in Shimla are either run by the Himachal Pradesh Road Transport Corporation (HRTC) or by private transport operators. Buses are available to transport passengers to every part of Shimla city. Shimla local transportation is concentrated in and on the vicinity of the Ring road of Shimla city. The Ring Road route covers the Main bus stand, Lift, Chhota Shimla, Kasumpti, Sanjauli, Lakkar Bazaar bus stand, Victory Tunnel and Boileauganj. Shimla Local Transportation also includes taxis. There are some restricted roads too in some parts of Shimla on which vehicles are not allowed. Himachal Pradesh tourism also runs a lift from Cart Road to the Mall.

Map 2 : Road and Rail Network in Shimla City



Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City

1.15.1 Surface Travel

Shimla is connected to the city of Kalka by one of the longest narrow-gauge railway routes still operating in India, the Kalka-Shimla Railway. This railway line starts at Kalka in the Himalayan Shivalik Hills foothills, passes through Dharampur, Solan, Kandaghat, Taradevi, Barog, Salogra, Totu (Jutogh) and Summerhill, before it finally ends at Shimla. Declared as a World Heritage by the UNESCO, the railway route is a main attraction for the tourists due to the Toy Train travel and scenic views. Connecting trains to major stations like New Delhi, Kolkata, Mumbai, Lucknow, Jaipur, etc. are available from Kalka and Chandigarh.

Two National Highways No. 22 and 88 pass through Shimla City. National Highway No. 22 connects Chandigarh to Shimla and NH No. 88 connects Shimla to district Kangra.

Table 7 : Road distances from Shimla to nearest Major Stations

Station	Distance	Approximate Traveling Time
New Delhi	343 Km.	10 Hours
Ambala	151 Km.	5 Hours
Chandigarh	119 Km.	4 Hours
Kalka	96 Km.	3 Hours

1.15.2 Parking Facilities

Shimla is a congested town and one can face parking problems if traveling to the city by own vehicle. There are 42 parking places within city, including the Lift parking, Near Hotel Holiday Home, Main Bus Stand, Railway Station Godown and the HP High Court. The MC Parking near Lift is the largest in Shimla town, and has a capacity of about 653 cars, while Sanjauli (400), Chhota Shimla (250), Tutikandi (400) are among the main parking places.

1.15.3 Air Travel

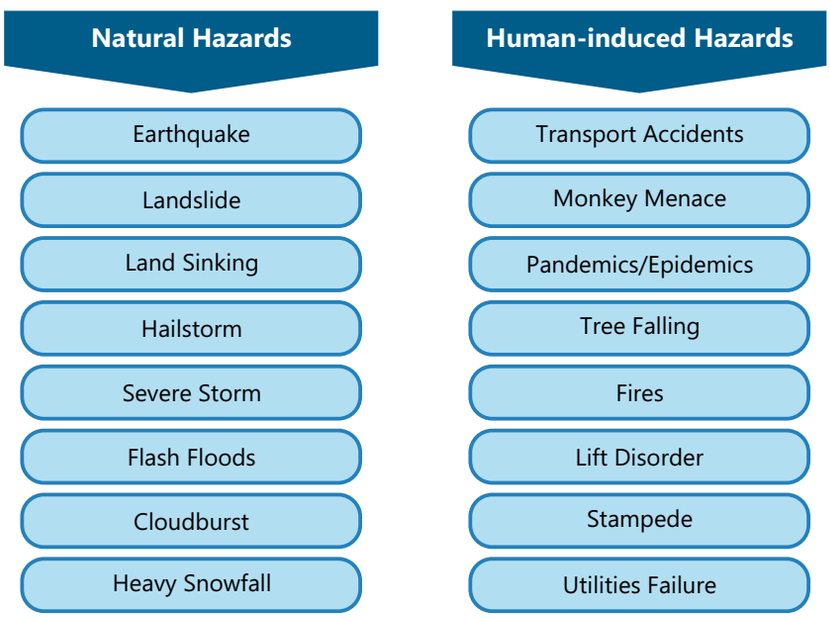
Shimla Airport is at Jubbarhatti, which is located 23 kms. from the city. Generally, scheduled flights to Delhi operate from this airport. Helicopter Services (Heli-Taxi Service) also operates to Chandigarh, Kullu and Dharamshala.

Shimla Airport, Jubbarhatti

2 Hazard, Vulnerability & Risk Profile of Shimla City

2.1 Potential Hazards for Shimla City

Shimla city is exposed to multiple Natural and Human-induced Hazards. They may include, but are not limited to the following:



2.1.1 Natural Hazards

1. Earthquake
2. Landslide
3. Land Sinking
4. Hailstorm
5. Severe Storms, including lightning and high winds (Thunderstorms)
6. Flash Flood/Cloud Burst
7. Heavy Snow Falls

2.1.2 Human-induced Hazards

1. Accidents- Train, Road, Air
2. Monkey Menace
3. Pandemics/Epidemics
4. Tree Falling
5. Fires: Household, Forest
6. Lift Disorder
7. Stampede
8. Utilities Failure: Energy, Telecommunication, Water and Sewerage System

2.2 Natural Hazards in Shimla City

Shimla due to its geological features and location is exposed to various natural hazards. The details of probable Natural Hazards are as under:

2.2.1 Earthquake

2.2.1.1 History of Earthquake in Himachal Pradesh

The North-Western fringe of Himalayas is bounded by two major thrusts namely Main Central Thrust and Main Boundary Fault running parallel to the axis. Himachal State therefore, falls in most active seismic zones-IV and V. Shimla being capital and most important city of the State has multifaceted functions. There is a mounting pressure of urbanization forces, whereby the city is susceptible to various hazards like earthquakes, landslides, cloudbursts and fire. In order to ensure safety and preparedness for these hazards, it is imperative to devise a pre-disaster mitigation plan for the Shimla city. Himachal Pradesh lies almost entirely in the Himalayan Mountains, and is part of the Western Himalayas. Due to its location, it weathers several mild earthquakes every year. On 24 November 2021, 3 low-intensity earthquakes occurred near Shimla city. Large earthquakes have occurred in all parts of the state, the biggest being the Kangra Earthquake of 1905.

Table 8 : Past Earthquakes in Himachal Pradesh

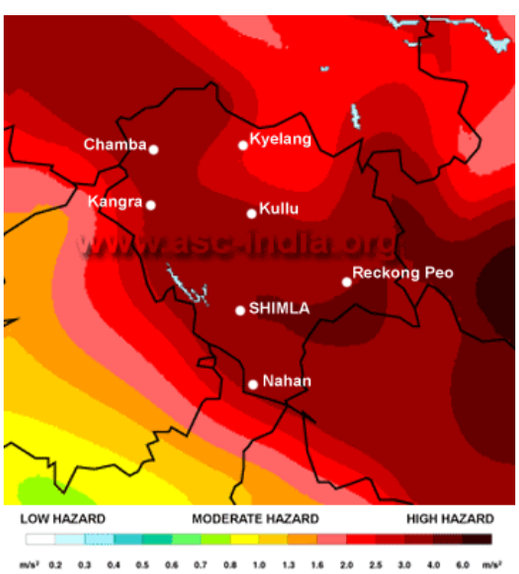
Date	Locations Affected	Magnitude	Damage
4 April 1905	Kangra	7.8	▫ 20,000 people died ▫ 53,000 domestic animals perished ▫ 1,00,000 houses destroyed ▫ Economic cost of recovery 2.9 million rupees
1 June 1945	Chamba	6.5	NA
19 January 1975	Kinnaur	6.8	▫ 60 people dies ▫ 100 badly injured ▫ 2000 dwellings devastated ▫ 2500 people rendered homeless
26 April 1986	Dharmshala	5.5	▫ People died ▫ Extensively damage to buildings ▫ Loss estimated at 65 crore
1 April 1994	Chamba	4.5	NA
24 March 1995	Chamba	4.9	▫ Faresome shaking ▫ More than 70% houses developed cracks
29 July 1997	Sundar Nagar	5	▫ Damage to about 1000 houses

The Himalayan Frontal Thrust, the Main boundary Thrust, the Karol, the Giri, Jutogh and Nahan thrusts lie in this region. Besides that, there are scores of smaller faults, like the Kaurik Fault which triggered the 1975 earthquake. However, it must be stated that proximity to faults does not necessarily translate into a higher hazard as compared to areas located further away, as damage from earthquakes depends on numerous factors such as subsurface geology as well as adherence to the building codes, population density, etc. Table 8 highlights some of the major earthquakes of the past within Himachal Pradesh. Figure 1 shows the Earthquake Hazard Map of Himachal Pradesh.

2.2.1.2 Seismic Hazard

Chamba, Kullu, Kangra, Una, Hamirpur, Mandi, and Bilaspur Districts lie in Zone V. The remaining districts of Lahaul & Spiti, Kinnaur, Shimla, Solan and Sirmaur lie in Zone IV. Since the earthquake database in India is still incomplete, especially with regard to earthquakes prior to the historical period (before 1800 A.D.), these zones offer a rough guide of the earthquake hazard in any particular region and need to be regularly updated.

Figure 1 : Seismic Hazard Map Himachal Pradesh



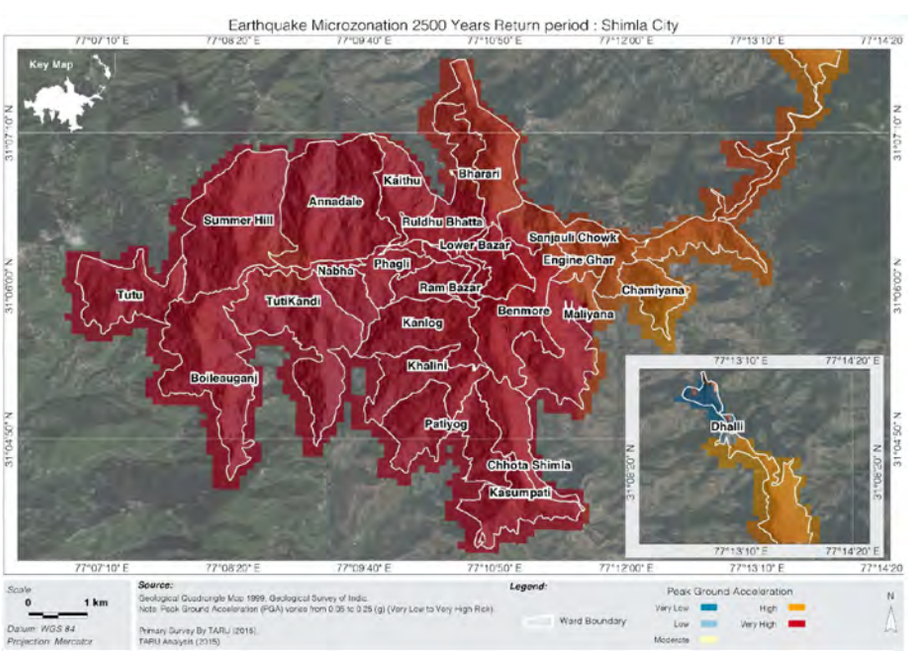
2.2.1.3 Earthquakes in Shimla

Shimla is situated on mountainous Middle Himalayas, which form the last traverse spur of the Central Himalayas, south of the River Satluj. The city is spread across twenty-six kilometres along a ridge that overlooks terrace cultivated hillsides. Administratively, the Municipal Corporation Shimla looks after the civil management. The municipal area is further divided into thirty - four wards. The unique setting of Shimla district is that it is bounded by two major thrusts, the Main Central Thrust (MCT) & Main Boundary Fault (MBF). Other thrusts present in the region, such as the Jawalamukhi Thrusts and the Drang Thrust, result in several other lineaments piercing the zone into fractured and faulted blocks and active faults enhancing the structural discontinuities. The region has experienced frequent mild tremors and periodic major earthquakes

in the past, and will continue to do so in the future. Shimla can expect maximum Peak Ground Acceleration (PGA) of 4.0 meters per Second Square. This suggests that Shimla can expect an earthquake of seismic intensity of VIII on the Modified Mercalli (MM) Intensity Scale. MM VIII indicates that there can be slight damage in specially designed structures; considerable in ordinary substantial buildings; and great damage in poorly built structures.

Panel Walls can be thrown out of frame structures. Chimneys, factory stacks, columns, walls and monuments can collapse. Heavy furniture can get overturned. Rock and mud can get ejected in small amounts. Changes can be caused in water levels. Earthquake induced ground failure can be expected along the northern slopes of the ridge, i.e. in Lakkar Bazaar, New Shimla, Vikas Nagar and Ruldu Bhatta.

Map 3: Seismic Hazard Map of Shimla City



Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City

2.2.2 Landslides

2.2.2.1 Landslides in Himachal Pradesh

Landslide is the most common hazard in Himachal Pradesh, which causes immense risk to life and property. Almost every year the state is affected by one or more major landslides affecting the society in many ways. Loss of life, damage of houses, roads, means of communication, agricultural land, are some of the major consequences of landslides. The fragile nature of rocks forming the mountains, along with the climatic conditions and various anthropogenic activities has made the state vulnerable to the Landslides.

2.2.2.2 Landslide Hazards in Shimla

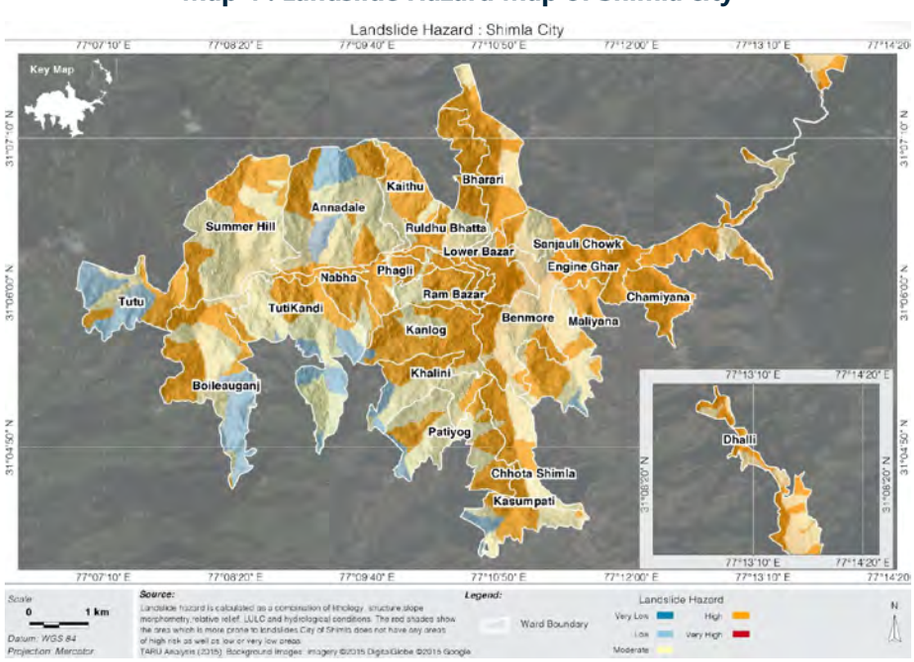
Landslides are downward sliding movement of soil, debris or rocks, resulting from natural causes, vibrations, overburden of rock material, removal of lateral supports, change in the water content of rock or soil bodies, blocked drainage etc. Landslide is a very common hazard in Himachal Pradesh as well as Shimla city, which causes immense loss of infrastructure, property and sometimes life too. The fragile nature of rocks forming the mountains along with the climatic conditions and various anthropogenic activities has made the city vulnerable to landslides. Overloaded slopes may initially cause only minor landslides, but at later stage could trigger larger landslides. The first major landslide occurred in Shimla in February 1971 when a large northern portion of the Ridge slumped down, threatening the safety of the reservoir below. Many areas of the town become prone to landslides especially during the rainy season. Table 9 shows the Economic losses caused by rains in Shimla city in the past 7 years.

Table 9 : Losses caused by Rain Damages occurred within MC Shimla

S. #	Financial Year	Loss (In Crores)
1.	2015-16	3.25
2.	2016-17	4.16
3.	2017-18	11.02
4.	2018-19	7.48
5.	2019-20	3.86
6.	2020-21	13.80
7.	2021-22	5.27

Source: Municipal Corporation Shimla

Map 4 : Landslide Hazard Map of Shimla city



Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City

Landslide near Shani Mandir, Dhalli Bypass (2017)

2.2.2.3 Reasons behind Landslides

Geologically weak material: Weathered materials, jointed or fissured materials, contrast in permeability and contrast in stiffness (stiff, dense material over plastic materials).

Erosion: Wave erosion of slope toe, glacial erosion of slope toe, subterranean erosion (Deposition loading slope or its crest, Vegetation removal.

Intense rainfall: Storms that produce intense rainfall for periods as short as several hours or have a more moderate intensity lasting several days have triggered abundant landslides.

Human Excavation of slope and its toe, loading of slope/toe, draw down in reservoir, mining, deforestation, irrigation, vibration/blast, water leakage from services. Earthquake shaking could trigger landslides in many different topographic and geologic settings. Rock falls, soil slides and rockslides from steep slopes involving relatively thin or shallow dis- aggregated soils or rock, or both have been the most abundant types of landslides triggered by historical earthquakes.

The problem of landslides is common and frequent in Shimla. Almost every year the whole district is affected by one or more major landslides affecting society in many ways. Loss of life, damage to houses, roads, and means of communication, agricultural land and floods are some of the major consequence of landslides in the region. The temporal occurrence of landslides with a peak in the month of monsoon suggests that landslides are directly related to monsoons. These prolong rainfall trigger landslides in the region, eventually jeopardize the stability of the hill as a whole. The vulnerability of the geologically young, unstable and fragile rocks of the state has increased many times in the recent past due to various unscientific developmental activities. Deforestation, unscientific road construction, terracing and water intensive agricultural practices, encroachment on steep hill slopes are the anthropogenic activities which have increased the intensity and frequency of landslides. Among the

human-induced causes, road construction in the hilly terrain is more responsible for landslides. The quantum of the damage by unscientific road construction may be judge by scientific research, which states that one kilometer of road construction in the Himalayas needs removal of 60,000 cubic metres of debris. Due to this and other anthropogenic activities, landslides have become a regular occurrence in the state, especially during the rainy season. The Geological Survey of India (GSI) is also currently updating its earlier studies on the town to assess the disaster-causing potential of its unstable slopes. GSI's former Deputy Director-General PN Razdan says, "The problem of landslides in Shimla town is aggravating and we feel that the town needs urgent treatment for this. Our study will identify the vulnerable areas and suggest remedial measures."

2.2.3 Sinking Zone in Shimla

Recent geological studies indicate that roughly 25% of the old town is in the sinking zone (Source: District Disaster Management Plan, Shimla) and unless improvements are made in the drainage and sewerage systems of the upper reaches, more could go under. Geologists say that when the famous Ridge of Shimla was constructed, the hilltop was sliced and all the debris was dumped on its northern slopes. Though it has compacted over the years, many parts of Lakkar Bazar and Rivoli bus stand do show a downward creeping movement. Slopes have become overloaded, and buildings in several heavily crowded localities in the central part of the town have become unsafe as they fall in the sinking zone. The Ridge is not only a portion of land in Shimla; it contains its life line. The water reservoir beneath it has storage of ten lac gallons of water. The reservoir was constructed without using an ounce of cement in the 1880s and only lime morter has been used. A major port on of the flat land consist debris and has resulted into so called sinking zone.

Sinking Area near the Ridge, Shimla

2.2.4 Severe Storms, including Lightening & High Winds (Thunderstorms)

Every year severe storms, lighting and high winds cause huge loss to the economy of Shimla City. It results into tree falling, damage to electricity supply wires, telephone cables, street lights, etc. Due to tree falling much time it causes loss to life, buildings or vehicles. As per the BMTPC wind hazard zone mapping of Himachal Pradesh, it is evident that Shimla lies in moderate damage risk zone. Winds are generally light throughout the year. The mean wind speed for Shimla for different months is shown in Table 10.

Table 10 : Mean Wind Speed in Km/Hr

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
4.4	4.8	4.9	4.4	4.1	3.1	2.1	1.3	1.6	2.8	3.2	3.8	**3.4**

Source: India Meteorological Department (IMD)

2.2.5 Cloudburst

A cloudburst is an extreme amount of precipitation, sometimes with hail and thunder, which normally lasts no longer than a few minutes but is capable of creating flood conditions. Flash floods, short lived extreme events, which usually occur under slowly moving or stationary thunderstorms, lasting less than 24 hours are a common disaster in state. As a result of the high velocity of the current which can wash away all obstacles in its way, this phenomenon has resulted in enormous loss of life and property in various parts of the region. Prolong monsoons increased the threat of facing cloudburst in Shimla which will cause huge loss to the city. Though there is no recorded history of cloudburst in Shimla City but the vulnerability of the town to this hazard cannot be ruled out.

2.2.6 Heavy Snowfalls

The climate of Shimla is extremely cold during winters. The temperature of Shimla city and its adjoining ecosystem may vary between minus 7° and 10° in winter. Snowfall in Shimla usually occurs during the winter, between December and February. In the past 30 years, the heaviest snowfall recorded in Shimla city within 24 hours occurred in the year 1990 i.e. 151.3cm and the second highest was in the year 2007 i.e 113 cm (IMD).

It is worth mentioning that the effect of global warming and greenhouse gas emissions is acutely felt in Shimla. The blatant proof of global warming can easily be found in Shimla-snowfall has decreased over a period of time. The time of snowfall has also changed, even a few years ago it occurred during the month of December; now snowfall can be expected only after the new year has safely passed-after the fifteenth of January.

2.3 Human-induced Hazards

2.3.1 Accidents

2.3.1.1 Road

On account of limited road width and as a result of manifold increase in number of automobiles and regional heavy traffic, entire peace and tranquility of the city has been disturbed. Traffic jams, bottlenecks, delays and accidents have become common. The problems in the peak hours of morning and evening are severe. Besides the wastage of man-hours, a lot of fuel is wasted and air is polluted. As there is little scope for the expansion of roads in central areas due to prevalence of structures on both sides, traffic problems have multiplied. Gradually the population pressure is increasing in Shimla and simultaneously the pressure of vehicles. In peak tourist season this traffic of vehicles multiplies.

Tragic accident of a school bus in Jhanjhiri near Khalini (2019)

Apart from the accidents, Shimla town has a serious problem of traffic congestion due to peculiar geography and age-old construction. Moreover, the road infrastructure in the town was created in very old times to cater the needs of the then population and little progress was made in this regard subsequently. With the passage of time the population and inflow of the tourist, the traffic congestion has taken a serious turn.

2.3.1.2 Train Accident

The Kalka-Shimla rail route is more than a century old. This is one of the four narrow gauge rail routes on hill terrain in the country, the other three being the Darjeeling, Ooty and Pathankot–Joginder Nagar routes. Started during the reign of Lord Curzon in November 1903, this rail route features in the Guinness Book of World Records for offering the steepest rise in altitude in the space of 96

kilometers. More than two-third of the track is curved, sometimes at angles as sharp as 48 degrees laid out on a 96 km long narrow-gauge track that passes through 103 tunnels and across more than 800 bridges and viaducts, it is one of the most beautiful hill railways in India. There is always a threat of accident being occurred on this track. In 2008, the train got derailed and 1 person died in that accident.

2.3.2 Monkey Menace

The monkey attacks are quite common in Shimla city. There are frequent incidents of monkeys biting the citizens and/or attacking the tourists and sometimes destroying the property as well. In the recent few years, the Municipal Corporation has taken some steps to deal with this hazard by controlling the population of monkeys in the city.

Monkeys attacking the locals and tourists is a common scene in Shimla

2.3.3 Tree Falling

Due to heavy monsoon, high winds, and age of the trees, falling trees are another major hazard which Shimla people face frequently. It causes loss to property and lives. The damage caused by falling trees to public and private property is worth in lakhs of rupees. Especially during the monsoon season and sometimes after heavy snowfall, several incidents of deodar trees falling are witnessed in the city.

2.3.4 Fires

Forest Fires are not very much prominent within Shimla City. In Shimla the old historical buildings are made up of wood and also in present buildings as well the flooring etc. is made up of wood. Every winter household's fires are very common which caused due to overheating, electric fires, etc. The main cause behind the fires in Shimla are human

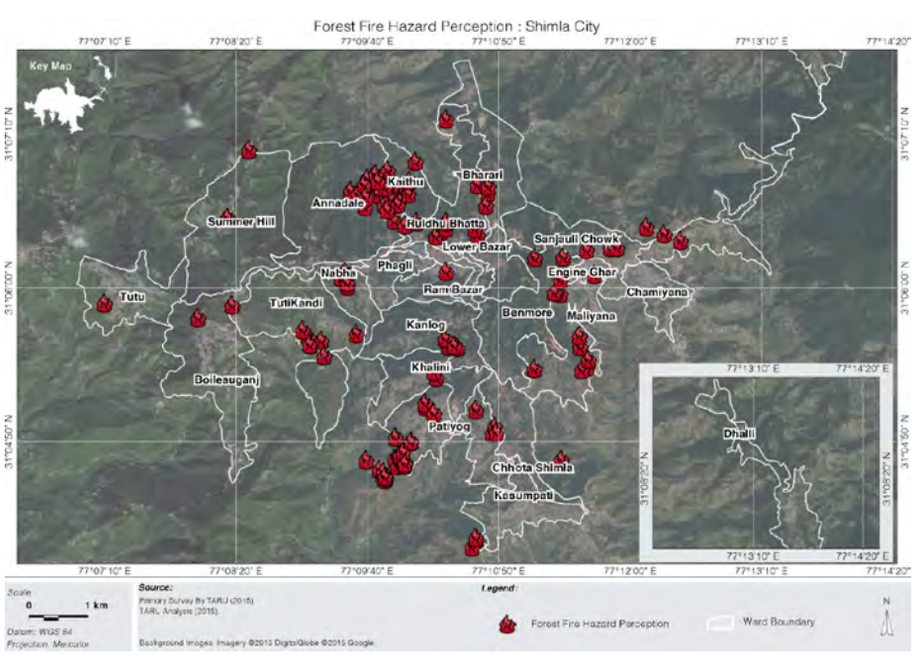
-induced. The old wooden structures, congested construction, poor and old wiring and resultant short circuit, rising temperature and extended dry spells are some of the main reasons behind fire hazard in the city. Fire department is mainly responsible for rapid assessment phase.

In Shimla city, there are three fire stations situated at the Mall, Chhota Shimla and Boileauganj. As a matter of concern, the department is devoid of adequate number of staff personnel and equipment. The population within the city is increasing but their safety measures are not equally growing. Although the use of GIS has started but it is at a much initial stage and the use of satellite imageries are negligible. In context of fire the construction of houses or government departments are not based on "National Building Codes". The Municipal Corporation Shimla contracted the Shimla-based NGO 'Doers' to formulate a city-level Fire Disaster Management Plan (FDMP). Besides preparing the FDMP, Doers also carried out a field-based geo-tagged mapping of the Fire Hydrants in Shimla-city and now the same is available with the Municipal Corporation and the Fire Department for a quick decision-support in the aftermath of a fire event.

2.3.4.1 Forest Fire

The forests of western Himalayas are more vulnerable to forest fires as compared to those in eastern Himalayas. Frequency and intensity of forest fires has increased in the Himalayan region since 1990. As one of the most frequent hazards in Himachal Pradesh, forest fires are an annual phenomenon in the state. Forest areas near habitations in Shimla city witness forest fires which are often the result of human negligence. As the instances of forest fires continue to increase in and around the city, the Municipal Corporation Shimla has developed a Fire Disaster Management Plan (2021) for the city.

Map 5 : Forest Fire Hazard Map of Shimla city



Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City

Forest fires are mostly anthropogenic in nature in Himachal Pradesh and may occur due to the following reasons:

- Forest floor are often burnt by villagers to get a good growth of grass in the following season or for a good growth of mushrooms,
- Wild grass or undergrowth is burnt to search for animals,
- Firing by miscreants,
- Attempt to destroy stumps of illicit fallings.

Categories of Forest Fires

Forest fire can be defined as an uncontained and freely spreading combustion which consumes the natural fuels i.e. litter, grass, dead branch, wood, snags, logs, stumps, weeds, brush, foliage and to some extent green trees (Brown and Davis, 1959). Basically forest fires have been categorized in to three types:

(i) **Ground Fires:** Ground fires are not easily predictable as it spreads within the canopies rather than on top of organic matter. It consumes organic matter like duff, musk or peat present beneath the surface litter of the forest floor. It has unique characteristic of having a smoldering edge with no flame and little smoke. Ground fires are most hard to handle and there should be proper policy and practice for control agencies.

(ii) **Surface Fire:** Surface fire is characterized by a fast moving fire, which consumes small vegetation and surface litter along with loose debris.

(iii) **Crown Fire:** Crown fires advances from top to top of trees or shrubs without any close link with surface fire. It is fastest to spread and most destructive for trees and wildlife.

Causes of Forest Fires

Basically causes of forest fire have been classified into three main categories:

(i) **Natural:** These are the fires which cannot be averted as these occurs naturally due to lightning, rolling of stones and rubbing of dry bamboos due to strong wind.

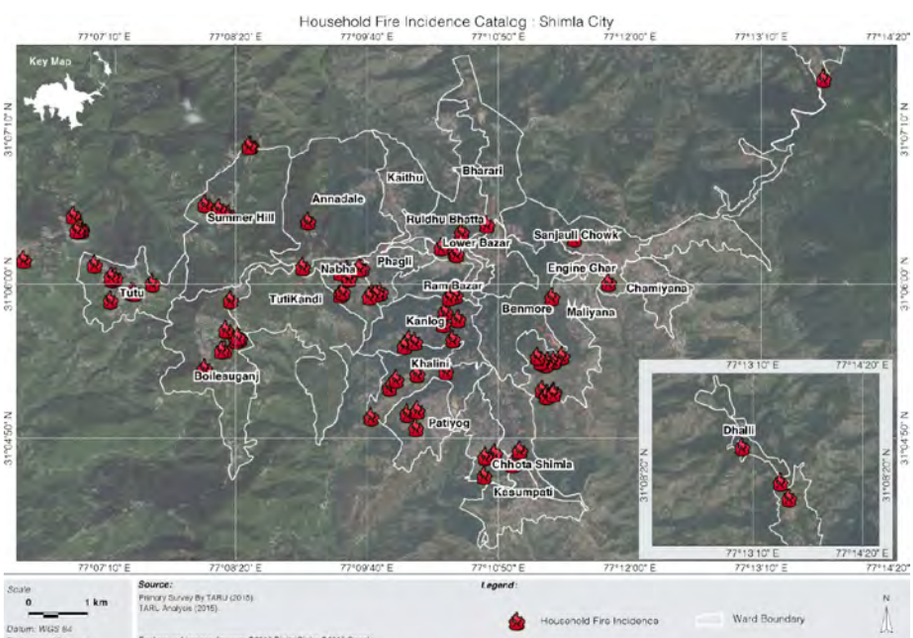
(ii) **Intentional/Deliberate:** Mainly intentional fires are created for the better growth of fodder grass. These fires are also been set by villagers to drive away the herbivores animals, which destroy their crops. Villagers also set fire for collecting forest products like honey, gum, mahua flowers etc. Railway transport also causes forest fires occasionally. There is less control over fires which are caused deliberately by local dwellers.

(iii) **Un-intentional/Accidental:** Unintentional/ accidental fires are the result of carelessness of human beings such as throwing of burning matchstick or cigarette. Other fires, which occur accidentally, are the spread of fire from labour camps, from picnic sites and other recreational areas due to human activities. These types of fires are controlled by certain parameters like its proximity to settlements and distances from roads. Although it is not easy to account natural or deliberate fires but the areas prone to fires can be detected and mapped.

2.3.4.2 Domestic Fire

One of the common reason for domestic fire is the mishandling of cooking fuel and live fire. There have been many incidents of fire in the city of Shimla. One main reason for these fires to spread and cause huge damages is the nearness of the houses or shops. Many a times, these fires were observed in the densly packed shopping area in Lower Bazar (January 9, 2016 at 3.00am). Some of the well known fire accidents within Shimla city are: Lower Bazar fire of 9 January, 2016; AG Building (Gorton Castle, January 28, 2014); Deepak project fire (Minto Court near Indian Institute of Advance Studies, November 2, 2014). While the losses in these accidents run into crores of rupees, the heritage and architectural loss is irreplaceable. Most of the heritage buildings in Shimla city were constructed during the British rule. The incidents of fire started in 1875 when Upper Bazaar located on The Ridge was gutted. In the past 144 years, more than 50 majestic buildings such as Gorton Castle, Grand Hotel, etc. have been razed in fires. A lot of money is spent on the name of procuring safety measures and maintenance, but still Shimla is losing these heritage buildings one by one.

Map 6 : Household Fire Hazard Map of Shimla city



Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City

From the primary survey carried out during the City HRVA in 2016, 28% of the households have experienced some form of fire accidents, but many of them did not face any losses. The survey respondents have memory of 12 incidents at the neighbour level which caused losses within the city – right from 1947 to 2015. Out of the sampled households, there are 16 houses which are having exposed fire in the kitchens, while rest of the households use non exposed fires, like induction, microwave and other kitchen utilities. The vulnerability of the households in terms of fire is still high, from the point of view of access to fire services. On an average, about 4% of the households are using open fires for cooking their meals. This may lead to fire hazard.

2.3.5 Lift Disorder

Local transportation in Shimla city is concentrated around the vicinity of Ring Road/Cart Road, Shimla bypass (NH-5) from Tutikandi to Dhalli and Sanjauli-Dhalli Bypass. The Ring road route covers the Main Bus stand, Chhota Shimla, Kasumpti, Sanjauli, Lakkar Bazaar Bus stand, Victory Tunnel and Boileauganj. There are 3 lifts which connect the Cart Road to Mall Road, which is another means of transportation in the city. In 2016, one of these lifts got dysfunctional and around 13 tourists got stuck in the lift when the total passengers' weight exceeded allowed weight limit and this disrupted the functioning of the lift.

2.3.6 Stampede

Due to congestion especially in central Shimla the chances of stampede is very high. There are single paths in Lower Bazaar, Ram Bazaar and Sabzi Mandi area. If any miss happening occurs in the bazaar it will result into stampede which due to congestion and slope terrain will cause huge losses. As Shimla has number of temples (such as Kalibari, Jakhoo, etc.) during peak festival days huge crowds assemble at these temples, hence there is always a chance of facing stampede in crowded places. An incident of fire, earthquake or a terrorist attack can potentially lead to stampede event within the city.

2.3.7 Utility Failure

Being a capital city, the dependency of public and government upon the supply of basic services like Energy, Telecommunications, Water Systems, Sewerage System, etc. is very high. Rising population is also causing pressure on basic services like water and sanitation. Shimla being a capital city and having cold climatic conditions the energy consumption of city is very high. By increasing population pressure on the city the transportation demand is also increasing which is causing pressure as well. The dependency of public and government business relies completely on energy supplied. Any failure in these will create hurdle in energy supply and affect the economy directly and indirectly. MC Shimla has prepared a mobile app for essential utility services of the wards by the name of shimla urban resilience (SUR). Below given are the vital utility services of the Shimla city:

2.3.7.1 Water Supply

Water is a vital renewable but finite resource. Water supply system in Shimla largely depends on the surface sources like springs, nallahs or streams for its safe water demand. Shimla had no systematic potable water supply till 1875. Later serious efforts were made when some land was acquired from the neighbouring Rana of Koti and first ever reservoir of 2MG (9 ML) capacity was constructed at Sanjauli in 1884 for systematic supply. Today water is pumped up from six sources to fulfil the increased demand of the city. These six sources are namely Gumma, Giri, Churot, Seog, Chair, K/brandi with average water supply daily of 45 MLD (2019) (SJPNL).

Demand and Supply:

As per records of the Department of Irrigation and Public Health, in lean period availability of water supply to the city is 36.63 MLD, whereas 44.28 MLD during non-lean period. The installed capacity of water supply system is 71.24 MLD

against present availability of water intake sources of 39.21 MLD (2016). There is different tariff within the city (2019) for households lying within MC limit and for outside MC limit, commercial consumption, consumption by government buildings, hospital, etc.. However, the average cost of water supply is Rs. 28 per 1000 litres in the domestic tariff category. The water supply is inadequate to city residents as well as Planning Area population due to rapid growth of population. As per 2001 Census, 1,74,789 persons were residing in Planning Area, which has been anticipated to increase to about 3,18,560 persons by 2021. Existing water supply is not sufficient to urban settlements and water for these settlements is managed through local natural sources i.e. 'Bowaries' (water not recommended to be used for drinking). and nallahs which have also been tapped for various Government water supply schemes. As of now, 14 bowaries have been restored by the SJPNL under the Amrut project within city (Annexure-10).

Table 11 : Details of Existing Water System

Source Name/ River Name	Trans-mission Type	Year of Start	Installed Capacity (MLD)	Quantity of Water Produced (MLD)	Supply to SMC (MLD)	
					Non-Lean Period	Lean Period
Dhalli Catchment Area	Gravity	1875	4.54	1.80	0.23	0.20
Cherot / agroti Nallah	Pumping	1889	4.80	3.86	3.50	2.48
Chair Nallah	Pumping	1914	2.50	3.00	1.20	0.55
Nauti Khad (Gumma)	Pumping	1924 & 1982	24.06	19.75	14.25	14.14
Ashwani Khad	Pumping	1992	10.80	10.80	7.60	4.96
From River Giri Scheme	Pumping	2008	20.00	20.00	15.00	12.00
Under Nautikhad Scheme	Pumping	2008	4.54	4.54	2.50	2.30
	Sub Total	-	**71.24**	**66.38**	**44.28**	**36.63**

Source: Shimla Jal Prabandhan Nigam Ltd.

Ashwani Khad, Shimla

Table 12 : Reservoirs and Tanks Serving Different Zones

S. #	Location of Tank	Capacity (ML)	Zones Served
1.	Sanjauli Reservoir	8.78	All zones
2.	Ridge Reservoir	4.63	Ridge, A.G. Office, Vice Regal Lodge, University, Kamna Devi, Chakkar & Totu
3.	Mains Field	3.63	Mains field, High Court, BCS and Kasumpti
4.	Mashobra	3.00	Mashobra
5.	Jakhoo Tanks	0.13	Sanjauli and Ridge
6.	Phagli	0.13	Phagli
7.	Jakhoo	0.45	Sanjauli and Ridge
8.	Shivpuri	0.045	Mains Field
9.	New Shimla Sec-I	0.023	Kasumpti
10.	New Shimla Sec-II	0.023	Kasumpti
11.	New Shimla Sec-III	0.136	Kasumpti
12.	Vikas Nagar	0.136	Kasumpti
13.	Vikas Nagar	0.136	Kasumpti
14.	Kasumpati	2.043	Kasumpti
15.	New Shimla Sector-IV	0.30	Kasumpti
16.	Dhingu Mandir	0.30	Dhalli and Sanjauli
17.	North Oak (O.H.)	0.05	Sanjauli
18.	North Oak (U.G.)	0.10	Sanjauli
19.	Engine Ghar	0.30	Sanjauli
20.	Bharari	1.20	Bharari
21.	Tuti Kandi (Near 103 Tunnel)	0.90	A.G. Office
22.	Kamna Devi	0.30	Kamna Devi
23.	Kelston	0.30	Bharari
24.	Corner House	0.30	Sanjauli
25.	Knolls Wood	0.90	B.C.S.
26.	New Shimla Sector-III	0.60	Kasumpti
27.	Tara Mata Mandir New Shimla	0.60	Kasumpti
28.	Kali Bari-I	0.160	A.G. Office
29.	Kali Bari-II	0.160	A.G. Office
30.	Sandal Chakkar	0.90	Chakkar
31.	IIAS (Summer Hill)	0.90	University
32.	Totu	1.60	Totu
Total		**33.13 ML**	

Source: Department of Irrigation & Public Health, Govt. of H.P.

Table 13 : Projections of Water Requirement (2021)

S. #	Sector	Demand of water (in MLD)	
		2004	2021
1.	Residential	24.50	39.00
2.	Commercial	0.17	4.10
3.	Institution	1.65	5.51
4.	Industrail	1.2	5.1
5.	Fire	1.31	4.6
6.	Floating Population	8.07	15.57
	Total	**37.44**	**73.88**

Source: Department of Irrigation & Public Health, Govt. of H.P.

As 135 liters per capita per day water is required to residents, the same is being inadequately supplied due to acute shortage at water sources. So far as demand and supply is concerned, only 30 MLD water is available, against demand of 39 MLD (2016). In order to cater water requirement of the city by the year 2021 reliable water sources like Giri River, availability of which is about 20 MLD have been proposed to be tapped to augment the existing water supply system and the same has been started and the required capacity of water is being supplied to the city from River Giri. A sum of Rs. 78 Crore was sanctioned by the Centre for early completion of the drinking water supply scheme for the state capital from the Giri river. 10 tube wells had also been installed. At present Rs. 70-80 crores are being invested every year on ensuring supply of water. The energy bill works out to the tune of Rs. 50 Crores per year. It is imperative to adopt rainwater harvesting techniques and water conservation strategies to cater for the future requirements.

2.3.7.2 Sewerage System

Sewerage System is an essential urban utility and forms an integral part of physical planning. Sewerage system for Shimla was designed for a population of 18,000 persons in 1880. The system continued for around 100 years without any augmentation. Population in the intervening period has increased to about 1,50,000. As a result, system has become grossly inadequate. Therefore, due to excess load certain portions have led to frequent leakages, causing environmental hazards and air pollution. The State Government has now taken steps to modernize the system to manage the city sewage and sullage efficiently for congenial environment of Shimla city. This milestone dream has been fulfilled by the financial patronage of OPEC and State Government. Therefore, the city has now systematic and properly designed sewerage system and most areas have been covered with necessary sewerage networks.

Table 14 : Zone-Wise Sewerage System and Treatment Plants

S. #	Location of Sewage Treatment Plant	Capacity in MLD
1.	Lalpani	19.35
2.	Dhalli	0.76
3.	Sanjauli & Malyana	4.44
4.	North Disposal (Golcha)	5.80
5.	Snowdon	1.35
6.	Summer Hill	3.93
	Total	**35.63**

Source: Shimla Jal Prabandhan Nigam Ltd.

2.3.7.3 Solid Waste Management

As estimated, the daily waste generation in Shimla City is approx. 90 MT. This translates into waste generation of 350 gms/capita/day. The collection of the waste through door to door collection and community bins is approx. 70-75 MT. Therefore 15-20 MT of waste could not be collected which leads to waste pilling.

Today Shimla city has a Solid Waste Treatment Plant at Bhariyal where the energy is produced from the waste. Considering the resident and floating population for projection years, and waste generation @350 gms/capita/day amounting to annualised waste generation of about 70 tonnes (2021). The total waste generated as projected is given in Table 15.

Table 15 : Population Growth and SWM Generation in SMC area

Head/Years	2011	2021	2031	2041
Resident Population (Nos)	1,69,758	2,56,883	3,49,361	4,18,296
Floating Population	76,000	1,00,000	1,25,000	1,50,000
Solid Waste Generation (MT)	86.01	124.91	166.03	198.90

Source: Solid Waste Management Plan for Municipal Corporation Shimla (2012)

Based on the land use survey, approx. 85% of the residential population is covered under door to door waste collection system, followed by 15% population dependent on the community bins for waste disposal. The rest of the population either dumps the waste in the open, incidence of burning waste has been less reported since inception of door to door garbage collection system. The door to door waste collection has been initiated in all the wards; however the percentage population covered under this system varies from ward to ward.

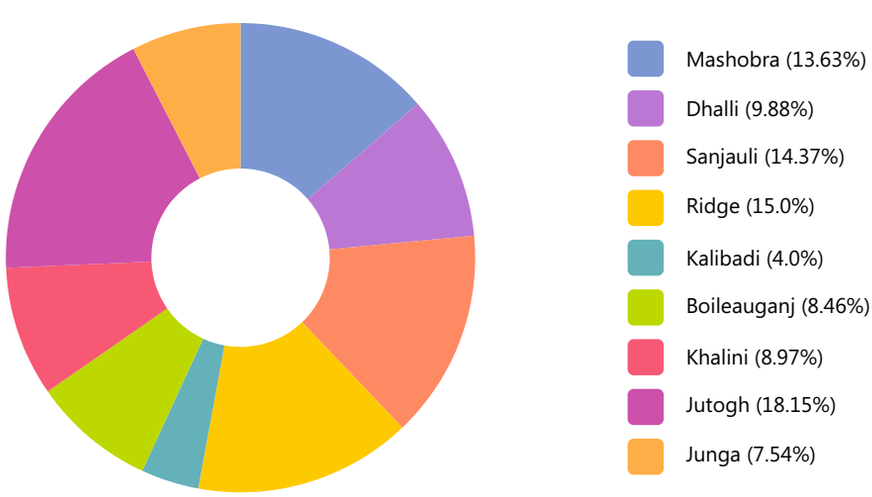
With regard to door-to-door collection scheme, most of the residents have outlined that system is effective. In absence of municipal door to door collection system, in several places, people have arranged their own collection system. In case of big hotels and institutions (schools, colleges, offices), most of them have their own cleaning and sweeping staffs. The Solid Waste Management plant is located at Bhariyal managed by Municipal Corporation Shimla.

2.3.7.4 Electricity

Shimla Planning Area is divided into nine major zones. The Electric sub-stations are placed in accordance with population size and commercial activities. About 577 medium and large range capacity electric transformers have been installed at different places. Major power supply to city comes from the Dehar Power Station, Northern Grid and other power houses. Main Electric Station is located at Totu, which is supplying power to urban as well as rural areas. Two main divisions are City as well as Rural and Urban. City Division serves localities namely, Boileauganj, Ridge, Kalibadi and Sanjauli, whereas Rural and Urban division caters areas including Mashobra, Dhalli, Khalini, Jatog and Junga. Shimla does not have any heavy industry. Provisions of HT lines are existing in Planning Area which accounts to 2.87% of the total electric installation. In addition, 46.33 % of transformers having a capacity of 250-500 kva are also installed, followed by 20-200 kva, which constitute 32.17 % of the total installation (2016).

Domestic consumption of electricity in city is high as compared to other sectors on account of Shimla being an administrative and service city accommodating a huge influx of migrant population as well as possesses peculiar climatic conditions. Therefore, 82.80 % of the total connections are recorded in domestic sector followed by 13.39% connections in commercial sector. 67796 connections have been recorded, out of which 54.05 % connections are in urban area and 45.95 % connections in rural areas.

Figure 2 : Spatial Distribution of Transformers Shimla City



Source: Himachal Pradesh State Electricity Board

2.3.7.5 Drainage

The Kufri- Dhalli- Sanjauli- Ridge-Totu spinal axis is a drainage divide of Shimla city. The tributaries on southern side go to the Yamuna and those on northern side to the Satluj. Encroachments on nallahs in the city is a common problem and same are susceptible to natural hazards like landslides, flooding and cloud bursts. Disposal of debris is choking natural drainage lines and the same is a matter of serious concern. The courses of many nallahs have been changed during the construction operations and such localities are witnessing drainage problems. There is no proper maintenance and cleanliness of drains along the roads. These aspects need proper attention. Many drains along he roads have been encroached upon.

2.3.7.6 Telecommunication

Shimla is being served by extensive networks of telecommunications. Private communication providers like BSNL, AirTel, Vodafone, Idea and Jio are providing efficient services to the masses. Telephone exchanges are spatially placed at strategic locations in Planning Area. Majority of households are enjoying proper communication services. Besides this, the District Disaster Management Authority (DDMA), Shimla also has satellite phone service available at the DEOC. Thus, Shimla being a capital has efficient telecommunication networks as compared to other areas.

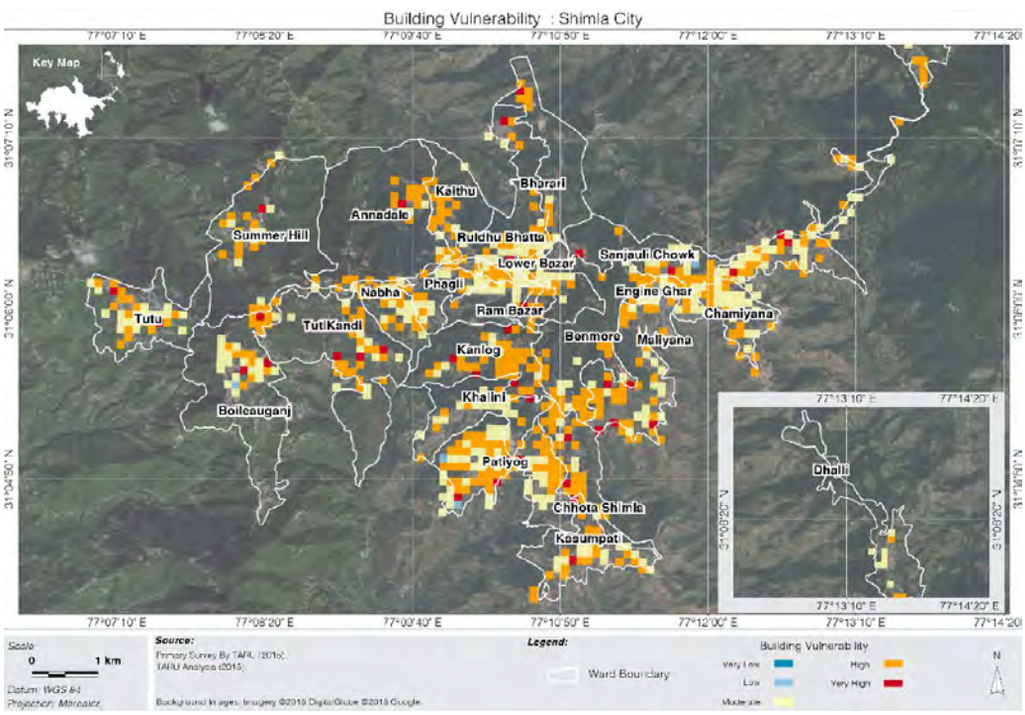
2.4 Physical Vulnerability of Shimla City

2.4.1 Building Vulnerability

Vulnerability of the population and the building stock are the most exposed features of a city. Social scientists classify vulnerability into two classes- intrinsic vulnerability and extrinsic vulnerability. Intrinsic vulnerability is the inbuilt characteristic(s) of the society, while extrinsic vulnerability is caused because of the extrinsic influences, like landslide, flood, earthquake, etc. For example, the intrinsic vulnerability of a building is determined based on its own structural elements, i.e. strength of the columns, presence of foundation, regular horizontal bands, etc. Similarly, for population, it includes the socioeconomic vulnerability of the people, like poor health conditions, illiteracy, poverty, lack of male members in a family, higher share of elderly population or kids, etc. Extrinsic vulnerability refers to the susceptibility of the building to the impacts of any external capable of causing damage. The traditional housing typologies that evolved in Himachal Pradesh have been known for its strength to withstand all natural calamities. However, the latest adoption of building materials and construction practices, are foreign and have been causing problem. RCC is one of the popular roofing materials that is used in all the new constructions in the city. However, there is a lack of trained engineers and masons to execute such work. Masons having the expertise and knowledge of constructing the traditional buildings have adapted themselves to the changing conditions and have become gap fillers in the RCC construction. The labour force for these constructional activities are brought in from the plain areas, who lacks knowledge or experience in managing slopes and dealing with construction in these areas.

Details of the foundation, structural elements, over-hanging loads, building floor plan, distance between adjacent buildings, presence of horizontal bands, structural configuration and irregularities, age of the building, etc. are vital aspects of the safety of buildings. These parameters were used in the Building Vulnerability Survey conducted in the city during July–August 2015, covered a total of 2,795 buildings, including important government buildings, public schools and hospitals and also a selected sample of 1,547 residential buildings. The findings of the same are illustrated in the map below.

Map 7 : Building Vulnerability Map of Shimla city



Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City

Dilapidated Stock

2% of the buildings (both residential & non-residential) are already dilapidated (based on HRVA 2016 carried out in 25 wards). Rest of the stock is either good (80%) or livable (about 18%). In terms of the age of the housing stock in various wards of Shimla, Kaithu, Annadale, Tutikandi-Badai, Phagli and Kasumpti wards have a higher share of dilapidated stock.

Sanjauli area of Shimla city dotted by recently done construction of RCC Buildings

2.5 Social Vulnerability of Shimla City

Social vulnerability is intrinsic vulnerability of a household and is usually attributed by the social background of the household as well as the means of economic sustenance. It is determined by the inability of people, organizations and societies to withstand the adverse impacts of hazards due to characteristics inherent in social interactions, institutions and systems of cultural values. Social vulnerability is linked to the level of well-being of individuals, communities and societies; levels of literacy and education; the existence of peace and security; access to basic human rights; systems of good governance; social equity; positive traditional values, customs and ideological beliefs; and overall collective organizational systems (ODPM, 2013). For example, when flooding occurs vulnerable groups such as, children, elderly and differently-abled, may be unable to protect themselves or evacuate if necessary.

2.5.1 Demographic Indicators of Vulnerability

The peculiar feature of Shimla demographics is that the real population on the ground is almost double the number of the natives residing in Shimla city. This is due to the fact of Shimla being a tourist attraction; at any time of the year the number of tourists visiting Shimla is equal or more than the local residents. According to the Census of India (2011), the Population Density of Shimla city (MC Shimla) is 4,800 persons per square kilometers.

Table 16 : Population of Shimla Urban

TOTAL	MALE	FEMALE
1,69,578	93,152	76,426

Source: Census of India, 2011

There is a shortage of areas with less steep slopes and this endorses that much of this population is present on more marginal locations of the city i.e. - steeper slopes, creeping slopes, sinking zones, along the natural drainage network, etc. in a densely-populated settlements. At the time of a hazard, the high density of population, multiplied by other factors such as weak strata, use of inappropriate construction materials and poorly constructed buildings would may possibly result in immense loss of lives and property. According to the Shimla city HVRA, majority of the population in Shimla city were in the working age group, as per the Census of India classification. About 55% of the people were in the middle age cohort, which is a positive sign for any population, since the proportion of dependents is less.

2.5.2 Status of Education

More literate a society, more aware a society. An aware member of a society will be updated on various government schemes and information that has been disseminated by various agencies, including the disaster management authority. Of the total households surveyed during the City HRVA in 2016, about 2.6% of the males and 6.75% of the females were not literate. Apart from this, other education cohorts do not show much variation between both male and females. In the field of technical education, the enrollment of females was 3 % lesser that of the males.

Table 17 : Literacy and Education Levels

Highest Class Completed	Male		Female	
	No.	Percentage	No.	Percentage
Not literate	104	2.66	266	6.75
Literate, no formal schooling	46	1.18	58	1.47
Class 3 or less	295	7.54	290	7.36
Class 4-5	230	5.88	288	7.31
Class 6-9	485	12.39	465	11.81
Secondary	525	13.41	526	13.36
Class 11	81	2.07	83	2.11
Class 12	583	14.90	572	14.53
BA/BS/B.Com	952	24.32	804	20.42
MA	390	9.96	474	12.04
M Phil	40	1.02	42	1.07
Technical	183	4.68	70	1.78
Total	**3,914**	**100**	**3,938**	**100**

Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City, 2016

2.5.3 Income Classification

The income disparity is very high in Shimla, with the income ranging from below Rs 100 to more than 1 crore (10 million) a month. Income was recorded into class intervals of 5000, leaving out the outliers. On comparing the educational status and the income, it was determined that the majority of the population were salaried or regular wage employees. Shimla being the state capital and the district headquarter, many people are also engaged in the government services. Given the time during which the survey was conducted, many of the respondents were only the housewives who stayed at home. So the highest share of work is depicted as 'housewife'. Second predominant work is the regular wage/salaried. This shows the economic stability of the households surveyed. The households with irregular income patterns are more vulnerable compared to the others.

Table 18 : Distribution of Employment

Type of Employment	No. of Employees	Percent
Self employed	741	8.9
Employer	265	3.2
Helper in HH enterprise	64	0.8
Regular salaried/wage employee	1457	17.4
Casual wage labour	106	1.3
Piece rate worker	55	0.7
Apprentice	87	1.0
House Wife	1897	22.7
Total	**4672**	**55.9**

Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City, 2016

2.5.4 Dependency Ratio

About 42% of the population are not working (Table 18) and hence has no earning. Rest of the family members of the surveyed household were earning on the basis of their employment types. When education and income are correlated, there is a strong positive correlation between higher education and higher incomes. This illustrates that the share of traditional economic activities are relatively lesser in the overall work pattern.

Table 19 : Earners and Dependents

Income Class in INR	No. of People	Percentage
Not earning	1,997	42.7
Up to 5,000	321	6.9
10,000	539	11.5
15,000	353	7.6
20,000	303	6.5
25,000	222	4.8
More than 30,000	937	20.1

Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City, 2016

2.5.5 Determinants of Social Vulnerability

Social vulnerability refers to the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist and recovery from the impact of a natural hazard (Wisner et al., 2004). Effectively addressing social vulnerability decreases both human suffering and the economic loss related to providing social services and public assistance after a disaster. Given below are some of the crucial dimensions of social vulnerability which often coexist in different groups.

- Level of Poverty
- Lack of or limited access to resources such as information, knowledge and technology
- Lack of or limited access to political power and representation (marginalization, exclusion)
- Lack of or limited social capital including social networks and connections
- Inappropriate and inadequate beliefs, customs and attitude in response to risk or disasters
- Poor residential settings (poor protection, poor maintenance, etc.)
- Frail and physically-limited individuals
- Lack of or limited access to critical services such as communication, transportation, power supply, water supply, sanitation, etc.

Table 20 : Determinants of Social Vulnerability

Concept	Description	Increase (+) or Decrease (-) Social Vulnerability
Socio-economic status (income, political power, prestige)	Wealth enables communities to absorb and recover from losses quicklier due to insurance, social safety nets and entitlement programs.	High status (-) Low income or status (+)
Gender	Women can have more difficult time during recovery compared to men because of the traditional lifestyles and physical strength.	Gender (+)
Ethnicity	Imposed language and cultural barriers that effect access to post disaster funding and residential location in high hazard areas.	SC/ST/OBC (+) General (-)
Age	Extremes of the age spectrum affect the movement out of harm's way.	Elderly (+) Children (+)
Employment	The potential loss of employment following a disaster exacerbates the number of unemployed workers in a community, contributing to a slower recovery from the disaster.	Employment loss (+)
Residential Property	The value, quality and density of residential construction affects potential losses.	
Infrastructure and Lifelines	Loss of sewers, bridges, water, communications, and transportation infrastructure compounds potential disaster losses.	Extensive Infrastructure (+)
Tenants	They often lack access to information about financial aid during recovery.	Renters (+)
Occupation (permanency of it)	Depending upon the type of occupation people will be vulnerable towards hazard.	Professional (-) Clerical or labourer (+) Service sector (+)
Family structure	Families with large number of dependents have limited finance to out source care for dependents.	Large families (+) Single parent household (+)
Education	Lower education constrains the ability to understand warning information and access to recovery information.	Less educated (+) Highly educated (-)

Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City, 2016

2.5.6 Access to Major Services

When disasters strike, the low income people are likely to have very limited access to basic services and facilities such as water supply, sanitation, healthcare, communication, transportation, emergency services, etc. A number of barriers, especially the policy and planning related processes, exclude some individuals and groups from access to and use of these services and resources and from participation in economic activities. Different communities may face similar risks of exposure to the negative effects of environmental and man-made hazards, but their actual vulnerability is dependent on their social conditions, civic and social empowerment and access to mitigation and relief resources. During the Social Vulnerability Analysis carried out by TARU Leading Edge Pvt. Ltd. in the year 2015, people's access to these services and facilities was analysed. The findings of the analysis help in understanding of the social vulnerabilities prevailing in Shimla city.

2.5.6.1 Access to the Main Road

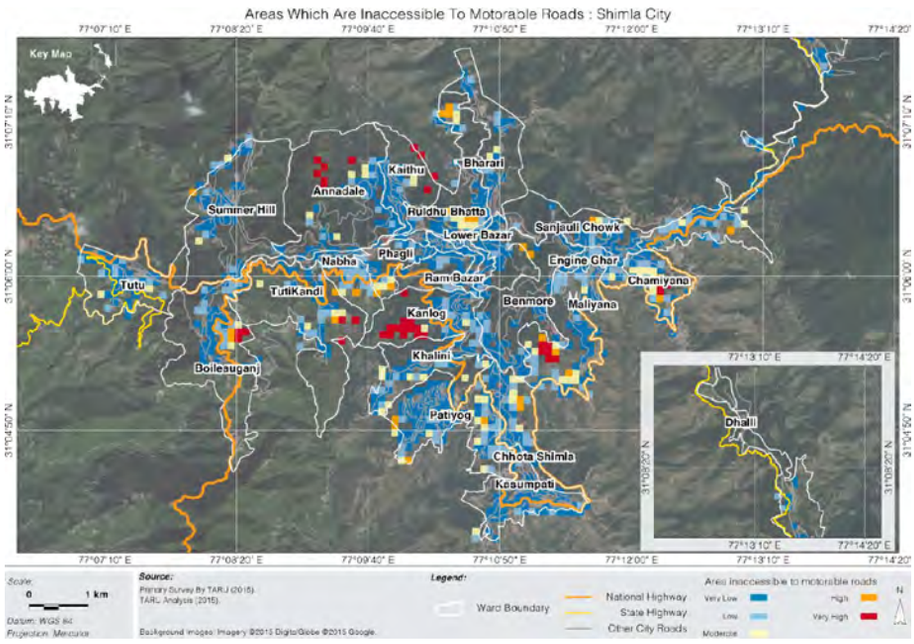
Shimla is a hill station with a majority of settlements located on steep slopes. As most of the buildings are constructed on the contours of steep hills, this makes a big proportion of people vulnerable to various hazards due to lack of access to the motorable roads. Table 21 shows the households which do not have an access to their house from the motorable roads (shown in red colour), which in turn enhances people's inability to escape in case of any eventuality. So these households need to be considered while making any preparedness plans of emergency management plans.

According to the Shimla City HRVA 2016, wards like Lower bazar, Ruldhu Bhatta, Kaithu, Chamiyana, Phagli have more than 80% of the households staying away from the motorable road, who has to use intricate network of staircases and narrow walkways to reach their houses. On the other hand, Ram Bazar, Boileauganj, Sanjauli chowk, Dhalli, Kasumpti, Chhota Shimla and Pateog have majority of the households closer to the main motorable road.

Table 21 : Percentage of households with access from Motorable Road

Ward No	On the main road		Interior from the road		Total	Ward name
	No.	Percentage	No.	Percentage		
1	17	32.7	35	67.3	52	Bharari
2	9	11.1	72	88.9	81	Ruldhu Bhatta
3	10	15.9	53	84.1	63	Kaithu
4	20	39.2	31	60.8	51	Annadale
5	34	35.4	62	64.6	96	Summer Hill
6	35	25.9	100	74.1	135	Totu
7	61	48.0	66	52.0	127	Boileauganj
8	9	25.0	27	75.0	36	Tutikandi-Badai
9	17	33.3	34	66.7	51	Nabha
10	6	12.2	43	87.8	49	Phagli
11	16	34.0	31	66.0	47	Krishna Nagar
12	9	52.9	8	47.1	17	Ram Bazar,Ganj
13	2	10.0	18	90.0	20	Lower Bazar
14	16	43.2	21	56.8	37	Jakhu
15	6	37.5	10	62.5	16	Benmore
16	14	30.4	32	69.6	46	Engine Ghar
17	36	52.9	32	47.1	68	Sanjauli Chowk
18	47	48.5	50	51.5	97	Dhalli
19	31	18.5	137	81.5	168	Chamyana
20	33	30.8	74	69.2	107	Maliyana
21	65	41.7	91	58.3	156	Kasumpti
22	36	44.4	45	55.6	81	Chhota Shimla
23	104	55.9	82	44.1	186	Pateog
24	44	37.3	74	62.7	118	Khalini
25	32	33.7	63	66.3	95	Kanlog

Map 8 : Areas accessible to Motorable Roads in Shimla City

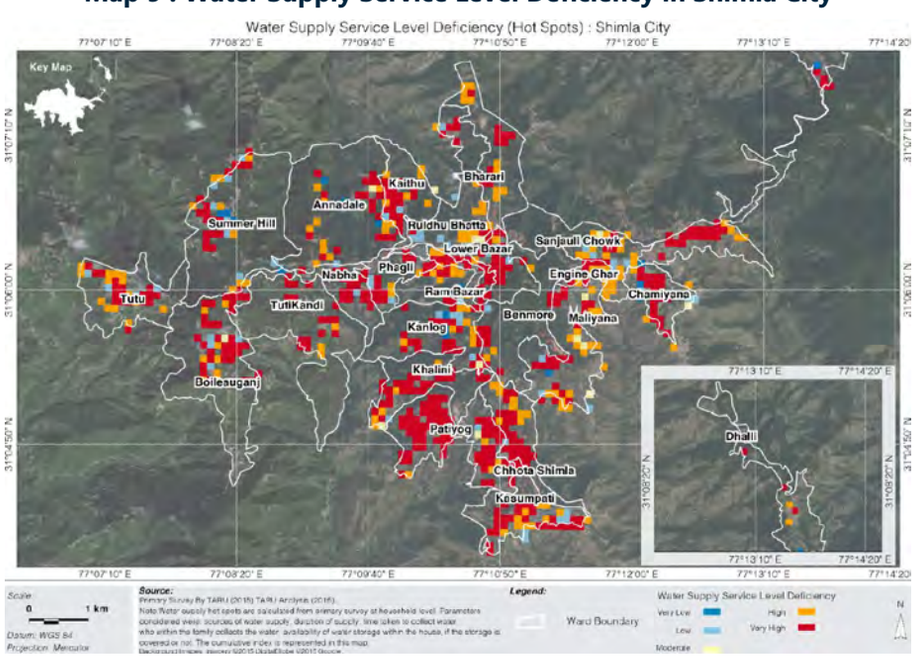


Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City, 2016

2.5.6.2 Access to Water Supply and Sanitation

Water supply in this city is very erratic and comes from many sources. Based on the parameters, source for drinking, who fetches water, time required in fetching, means of main storage, storage coverage, availability of water in hours per day and adequacy of water pressure, an index has been derived. The bright red grids shows the areas where the households having difficulty in accessing water has been indicated.

Map 9 : Water Supply Service Level Deficiency in Shimla City



Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City, 2016

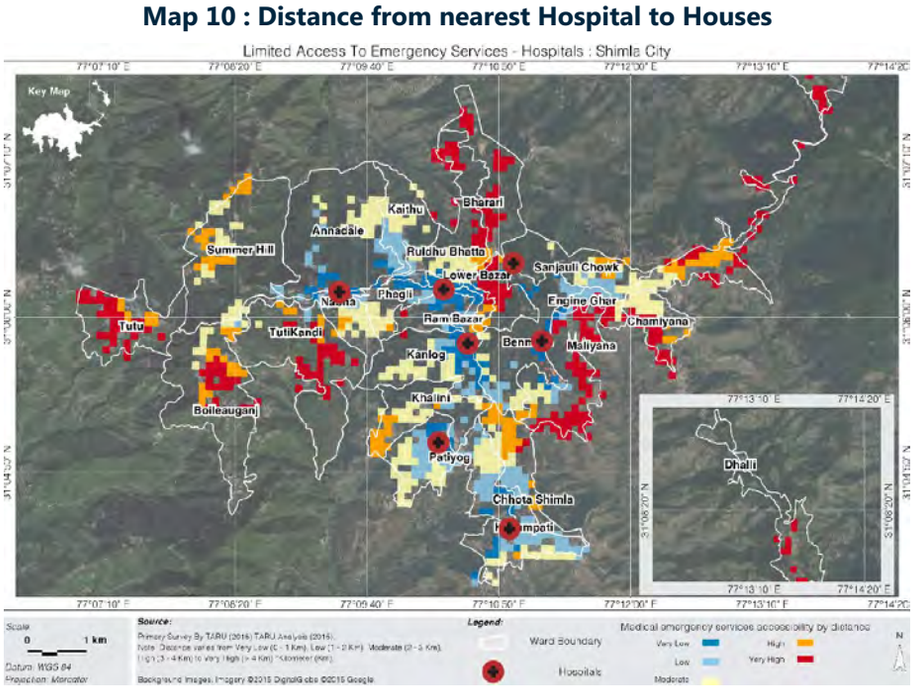
2.5.6.3 Access to Health Facilities

Equal access to basic medical and healthcare services is a fundamental right of the people. Access to hospitals is a critical measure for understanding the vulnerability of the households. Healthcare accessibility refers to the relative ease by which healthcare resources can be reached from a given location, and it is an interface between potential users and healthcare resources, such as facilities (hospitals, medical centers and clinics). The long distance, poor road conditions, and costs associated with travelling are barriers to access the healthcare facilities. In the HVRA for Shimla city, all the sampled households were considered for assessing the distance and time taken for accessing the reach of health facilities. Below table shows how many households are how much distance from the nearest hospital. As shown in the Table 22, about 65% of the houses are either 5 km. or more from the nearest hospital.

Table 22 : Distance from nearest Hospital to Houses

Distance from Hospital	No. of Households	Percent
500	131	4.2
1,000	263	8.4
2,500	723	23.1
5,000	1,507	48.2
7,500	339	10.8
10,000	140	4.5
15,000	23	0.7
Total	**3,126**	**100.0**

Map 10 : Distance from nearest Hospital to Houses



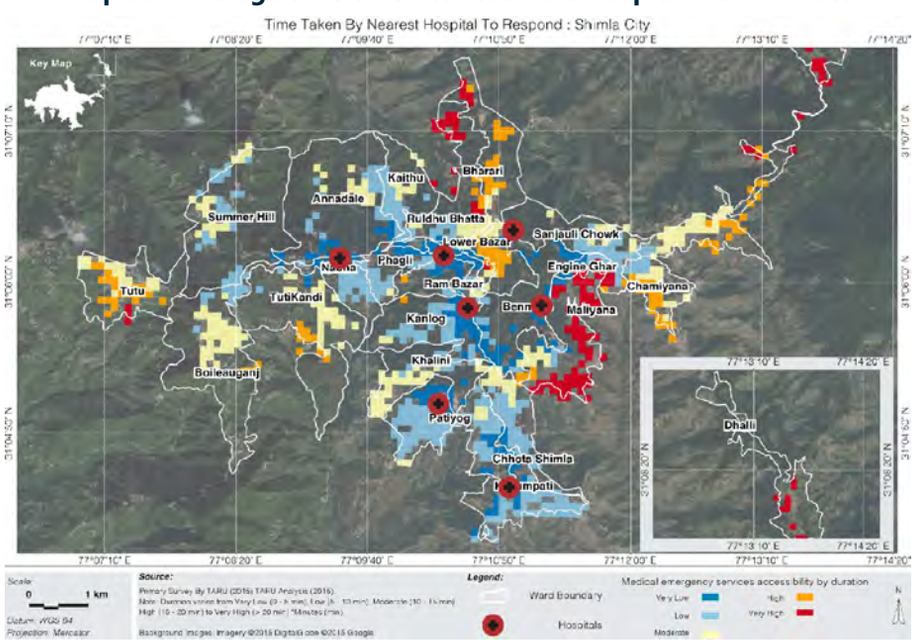
Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City, 2016

Access to healthcare is a measure of human well-being that is constrained by numerous geographically varying factors, the most immediate of which is the time it takes individuals to travel to a properly equipped and adequately staffed healthcare facility. As such, people facing long travel times to healthcare facilities are less likely to seek care when it is needed and the consequences of failing to seek care include increased mortality and morbidity from treatable conditions. About 8% of the households have to travel more than 20 minutes in order to reach a hospital. Considering the traffic conditions, and traffic jams within the city, the cost payable by these households to access health facilities is much pricier. Majority households (56%) are within a distance of 10 minutes travel. As mentioned earlier, the distance is only notional and based on the real experience, the roads of Shimla cannot facilitate such time in reaching from one point to another.

Table 23 : Average time taken to reach the Hospital from Houses

Time taken to reach Hospital	Frequency	Percent
5	625	20.0
10	1,134	36.3
15	708	22.6
20	396	12.7
25	160	5.1
30	67	2.1
60	36	1.2
Total	**3,126**	**100.0**

Map 11 : Average time taken to reach the Hospital from Houses



Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City, 2016

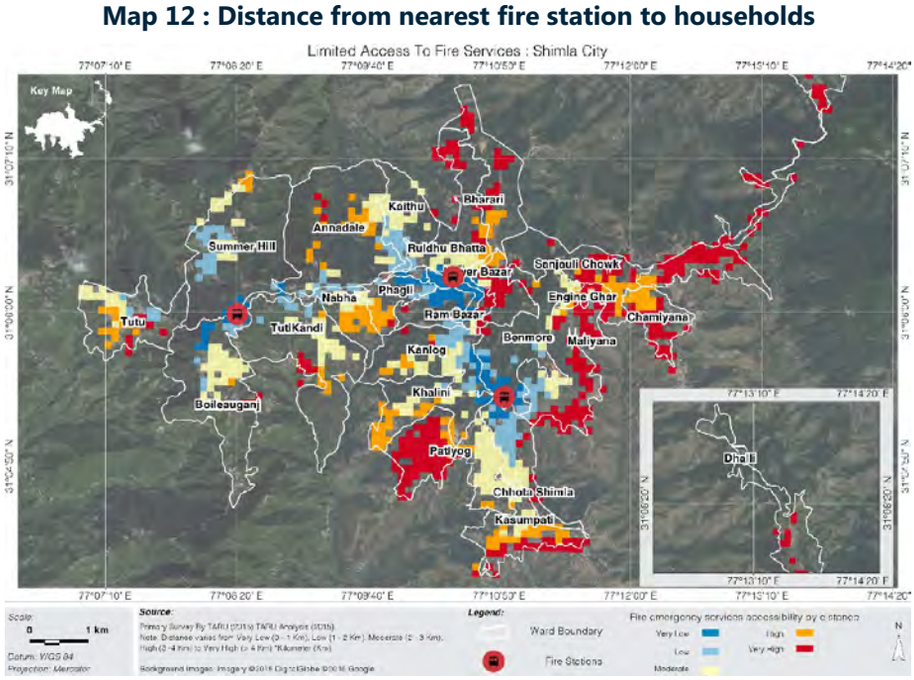
2.5.6.4 Access to Fire Service

There are three fire stations within the city boundary. However the access to individual houses is very narrow and many of the times not accessible at all. In understanding the accessibility of the services, two components are important- Distance from the service and the time taken to access the service. The private hospitals are not taken into consideration for this analysis. There are private hospitals within the city in some of the 34 wards. If those hospitals are considered, the distance and duration to reach them will be reduced considerably. However, considering the cost of accessing their services, those services are deliberately excluded from this analysis. Distance to the nearest fire service from the households is explained below.

Table 24 : Distance from nearest fire station to households

Distance from Fire Service in Meters	No. of Households	Percent
500	185	5.9
1000	152	4.9
2500	378	12.1
5000	1701	54.4
7500	523	16.7
10000	138	4.4
15000	49	1.6
Total	**3126**	**100.0**

Map 12 : Distance from nearest fire station to households



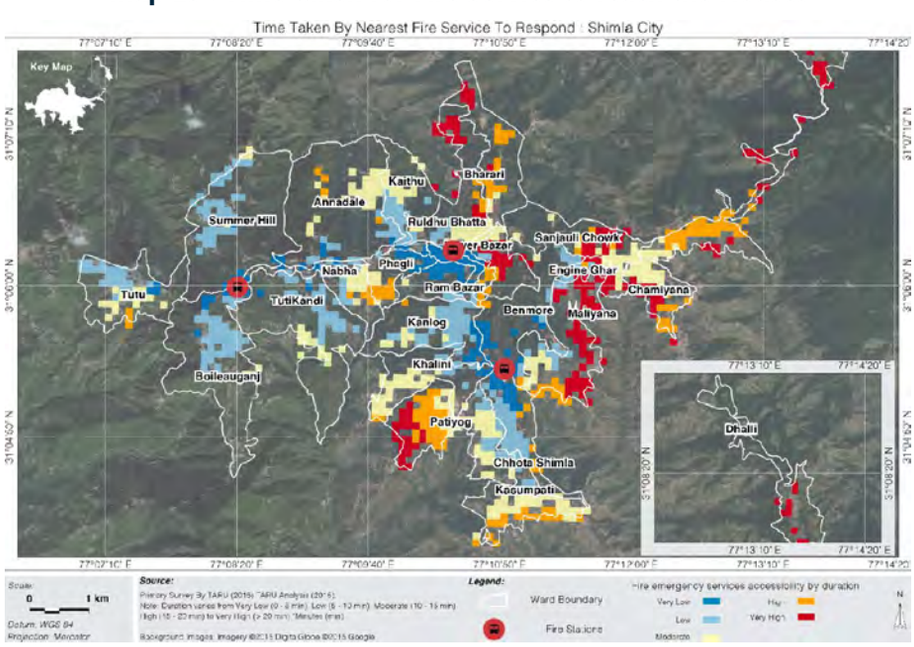
Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City, 2016

Based on the type of the access roads, households are assessed to the distance to the nearest motorable road. This is important in order to understand their evacuation time in case of a disaster. So as per our analysis, as shown in Table 24, about 6% of the households are located at a distance more than 500 mt. from the main access road. Special provisions need to be made for the evacuation of the households. As a consequence, the time taken by the Fire Service to reach the houses is more than 10 minutes in majority of the cases.

Table 25 : Time taken for Fire Service to reach the Houses

Time taken in Minutes	No. of Households	Percent
0	2	0.1
5	403	12.9
10	942	30.1
15	851	27.2
20	504	16.1
25	282	9.0
30	99	3.2
60	43	1.4
Total	**3126**	**100.0**

Map 13 : Time taken for Fire Service to reach the Houses



Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City, 2016

2.6 Economic Vulnerability of Shimla City

Economic vulnerability of a country/ region/ city can be defined as the potential or capability of exogenous shocks faced by the society, to hamper its development. There are two sources of vulnerability- first is external which is mainly related to balance of trade or instability in the international market and second is vulnerability caused by natural disasters.

2.6.1 Economic Profile of Shimla

Shimla being the state and administrative capital of Himachal Pradesh, majority of economic activities are concentrated in Shimla. Natural resources play a key role in economic survival of the town and hinterland, as tourism and agriculture, are the mainstays of the economy. The shift from agriculture to horticulture has changed the economic pattern of the region, as Shimla has become major centre for collection and distribution. District Domestic Product (DDP) of Shimla at current prices has increased from 379868 lakhs in 2004-05 to 850,323 lakhs in 2011-12 showing an increase of 12.20 percent. The per capita income at current prices witnessed an increase of 9.76 percent as it increased to 85,686 in 2011-12 from 44,644 in 2004-05.

Table 26 : Economic Indicators for Shimla

No.	Indicators	2004-05	2011-12	CAGR
1.	**GSDP in Current Prices**			
	Shimla	3,79,868	8,50,323	12.20%
	Himachal Pradesh	24,07,658	50,47,535	14.94%
2.	**Per Capita Income**			
	Shimla	44,644	85,686	9.76%
	Himachal Pradesh	33,348	74,694	12.21%

2.6.2 Work Force Participation

Shimla houses major state level and district level government offices. A considerable proportion of the city's workforce is engaged in these establishments and in the tourism sector. The total working population has been close to 40% over the last three decades. The female working population in 2011 was about 25% in comparison to 75% male working population.

Table 27 : Work Force Participation in Shimla Urban

Particular	1991		2001		2011	
	No.	%	No.	%	No.	%
Total Population	82054		142555		201351	
Total Working Population	33699	41	54404	38.1	84615	42
Total Main Workers	31965	94.8	52809	97	74601	88.1
Total Marginal Workers	1734	5.2	1595	3	10014	11.9
Total Non-Workers	48355	59	88151	61.9	116736	58

2.7 Population Risk

Estimation of the potential loss of lives has been calculated using the peak ground acceleration (PGA) of an earthquake of 2500 year return period. Number of expected casualties was calculated for both mid night and day time scenario as the population under is higher at night time in comparison to day time when most of the people are awake and they have the possibility to come out of the buildings to an open space. Similarly, population causality risk for landslide and other hazards has been calculated and then combined. As per Table 27, if any earthquake happens at night, roughly 20466 people will perish within the city, while if the quake happens during the day time, the number will be 5116 (City HRVA 2016). This also indicates that the residential buildings are more vulnerable compared to outdoors. So in an event of an earthquake, it is always advised to get to a safer open space, compared to practicing Duck – Cover – Hold (DCH).

Cumulative population risk has been carried out by combining the seismic risk, landslide risk and urban fire risk. Other risks, viz., forest fire risk, urban heat island risk, hailstorm, etc could not be simulated for Indian conditions. Further research is required for doing so. So combining the three above mentioned risks, annualized cumulative risk has been calculated and represented in the Map 14. The highest risk class, 'very high' shows that the households within this 100 sq mt grid have a very high probability of getting impacted by one or more of the hazards while the households on the 'moderate risk' show that they have a moderate probability that they may get effected by one of the hazards.

Table 28 : Assumed Death Rates for Earthquake

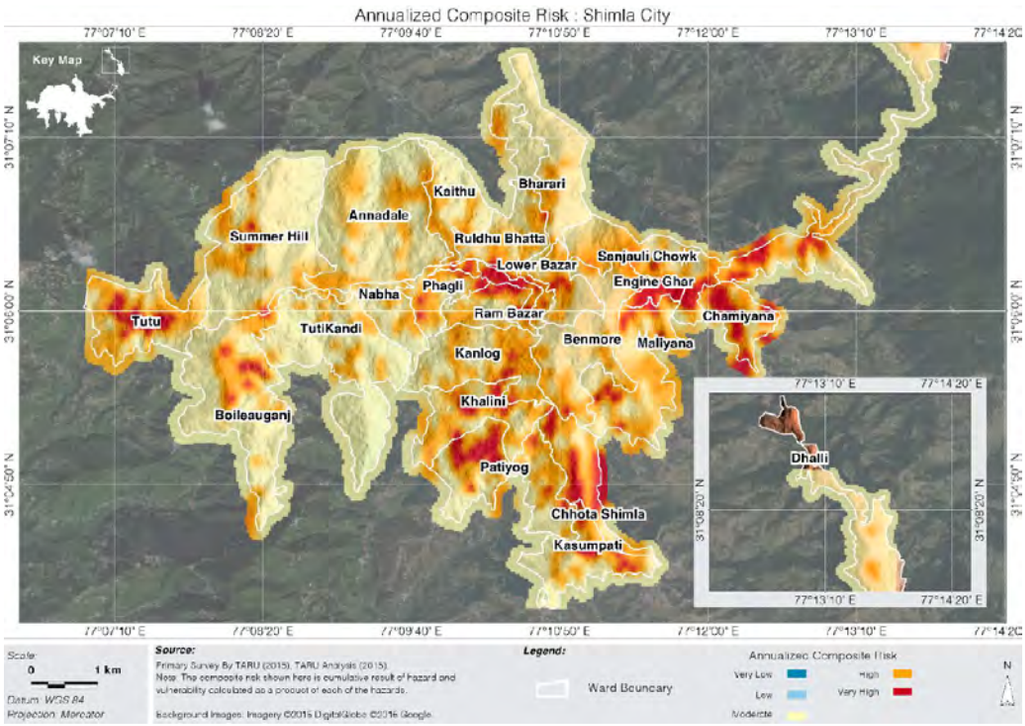
Time of Occurrence	Deaths in Collapsed Houses	Deaths in partially collapsed houses
Midnight (Sleeping)	40 %	20 %
Daytime (Working)	10 %	5 %

Source: Arya (1992)

2.8 Building Risk

Based on the building vulnerability and the hazards that building is exposed to, an annualised building risk has been calculated. Buildings with lower rapid visual screening (RVS) score tend to get more damaged compared to the buildings with higher RVS score. Buildings in very high risk zone tend to fail more when exposed to an earthquake or landslide compared to the buildings in the lower risk zones.

Map 14 : Annualized Composite Risk of Shimla City

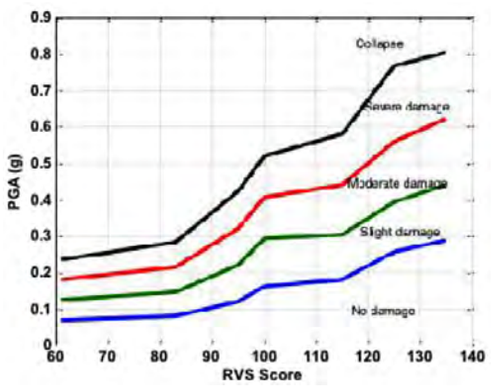


Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City, 2016

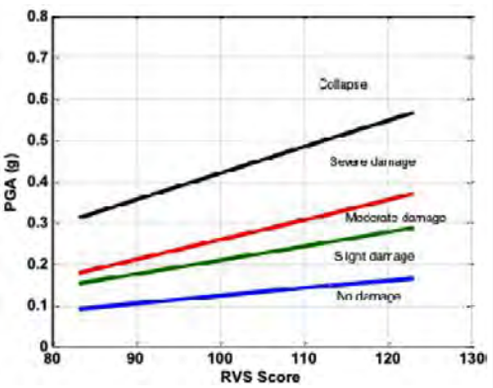
2.8.1 Fragility Curves

During the Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City, the Fragility curves (Figure 3) were developed for reclassified five predominant building typologies.The damage parameters (D) have been classified as no damage (D<0.2), slight damage (0.2<D<0.4), moderate damage (0.4<D<0.6), heavy damage (0.6<D<0.8) and collapse (D>0.8). The PGA values with respect to RVS scores for damage categories have been determined from the fragility curves. The state of damage of all types of buildings can be found out from fragility curve shown in the Figure 3, provided that the PGA value of the region and RVS score of building is known. Fragility curve shows that a building with low RVS score means it is a highly vulnerable building and will suffer more damage at low intensity of earthquake only (low PGA value). For RC frame structures, a building with RVS score of 70 will suffer D3 or higher category of damage due to earthquake capable of producing PGA value of more than 0.14g. Fragility curve of brick masonry building shows that buildings having RVS score of 85 will suffer D4 to D5 category of damage at the sites where PGA exceeds above 0.18g. A building of low vulnerability, having RVS score of 120 will sustain high intensity of earthquake. It will incur damage of grade D1 and D2 only, even at the PGA values of 0.15g to 0.27g. Stone masonry and rammed earth buildings may receive sever damage (D4 and D5) at PGA values of 0.1 g and 0.16g only even though their RVS score vary from 85 to 110. Rammed earth wall being brittle in nature receive damage at early stage of deformation due to lateral forces. Stone masonry buildings do not have interlocked masonry units due to undressed/ rounded stone used in wall construction which may collapse even in case of minor shaking in the low intensity earthquakes. Hybrid and other buildings will sustain large earthquakes without being majorly damaged. Most of the buildings will suffer D1 or D2 category of damage only.

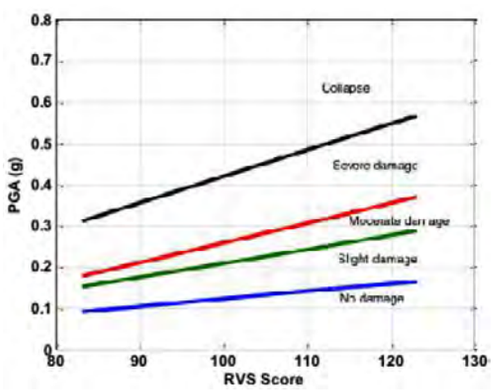
Figure 3 : Building Fragility Curves



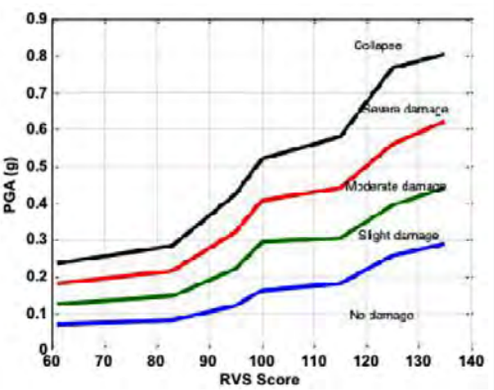
RCC Buildings



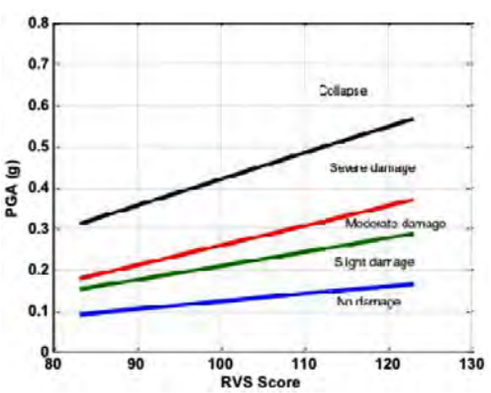
Brick Masonry Buildings



Stone Masonry Buildings

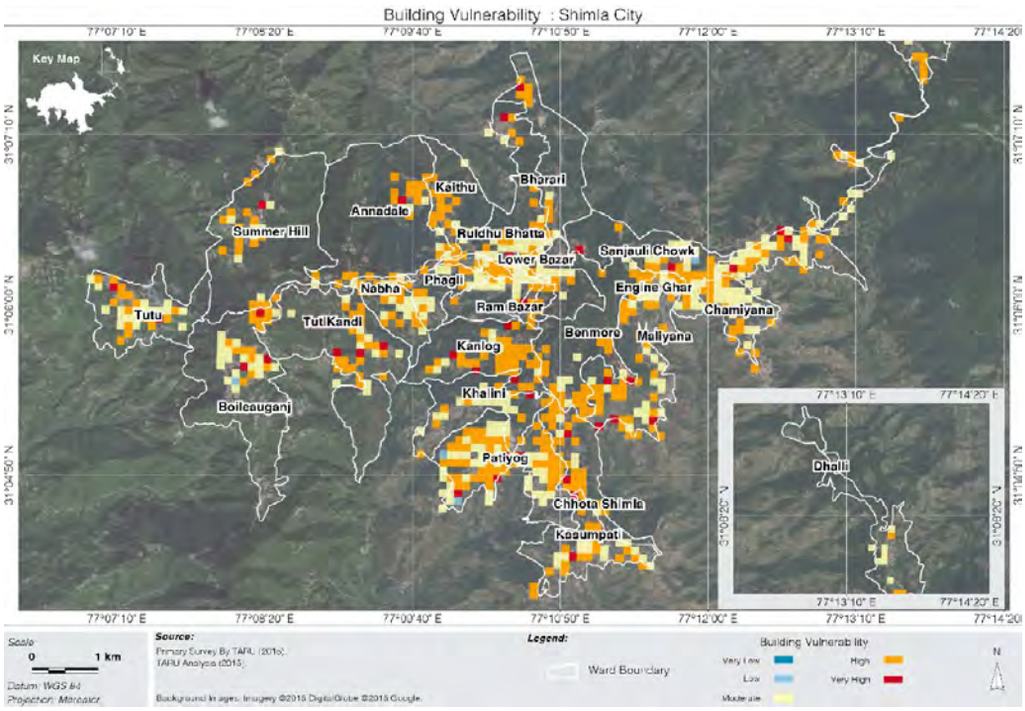


Rammed Earth (Traditional) Buildings



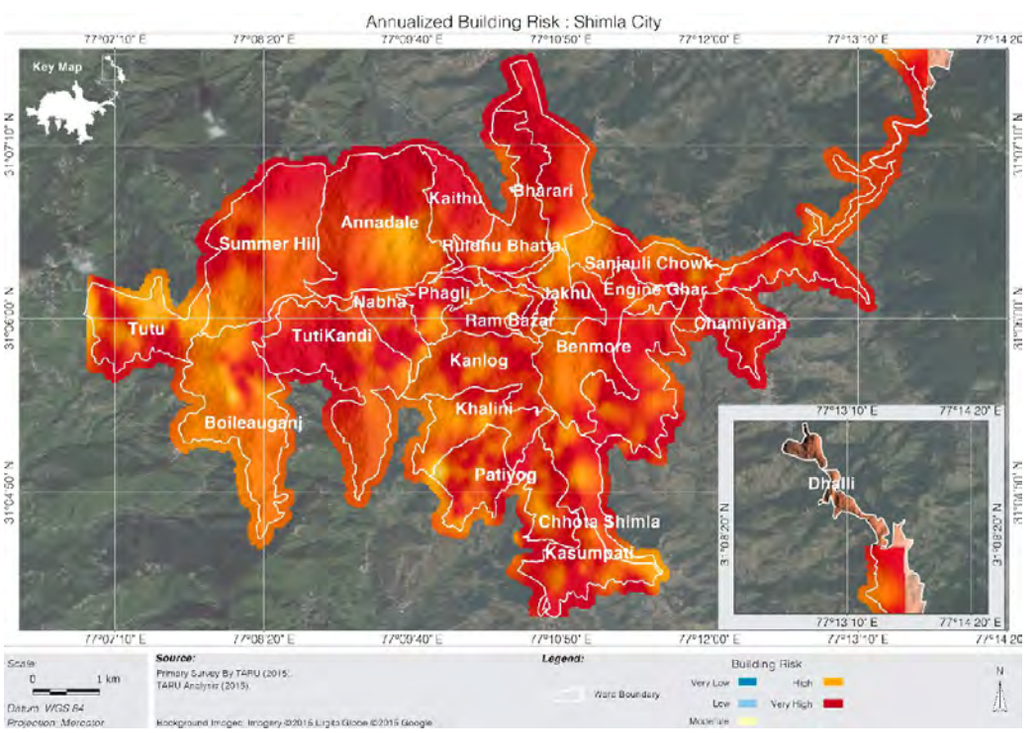
Rammed Earth (Hybrid) Buildings

Map 15 : Building Vulnerability of Shimla City



Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City, 2016

Map 16 : Annualized Building Risk of Shimla City



Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City, 2016

Rammed earth buildings are more fragile than other building typologies. Rammed earth and stone masonry buildings are expected to get severely damaged or collapse completely in the event of low intensity earthquakes as well. Hybrid buildings demonstrate better performance in earthquake and are only partially damaged. These conditions may also vary based on the season of the year when the earthquake occurs- dry season or monsoon season. Monsoon season has more earthquake triggered landslides, which may cause additional building damage and loss of lives. In this study, the complexity of the multiple events occurring at the same time has not been considered. The damage which the existing buildings within the city may experience in an event of an earthquake with 2500 year return period are given in Table 30. The number may differ from analysis to analysis, however, there is a presence of risk, which is important to the current study.

Table 29 : Description of Damage Grades

Grade of Damage	Description of Damage
Grade 1 (D1)	Slight damage fine cracks in plaster, fall of small pieces of plaster
Grade 2 (D2)	Moderate damage small cracks in plaster: fall off fairly large pieces of plaster, pan tiles slip off, cracks or minor damage to chimneys
Grade 3 (D3)	Large and deep cracks in plaster, fall of chimneys
Grade 4 (D4)	Gaps in walls, parts of buildings may collapse, separate parts of the buildings lose their cohesion and inner walls collapse
Grade 5 (D5)	Total collapse of the buildings

Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City, 2016

Table 30 : Damage Ratio in Building Typologies

Building Typology	Total Buildings	Building Damage	Damage Ratio
RC frame	416	130.1	3.2
Burnt brick	35929	13358	2.6
Stone masonry	2738	1089.3	2.5
Rammed earth	1314	1314	1.0
Hybrid	1073	341	3.1

Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City, 2016

2.9 Infrastructure Risk

Water lines will be broken by landslides and ground shaking leaks precious water into the streets, and the damaged water supply system cannot provide more water to the city. Damage to the electrical transmission system causes power cuts throughout Shimla. In the immediate aftermath, residents will not fully comprehend that Shimla is completely isolated. Communication options will be severed due to landslides and building collapses which blocks road access. It may take days or weeks to bring in emergency water and power—and much longer to fully restore all the systems.

Water, electricity, communication systems and roads are the basic infrastructures that serve Shimla's residents. These are called lifelines because people depend on them for life-sustaining services. This is especially true for the city of Shimla, where loss of transportation systems and clean water in particular are life-threatening. Shimla's water, electrical power, communication systems and roads are all vulnerable to earthquakes. When earthquakes strike, ground shaking can stretch and compress buried pipelines, conduits and bridges, and can damage unsecured equipment. Landslides rip through pipelines, topple electrical poles, undermine and bury roads, and also blocks rivers. Bridge decks can be pulled off from their abutments and sandy saturated soils can liquefy and settle or move, damaging cables, pipelines, dams and equipment. Ground shaking and ground failure affect infrastructure, water mains, electrical transmission and distribution systems, and roads. This damage can be minimized by actions taken ahead of time to make pipelines, bridges and roads more robust.

In order to assess the damage that may be caused to the infrastructure systems, a detailed infrastructure mapping has been carried out (as part of the elements at risk database) as a part of the Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City, 2016. Risk has been calculated based on individual infrastructure's exposure to high hazard zones. However, probability of the failure of the infrastructure in a given year cannot be estimated based on the existing data conditions. Maps or database of the physical infrastructure is not available with the municipal corporation. Under these circumstances, hotspots (where additional strengthening or backup plans need to be implemented) have been identified. Higher preference has been given to the trunk infrastructure compared to the distribution networks. Shimla may be isolated in terms of supplies and communication because of the following:

1. It is remote, and roads leading to and from Solan and Kufri may lack capacity and are subject to blockage by landslides and debris from collapsed buildings;
2. Shimla will be divided into 3-4 islands – Totu; areas from RTO to High Court; Secretariat – Kasumpti - Chhota Shimla; Sanjauli - Chamiyana - Engineghar; Dhalli.
3. Many of its slopes are unstable (ref. landslide hazard maps) during earthquake shaking, and the resulting landslides will damage utility systems, roads and streets;
4. Hillside construction is exceptionally vulnerable (Sanjauli, Kasumpti, Dhalli, Totu) to damage from shaking, and collapsing buildings will damage electrical and communications systems and block streets; and
5. The city's dense, urban population is uniquely dependent on infrastructure for food, water and medical care.

2.9.1 Water Supply

The city may suffer a major jolt with the failure of the main trunk lines that supply water to the city. These trunk lines are of varying diameter and exposed in many parts of the city. The water supply network is a critical element of civil infrastructure system. Its complexity of operation and high number of components mean that all parts of the system cannot be simply assessed. Earthquakes are the most impacting natural hazard for a water supply network, and seismic risk assessment is essential to identify its vulnerability to different levels of damage and ensure the system safety. A moderate landslide or a PGA more than 0.3 will damage much of the existing water supply network. Partial destruction of the pipelines does not mean the destruction of the entire network of a system. For a particular network topology, the destruction of the some pipelines may greatly reduce the performance of system, while others hardly have a significant impact on the overall performance of the system.

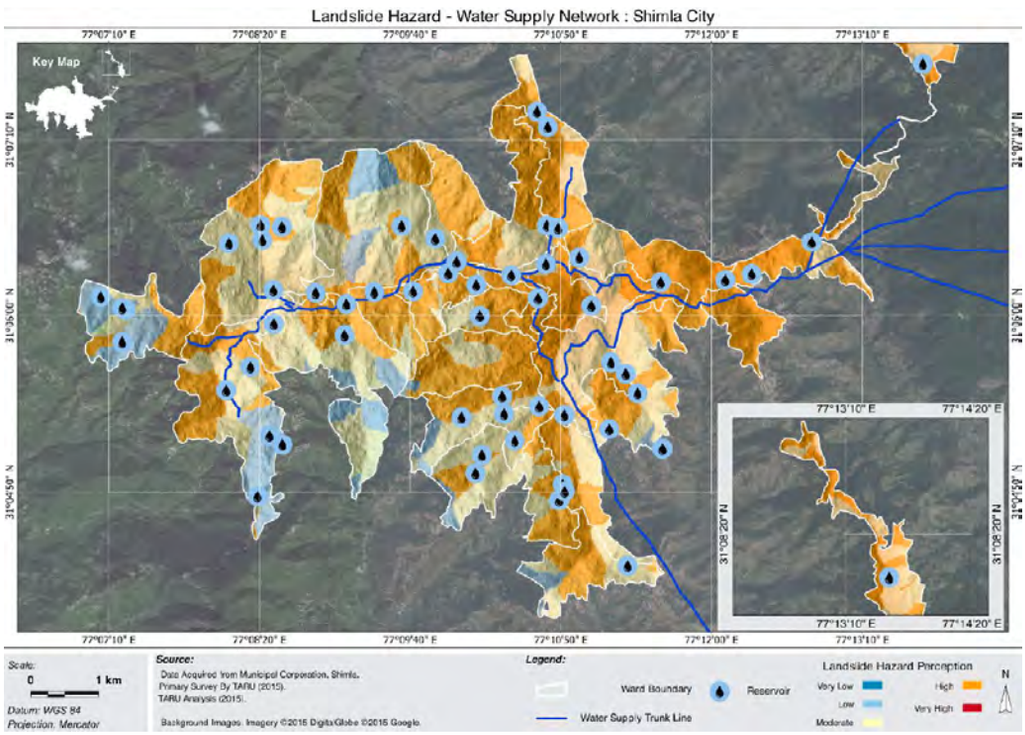
Table 31 : Phenomenon of Damage

Risk Class	Damage Degree	Phenomenon of Damage
Moderate Risk	Slight Damage	Pipes & fittings are largely intact, the individual joint fillers may have a slight crack, which will result in slight leakage.
High Risk	Moderate Damage	Pipes almost have no damage, and the individual joints have smaller cracks. It is easy to leak, can be repaired easily.
Very High Risk	Serious Damage	Pipes, fittings and sockets and other accessories are damaged seriously, and joint fillers are basically crushed. Leaking seriously and it is difficult to repair.

Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City, 2016

The treated water pipelines in Shimla traverse a slope which often has active landslides. Distribution mains and local distribution lines cross numerous areas where landslides could occur or have occurred. The treatment structures and equipment can be damaged or dislodged by earthquake shaking, rendering them useless until repairs are made or replacements installed. The components comprising the electrical substations at the water treatment plants and at the pump locations are not currently anchored for earthquake motions. Even if the pipelines remain intact, electric system failures, and failures at the treatment plant substations, would cripple the municipal water system. As a result there would be no electricity to power pumps, chemical processes, flow controls and communications. Because the first set of raw water pumps are not connected to emergency generators or diesel pumps, the water supply is limited to the amount already in the system. The electric pumps that carry treated potable water to the main reservoir at AG Office through other feeder lines may get damaged. The stored diesel fuel at the pumping stations varies in amount, that can last for a few days to three weeks. However, because diesel motors and fuel tanks are vulnerable to shaking damage if not anchored to resist earthquake forces, they would not be operable without repairs. Chemicals needed to disinfect the water supply (salt and alum) are to be stored adequately, so that the same can be distributed to individual households, in order to ensure that water from various streams/sources throughout the city can be brought to service.

Map 17 : Landslide Hazard Risk to Water Supply Network



Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City, 2016

2.9.2 Roads Railway Network

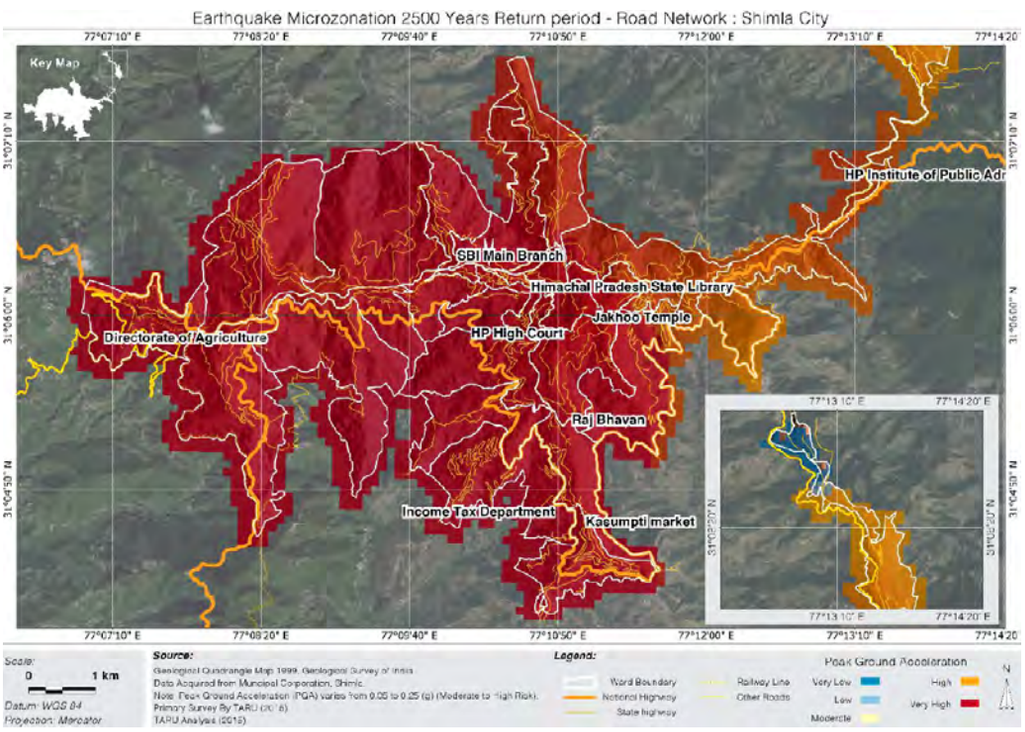
In the event of an earthquake, road access to Shimla, and circulation within the city, would be lost. Multiple slides would sever the NH-22 and the road from Solan and airport, requiring heavy equipment and construction of temporary bridges. Repairing slides and bridge damage to establish even minimal access could take weeks, even with measures to speed repairs by allowing work at multiple locations, such as by transporting earthmoving equipment to intermediate points. Collapsed buildings with trapped victims would not be removed from streets until search and rescue operations are complete. Emergency vehicles, and lorries with critical equipment and supplies, would not be able to move within or through the city for weeks. Search and rescue and life-saving medical care would be impeded. Unless these damaged stretches are repaired, moving of emergency supplies and personnel can be done only through helicopters.

Shimla depends on two-lane roads for supplies and services needed for day-to-day survival. The most important road is the national highway linking Shimla to the other parts of the state/country, especially NH-22 from Chandigarh. These roads traverse steep slopes where landslides and rock falling frequently occur, blocking the way. These roads have several narrow stretches carved out of hills. The system of urban streets within the city is also critical to movement of supplies and people. Shimla's relatively few major urban roads and streets are narrow and congested on weekdays by automobiles, motorbikes, pedestrians, and parked vehicles.

Parking on streets being a routine, circulation within the city will be vulnerable to landslides and blockage by collapsed buildings. Debris from damaged and collapsed

buildings would smash cars and block streets, connecting walkways and stairs. It could take several weeks to open major urban roads and streets to allow distribution of critical equipment and relief supplies brought in by helicopter by lorries/trucks. It would take much longer for street clearing operations to reach some areas of the city. The overlay of the earthquake risk and the road network has been shown in the Map 18.

Map 18 : Earthquake Hazard Risk to Road Network in Shimla



Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City

2.9.3 Cooking Gas, Petrol and Diesel

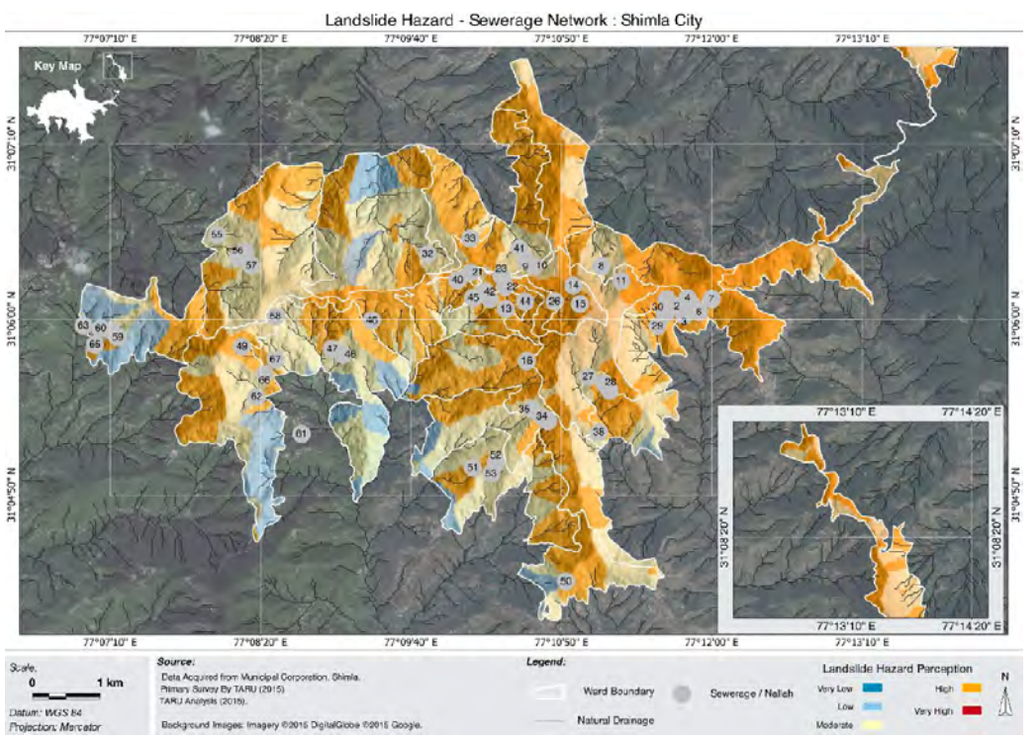
There are five LPG godowns in the city (Boileauganj, Tolland, Lakkar bazar and one each in Tutikandi and Bharari) and about 6 fuel dispensing stations. With the road transport being cut off because of the debris and landslides blocking the way, the fuel supplies from outside the city may be disturbed. Whatever is stored in these stations will last for few days or weeks and the fuel will be scarce till the road network is restored. Damage to roads and congestion would limit supplies severely for weeks. Lack of fuel would limit local generators' capacity to deliver electricity and would hamper repairs that are dependent on the generators and heavy equipment. Fuel for emergency generators and diesel pumps at the water treatment plant must be delivered by helicopter until access roads are reopened. Automobiles, lorries and equipment require petrol or diesel to operate, and backup generators require diesel. Fuel delivery depends on lorry tankers driving from Solan to reach depot areas at Shimla.

In this scenario, cooking gas supplies would diminish quickly because of road closures. The lack of gas to cook food and boil water would have health implications. Residents use liquefied petroleum gas (LPG) from individual high-pressure cylinders for cooking fuel. These cylinders will be supplied once the roads are functional.

2.9.4 Sewerage / Nalah Network

Current sewerage system depends heavily on the existing natural drains/nalahs. With earthquake and the triggered landslides, many of these nalahs will be disturbed and the waste water will be flowing on the roads. Landslides and debris blocks the system of street-side wastewater channels. Ground movement breaks drains, culverts and sewer pipes, and debris from collapsed buildings and landslides will block them. Interruption of the drainage system would divert waste and surface runoff from rainfall onto the streets, into low-lying areas and natural channels. Uncontrolled waste would contaminate drinking water supplies. Some of the areas, where these nalahs will be disturbed are shown in the Map 19.

Map 19 : Landslide Hazard Risk to Sewerage Network in Shimla



Source: Hazard Risk and Vulnerability Assessment (HRVA) of Shimla City

2.10 Summary

In a city like Shimla, where natural hazards pose more risk compared to other hazards like disease or epidemic, it is important to understand the risk the society and the individual is exposed to. Risks are often quantified in aggregated ways. Such gross risk estimates can be useful for comparative purposes, but usually conceal large variations in the risk to individuals or different regions. The process of economic development needs to incorporate a risk mitigation strategy because traditional ways of coping with environmental risks are otherwise likely to be lost.

Estimation of the potential loss of lives has been calculated using the peak ground acceleration (PGA) of an earthquake of 2500 year return period. Number of expected casualties was calculated for both mid night and day time scenario as the population under is higher at night time in comparison to day time when most of the people are awake and they have the possibility to come out of the buildings to an open space. If any earthquake happens at night, roughly 20466 people will perish within the city, while if the quake happens during the day time, the number will be 5116. Cumulative population risk has been carried out by combining the seismic risk, landslide risk and urban fire risk. Other risks, viz., forest fire risk, urban heat island risk, hailstorm, etc could not be simulated for Indian conditions.

Moreover, on the basis of the building vulnerability and the hazards they are exposed to, an annualized building risk has been calculated. As per the analysis, whereas, stone masonry and rammed earth buildings may receive severe damage, hybrid and other buildings will sustain large earthquakes without having any major damage. Rammed earth buildings are more fragile than other typologies. However, the impact and the damage incurred also depends on the season during which the earthquake occurs. Therefore, for a better understanding, such damages have been graded and mapped in this study.

Risk to the infrastructure includes- breaking of the water lines by landslide and ground shaking, damage to the electrical transmission system and blockage of roads. These being the lifelines of the residences of Shimla, infrastructural risk can also be life-threatening. In order to assess the damage that may be caused to the infrastructural systems, a detailed infrastructure mapping has been done.

3 Risk Reduction Measures

3.1 Structural Mitigation

Structural mitigation measures are those that involve or dictate the necessity for some form of construction, engineering, mechanical changes or improvements aimed at reducing hazard risk likelihood or consequence. They often are considered attempts at "man controlling nature" when applied to natural disasters. Structural measures are generally expensive and include a full range of regulation, compliance, enforcement, inspection, maintenance, and renewal issues.

Although each hazard has a unique set of structural mitigation measures that may be applied to its risk, these measures may be grouped across some general categories. Each category has been described with examples of how the mitigation type would be applied to one or more individual hazard types. The general structural mitigation groups described are:

1. Resistant construction
2. Building codes and regulatory measures
3. Relocation
4. Structural modification
5. Construction of community shelters
6. Construction of barrier, deflection, or retention systems
7. Detection systems
8. Physical modification
9. Treatment systems
10. Redundancy in life safety infrastructure

3.1.1 Resistant Construction

Clearly, the best way to maximize the resistance of a structure to the forces inflicted by various hazards is to ensure that it is designed for it prior to construction. Through awareness and education, individual, corporate, and government entities can be informed of the hazards that exist and the measures that can be taken to mitigate the risks of the respective hazards, allowing resistant construction to be considered. As a mitigation option, designing hazard resistance into the structure from the start is the most cost-effective option and the option most likely to succeed. Whether or not builders choose to use hazard-resistant design depends upon whether they have access to the financial resources, the technical expertise necessary to correctly engineer the construction, and the material resources required for such measures.

3.1.2 Building Codes and Regulatory Measures

Hazard-resistant construction, as previously explained, is clearly an effective way to reduce vulnerability to select hazards. However, the builders must apply measures for hazard resistant construction for an actual reduction in a population's overall vulnerability. One way that governments can ensure members of the population apply hazard-resistant

construction is by creating building codes to guide construction and passing legislation that requires those codes to be followed. Regulatory structures in some form are one of the most widely adopted structural mitigation measures, and are being used by almost every country in the world. With sufficient knowledge about the hazards that are likely to affect a region or a country, engineers can develop building codes that guide builders to ensure that their designs are able to resist the forces of the relevant hazards. Although it is simple in theory, the inherent problems with codes and regulations can drastically decrease their effectiveness. Building codes ensure that structure designs include resistance to various forms of external pressure. Each hazard emits an unique set of external pressure on the structures, such as:

1. Lateral and/or vertical shaking (earthquakes)
2. Lateral and/or uplift load pressure (severe storms, cyclonic storms, tornadoes, windstorms)
3. Extreme heat (structure fires, wildland fires, forest fires)
4. Roof loading (hailstorms, snowstorms, ash falls)
5. Hydrological pressure (floods, storm surge)

When properly applied, building codes offer a great deal of protection from a wide range of hazards. They are a primary reason for the drastic drop in the number of earthquake deaths in the developing world in the last century. They are so effective because they completely integrate protection measures into the structure from the design phase onward, rather than applying the measures after construction.

3.1.3 Relocation

Occasionally, the most sensible way to protect a structure or people from a hazard is to relocate it or them away from the hazard. Homes and other structures may be disassembled and demolished. Although destroying the original structure and rebuilding it elsewhere is often less expensive and technically more feasible, in certain circumstances such actions are either impossible or undesirable. For example, the structure in question may be a cultural heritage site that cannot be replaced.

3.1.4 Structural Modification

Scientific progress and ongoing research continually provide new information about hazards. This new information can reveal that structures in identified risk zones are not designed to resist the forces of a likely hazard. There are three treatment options for these structures. The first is to do nothing. Second, the structure may be demolished and rebuilt to accommodate the new hazard information. Third, often the most appropriate action, is to modify the structure such that it resists the anticipated external forces. This action is often referred to as retrofitting. About 5% of the total housing stock can be replaced each year in consultation with the Municipal Corporation, Shimla and the existing building groups. How the retrofit affects the structure depends on the hazard risk that it is being treated for. Examples of hazards and their retrofits include:

- **Earthquakes:** Sheer walls, removal of cripple walls, foundation anchor bolts, frame anchor connections, floor framing, chimney reinforcement, base isolation systems, external frames, removal of roof weight, soft-storey reinforcement
- **Wildfire:** Replacement of external materials, including decks, gutters, downspouts, panelling, doors, window frames, and roof shingles, with those that are fire-resistant
- **Hail:** Increase roof slope, strengthen roof materials and strengthen load-carrying capacity of flat or shallow-angle roofs
- **Lightning:** Electrical grounding of the house with lightning rods or other devices
- **Extreme Heat:** Air-conditioning system

3.1.5 Construction of Community Shelters

The lives of community residents can be protected from the adverse consequences of a disaster through the construction of shelters designed to withstand a certain type or range of hazard consequences. Some of the communities have existing parking lots which can be converted to emergency shelter with slight modifications. Shelters are usually constructed when it is either unlikely or unrealistic for all or a majority of the community members to be able to protect themselves from the hazard in their homes or elsewhere. Two systems must be in place for shelters to work. First, there must be an effective early warning system that would enable residents to have enough time to travel to the shelter before the hazard event. This immediately rules out several hazards for which warning is impossible or unlikely, such as earthquakes or landslides. Second, there must be a public education campaign that both raises awareness of the existence of the shelter and teaches residents on how to recognize when they should travel to the shelter.

3.1.6 Construction of Barrier, Deflection, or Retention Systems

The forces that many hazards exert upon man and the built environment can be controlled through specifically engineered structures. These structures fall under three main categories: barriers, deflection systems, and retention systems. Barriers are designed to stop a physical force dead in its tracks and acts as blocking devices. Their job is to absorb the impact of whatever force is being exerted. Barrier walls can be made of natural materials, such as trees, bushes, or even existing soil, or they can be constructed out of foreign materials, such as stone, concrete, wood, or metal. Depending upon the hazard type, barriers may be built on just one side of a structure, or may completely surround it. Examples of barriers and the hazards they are designed to protect against include:

- Natural or synthetic wind and particle movement barriers (strong seasonal winds, sand drift, dune movement, beach erosion, snow drift)
- Defensible spaces (wildfires, forest fires)
- Mass movement protection walls (landslides, mudslides, rockslides, avalanches)
- Security fences, checkpoints (terrorism, civil disturbances)
- HAZMAT (hazardous material) linings - for sewerage treatment plants, solid waste dumps, etc. (ground contamination)

determined that such action is required for the common good of the society. Although the use of regulatory measures is universal, compliance is a widespread problem because the cost of enforcement can be prohibitive and inspectors may be untrained, ineffective, or susceptible to bribes.

Examples of regulatory mitigation measures include:

- **Land use management (zoning):** This refers to the legally imposed restrictions on how land may be used. It may apply to specific geographic designations, such as coastal zone management, hillside or slope management, floodplain development restrictions, or microclimatic siting of structures (such as placing structures only on the leeward side of a hill).
- **Open space preservation (green spaces):** This practice attempts to limit the settlement or activities of people in areas that are known to be at high risk from one or more hazards.
- **Protective resource preservation:** In some situations, a tract of land is not at risk from a hazard, but a new hazard will be created by disturbing that land. Examples include protecting forests that serve to block wind and wetlands preservation.
- **Denial of services to high-risk areas:** When squatter and informal settlements come up on high-risk land despite the existence of preventive regulatory measures, it is possible to discourage growth and reverse settlement trends by ensuring that services such as electricity, running water, and communications do not reach the unsafe settlement. This measure is only acceptable when performed in conjunction with a project that seeks to offer alternative, safe accommodations for the inhabitant(otherwise, a secondary humanitarian disaster may result).
- **Density control:** By regulating the number of people who may reside in an area of known or estimated risk, it is possible to limit vulnerability and control the amount of resources considered adequate for protection from and respond to that known hazard. Many response mechanisms are overwhelmed because the number of casualties in an affected area is much higher than was anticipated.
- **Building use regulations:** To protect against certain hazards, it is possible to restrict the types of activities that may be performed in a building. These restrictions may apply to people, materials, or activities.
- **Mitigation easements:** Easements are agreements between private individuals or organizations and the government that dictate how a particular tract of land will be used. To ensure risk reduction in certain vulnerable areas, these agreements restrict the private use of land.
- **HAZMAT (hazardous material) manufacture, use, transport, and disposal regulations:** Hazardous materials are a major threat to life and property in all countries. Most governments have developed safety standards and procedures to guide the way that these materials are manufactured and used by businesses and individuals, the mechanisms by which they are transported from place to place, and the methods and devices that contain them .

Deflection systems are designed to divert the physical force of a hazard, allowing it to change course so that a structure situated in its original path escapes harm. Like barriers, deflection systems may be constructed from a wide range of materials, both natural and manmade. Examples of deflection systems and the hazards they are designed to protect against include:

- Avalanche bridges (snow avalanches)
- Chutes (landslides, mudflows, lahars, rockslides)
- Diversion trenches, channels, canals, and spillways
- Retention systems are designed to contain a hazard, preventing its destructive forces from ever being released. These structures generally seek to increase the threshold to which hazards are physically maintained. Examples include:
- Landslide walls (masonry, concrete, rock cage, crib walls, bin walls, and buttress walls)
- Slope stabilization covers (concrete, netting, wire mesh) vegetation landslides, mudflows, rockfalls;

Detection systems are designed to recognize a hazard that might not otherwise be perceptible to humans. They have applications for natural, technological, and intentional hazards. As more funding is dedicated to the research and development of detection systems, their ability to prevent disasters or warn of hazard consequences before disaster strikes increases. With natural disasters, detection systems are primarily used to save lives. With technological and intentional hazards, however, it may be possible to prevent an attack, explosion, fire, accident, or other damaging events. Examples of detection systems are - imaging satellites (wildfires, landslides, avalanches, fire risk, terrorism, virtually all possible hazards in Shimla).

3.2 Non-Structural Mitigation

Non-structural mitigation, as defined previously, generally involves a reduction in the likelihood or consequence of risk through modifications in human behaviour or natural processes, without requiring the use of engineered structures. Non structural mitigation techniques are often considered mechanisms where "man adapts to nature." They tend to be less costly and fairly easy for communities with limited financial or technological resources to implement. The following section describes several of the various categories into which non-structural mitigation measures may be grouped, and provides several examples for each:

- Regulatory measures
- Community awareness and education programs
- Non-structural physical modifications
- Environmental control
- Behavioural modification

3.2.1 Regulatory Measures

Regulatory measures limit hazard risk by legally dictating human actions. Regulations can be applied to several facets of societal and individual life, and are used when it is

- Storm water management regulations: Storm water runoff can be destructive to the areas where it originates (through erosion), and to the areas where it terminates (through silting), pollution, changes to stream flows, and other effects. Development, especially when large amounts of land are covered with impervious materials like concrete, can drastically increase the amount of runoff by decreasing the holding capacity of the land. Regulations on storm water management, imposed on private and public development projects, help to manage those negative effects, reducing both hazard risk and environmental vulnerability.
- Environmental protection regulations: Certain environmental features, such as rivers, streams, lakes, and wetlands, play an important part in reducing the vulnerability of a community or country. Preventing certain behaviours, such as dumping or polluting these features, helps to ensure that these resources continue to offer their risk-reduction benefits.
- Public disclosure regulations: Property owners may be required to disclose all known risks, such as flood or earthquake hazard risk, when selling their property. This ensures hazard awareness and increases the chance that purchasers will take appropriate action for those known risks when they begin construction or other activities on that land. Mitigation requirements on loans. Banks and other lending institutions have much at stake when they lend money to developers. Therefore, lenders can apply mitigation requirements or at the very least require that hazard assessment be conducted, and governments can require that such actions be taken by those lending institutions. Such policies limit the building of unsafe projects.

3.2.2 Community Awareness and Education Programs

Community can protect itself from the effects of a hazard if it is first informed that the hazard exists, and then educated about what it can do to limit its risk. Public education programs are considered as both mitigation and preparedness measures. An informed individual who applies appropriate measures to reduce their risk before a disaster occurs has performed mitigation. However, a public that has been trained in response activities has participated in a preparedness activity. Often termed as 'risk communication', projects designed to educate the public may include one or more of the following:

- Awareness of the hazard risk
- Behaviour modification
- Pre disaster risk reduction behaviour
- Pre disaster preparedness behaviour
- Post disaster response behaviour
- Post disaster recovery behaviour
- Warning

Early warning systems inform the public that a hazard risk has reached a threshold requiring certain protective actions. Depending upon the hazard type and the warning system's technological capabilities, the amount of time citizens have, to act, varies. Some warning systems, especially those that apply to technological and intentional hazards, are not able to provide warning until the hazard has already begun to exhibit its damaging behaviour (such as a leak at a chemical production facility, or an accident involving a hazardous materials tanker truck). The UN Platform for the promotion of early warning states that four separate factors are necessary for effective early warning:

- Prior knowledge of the risks faced by the community
- A technical monitoring and warning service for these risks
- The dissemination of understandable warning to those at risk
- Knowledge by people on how to react and the capacity to do so

Warning systems, therefore, are dependent upon hazard identification and analysis, effective detection systems (as described in the section structural mitigation), dissemination of the message, and public education.

3.2.3 Behavioural Modification

Through collective action, a community can alter the behaviour of individuals; resulting in some common risk reduction benefit. Voluntary behaviour modification measures are more difficult to implement than the regulatory measures previously listed, because they usually involve some form of sacrifice. However, through effective public education, behavioural modification is possible. Tax incentives, or subsidies, can help to increase the success of behavioural modification practices. Examples of mitigation measures that involve behavioural modification include:

- **Rationing:** Rationing is often performed prior to and during periods when water shortage is expetcted. Because it can be very difficult for governments to limit vital services such as water to citizens, it is up to citizens to limit their individual usage. Electricity rationing is also performed during periods of extreme heat or cold to ensure that electrical climate control systems are able to perform as required.
- **Environmental conservation:** Many practices, in both urban and rural areas, are very destructive to the environment. Once the environmental feature—a water body, a forest, or a hillside—is destroyed, secondary hazardous consequences may appear that could have been avoided. Through proper education and the offering of alternatives, destructive practices can be halted before too much damage is done. Examples of environmental conservation include environmentally friendly farming practices, wood harvesting that does not cause deforestation, and protecting coral reefs from dynamite fishing and other fishing practices.
- Through tax incentives, subsidies, and other financial rewards for safe practices, individuals and businesses can be coaxed into safer practices that reduce overall risk through financial incentives. Examples of schemes that use financial incentives include lower insurance premiums, housing buyout programs to move out of high-risk areas and environmentally friendly farming practices (no deforestation, flexible farming and cropping).

- Strengthening of social ties When a community strengthens its social ties, it is more likely to withstand a hazard's stress better. For many reasons, the largest is the case urbanization, where these social ties break and are not replaced. In Chicago in 1995, a heat wave caused the death of 739 people. It was later determined that weak social structures were primarily to blame for the deaths, which could have been prevented had friends, family, or neighbours checked on the victims.

3.2.4 Risk Transfer, Sharing, and Spreading Systems

Risk transfer, sharing, and spreading are often considered as mitigation measures, although they do absolutely nothing to reduce actual disaster consequences or reduce hazard likelihood. The concept behind these measures is that the financial disaster consequences that do occur are shared by a large group of people, rather than the entire burden falling only on the affected individuals. The result is a calculated average consequence cost, such as an insurance premium.

Insurance, which is the most common mitigation measure in this category, is defined as: "A promise of compensation for specific potential future losses in exchange for a periodic payment". Insurance is a mechanism by which the financial well-being of an individual, company, or other entities are protected against an incidence of unexpected loss. Insurance can be mandatory (required by law) or optional. Insurance operates through the use of premiums, or payments determined by the insurer. In exchange for premiums, the insurer agrees to pay the policyholder a sum of money (up to an established maximum amount) upon the occurrence of a specifically defined disastrous event. Insurance allows losses to be shared across a wider population.

Reinsurance companies insure insurance companies and tend to be internationally based to allow the risk to be spread across even greater geographical area. It is found that two conditions must be satisfied for a risk to be insurable. First, the hazard in question must be identifiable and quantifiable. In other words, the likelihood and consequence factors must be well understood before an insurer can responsibly and accurately set insurance premiums such that they will be able to adequately compensate customers in the event of a disaster.

Second, insurers must be able to set premiums for "each potential customer or class of customers". Common hazards, such as house fires and storm damage, have a wealth of information available upon which insurers may calculate their premiums. For catastrophic but rare events, such as earthquakes, it can be difficult or impossible to estimate with any degree of precision how often events will occur and what damages would result.

3.3 Summary

Structural mitigation measures are those that involve or dictate the necessity for some form of construction, engineering, mechanical changes or improvements aimed at reducing hazard risk likelihood or consequence. Through awareness and education, individual, corporate, and government entities can be informed of the hazards that exist and the measures that can be taken to mitigate the risks of the respective hazards, allowing resistant construction to be considered. Regulatory structuresin some form are one of the most widely adopted structural mitigation measures, and are being used by almost every country in the world. Although it is simple in theory, the inherent problems with codes and regulations can drastically decrease their effectiveness. On the other hand, occasionally, the most sensible way to protect a structure or people from a hazard is to relocate it or them away from the hazard. Homes and other structures may be disassembled and demolished. Some of the communities have existing parking lots which can be converted to emergency shelter with slight modifications. Shelters are usually constructed when it is either unlikely or unrealistic for all or a majority of the community members to be able to protect themselves from the hazard in their homes or elsewhere.

The forces that many hazards exert upon man and the built environment can be controlled through specifically engineered structures. These structures fall under three main categories: barriers, deflection systems, and retention systems. Non structural mitigation techniques are often considered mechanisms where "man adapts to nature." They tend to be less costly and fairly easy for communities with limited financial or technological resources to implement. Public education programs are considered as both mitigation and preparedness measures. An informed individual who applies appropriate measures to reduce their risk before a disaster occurs has performed mitigation. Warning systems however are dependent upon hazard identification and analysis, effective detection systems (as described in the section structural mitigation), dissemination of the message, and public education.

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4 Mitigation Measures

The mitigation measures can be proposed into seven major groups:

1. Risk assessment
2. Construction work
3. Repair and maintenance
4. Research and technology transfer
5. Training and capacity building
6. Land Use Planning and Regulations
7. Resources for Mitigation

4.1 Earthquake Risk Mitigation

Mitigation can be done for seismicity by taking into consideration Structural and Non-Structural measures.

4.1.1 Structural Measures

4.1.1.1 Seismic Retrofitting

Retrofitting refers to the addition of new technology or features to older systems. Whereas seismic retrofitting is the process of strengthening older buildings in order to make them earthquake resistant. Seismic retrofitting is a cost and time intensive process and it cannot be opted for each and every building of the city but it is required to identify such buildings which are crucial in order to response during the earthquake.

(i) **Hospitals:** During the time of Earthquake the need of health increases by many folds but because the hospitals are not prepared for the earthquake the health facilities go below the normal time many times. It creates a huge gap between the need and supply of health facilities. Hence, it is very much required to identify the most crucial health care centres and do the retrofitting of those buildings on priority basis. Indira Gandhi Medical College, Den Dayal Upadhyay and Kamla Nehru Hospital, the 3 major hospitals in the city would require to be examined critically from earthquake safety point of view and wherever needed retrofitting should be carried out on priority.

(ii) **Shelters:** The other most important requirement after the earthquake is shelter to keep the displaced people. Keeping into consideration the climatic conditions and terrain of Shimla it is urgently required to identify the places which could be used as shelters. These buildings could be schools, dharamshalas, community centres, religious institutions (Kalibari, Gurudwara, Sankat Mochan, Jakhu Temple) etc. It is important that these buildings should survive after an earthquake and for this purpose retrofitting of these buildings is urgently required.

(iii) **Life Line Buildings:** The buildings of District Administration, Government Offices, Secretariat, Fire Services, Municipal Corporation, PWD, etc. are important to provide response after an earthquake and it is important these buildings should be safe at any cost. The MC Shimla has carried out the Rapid Visual Screening of 300 Life line buildings in 2016.

(iv) **Critical Infrastructure:** Critical infrastructure such as water supply, sewerage, telecommunication, power supply, etc. should also be evaluated from seismic risk point of view and must be strengthened to withstand earthquake threat.

(v) **Heritage Structures:** Shimla is known for its heritage value and if the heritage buildings get harmed due to the earthquake, Shimla will lose its value. Hence it is required to do the retrofitting wherever required of important heritage structures such as Church, Advanced Studies, Railway Board Building, AG Office, and Hotel Clark etc.

4.1.1.2 Decongestion of Road Network:

It is very important that the road connectivity remains intact during disasters. In the present scenario, there is likelihood that all the roads would be cut off at various locations due to collapse of structures constructed very close to the roads. The uprooting of trees will also lead to blockage of roads. Most of the critical facilities such as hospitals, important offices are located in congested localities and there is a likelihood that the roads leading to these facilities would be blocked and access will cut off. There are many traffic bottlenecks in the town which need to be addressed systematically. A Decongestion Action plan has been prepared by the Police Department along with MC Shimla.

4.1.1.3 Power Supply:

Power supply is going to play critical role in post disaster situation. In the present scenario there is very likelihood that the overhead power lines are likely to be snapped to the collapsing structures or the falling trees. The power lines need to be laid underground. To begin with the supply lines connecting the hospitals, telecommunication facilities and critical buildings can be laid underground. The HPSEB Ltd. needs to work out a schedule for this action.

4.1.1.4 Open Spaces:

Lack of adequate open spaces is one of the major drawbacks of Shimla city. Open spaces are required to be created in all the localities so that they can be utilized for evacuation & emergency response. These spaces can be created by removal of encroachment or re-location of government infrastructure/ facilities.

4.1.1.5 Removal of Dilapidated Structures:

One of the reason contributing to the seismic vulnerability of the town is the old and dilapidated structures. The structures which cannot be strengthened needs to be demolished so that they don't collapse during earthquakes or landslides and cause avoidable loss of life. The building which can be strengthened must be ordered to do accordingly.

4.1.1.6 Completion of Unfinished Structures:

A typical phenomenon which can be seen in Shimla town is large number of structures constructed using pillar construction and most of the stories awaiting completion. These unfinished stories act as soft stories and attract large earthquake forces. A deadline may be given to all such owners to complete the construction within stipulated time frame.

4.1.2 Non-Structural Measures

4.1.2.1 Seismic Micro-Zonation:

Seismic Micro-zonation is the first step in earthquake risk mitigation and requires multi-disciplinary approach with major contributions from the fields of geology, seismology, geophysics, geo-technical and structural engineering. A detailed Micro-zonation can be carried out for Shimla city.

4.1.2.2 Training and Capacity Building:

(i) Awareness: General awareness generation among the communities regarding earthquake risk mitigation, preparedness and response should be carried out on regular intervals.

(ii) Training: Training of volunteers on First Aid, Search and Rescue, Health Care, medical first response etc. is required and have been conducted by MC Shimla over the years. The Ward-level disaster management teams have been formed and trained in various aspects of disaster management.

4.1.3 Earthquake Safety Plans

4.1.3.1 Household Plans:

Each household should have their own earthquake management plan which is properly shared with the family members.

4.1.3.2 School Safety Plans:

Each school should have earthquake management plan and regular mock drills are required to be conducted to institutionalize the system.

4.1.3.3 Institutional Plans:

Each private and government institution should have their own earthquake management plans, properly shared with all the staff of the organisation.

4.1.3.4 Hospital Safety Plans:

Each hospital should have their own earthquake management plan and plan to deal with mass casualties. All the above plans need to be shared with the District Administration, Municipal Corporation and Emergency Services such as Fire, and Police so that they are aware of the arrangement. Recently, the Disaster Management Plan for Indira Gandhi Medical hospital has been prepared.

4.1.3.5 Disability Plans:

MC Shimla has already prepared the Disability Plan for Shimla city.

4.1.4 Emergency Support Functions:

(i) All the departments which have role in Emergency Support Functions (ESFs). For them ESFs should be designed in advance so that departments know their role and responsibilities and they make preparations in advance.

(ii) Regular coordination meetings are required with the District Administration, MC and the ESF departments to have clarity about the ESFs.

4.1.5 Amendment in Building Bye Laws:

(i) There is urgent need of doing amendments in Building Bye Laws and Town and Country Planning Act. This will help to have safe development in future.

(ii) BIS Codes should be made applicable for new construction forthwith.

(iii) Risk sensitive land use planning and development control regulations should be enforced.

(iv) City Development should be re-visited and re-drafted on the basis of HRVA of the city. All the stakeholders should be involved in this process.

4.1.6 Community Networking:

(i) Community is both the victim and first responders in disasters. It is therefore needed that networking with all the community based organisations such as CBO, NGO, Market Organisations, Faith based organisation, etc. should be done and their database created.

(ii) Ward wise response plans and committees should be constituted to look into various aspects of disaster management.

(iii) The government functionaries at ward level should also be made a part of the core committee at the ward level and the core committee should be delegated authority to take decisions in emergencies.

(iv) The committees so formed should be trained and equipped to handle emergencies.

4.1.7 Emergency Operation Centre (EOC):

(i) Based on the guidelines formed for EOC by NDMA / UNDP EOC guidelines, a City EOC should be established at the MC level that should coordinate with the District and State Emergency Operation Centres.

(ii) To improve the inter-departmental coordination and response mechanism it is important to have a centralised command system which coordinates with various departments both for mitigation and response work.

(iii) The EOC would act as central focus point for information gather, dissemination and coordination.

(iv) It would be a nerve centre for emergency response.

(v) During the normal time the EOC would work for awareness and preparedness for emergency response.

4.1.8 Risk Transfer:

Entire risk cannot be mitigated. Whatever risk cannot be mitigated must be transferred by way of risk insurance and preparedness. Insurance coverage is available against all the major hazards and this need to be promoted amongst the stakeholders.

4.2 Landslide/Sinking Zones/Storm Waters Mitigation Plan

4.2.1 Structural Measures:

4.2.1.1 Tree Plantations:

The areas which are vulnerable to this hazard requires tree plantation to reduce the phenomenon of landslides. Suitable indigenous varieties of species need to be identified and planted. The old Deodar trees of Shimla have either been cut down for developmental purposes or fallen due to landslides. An action plan also needs to be prepared to replenish the dwindling forest wealth of the town.

4.2.1.2 Regulation for Construction:

It is required to have strong laws for regulating the construction at steep and unstable slopes.

4.2.1.3 Drainage Improvement

It is important to have proper drainage system to cater to the storm water. All the encroachment on the drainage system needs to be removed so that storm water flows down smoothly causing least damage to the soil, infrastructure and property. The existing water ways also needs channelization wherever needed to reduce soil erosion. This activity would also reduce the pace of landslides and reduce the impact of heavy rains/cloudburst etc.

4.2.2 Non-Structural Measures

4.2.2.1 Land Slide Micro-Zonation:

Landslide micro-zonation is needed for further planning for the city.

4.2.2.2 Cutting of Hill Slopes:

One of the major reasons of landslides is unscientific cutting of slopes and construction in high steep slopes. There is need to enforce the development control regulations for such areas.

4.2.2.3 Awareness:

There is a need of community awareness regarding landslide and associated threat so that communities could be sensitised.

4.3 Fire Hazard Mitigation Plan

4.3.1 Structural Measures:

4.3.1.1 Strengthening of Fire Department:

The staff strength of fire department is inadequate keeping in view the fire vulnerability of the town. Also, the department has special needs to match the requirement of the town. Firefighting equipment and vehicle capable of moving in the narrow lanes of the town needs to be added to the fleet of the Fire Department.

4.3.1.2 Decongestion of Critical Locations:

Areas such as Lower Bazaar, Ram Bazaar and other such locations which are vulnerable to fire hazard need decongestion. The temporary structures need to be removed at these locations.

4.3.1.3 Identification of Vulnerable Buildings:

Shimla Town has very old and important structures which have generally a lot of wood in the shape of building content. Fire safety concerns of these building should be addressed.

4.3.2 Non-Structural Measures:

4.3.2.1 Enforcement of Building Codes on Fire Safety:

Building Codes on Fire Safety (BIS Codes) must be made compulsory and strictly enforced. No structures complying with these codes housing large number of occupants such as offices, hospitals, schools etc. should be allowed to function till it adheres to these codes. Regular mock drills on fire safety should be held in all building housing large number people.

4.3.2.2 Hands on Training on Fire Equipment:

The school children, government functionaries should be given hands-on training to handle fire-fighting equipment.

4.3.2.3 Community Awareness and Preparedness:

The community at large should be educated about dos and don'ts of fire hazard.

4.3.2.4 Risk Transfer:

Entire risk cannot be mitigated. Whatever risk cannot be mitigated must be transferred by way of risk insurance and preparedness. Insurance coverage is available against all the major hazards and these needs to be promoted amongst the stakeholders.

4.4 Efforts required to mitigate the risk of common hazards in Shimla

(a) At each ward level Buildings and Open spaces will be identified and list prepared for probable shelter and later these buildings could be retrofitted.

(b) The community has traditional wisdom to cope up with natural hazards. The best practices should be documented and promoted.

(c) The people of Shimla are traditionally capable of dealing with natural phenomenon such as snowfall. The traditional practices and administrative preparation need to be revived and put on alert during the winter season.

(d) The Urban Search and Rescue is a specialized job. The existing network of Fire and Emergency Services needs to be strengthened to perform this job. Fire & Emergency set up also needs to be equipped with modern equipment for SAR.

(e) The capacity of MC Shimla also needs improvement to deal with role and responsibility vis a vis disaster management in terms of trained manpower and equipment and machinery.

(f) The blind curves and accident prone area's need to be identified and improved in a phased manner.

(h) Monkey menace needs to be tackled in a scientific way.

(I) In order to promote culture of safety local leadership should be motivated and roped in.

(j) Disaster Risk Reduction needs to be mainstreamed into developmental plans and programs. The MC Shimla has already prepared a plan for the mainstreaming CDMP and HRVA into the Departmental DM Plans. This was done under the USAID-GoI-UNDP project of 'Enhancing Institutional and Community Resilience to Disasters and Climate Change'.

(k) Mainstreaming Disaster Risk Reduction into development sectors and approaches.

(l) Mainstreaming Disaster Risk Reduction into on-going Flagship Programmes of MC Shimla.

(m) Mainstreaming People with Disability (PwD) into DRR (MC Shimla has already prepared a Disability Plan of shimla city made by UNDP).

5 Institutional Capacity Building

5.1 Capacity Building

5.1.1 Definition of Capacity

Capacity is defined as "the ability of individuals, organizations, organizational units and/or systems to perform functions effectively and in a sustainable manner". The United Nations Office for Disaster Risk Reduction (UNDRR) views Capacity as the combination of all the strengths, attributes and resources available within a community, society or organization that can be used to achieve agreed goals. Capacity may include infrastructure and physical means, institutions, societal coping abilities, as well as human knowledge, skills and collective attributes such as social relationships, leadership and management. Capacity may also be described as capability. Capacity assessment is a term for the process by which the capacity of a group is reviewed against desired goals, and the capacity gaps are identified for further action.

5.1.2 Framework for Capacity Development

Capacity assessment has been done to assess and evaluate various dimensions of capacity within the broader institutional system as well as assess the capacity of specific units and individual / community within the system. Conducted as a part of Shimla City HVRA, the study aimed to determine desired capacity (capacity needs) and assess existing capacities (capacity assets). The assessment has helped analyze the gap between what is desired and what exists. The assessment framework was used to design solution if the desired capacities are defined. Capacities to reduce the risk of geological and hydro meteorological hazards lie both within institutions and in the relationships across institutions and sectors. These capacities arise from the relations that are defined through the roles and responsibilities and rules of engagement, and sometimes they are defined in the operation plans of the institutions or highlighted through the ongoing practices which are not documented.

5.1.3 Scope of Capacity Building:

The Capacity Building approach may include:

- ★ Training programs for developing community based DM system to view regional diversities and multi-hazard vulnerabilities
- ★ Undertake consultative process involving District and other stakeholders within the district and local level authorities in charge of implementation
- ★ Identification of knowledge based institutions for capacity building
- ★ Adaptation of traditional and global best practices and technologies for the city Disaster Management
- ★ Undertaking table top exercises, simulations, mock drills and development of skills to test the plans of the city.

- ★ Capacity analysis of different departments of MC like Road and Building and Health
- ★ Organizational development, not only within organization but also between different organizations and sectors within city (public, private and community)
- ★ Development of Institutional and legal framework for making legal and regulatory changes to enable the organization to enhance its capacity.

1. Awareness and Capacity Building

- The nodal planning department undertakes sensitization programme on safe development practices.
- The planning department staff need further training on incorporation of risk in physical planning (risk sensitive land use planning, redevelopment planning after disasters).
- Capacity building of built environment professionals (Architects, Engineers, Planners), construction workforce (masons, carpenters, bar benders) and building materials supplier and distributors.
- There is need to train health professionals in disaster management / emergency care management / mass casualty management – especially in handling of large scale emergencies.
- Communities have to be trained in basic search and rescue and first aid (create a pool of volunteers at the city/ward level).
- The city has to practice mock drills on a regular basis and test the current city and department level/sector level plan, incorporate the gaps and continuously improve the plan.
- Public education on hazards and risk need to be communicated (their role in the first 72 hours, emphasis on home preparedness plan).
- All departments across the city will have to draw quality training on disaster management. Resource institutions and key resource persons will have be arranged for undertaking department-wise trainings so as to enhance the level of preparedness and respond to an emergency.
- Capacity building of building sector professionals and health sector professionals should be undertaken on priority basis. Training of communities is the key.
- Programme such as community emergency response team (CERT)/ neighborhood emergency response team (NERT) can be initiated across the city and a pool of volunteers in the city can be always be ready for immediate action in case of an emergency.
- Through the community/neighbourhood programme families can be encouraged to prepare their home disaster management plans.
- The volunteers will have to be trained in basic first aid, light search and rescue, preparation of survival kit for their homes and urgent non-engineering repairs or even temporary shoring of small destabilized slopes and buildings (of small heights and mainly non-structural elements).

Attempt has been undertaken by the Shimla Municipal Corporation to involve public in disaster management issues. 'Building Urban Actions for Resilience in Emergencies' (BUARE), a collaborative initiative of Municipal Corporation Shimla, Himachal Pradesh State Disaster management Authority and UNDP India was an example of capacity building where the various activities were undertaken as first aid trainings, street plays, exhibition, SAR, within the wards in 2015.

2. Emergency Preparedness

Most of Shimla city's critical services (water supply, health / medical services, communications, transportation, emergency services including search and rescue) will not withstand moderate to major disaster event. More stress should be given to have effective back-up mechanisms for failure of existing services and a timely recovery plan. There is an urgent need to establish measures for mass casualty care. City health contingency plan (in line with state/district health contingency plan) needs to be prepared. Service networks within hospitals (electricity, water supply, and communications) may be badly disrupted in case of earthquake. The emergency plan of hospitals need to incorporated in these scenarios in the plan preparation. As a good progress in this direction, the MC Shimla has helped Indira Gandhi Medical College & Hospital (IGMC) in preparing its Disaster Management Plan.

Schools in the city can undertake school safety and preparedness programme. The Municipal Corporation Shimla has been building the capacities of Schools for School Safety and Disaster Management Plans. Himachal Pradesh Home Guards is currently providing support to select schools on emergency preparedness (tips on evacuation and elementary skills as responders).

Coordination mechanism among departments (state / district / city) need significant improvement. Realistic pre-arrangements have to be defined in terms of action to be initiated for rescue and relief activities. City wide resource inventory has to be prepared on a priority basis and access should be made available to key departments (city database, tools and equipment's, human resources, registered / un-registered volunteers, relief materials, food supplies etc).

Given that the city witnesses a large floating population (tourists) it is important that the disaster management plans are developed for hotels / restaurants/ lodges and other small businesses. Training on Disaster Preparedness for Tourism Sector has been conducted by the Municipal Corporation Shimla.

Every department should bring out a command mechanism for emergency response as part of their preparedness measures. The department plan should be always at a functional stage (regularly updated) and should have the mechanism for self-activation. Inter-departmental coordination arrangements have to be rolled for planned execution. The buildings in the city are prone to fire hazard. The city must work towards implementing a full scale fire preparedness / prevention plan. As a major progress in this direction, the Municipal Corporation Shimla has developed a Fire Disaster Management Plan for the city in 2021.

3. Emergency Response

Networking of hospitals and resource planning and management for disaster situations. Securing medical supplies for emergency response (the current supplies will last for approx. 2- 2 ½ months, however the challenge is that the stocks are kept in unsafe buildings and may not be accessible during a seismic event.

The availability of staff (medical and paramedical) during a large scale emergency will depend on their availability. There is a need to deploy fully trained Quick Response Team of minimum 15-20 people (day/night shift) drawn from Home Guards and Civil Defence. The current set of tools and equipment's available with the emergency service agencies may not be relevant in the context of Shimla city. There is need to have portable tools and equipment's which can be quickly mobilized for search and rescue operations.

Municipal Corporation Shimla has mapped all of its available resources and has made the same available for the India Disaster Resource Network (IDRN) platform. The present resources available at the MC Shimla are provided in Annexure- 4 (A, B & C) The emergency services team will require couple of small vehicles (van type which can navigate the hill roads) loaded with compact tools. Collapse Search and Rescue training (professional course) will have to be provided to Emergency Service Departments in the city. The community members / volunteers can be on light search and rescue with equipment cache.

Civil Defence volunteers and other category of volunteers identified across the city will have to be covered under insurance. Resource deployment plan for emergency has to be undertaken / given priority. As city of Shimla falls in high seismic risk zone, liaison arrangements between city-district-state-national and other key resource institutions have to be established in advance.

4. Planning and Infrastructure Development

Commercial interests and regularization are the main impedements to risk mitigation action. There is no prior exposure of planning professionals in preparation of Redevelopment Plan for seismic safety and other hazards. The risk of the built environment is significant and hence a strategy has to be laid down towards physical planning, rejuvenation, which incorporates DRR. Structural strengthening/ retrofitting of key lifelines (medical facilities, communications, roads and bridges, urban services – water supply, sanitation, transport, electricity) needs to be done.

Revisit city planning / city development from the perspective of risks (geophysical, hydro meteorological) and impacts of climate change. The focus of mitigation has been very limited and this need to be looked on priority given the risk. Technical institutions can provide inputs to a range of mitigation options for the city. Specific agreements can be made between the local government institutions and the technical institutions for support. Buildings safety has been ignored for a long time. Regulatory aspects of development control should make mandatory safety rules and compliance as per the National Building Code norms.

5.2 Recommended interventions for Capacity Development at the City-level

- Capacity Building training calendar of Disaster Management can be prepared on Short and Long-term programmes for various Stakeholders that should include various trainings for the capacity building of institutions, professionals, community, Persons with Disabilities (PwD)
- MC should coordinate with volunteers and social organizations like Home Guards, NYKS, NCC, Red Cross, Market Trade Associations, Youth Clubs, Self Help Group (SHGs), CBO's, NGO's and Anganwadi centres, etc., to play a vital role in spreading mass scale community awareness.
- Skill-development at the community level can be done on the Public Private Partnership (PPP) model to ensure sustainability of the community against disasters.
- Traditional ways of promoting knowledge and awareness such as folk songs, nukkad nataks, etc. should be adopted to strengthen preparedness for disasters and pandemics like COVID-19.
- Use of modern communication and ICT tools for effective and efficient disaster management can be utilized for compiling of information dissemination and for spreading forecasts and early warnings.
- The digital mapping of resources would be done and the same would be hosted in web-based portals (IDRN), for easy access and retrieval. Moving forward in this direction, the MC Shimla has carried out the micro-mapping of critical facilities, utilities and infrastructure in the city along with the telephone app for disaster management of the city.
- As another key initiative, the digital mapping of the Fire Hydrants in the city has been carried out as a part of the Fire Disaster Management Plan of Shimla city.
- Development of various IEC materials related to do`s and don`ts of local hazards in form of posters, leaflets, banners, training modules and audio visual material must be produced using capacity-building funds within the city.
- The efficacy of CDMPs shall only be tested and refined through training, seminars, mock drills, awareness, prevention and mitigation measures to be undertaken in the Pre-Disaster phase of the Disaster Management Cycle. MC Shimla along with the DDMA Shimla should undertake mock drills in different parts of the city at least once or twice a year to test the efficacy of the plans and SOPs prepared. Lessons learnt from the actual drills and exercises should be used to revise plans and they should serve as a basis for the training of various stakeholders across different sectors.
- Inventory of trained professionals should be maintained by the MC and uploaded on the website. Also data documentation of the damages and losses during the monsoon and winter season within city should be done on yearly bases and uploaded on the state online portals of damages and loss.
- For the emergency operations the city should establish its own 24x7 EOC fully equipped with an interoperable and redundant communication system.

5.3 Capacity Building interventions by the Municipal Corporation Shimla

S. #	Name of Training	Year
1.	Training of Trainers Programme on Incident Response System (IRS) (Basic and Intermediate Course)	**2013**
2.	First Aid training	**2014**
3.	Training Programme for School Teachers on Psychosocial Care for Children in Disasters	**2014**
4.	First Aid trainings under BUARE within wards of Shimla city	**2015 and 2016** 'Building Urban Action for Resilience in Emergencies (BUARE)' was a community awareness campaign undertaken under the UNDP project with support of various stakeholder departments covering a period of six months
5.	Street plays on hazards of Shimla city like earthquake, fire and landslide conducted in schools	
6.	Basic Concepts of Search and Rescue in earthquake and fire	
7.	Ward disaster and resource mapping	
8.	Awareness based on Environment cleanliness like garbage disposal and sanitation	
9.	Psycho-Social Care in disasters	
10.	Preparation of IEC material related to earthquake	
11.	Training of Trainers on Psychosocial Care in Disasters	**2018** Held in collaboration with NIMHANS Bengaluru
12.	Sensitization Program on Disaster Management and Formation of Volunteer Teams Within Wards For Elected Members of Shimla Municipal Corporation	**2019** Was undertaken in collaboration of HIPA Shimla
13.	Two-day Sensitization and Refresher Training Programme on Psychosocial Care in Disasters	**2019** This training comprised of sensitization of heads of stakeholder departments within city and refresher course for the participants of TOT held in 2018. The training was held by NIMHANS Bengaluru
14.	Two Day Workshop on the Formation of School Disaster Management Plan for Private /Public Schools within Shimla City	**2019** This training comprised of 15 private / public schools within the city and undertaken by SCERT Solan
15.	Two Day Workshop on Structural Safety Audit for Architects and Engineers	**2019** Participants comprised of five major departments of the state HPPWD, HIMUDA, TCP, Urban Development and Municipal Corporation. The training was undertaken by Consultants of UNDP Delhi
16.	Departmental Workshop on Psychosocial Care in Disasters	**2019** This was an Eight day training programme for sensitization of various departments that

		included Departments of Police, ITBP, SSB, Home Guards; Department of Welfare (Anganwadi workers); Departments of HP University, Shimla with students from Geography, Mass Communication and Journalism, Social Work and Interdisciplinary Studies; Department of Health along with Nursing colleges; Department of Mass Media and Information; Educational Institutions which comprised staff of local schools and colleges; NGOs from within the city. Training was undertaken by the trainers trained by NIMHANS.
17.	Two Day Training programme for the Masons/ Bar binders/ Construction artisans within MC Shimla	**2020** Held in collaboration with HIMCOSTE Shimla
18.	Online Workshop for College institutes of Shimla city on Psychosocial Care and Impact of COVID-19	**2020** Held in collaboration with NIMHANS Bengaluru
19.	3-days Online Training Programme on "Landslides Risks Reduction and Resilience	**2020** Held in collaboration with NIDM
20.	Two Day Sensitization Programme On Hospital Safety/ Disaster Management and Demonstration on Structural Safety Aspects in IGMC Shimla	**2021** Held in collaboration with Geo-Hazard Society India
21.	Two Day Workshop on Role of Private Businesses Particularly Hotels and Tourist Operators in Disaster Management	**2021** Conducted by Individual Consultant of UNDP Delhi from Ahmedabad
22.	Sensitization Programme on Disaster Management of The Elected Members of Shimla City regards to the city plans	**2021** Held in collaboration with consultants of the various plans being prepared for MC Shimla- Doers Shimla and Knowledge Links Delhi and Himalayan Association for Research & Innovation Shimla
23.	Sensitization on Medical Preparedness and Mass Casualty Management	**2021** Held in collaboration with GeoHazard Society India
24.	Local Disaster Awareness and Capacity Building of Community within wards of Shimla City especially regards to earthquake and fire safety	**2021** An 8-day campaign was conducted in the 34 wards of the city with Collaboration of Home Guard 3rd Battalion
25.	One Day Workshop on Business Continuity plan for Vyapar Mandal Shimla city	**2021** Held in collaboration with Himalayan Association for Research & Innovation Shimla
26.	Three-day Training programme for Ward Volunteers of Shimla city with regards to Search and Rescue and First Aid	**2021** Held in collaboration with Home Guard 3rd Battalion

6 Response Plan

6.1 Response related to Earthquakes

The onset of an emergency creates the need for time sensitive actions to save life and property, reduce hardships and suffering and restore essential life support and community systems. The damage and loss scenario could be more disastrous now as the population of the city and built-up environment has increased many times in the last few decades. Present estimate of devastation in a repeat hypothetical earthquake is that (a) loss of more than 1,20,000 lives may occur; (b) the urban facilities particularly hospitals, schools, communication buildings, transportation routes in the hilly region and water supply facilities will be badly damaged. The Municipal Corporation Shimla shall strengthen the institutional mechanism to carry out different response activities at the city-level which may include the activation of the DM Committees, Emergency Operation Center, Search & Rescue Coordination, Relief interventions, Psycho-social Care, Media management, Disposal of Dead Bodies, etc. The response activities may vary according to the level and type of disaster. There are four levels of earthquake disasters. These levels are derived through intensive research studies in various fields. Details of the levels are as under:

L0 level disaster: This level indicates a normal time situation i.e. when there is no disaster. At this point of time the nodal agency concentrates on the first phase of disaster management and i.e. the proactive approach. Various preparedness activities should be carried out to be fully prepared at the time of actual disaster situation. In this level, the earthquake which is less than 5.0 magnitude can occur. Such earthquakes with zero damage do not require much attention. However, the local authorities should not ignore such events and try to find out the losses if any and make future plans to minimize the damage or the losses.

L1 level disaster: When the magnitude of earthquake is greater than 5.0 and less than 6.0 than the level of disaster is considered as L1. This level is more intensive than the previous level i.e. L0 level. As soon as such earthquakes are reported or occurred the nodal agency and the concerned line departments should take appropriate actions as soon as possible. The nodal agency should also alert the authorities. The City administration should be able to manage earthquake at this level.

L2 level disaster: The magnitude of earthquake ranging between more than 6.0 and less than 6.7 than it's a L2 level disaster. This level can lead towards lot of destruction and therefore requires some basic initial management response steps. In the beginning the response steps should be prompt and therefore it should avoid formal orders from any quarters. The City DM Committee should activate the search and rescue operations immediately.

L3 level disaster: When the magnitude of earthquake is greater than 6.7 than it is considered as L3 level disaster. It leads to massive destruction of both lives and properties. The normal pace of life disturbed. In such situation the city level disaster management authority cannot tackle the situation on its own and thus requires the outside assistance which includes the assistance of Central Government etc.

6.1.1 Measures to be taken in case of earthquake disaster by the City Disaster Management Committee, Municipal Corporation, Shimla

6.1.1.1 Real Time Information on Earthquake

Throughout the county the Indian Meteorological Department is designated as earthquake monitoring agency. The IMD notifies the responsible agencies about the occurrence of earthquakes. The City Disaster Management Committee shall obtain information related to the earthquake, its magnitude, epicenter etc. through credible sources. Online information can also be gathered directly through the website of IMD.

6.1.1.2 Impact Assessment

(i) The City Disaster Management Committee shall be fully activated and pre-designed response plan shall immediately be triggered according to the magnitude and epicenter of the earthquake.

(ii) The Municipal Corporation/City Administration shall gather information regarding the damages in respect of deaths, injuries and damages to the buildings/infrastructures.

(iii) If required the Municipal Corporation shall conduct an aerial survey to determine the scope of the damage, casualties, and status of key facilities.

(iv) City administration/Municipal Corporation shall identify areas and assess the requirement of police, armed forces, volunteer etc for search and rescue operations. The priority of conducting these operations will be established by the City Disaster Management Committee, Municipal Corporation, Shimla in collaboration with DDMA Shimla.

6.1.1.3 Deployment of Search and Rescue Teams

(i) As an immediate measure City Administration would deploy local SAR teams of Civil Defence/Home Guards, Police and Local Volunteers etc.

(ii) The police force will also be deployed to undertake different types of search and rescue activities.

(iii) Requirement of Armed Forces – Army, Air Force, CPMFs, NDRF etc. would be worked out and demand for the same shall be placed with the DDMA Shimla and HPSDMA.

(iv) The DDMA Shimla with the support of City Administration shall arrange for local transportation (from airport/railway station to affected site) of NDRF teams and supplies POL etc. for their equipment/vehicles of NDRF.

(v) The police department shall control traffic to ensure that the NDRF teams/other SAR and relief teams could reach the earthquake affected areas without delay.

(vi) ESF department as per DDMP Shimla//City Administration shall provide access routes for transportation of NDRF, other SAR and Relief Teams to the affected sites. If needed, roads and bridges shall be repaired or reinforced even on a temporary basis or emergency detours be provided.

6.1.1.4 Emergency Medical Relief

(i) The City Hospitals – IGMC, DDU etc., primary health centers, health department etc. would activate their respective emergency medical plan forthwith.

(ii) NDRF teams are also trained in Emergency Medical Services (EMS) such as Medical First Response techniques with basic knowledge of life saving of disaster victims. Each NDRF battalion has 9 Doctors and 90 paramedics. NDRF teams shall provide EMS to the areas of their deployment during post disaster phase.

(iii) If needed Ministry of Defence through DDMA Shimla and State Government would be requested to provide mobile field hospitals, Heli-ambulances. They will be activated to reach the earthquake affected areas immediately along with dressing material, splints, portable X-ray machines, mobile operation theatres, resuscitation equipment and life-saving drugs, etc..

(iv) The Department of Health and Family Welfare at the City Level would coordinate with its counterpart at District and State level for medical assistance required for the State.

6.1.1.5 Supply of Relief Materials to affected States

(i) The City Disaster Management Committee would assess requirement of relief items and material required for the affected areas. It would also project its demand to the District and State Government.

(ii) The ESF departments both city and district level would arrange to supply relief material to the affected locations.

(iii) The MC Shimla would consolidate demands received from the city and would coordinate with Deputy Commissioner for State assistance, if any.

(iv) The DDMA Shimla with the support of MC Shimla would appoint Nodal Officers at airports/helipads to coordinate, receipt and channelization of relief material. Adequate arrangements would be made for the transportation of relief material to the affected areas of city.

(v) A mechanism would be put in place for proper accounting for and distribution of the relief material received in the city.

6.1.1.6 Establishment and Running of Relief Camps

(i) Municipal Corporation/City administration would establish relief camps as per requirement.

(ii) ESF departments would arrangement for all basic amenities in these camps.

(iii) These relief camps would be run and managed by the ward level DM Committees.

(iv) Temporary shelters would be constructed as per requirement by the MC.

6.1.1.7 Repair and Restoration of Roads, Communication, Electricity and Water Supply

(i) The NHAI, HP PWD and MC Shimla would undertake repairs, build temporary bridges, access ways and other temporary structures for restoration of National and State Highways and other roads.

(ii) The HP PWD would also repair damaged helipads and make temporary helipads as per requirement.

(iii) Communication network would invariably be damaged in an earthquake. The BSNL and other service providers would take immediate steps to restore communication in the affected areas. Secondary ESF departments (Police and the Units of Armed Forces in the area) would also provide communication facilities for disaster communication and relief.

6.1.1.8 Earthquake Damage Assessment of Public Building and Infrastructure and Individual Houses

(i) All Departments would constitute teams of officers/technical persons to Inspect buildings and structures that are critical to emergency service operations and mass care activities. Designate those that may be occupied and identify/mark those that are unsafe.

(ii) Inspect buildings and structures that may threaten public safety. Identify/mark those that are unsafe and may not be occupied.

(iii) Inspect less critical damaged infrastructure. Designate those that may be used/occupied and indentify/mark those that are unsafe to use/occupy.

(iv) Municipal Corporation/City Administration shall constitute teams of qualified technical personnel for damage assessment of individual houses. These teams shall also identify/certify those houses that are unsafe and may not be occupied.

(v) The Disaster Management Authority under Municipal Corporation and city administration in consultation with the IITs and NITs develop guidelines for assessment of damaged individual housing units.

6.1.1.9 Establishment and Running of Relief Camps

(i) The City Disaster Management Committee and City Administration shall set up an Emergency Information Centre (EIC) and the City EOC to support and work in coordination with the District EOC for release of consolidated information to all stakeholders including Media at the City Level.

(ii) While the District-level Disaster Helpline **(1077)** is already there, a helpline would be established at the City-level or other suitable location for providing information about victims to the next of kin, friends and others.

(iii) EIC shall maintain all records and document of all major actions taken in managing the incident.

Figure 4: Earthquake Standard Operating Procedures (SOPs)

6.1.1.10 Prevention of Human Trafficking of Widows/Orphans

Human trafficking is a common phenomenon of the aftermaths of disaster. To combat it, the Deptt. of Women Empowerment & Child Development shall set-up a monitoring and coordination mechanism to support the DDMA Shimla and MC Shimla for prevention of human trafficking of women and children in the affected area .

6.1.1.11 Identification and Disposal of Dead Bodies

The Home Department shall deploy forensic teams and equipment for DNA Finger printing of victims in mass casualty cases. The Department would also coordinate with MHA for central assistance as per requirement. While disposing of unclaimed/unidentified dead bodies NDMA Guidelines shall be followed. All this should be conducted as per the existing SOPs and ESFs (Annexure 6 & 7) in coordination with the District Administration and the State Health and Family Welfare Department.

6.1.1.12 Psycho-social Support

(i) The Health and Family Welfare Department shall arrange to provide psycho-social support to the victims of disaster and train volunteers for this job.

(ii) The Health and Family Welfare Department shall assess the requirement of central assistance for providing psycho- social support to the victims.

6.1.1.13 Financial Assistance to the Victims of Disaster

(i) The victims/dependants of victims shall be provided disaster relief assistance as per the HP DM and Relief Manual, 2012 and as per additional assistance guidelines issued by the Government in such cases..

(ii) The damage and needs assessment carried out by the State Government shall be sent to the Central Government for seeking grants under NDRF or Prime Minister's Relief Fund.

6.2 Fire Response Plan for Shimla City

Fire is a common occurrence in Shimla especially both during summer and winter season and results into multiple losses of life and large property damage. Some of the reasons behind the outbreak of fires in the city are high summer temperature, lightning, short circuit, negligence, accidental fire and kitchen-fires, cooking fire etc.

6.2.1 Measures to be taken by City Disaster Management Authority in case of Fire

6.2.1.1 Real Time Information of Fire

(i) The Fire Department is the Nodal Agency which is designated to monitor the fire incidents which include both natural and human-induced fires. The Fire Department can detect fire at its own level or the incident of fire is reported to the department. The local people, media and environmental agencies can also report about any fire incident to the fire stations or to

the City EOC which can further alert the key responders and vulnerable population.

(ii) Forest Department shall notify the forest fire incident at the nearest fire station or to the District or City Emergency Operation Centre and key responders along with some preliminary information on location, damage caused, reason behind the fire outbreak etc.

6.2.1.2 Impact Assessment

(i) The Fire Department (Shimla) would be fully activated and the pre-designed response plan should immediately be triggered.

(ii) The Municipal Corporation, Shimla and the City EOC in coordination with the DEOC shall gather information about the deaths, injuries and damages to the infrastructure and property.

(iii) The City Administration, if needed, will conduct a survey to determine the scope of damage, causalities, and the status of key facilities.

6.2.1.3 Emergency Response

(i) The Fire Department shall rush its fire tenders to the site of fire.

(ii) The Police department shall control traffic, crowd and law & order in the city and provide free access to the fire tenders and its personnel. The police shall further ensure that the crowd does not cause any hindrance in the functioning of the fire department.

(iii) The Electricity Department shall disconnect power supply to the affected areas.

(iv) Irrigation and Public Health Department shall provide water through pipelines, hydrants, sprinklers etc. to control the fire.

(v) Municipal Corporation, Shimla along with the Fire Department shall work out, if needed and same shall be coordinated.

6.2.1.4 Deployment of Search and Rescue (SAR) Teams

(i) At the time of a fire incident to minimize the losses, the Disaster Management Cell, MC Shimla in support of the DDMA Shimla, shall deploy local Search and Rescue teams of Civil Defence, Home Guards, persons from fire department and local volunteers etc. to rescue people from the immediate area of smoke and/or fire.

(ii) The personnel of the Police Department will be deployed by the City Administration for search and rescue operations as per assessment of the situation.

(iii) Municipal Corporation, Shimla and the entire City Administration along with Fire Department will mobilize local response and shall identify areas and access the requirements for the urban search and rescue operations. Requirement of outside response, if need be, shall be worked out and coordinated.

6.2.1.5 Emergency Medical Relief

(i) The Local volunteers who are also trained in the emergency medical response shall be deployed for first medical response immediately along with the Home Guards.

(ii) The Hospitals/CMO/Department of Health and Family Welfare will dispatch a team of medical specialists with adequate medicine to the disaster site with medicines etc. and also alert the hospital to be prepared to receive the victims. 108 medical responses will also be activated Accredited Social Health Activist (ASHA) within wards.

6.2.1.6 Emergency Logistics

(i) The firefighting equipments like fire extinguisher, fire blankets, foam fire buckets, etc. will be required during a fire incident to control and stop the fire. The Fire Department shall arrange the same.

(ii) The necessary equipment will also be mobilized for search and rescue of the trapped people in fire and in thick smoke.

(iii) The Irrigation and Public Health Department will move its resources – men and material to help douse the fire.

(iv) The equipment available with City Disaster Management Cell/City EOC, Municipal Corporation, Shimla, Fire Department and the DDMA Shimla will also be mobilized as per requirement.

6.2.1.7 Repair and Restoration of Road, Power, Water and Telecommunication

(i) The Public Works Department will repair and restore the affected roads. The department may take assistance of other ESF agencies, if required.

(ii) The damaged water supply, electricity and telecommunication lines will be restored by the respective departments forthwith.

(iii) The I & PH Department would restore water supply to the affected areas and would also ensure supply of water through other means till water supply is not fully restored through pipelines.

(iv) HP SEB Limited would take immediate steps for restoration of electricity supply to the affected areas.

(v) During a fire incident the communication network may be destroyed. The BSNL and other service providers would take immediate steps to restore communication in the affected areas. The ESF departments for communication would also provide communication facilities for disaster communication and relief.

6.2.1.8 Supply of Relief Material to the Affected Areas

(i) The City Disaster Management Committee, M.C., Shimla would assess requirement of relief material and mobilize the local reserves to the affected area. It will also place its requirement for relief material to the District and the State authorities.

(ii) The ESF departments at city level would arrange to supply relief material to the affected locations.

(iii) Provision of temporary shelter will be made for those persons whose houses have been affected severely and for those whose houses have been damaged completely.

6.2.1.9 Environment Impact Assessment

Department of Environment and Forest will get the environment impact assessment carried out for the affected area.

6.3 Trigger Mechanism

The Trigger Mechanism prescribes the manner in which the disaster response system shall be automatically activated after receiving early warning signals of a disaster happening or likely to happen or on receipt of information of an incident. Activities envisaged in this SOP under the response Phase shall be initiated simultaneously without loss of time to minimize the loss, damage and mitigate the impact of disaster. The objective of having a trigger mechanism for natural disasters is to have a suo-motto activation mechanism for spontaneous response to set in motion command, control and management of the situation. There shall be two types of situation with different trigger mechanisms for natural disasters:

Figure 5 : Information flow chart in Case Where Early Warning Signals are Available

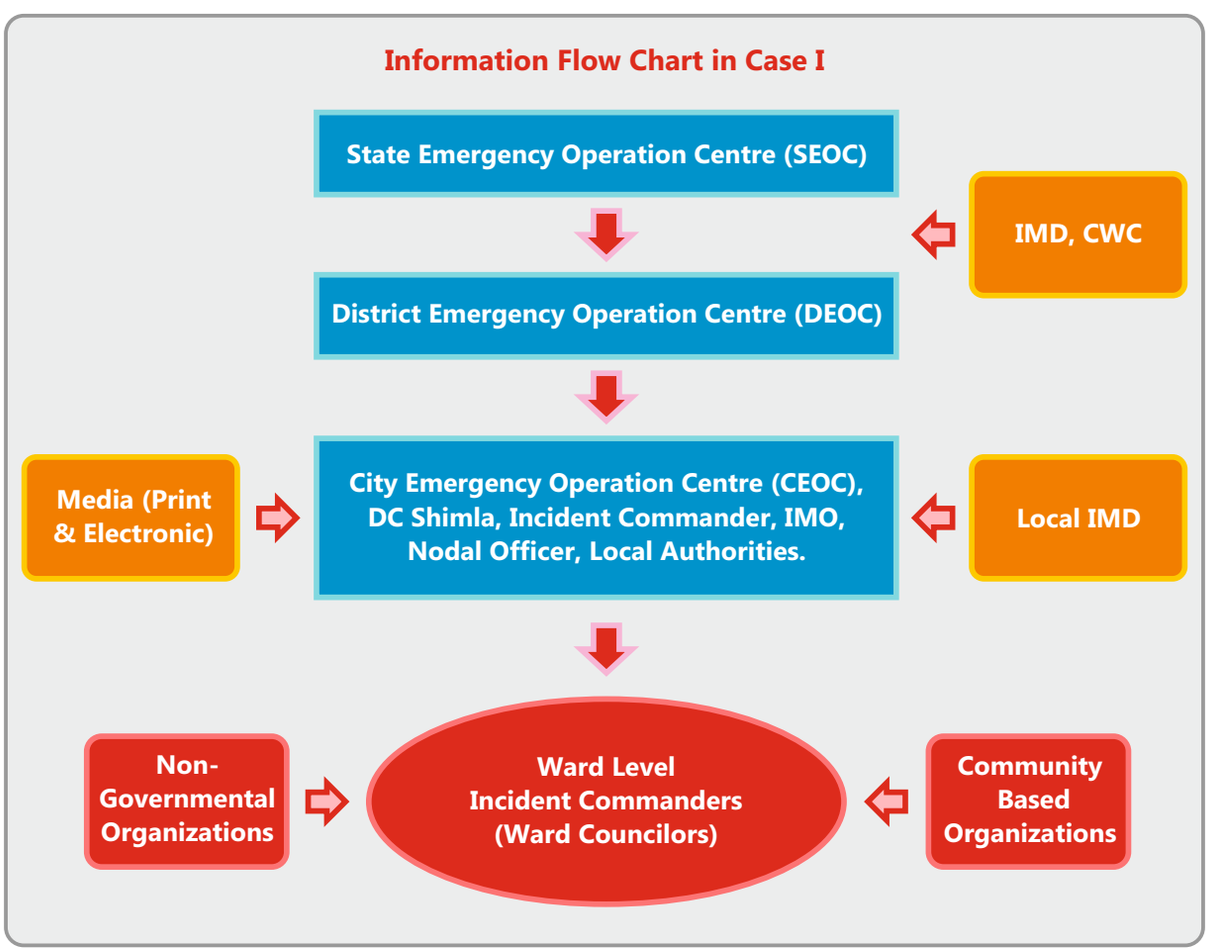
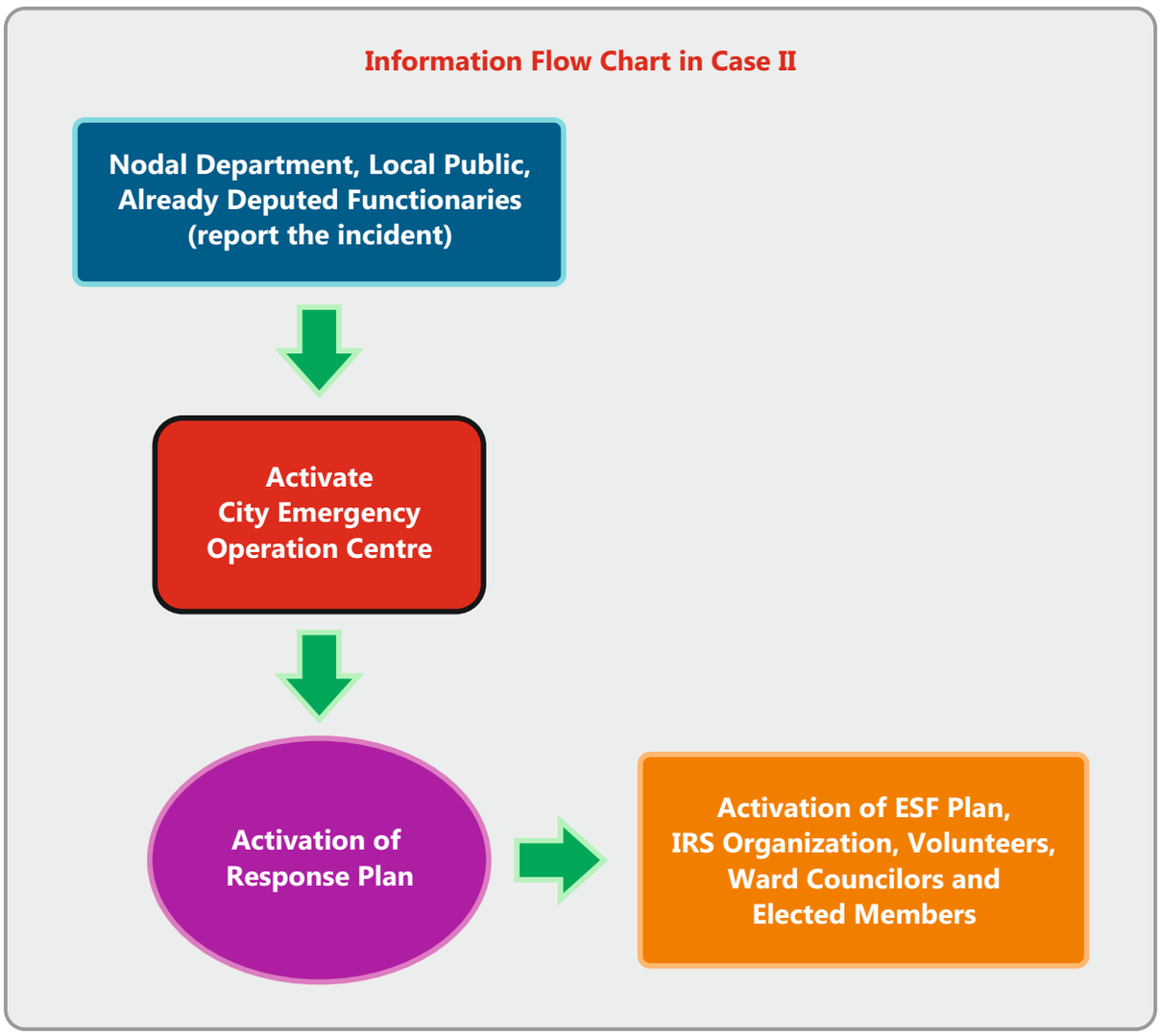


Figure 6 : Information Flow Chart in Case Where Disaster occurs without Early Warning



7 GO-NGO Coordination

7.1 Institutional and Legal Framework

The DM Act 2005 recognizes that sometimes the development patterns that do not recognize disaster risk and vulnerability in the specific geographic areas may induce disasters. The proactive approach in the DM Act 2005 to address disaster risk and vulnerability through pre- disaster preparedness and mitigation activities also envisions accountability and multi stakeholder participation, including coordination of the activities of the NGOs at various levels.

Section 30 (2) (xix) of the Act mandates for collaboration with stakeholder agencies including NGOs for the purpose of improving the effectiveness of Disaster Management. Similarly, the Act mandates NGOs to act in an equitable and non-discriminatory manner for the purpose of assisting or protecting the disaster affected communities or for providing relief to the affected communities or while dealing with any effects of threatening disaster situations and has fixed the responsibility to monitor this on DDMAs vide section 34 (l).

The above provisions ensure that the concerned DM interventions being addressed are supported and facilitated by the Civil Society Organizations working at the grass roots and also takes care of the ground realities. Section 30 (2) (xix) of the Act stipulates that the DDMA shall "advise, assist and coordinate the activities of the Departments of the Government at the district level, statutory bodies and other governmental and non-governmental organizations in the district engaged in disaster management" and Section 24 (l) lays down that the Municipal Corporation, Shimla shall "ensure that the non-governmental organizations carry out their activities in an equitable and non-discriminatory manner". The Act also directs the State Government under Section 38 (2) (a) to coordinate "actions of different departments of the Government of the State, the State Authority, District Authorities, local authority and other nongovernmental organizations".

Sections 35 and 38 specifically emphasize the coordination of actions with NGOs. The National Policy on Disaster Management (NPDM) also states the national vision for community mobilization and participation in DM and aims to provide momentum and sustenance through the collective efforts of all government agencies and NGOs. There is emphasis on community based disaster management, including last mile integration of the policy, plans and execution and early warning dissemination. Promoting a productive partnership with NGOs is a prominent thrust area in the NPDM.

There is a large scope for improving the engagement of NGOs in DM and on efficiently utilizing their unique advantages and core competencies by strengthening humanitarian coalitions, alliances and NGO networks. There is also need to strengthen public awareness, capacity building and knowledge management through CBOs and NGOs. Institutional mechanisms for the advocacy and engagement of NGOs with government agencies on DM concerns require to be strengthened. Replication and scaling up of community level good practices has to be promoted.

7.2 Advantages of involving the NGOs

NGOs can play a very important role in mobilizing communities and in linking PRIs/ULBs with corporate sector entities for initiating DRR related activities. The strong linkages which NGOs have with grassroots communities can be effectively harnessed for creating greater public awareness on disaster risk and vulnerability, initiating appropriate strategies for strengthening the capacity of stakeholder groups to improve disaster preparedness, mitigation and improving the emergency response capacities of the stakeholders. In addressing the emerging concerns of disasters and climate change, NGOs can play a very significant role in working with local communities and introducing innovative approaches based on good practices followed in other countries.

NGOs can bring in the financial resources from bi-lateral and multilateral donors for implementing pragmatic and innovative approaches to deal with disaster risk and vulnerability, by effectively integrating and converging the various government programmes, schemes and projects to create the required synergy in transforming the lives of at-risk communities.

7.3 Actions to be taken by the Municipal Corporation, Shimla

- Developing a database of NGOs, CBOs and Faith Based Organizations at all levels working in the field of disaster management and emergency response and other others focusing on geographic outreach and thematic capacities of the organizations.
- Developing the capacity of identifying NGOs, CBOs and organizations in disaster management and emergency response.
- Constitution of a City-level Inter-Agency Group (IAG) with an objective to:
  - Promote and institutionalize unified response strategy in humanitarian crisis.
  - Mainstreaming the emergency preparedness as in integrated development strategy.
  - Systematize the emergency response mechanism.
  - Bringing in the culture of "working together" in emergencies and normalcy.
  - Engagement in activities that will build the capacities of stakeholders and local communities to cope with calamities.
- Development of Criteria for membership of IAG: Any of the following criteria is proposed to become a member of the Shimla City IAG:
  - City Level agencies working in emergency response and preparedness for minimum of five years.
  - International and national funding agencies supporting emergency preparedness and community led risk reduction initiatives for a minimum period of three years.
  - Academic and /or research institutions actively involved on disaster related knowledge management and practices.
- Membership claim may be scrutinized by a committee of the City IAG for authentication of the prospective member organization.

Table 32 : Non-Government Organisations Action Points

S. #	Issues	Action Points
1.	Geographic spread of NGOs	Develop a database of NGOs at all levels working on disaster management focusing on geographic outreach and thematic capacities of the organizations. **(Action: Municipal Corporation, Shimla with the help of NGOs)**
2.	Volume of support provided by the NGOs	Compile statistics on quantum of support provided by NGOs at all levels, both international and national. **(Action: Municipal Corporation, Shimla)**
3.	Coordination	Establishing inter agency mechanisms for coordination and networking activities (information and knowledge management, training and capacity building, collaborative advocacy, quality and accountability) at all levels. **(Action: Municipal Corporation, Shimla)**
4.	Accessibility	Establish protocols for cooperation and ensure access to the affected areas with support from government agencies at respective levels like NDRF & SDRF that have good logistics base to reach inaccessible areas. **(Action: Municipal Corporation, Shimla, NGOs, CBOs)**
5.	Hazard and Vulnerability based Planning	Conduct community centric hazard and vulnerability analysis at all levels and develop disaster management plans in accordance. **(Action: Municipal Corporation, Shimla, NGOs)**
6.	Community Participation	Ensure community participation in assessment, planning, implementation and monitoring of activities at all levels. **(Action: Municipal Corporation, Shimla, NGOs, CBOs)**
7.	Mainstreaming of Disabilities issues in Disaster Management	Support the most vulnerable groups through mitigation activities as well as disaster preparedness and response, with a particular focus on the special needs of the persons with Disabilities (PWDs). **(Action: Municipal Corporation, Shimla, NGOs)**
8.	Gender Mainstreaming	Make women's as well as men's concerns and experiences an integral dimension in the design, implementation, monitoring and evaluation of policies and programs such that inequalities between men and women are not perpetuated through the routine operations of DM. **(Action: Municipal Corporation, Shimla)**
9.	Focus on the most Vulnerable rather than only on Epicenter	National level: Advocate with all actors to reach out to gap areas State level: Coordinate among actors to identify gap areas District and Local level: Ensure targeting with equity and outreach to all excluded areas. **(Action: District NGOs task forces in DM)**

10.	Rural-urban diversity	Develop the capacities of NGOs specialized civil society agencies at all levels to manage urban as well as rural disasters and accordingly make investments. **(Action: Municipal Corporation, Shimla)**
11.	Adherence to standards	National level: Develop minimum standards for India State level: Develop minimum standards for the state District and local level: Develop capacities for adherence to minimum standards through collective and coordinated efforts of all stakeholders. **(Action: Municipal Corporation, Shimla)**
12.	Transparency and accountability	Develop an agreed framework of accountability for all levels and mechanisms to bring in transparency. **(Action: Municipal Corporation, Shimla)**
13.	Do No Harm	Advocacy at all levels on Do No Harm through disaster response and development interventions. **(Action: Municipal Corporation, Shimla, NGO Task Forces in DM)**
14.	Exit Strategy	Ensure that the NGO programmes have an exit strategy to link with long term recovery/rehab/development programs of other NGOs or the government. **(Action: Municipal Corporation, Shimla, NGO Task Forces in DM)**

Source: NDMA Guidelines on the Role of NGOs in Disaster Management

7.4 Coordination of Actions of Other Actors

Disasters affect all aspect of human life and all aspects of development. Therefore, Disaster Management is a multi-agency function. It involves actions by all departments, organization and agencies. In short, it involves all departments of the Central Government, State Government, Armed Forces, Civil Society and Commercial Organization (NGOS, CBOs, Faith Based Organization, Traders Organizations and Corporate Sector), International Organizations working in the field of disaster response, UN Agencies etc. It is therefore, important that roles and responsibilities of each stakeholder are laid down during normal time and coordination mechanism worked out so that the same works during emergencies. It is must that regular meetings with all the stakeholders are held at least once in six months or a year. And all stakeholders are also associated in the mock drills to test their preparedness and clarity of roles and responsibility.

7.5 Major NGOs working in Disaster Risk Management in the City

There are several Non-Governmental organizations working in Shimla city which can contribute to disaster preparedness and response related initiatives in the city. They include the following:

Helpage India, Church's Auxiliary for Social Action (CASA), Doers, Umang Foundation, etc.

8 Recommendations for Disaster Risk Management

Shimla being a hill station, is one of the favorite tourist destinations in India. However, the city cannot only sustain on tourism alone. Tourism apart from inducing economic activities, also has a negative impact on the city and its resources. Already the city depends on water supply from sources which are at a distance from the city limits, the increased pressure on the existing water supply systems may worsen the situation in the long-term.

Second problem is parking. During the weekends and holidays, the population of Shimla gets doubled. People from the neighbouring areas like – Solan, Chandigarh, Delhi and Haryana come to Shimla with private vehicles, which almost equals the existing population of the city. At the peak hours, the traffic situation goes from worse to worst, with little space available. If an earthquake or any other disaster occur at this hour, the consequences will be catastrophic. Even with a significantly augmented parking capacity, the number of vehicles has not reduced on roads. The city needs to continuously take the measures to ensure that the emergency vehicles, like- ambulances, fire trucks, military vehicles, etc. can move and function effectively during emergencies or in case of hospitalization of patients.

Third problem is the haphazard construction. Many people are aware of the unsafe conditions of the housing stock within their city but do not take any action to alter the construction quality. Two types of construction qualities have been observed in the city – one, for self-occupying; second, for lending purposes. The quality is apparent in terms of the construction details, material used and also the maintenance. In general, the construction done by the middle income and lower income people is of further inferior quality. Many a times, the buildings are built on installments ie. some part of the building is built at one time while the other floors are constructed at different time periods, leading to weak joints between these floors.

Fourth problem is the lack of engineered building techniques. The construction labourers in the city are from either UP or Bihar and are not aware of hill-side construction measures, while local labourers are trained in traditional construction practices and techniques like Dhajji dewari or Kath-kuni. However, because of non-availability of wood and mud, owners have turned to RCC in recent times. Thus construction workers not being trained in the RCC and brick usage, produce inferior quality of construction. Apart from the above mentioned problems the city is impacted by several hazards, thereby increasing its risk. Some of the measures to reduce the risks were proposed in the earlier section. Here a description of the same is provided.

Replacement, Restoration and Retrofitting of Housing Stock:

As the housing stock is very vulnerable, it is proposed that at least 10% of the existing stock be replaced annually. This will ensure that the existing stock is upgraded to safer stock.

Retrofitting of Power Distribution System:

City's existing power distribution system is vulnerable to landslides and earthquakes. So retrofitting the buildings and equipment will enable them to become more resilient.

Construction of Support Infrastructure at Parking Lots:

There are several parking lots in various parts of the city. In case of emergency, currently there are no assembly points or rescue shelters within the city. So if basic infrastructure – toilets, water supply, etc. is affected, these parking lots can be converted into emergency shelters.

Construction of Emergency Evacuation Shelters:

Wherever parking lots are not available, new evacuation shelters be constructed in order to facilitate the relief and rescue operations.

Revitalization of Natural Drains:

Many of the buildings (both private and public) have come up by disturbing the natural drainage patterns. In those cases, the streams are diverted to other places, causing many of the areas to become vulnerable to landslides. By revitalizing the natural drainage, we can make sure that there are no accumulation of water, which gives rise to mass movement. The nallahs can be cemented for preventing land seepage where ever possible.

Construction of Retaining Walls:

Many parts of the roads are already provided with retaining walls. However, the 'weepholes' are blocked either due to siltation or with food wrappers and plastic bottles. Removing these obstacles will help drain out the excess water retained in the soil. Constructing the retaining walls, where they are damaged or were not constructed earlier will help secure the roads from slides and mass movement.

Structural Modification/Retrofitting of Important Buildings:

Many of the government buildings were constructed more than 150 years ago and hence many of them are in physically weak conditions, due to which they may not be able to take the seismic or landslide loads. So retrofitting them will ensure business continuity even in the event of a disaster.

Construction of Barrier, Deflection, or Retention Systems:

Places where landslide susceptibility is high, constructing the landslide barriers, deflection structures and retention systems will provide adequate safety to the existing housing.

Land Use Planning & Management:

In order to identify and delineate hazardous zones, and provide for zoning regulations, a detailed land use planning exercise needs to be carried out. Some basic studies are needed before taking up this exercise, like hazard zonation, seismic micro-zonation, landslide susceptible area marking, etc. Based on these studies, land use zoning can be carried out in the safer areas.

Community Awareness and Education Programs:

Community awareness is one of the key elements in reducing the risk. A proper public participation based awareness generation among the community is needed if the city wants to reduce the risk.

Reforestation:

Many of the areas within and outside the city boundaries are being cleared off for building or constructional purposes. These deforestation activities will increase the run off thereby increasing the landslide susceptibility. So proper precautions need to be taken in order to reduce the barren areas.

Training Programme for Professionals in Construction Industry:

Separate professional training and certificate programs for the masons, contractors, architects, engineers, construction labourers will help ensure that the hazard and vulnerability information is passed on to the construction workers. At the same time, latest building codes and how to adhere to the same can also be transmitted to the construction professionals.

Risk Transfer, Sharing, and Spreading:

Encouraging each and every household to insure their property can help the city by reducing the burden of financial support to be given by either city or the state. If the premium is beyond the financial capacity of the household, various cost sharing mechanisms can be worked out. A set of recommendations from Director, Town and Country Planning, Divisional Town Planning Office, Himachal Pradesh in this regard are given below:

- To stop the construction activity of high raise buildings in Shimla town - especially core area.
- Building code and other regulatory measures shall be adopted by Municipal Corporation and other Authorities in Shimla Town.
- The masons, plumbers, bar-bender and other skilled workers have to be trained for construction of buildings. The skill development programme shall be started soon.
- Vide notification dated:-13.08.2015 this department has banned the construction activity Sanjauli Dhalli bypass 15.00m on either side to avoid cutting of steep slopes.
- The Town and Country Planning Department has identified the Sinking and Sliding Zone in the Interim Development Plan in Shimla Town, whereas Geological Report is required for reconstruction. New construction on vacant plot in these areas shall be allowed on the basis of a structural design in consonance with Geological Report from the state Geologist.
- All the buildings bye laws of Department of Town and Country Planning be followed.
- The natural drainage system shall not be disturbed and minimum 3.00 mt. distance from nallah and 5.00 mt. from khud has to left as per bye laws.
- No Planning Permission case in Shimla Planning Area should be allowed above 45° slope.
- Every Govt. and Semi Govt. building should install a fire hydrant for fire safety.
- The Govt./Authorities shall not allow construction in already congested area. To decongest the city, developing Satellite Towns is very important. The Town & Country Planning Deptt. has already identified these at Waknaghat, Ghandal and Fagu.
- The constructions shall be quite away from highest flood level on major rivers in state.
- Proper monitoring of construction activities especially with reference to structure design, slopes etc. are regularly to be done by authorities.
- The dumping grounds have been identified by R&B department of the Municipal Corporation within Shimla city. In the future, they can be developed as grounds and can be used for disaster evacuation sites and/or for parking.
- Alternative spokes has to be developed to ease traffic between cart road and bypass.
- All the safety measures has to be adopted in private building also.

Summary

Shimla city, along with having several advantages such as- scenic beauty and famous tourist destination, also suffers from a few serious backlogs. During the weekends and holidays, the population of Shimla gets doubled with tourists from the neighbouring states coming to Shimla in their private vehicles. The city needs to take measures to reduce the number of vehicles on the streets, to ensure that the emergency vehicles, like- ambulances, fire trucks, military vehicles, etc. can move easily. Haphazard construction within the city is yet another major problem that needs to be dealt with. Many people are aware of the unsafe conditions of the housing stock within their city but do not take any action to alter the construction quality. Moreover, many a times, the buildings are built in installments i.e. some part of the building is built at one time while the other floors are constructed at different time periods, leading to weak joints between these floors. Another problem is the lack of engineered building techniques. Some of the recommendations for risk reduction in the city are:

- Replacement, Restoration and Retrofitting of Housing Stock
- Retrofitting of Power Distribution System
- Construction of support infrastructure at parking lots
- Construction of Emergency Evacuation Shelters
- Revitalisation of natural drains
- Construction of retaining walls
- Structural modification retrofitting of important buildings
- Construction of barrier, deflection, or retention systems
- Land use planning & management
- Community Awareness and Education Programs
- Reforestation
- Building codes and regulatory measures
- Training programme for professionals in construction industry
- Risk transfer, sharing, and spreading

9 Financial Resources

9.1 Potential Resources at the District/State/National/International Level

District-level Resources

- Funds can also be requested through the District Disaster Response Fund
- Funds can also be requested through the District Disaster Mitigation Fund
- Contingency Funds available at the DDMA Shimla to procure any crucial resource for disaster preparedness, response or mitigation can also be requested by the MC Shimla.

State-level Resources

- According to the DM Act 2005, all the state departments shall allocate funds for prevention of disaster, mitigation, capacity-building and preparedness. The same can also be accessed by the Municipal Corporation Shimla for relevant activities at the city-level.
- Funds can also be requested through the State Disaster Response Fund.
- Funds can also be requested through the State Disaster Mitigation Fund.

National or Regional Resources

- Municipal Corporation Shimla may try to access the CSR funds through forging partnerships to build community resilience in the city.
- Partnerships with Non-Governmental Organizations working on Disaster Risk Management can also be developed keeping in view the interventions on common agenda.

International Resources

MCR2030

With a goal to make resilient and sustainable by 2030, the Making Cities Resilient 2030 (MCR2030) is a unique cross-stakeholder initiative for improving local resilience through advocacy, sharing knowledge and experiences, establishing mutually reinforcing city-to-city learning networks, injecting technical expertise, connecting multiple layers of government, and building partnerships. Through delivering a clear roadmap to urban resilience, providing tools, access to knowledge and monitoring and reporting tools, MCR2030 will support cities on their journey to reduce risk and build resilience.

United Nations Office for South-South Cooperation (UNOSSC)

South-South cooperation is a broad framework of collaboration among countries of the South in the political, economic, social, cultural, environmental and technical domains. Within this framework, collaboration can be initiated with donor countries and multilateral organizations to facilitate South-South initiatives through the provision of funding, training, management and technological systems as well as other forms of support.

Annexure- 01 (A)

Contact Details of Mayor, Deputy-Mayor & Councillors, Municipal Corporation, Shimla

S. #	Name	Designation	Address	Ward Name & No.	Mobile No.
1.	Smt. Tanuja Chaudhary	Councillor	Sethi Niwas, Keleston, Shimla	Bharari (1)	9218501091
2.	Sh. Sanjeev Thakur	Councillor	Krishna Cottage, Ruldu Bhatta, Shimla	Ruldu Bhatta (2)	9816061212
3.	Sh. Sunil Dhar	Councillor	Madhusudan Building, Lower Kaithu, Shimla	Kaithu (3)	9418012234
4.	Smt. Kusum Sadrate	Councillor	Balency Estate, Lower Kaithu, Annadale Shimla-2	Annadale (4)	9459795447
5.	Smt. Shelli Sharma	Councillor	D-2, Rediyent Homes, Summer Hill, Shimla-5	Summer Hill (5)	9418037505
6.	Sh. Vivek Sharma	Councillor	Sharma Building, Totu Chowk, Shimla	Totu (6)	9816049696
7.	Sh. Divakar Dev Sharma	Councillor	Devi Cottage, Near Vaid Building, New Totu, Shimla	Majiath (7)	8091100444
8.	Smt. Kiran Bava	Councillor	Bava Niwas, Chakkar, Shimla	Boileauganj (8)	9816115690
9.	Sh. Sanjay Parmar	Councillor	Yogdha Ashram, Boileauganj, Shimla-5	Kachi Ghati (9)	9816516513
10.	Sh. Ananad Kaushal	Councillor	Hira Niwas, Tutikandi, Shimla-4	Tutikandi (10)	9816263401
11.	Smt. Simi Nanda	Councillor	Amit Lodge, Shimla-4	Nabha (11)	9816855055
12.	Sh. Jagjeet Singh Bagga	Councillor	Sent Alvance Cottage, Shimla	Phagli (12)	9418026700
13.	Sh. Bittu Kumar	Councillor	Hno 12, Below Singh Sabha, Gaddi Khana, Krishna Nagar, Shimla-1	Krishna Nagar (13)	9418065087
14.	Smt. Sushma Kutiala	Councillor	78-Butail Niwas, Ram Bazar, Shimla	Ram Bazar (14)	9816014452
15.	Sh. Inderjeet Singh	Councillor	Tashina Cottage, Khalini, Shimla-2	Lower Bazar (15)	9816000070
16.	Smt. Archana Dhawan	Councillor	30 Charli Mount, Jakhu, Shimla	Jakhu (16)	9418269009
17.	Smt. Kimi Sood	Councillor	Chief Fire Office Building, Near Henault School, Stoke's Palace, Chotta Shimla-2	Benmore (17)	9418048224

S. #	Name	Designation	Address	Ward Name & No.	Mobile No.
18.	Km. Arti Chauhan	Councillor	Suryanshi Chauhan Niwas, Sanjauli, Shimla-6	Engine Ghar (18)	9805232799
19.	Smt. Satya Kundal	Mayor	Mayur Niwas, North Oak, Sanjauli, Shimla-6	Sanjauli Chowk (19)	9816014452
20.	Smt. Kamlesh Mehta	Councillor	Mehta Niwas, Inder Nagar, Dhalli, Shimla-12	Dhalli (20)	9418543130
21.	Sh. Shalinder Chauhan	Deputy-Mayor	Bhikta Niwas, Near Durga Mandir, Dhalli, Shimla-6	Mashobra (21)	9816421310
22.	Smt. Shardha Chauhan	Councillor	Akhil Niwas, Cemetry Road, Sanjauli, Shimla-6	Shanti Vihar (22)	9816710542
23.	Smt. Rita Thakur	Councillor	Daroga Niwas, Gahan, Kamla Nagar, Shimla-6	Bhattakufar (23)	9816004770
24.	Smt. Meera Sharma	Councillor	Shardha Sadan, Sangti, Sanjauli, Shimla-6	Sangti (24)	9459177950
25.	Sh. Kuldeep Thakur	Councillor	Shanan, PO Sanjauli, Shimla	Malyana (25)	9805152999
26.	Sh. Rakesh Kumar Sharma	Councillor	Ram Krishna, Bhawan, Panthaghati, Shimla-9	Pantha Ghati (26)	9816158564
27.	Sh. Rakesh Chauhan	Councillor	Dhar House, Jiwanoo Colony, Kasumpti, Shimla-9	Kasumpti (27)	9816400026
28.	Km. Vidushi Sharma	Councillor	Set No.5, Saroj Meshan, Chotta Shimla-2	Chotta Shimla (28)	9418686428
29.	Smt. Rachana	Councillor	Palak Bhawan, Lower Vikas Nagar, Shimla	Vikas Nagar (29)	7018063131
30.	Smt. Renu Chauhan	Councillor	Jayoti Niwas, Kanganadhar, Shimla	Kangnadhar (30)	7018705242
31.	Smt. Asha Sharma	Councillor	Yashodha Bhawan, BCS, New Shimla	Pateog (31)	9816734974
32.	Km. Kusum Lata Thakur	Councillor	Ashwani Building, Sector-2, New Shimla	New Shimla (32)	9816700744
33.	Sh. Puran Mal	Councillor	Nav Niketan Bhawan, Lower Khalini, Shimla-2	Khalin (33)	7018593105
34.	Smt. Brij Sood	Councillor	New Narang, Near KNH, Shimla	Kanlog (34)	9459364608

Annexure- 01 (B)

City Disaster Management Committee, Municipal Corporation Shimla

S. #	Designation of the Officer	Role in the Disaster Management Committee
1.	Commissioner	Chairperson
2.	Joint Commissioner	Member Secretary
3.	Municipal Engineer	Member
4.	Executive Engineer - Roads & Buildings	Member
5.	Architect Planner	Member
6.	Corporation Health Officer	Member
7.	Superintending Engineer, GSWS&S Circle	Member
8.	Executive Engineer, Sewerage, GSWS&S Circle	Member

NOTE: Vide Office Order No. MCS/AC/CRM/2016-4561 dated 18/11/2016.

Annexure- 01 (C)

Structure of the Ward Disaster Management Committees

S. #	Designation of the Officer	Role in the Ward DM Committee
1.	Ward Councillor	Chairperson
2.	Medical Officer, Department of Health and Family Welfare	Member
3.	Constable, Police Department, District Shimla	Member
4.	Patwari, District Revenue Office, District Shimla	Member
5.	Junior Engineer, Department of Irrigation and Public Health	Member
6.	Junior Engineer, Department of Road and Building, MC Shimla	Member
7.	Representative from Govt/ Public/ Private Institution	Member
8.	Representative from Govt/ Public/ Private Institution	Member
9.	Representative Social Worker / Volunteer from Community	Member
10.	Representative Social Worker / Volunteer from Community	Member
11.	Prominent Local personality from Defence / Government Official	Member

NOTE: According to the Ward Disaster Management Plans developed by the MC Shimla.

Annexure- 02 (A)

Key Contact Numbers - Municipal Corporation, Shimla

S. #	Designation	Name	Office	Epbax No.	Resi./Mobile No.
1.	Mayor	Smt. Satya Kaundal	2812360	-	9816014452
2.	P.S. to Mayor	Sh. Daljit S. Parmar	2812360	-	2812150
3.	Deputy Mayor	Sh. Shalinder Chauhan	2804058	-	9816421310
4.	Commissioner	Sh. Ashish Kohli	2812899	205	9418085682
5.	P.A. to Commissioner	Smt. Sunita Sharma	2812899	206	2652695
6.	Addl. Comm. (Legal)	Sh. Joginder Chauhan	2808095	207	2670400
7.	P.A. to Addl Com	----------	Ext:-	208	-
8.	Addl. Commisioner	Sh. Ajit Bhardwaj	2656576	209	9418460333
9.	P.A. to Joint Commisioner	Sh. Desraj	2656576	210	-
10.	MD-cum-CEO-(SJPNL)	Sh. Dharmendra Gill	-	-	9418301809
11.	EE-cum-Project Director	Sh. Prem Dass	-	211	9418454500
12.	Accounts Officer	Sh. Amar Dutt Bharadwaj	Ext:-	214	9418052409
13.	Health Officer	Sh. Dr. Chetan Chauhan	Ext:-	224	9459302515
14.	AGM (Water SJPNL)	---------	Ext:-	-	-
15.	Executive Eng. (R&B)	Sh. Rajesh Thakur	Ext:-	215	9418458702
16.	Architect Planner	Sh. Davinder Mista	2802778	-	7018589448
17.	AGM (Sewarage SJPNL)	Sh. Gopal Krishnan	-	-	9418024204
18.	Asst. Eng. (R&B)	---------	-	218	-
19.	Manager(Sewarage SJPNL	Sh. Adarsh Bhota	Ext:-	-	9418071484
20.	Asstt.. Eng. (Project Cell)	---------	-	-	-
21.	Market Supdt./VPHO	Sh. Neeraj Mohan	2652452	-	9418092015
22.	Asstt. Secretary Tax	Sh. Hem Chand	2650285	-	-
23.	Suptd. (General)	Sh. D D Thakur	Ext:-	238	9459129594
24.	Suptd. WS&SD (Rev.)	---------	Ext:-	-	-
25.	Project Cell	---------	Ext:-	231	-
26.	Computer Section	Mrs. Mamta Goel	Ext:-	221	9418068315
27.	Cash Branch	Sh. Brij Mohan	Ext:-	-	2802780
28.	Secy. SJSRY	---------	Ext:-	2652771	-
29.	C.S.I	---------	Ext:-	223	-
30.	Food Inspector	---------	Ext:-	-	-

S. #	Designation	Name	Office	Epbax No.	Resi./Mobile No.
31.	Health Laboratory	---------	Ext:-	-	2804197
32.	General Branch	Sh. D D Thakur	Ext:-	219	-
33.	Health Deptt.	---------	Ext:-	226	-
34.	Estate Branch	---------	Ext:-	-	2802779
35.	AP Branch	---------	Ext:-	-	2802778
36.	Account Branch	---------	Ext:-	229	-
37.	Drawing Branch (R&B)	---------	Ext:-	230	-
38.	SEHB	---------	Ext:-	212	-
39.	Meter Reader (WS&SD)	---------	Ext:-	233	9495744801
40.	Reader Branch	Sh. Ram Kumar	Ext:-	236	9816019879
41.	Superintendent (R&B)	---------	Ext:-	235	-
42.	General Branch	Chowkidar Room	Ext:-	-	-
43.	Ridge Reservoir	Control Room	2658916	-	-
44.	JE. Central Zone (WS&SD)	---------	2652519	-	-
45.	J.E Chotta Shimla WS&SD	---------	2623760	-	-
46.	J.E. Sanjauli (WS&SD)	---------	2842131	-	-
47.	JE. Ridge Reser. WS&SD	---------	2654916	-	-
48.	J.E Chaura Maidan WSSD	---------	2813671	-	-
49.	New Shimla	---------	2670569	-	-
50.	Mashobra Pump House	---------	2740214	-	-
51.	Guma Pumping Station	---------	2781218	-	-
52.	Chharabra Reservoir	---------	2740233	-	-
53.	Craignano Guest House	---------	2740236	-	-
54.	Phagli M.C. Store	---------	2835209	-	-
55.	Zonal Office Dhalli	---------	2647030	-	-
56.	Zonal Office New Shimla	---------	2621725	-	-
57.	Zonal Office Totu	---------	2838668	-	-

Annexure- 02 (B)

Contact Details - Architecture Planning Wing

S. #	Name of the Junior Engineer	Contact No.	Ward Name and Number
1.	Sh. Mohan Thakur, JE	9418064474	Bharari (1), Ram Bazar (14), Lower Bazar (15), Jakhoo (16) & Benmore (17)
2.	Sh. Jitender Samta, JE	9418233114	Ruldu Bhatta/ Kufta Dhar (2), Kaithu (3), Annadale (4) & Malayana (25)
3.	Sh. Mukul Joshi, JE	9805016827	Sanjauli (19), Upper Dhalli (20), Lower Dhalli (21), Bhatta (22) & Kuffar (23)
4.	Sh. Rajender Kumar, JE	9418367553	Boileauganj (6), Totu (7), Majyat (8), Tutikandi (10) & Nabha (11)
5.	Sh. Kapil, JE	7559731725	Summer Hill (5), Kachighati (9), Engine Ghar (18) & Panthaghati (26)
6.	Sh. Raj Kumar, JE	9779107617	Phagli (12), Krishna Nagar (13), Sangti (24), & Vikas Nagar (29)
7.	Sh. Rohit Kumar, JE	8580423466	Kangnadhar (30), Patyog (31), New Shimla (32), & Khalini (33)
8.	Sh. Dharmender, JE	7018406196	Kanlog (34), Kasumpti (27) & Chotta Shimla (28)

Annexure- 02 (C)

Contact Details - Road Construction & Building Wing

S. #	Name of the Junior Engineer	Contact No.	Ward Number and Area
1.	Sh. Rakesh Kumar, JE	8219516474	Bharari (1), Ruldu Bhatta (2), Jakhoo (16) & Benmore (17)
2.	Sh. Chander Shekhar, JE	9817057366	Kaithu (3) & Summer Hill (5)
3.	Sh. Saksham, JE	9459743003	Annadale (4), Ram Bazar (14) & Lower Bazar (15)
4.	Sh. Munish Rana, JE	8351846016	Totu (6) & Majath (7)
5.	Sh. Bachiter Singh, JE	9418627780	Boileaugan (8), Kachhighatti (9) & Tutikandi-Bhadai (10)
6.	Sh. Dinesh Thakur, JE	9816035624	Nabha (11), Phagli (12) & Kanlog (34)
7.	Sh. Kapil Verma, JE	9857064300	Krishna Nagar (13) & Challenge Fund Building
8.	Sh. Praveen Jhinta, JE	8580738200	Sanjauli (19), Dhalli (20) & Mashobra (21)
9.	Sh. Amar Singh, JE	9805272559 8580535384	Malyana (25)
10.	Sh. Nikram Thakur, JE	9418076416 7018353570	Engine Ghar (18), Shanti Vihar (22), B (15), Jakhoo (16) & Benmore (17)
11.	Sh. Yogender Kashyap, JE	9805408496	Panthaghati (26), Chhotta Shimla (28) & Vikas Nagar (29)
12.	Sh. Rakesh Chaudhary, JE	9817222688	Kangana Dhar (30), Pateog (31), New Shimla (32), Khalini & Ray Project (33)
13.	Sh. Sanjeev Gupta, JE	9418486558	All wards

Annexure- 02 (D)

Shimla Environment Heritage Conservation & Beautification (SEHB) Society, MC Shimla

S. #	Ward Name & No.	Supervisor	Contact No.	Assistant Supervisor	Contact No.
1.	Bharari (1)	Sh. Naresh Kashyap	9318804823	Sh. Prem Kumar	9418584666
2.	Ruldu Bhatta (2)	Sh. Suresh	9418029486	Sh. Sachin Kumar	8351025305
3.	Kaithu (3)	Sh. Naresh Kumar	9459092003	Sh. Inder	9817425291
4.	Annaldale (4)	Sh. Bharat Kumar	9816405988	Sh. Chandu Lal	9418289073
5.	Summer Hill (5)	Sh. Harpal	7018663221	-	-
6.	Totu (6)	Sh. Ajit Narval	9418670073	-	-
7.	Totu (6)	Sh. Bharat Bhusan	8580520906	-	-
8.	Majhait (7)	Sh. Narender Kumar	9817799610	-	-
9.	Boileauganj (8)	Sh. Narender Thakur	7018588976	Sh. Raghuveer	9736111075
10.	Kachi Ghatti (9)	Nil	-	Sh. Devi Raml	8580463585
11.	Tutikhandi (10)	Sh. Madan	9817661762	-	-
12.	Nabha (11)	Sh. Lalit	7018875004	-	-
13.	Phagli (12)	Sh. Dalvinder	9882230800	-	-
14.	Krishna Nagar (13)	Sh. Rahul	9816734118	-	-
15.	Ram Bazar (14)	Sh. Gaurav	8894632319	-	-
16.	Lower Bazar (15)	Sh. Vijay	9805919115	-	-
17.	Jakhoo (16)	Sh. Shiv Ram	7018423191	-	-
18.	Benmore (17)	Sh. Naresh Thakur	9418481371	-	-
19.	Engine Ghar (18)	Sh. Sunil Kumar	7559642306	-	-
20.	Sanjauli Chowk (19)	Sh. Pratap Singh	8219392494	-	-
21.	Dhalli (20)	Sh. Dinesh	9816599290	-	-
22.	Mashobra (21)	-	-	-	9817205932
23.	Shanti Vihar (22)	Sh. Dilbhag	9418009742	-	-
24.	Bhattakufar (23)	Sh. Rajeev	7018140027	-	-
25.	Sangti (24)	Sh. Neeraj	9736600167	-	-
26.	Malyana (25)	Sh. Harish	8988845551	-	-
27.	Panthaghati (26)	Sh. Inderjeet	9418013371	-	-
28.	Kasumpti (27)	Sh. Rakesh	9817663964	-	-

S. #	Ward Name & No.	Supervisor	Contact No.	Assistant Supervisor	Contact No.
29.	Chotta Shimla (28)	Sh. Yogesh Mandla	9816468339	-	-
30.	Vikas Nagar (29)	Sh. Ankush	9736620641	-	-
31.	Kangna Dhar (30)	Sh. Khub Ram	8679105086	-	-
32.	Patyog (31)	Sh. Arvind	9882640313	-	-
33.	New Shimla (32)	Sh. Padam	7018821829	-	-
34.	Khalini (33)	Sh. Inder Singh	9418024326	Sh. Pawan	9418305218
35.	Kanlog (34)	-	-	Sh. Om Prakash	7018397720

Annexure- 02 (E)

Contact Numbers for Complaints Redressal

S. #	Water Complaints	Contact No.	Office Address
1.	Ridge	2658916	-
2.	Sabzi Mandi	2652519	-
3.	Kasumpti	2620913	-
4.	Sanjauli	2842131	-
5.	Chotta Shimla	2623760	-
6.	Chaura Maidan	2813671	-
7.	New Shimla	2670569	-
8.	Dhalli	2842131	-
	Electricity Complaints	**Contact No.**	**Office Address**
1.	Chotta Shimla	2623760	-
2.	U.S Club	2801571	-
3.	Bharari	2814914	-
4.	Idgah	2812375	-
5.	Khalini	2623724	-
6.	Sanjauli	2640008	-
7.	Ridge	2657655	-
8.	Summer Hill	2830533	-
9.	Kasumpti	2621385	-
10.	Charlie Villa	2623951	-
11.	I..G.M.C. Hospital	2811339	-

Annexure- 03 (A)

Major Contact Details related to Disaster Management

S.#	Name	Designation	Department	Address	Mobile No./Email
1.	Sh. Sudesh Kumar Mokhta	Special Secretary (Revenue-DM)	State Disaster Management Authority	HP Secretariat, Shimla - 171002	0177-2880331
2.	Sh. Milap Chand	Under Secretary	State Disaster Management Authority	HP Secretariat, Shimla - 171002	94180-67711
3.	Sh. Vivek Sharma	Senior Consultant	State Disaster Management Authority	HP Secretariat, Shimla - 171002	86298-80160
4.	Sh. Aditya Negi	Deputy Commissioner-CumChairman,DDMA	State Disaster Management Authority	D. C. Office, Shimla	0177-2655988 94596-26586
5.	Sh. Sant Ram Sharma	District Revenue Officer	District Disaster Management Authority	D. C. Office, Shimla	0177-2657013 9418161070
6.	Sh. Manjeet Sharma	SDM Urban	District Disaster Management Authority	D. C. Office, Shimla	0177-2657007 9418120005
7.	Sh. Sachin Kanwal	ADM Protocol	District Disaster Management Authority	D. C. Office, Shimla	0177-2653436
8.	-	-	District Control Room	D. C. Office, Shimla	1077
9.	Sh. Ashish Kohli	MC Commissioner	Municipal Corporation, Shimla	Municipal Corporation, Shimla	0177-2812899 9418085682
10.	Sh. Ajit Bhardwaj	Additional Commissioner	Municipal Corporation, Shimla	Municipal Corporation, Shimla	0177-2812899
11.	Sh. Rajesh Thakur	Executive Engineer	Municipal Corporation, Shimla	Municipal Corporation, Shimla	9418458702

12.	Sh. Chetan Chauhan	Corporation Health Officer/ Member	Municipal Corporation, Shimla	Municipal Corporation, Shimla	9459302515
13.	Sh. Devender Mista	Architect Planner/Member	Municipal Corporation, Shimla	Municipal Corporation, Shimla	0177-2802778 7018589448
14.	----------	Assistant Engineer-(R&B)	Municipal Corporation, Shimla	Municipal Corporation, Shimla	7018074689
15.		Junior Engineer (Electricals),	Municipal Corporation, Shimla		
16.	Smt. Satya Kaundal	Mayor	Municipal Corporation, Shimla	Municipal Corporation, Shimla	0177-2812360 9816014452
17.	Sh. Shalinder Chauhan	Deputy Mayor	Municipal Corporation, Shimla	Municipal Corporation, Shimla	01772804058 9816421310
18.	Ms. Harkanchan Singh	City Project Coordinator UNDP Project	Municipal Corporation, Shimla	D.C. Office, Shimla	9816115320, Harkanchan 15dm@gmail.com
19.	Ms. Monika Bhutungru	S. P. Shimla	Police	-	0177-2656535, 8894728001 sp-shi-hp@nic.in
20.	Sh. Sushil Sharma	Addl. S. P. Shimla	Police	-	0177-2803212,8894728003 addlsp-shi-hp@nic.in
21.	Sh. Subash Kumar	Line Officer (Police Lines Kaithu)	Police	-	0177-2805264
22.	Sh. Deena Nath	Sub Inspector (Police Lines Bharari)	Police	-	0177-2807084 94180-34996
23.		Control Room/ Reporting Room/ Police Assistance	Police	-	0177-2812344

24.	Sh. Mohinder Lal	Police Control Room (Incharge)	Police	-	0177-2812344 100
25.	Sh. Sandeep Chaudhary	(Inspector), Police Station Sadar	Police	-	0177-2652860
26.	Sh. Parveeen Thakur	Inspector	Police	Police Station East (Chotta Shimla)	0177-2620954
27.	Sh. Laxman Thakur	S.H.O. Boileiuganj	Police	Boileauganj Police Station (West)	0177-2830193, 8894728013
28.	Sh.Hetram Garg	Sub-Inspector	Police	Police Post (Lakkar Bazar)	0177-2655376, 8894728039
29.	Sh. Desh Raj Guleria	S.H.O. Dhali	Police	Police Station (Dhali)	0177-2841377
30.		State Police Control Room	Police	Shimla	(0177) 2621711, 2621618, 2621723, 2621736
31.	Sh. Satinder Pal Singh	Commandant General	Civil Defence	-	0177-2811453
32.	Sh. Bal Krishan	S.F.O.	Fire	The Mall, Shimla	0177-2805264
33.	Sh. Som Prakash	S.F.O.	Fire	Chotta Shimla	0177-2807084 94180-34996
34.	Sh. Sudhakar	S.F.O.	Fire	Boileuganj	0177-2812344
35.	Sh. Anil Bahri	Engineer-in-Chief	Irrigation & Public Health	Chakkar - Boileauganj Bypass Rd Shimla, Himachal Pradesh 171004	0177-2658886 098172 52400

36.	Army	-	-	Training Command Shimla-3	0177-2804590
37.	Sh. Bhawan Kumar Sharma	Engineer-in-Chief	Public Works Department	Nirman Bhawan, Nigam Vihar	0177-2621401 9418488908
38.	Sh. K. C. Chaman	Director	Food and Civil Supplies	Block No. 42 Aapurti Bhavan, SDA Complex, Kasumpti, Shimla,171009	0177-2623749 9418480006
39.	Sh. J. C. Sharma	Add. Chief Secretary	Information and Public Relation, Shimla-2	-	01772620625 9418-000066
40.	Mr. Chunni Lal Sharma	President	Vishal Himachal Taxi Operator Union	Near Lift, Shimla	0177-2657645 0177-2805164
41.	-	-	Jai Mata Tara Taxi Union	ISBT, Tutikandi, Shimla	0177 281 0018
42.	Sh. Ashok Chauhan	President	Rajdhani Taxi Operator Union	Lakkar Bazar, Shimla	9816307891
43.	Sh. Birbal	HRTC Helpline (ISBT)	Roadways	ISBT, Tutikandi, Shimla	9418000529
44.	Sh. Ramanand Thakur	HRTC (Control Room)	Roadways	-	0177-2657326, 9418459972
45.	-	Shimla Railway Reservation	Railways	-	131, 0177-2652915
46.	-	Kalka Railway Enquiry	Railways	-	139
47	-	Chandigarh Railway Enquiry	Railways	-	0172-2653131
48.	-	Airport In-charge	Jubbarhatti Airport	Jubbarhatti, Shimla	0177-2736835

Annexure- 03 (B)

Nodal Officers for Disaster Management - Shimla City

S.#	Name	Designation	Department	Address	Mobile No./Email
1.	Sh. D C Sharma	Divisional Fire Officer	Fire	HP Secretariat, Shimla - 171002	01772629945 9418496040
2.	Sh. Mohit Chawla	S.P. Shimla	Police	SP Office Shimla	0177-2656535 SP-SHI-HP@NIC.IN
3.	Smt. Anjali Sharma	Town & Country Planner	Town and Country Planning	SDA Complex Block Number, 32A,Kasumpti, Shimla,171009	0177-2625572 9418072391
4.	Sh. Ram kumar Gautam	Director	Urban Development	Palika Bhavan, Talland, Shimla, Himachal Pradesh 171002	01772626518 9418480006
5.	Sh. Chiranji Lal Sharma	Manager-cum-Co.Secretary	H.P. Minorities Finance and Development Corporation	-	01772622164 9816835999
6.	Dr. Uvi Tyagi	OSD, Health & Family Welfare	Health and Family Welfare	SDA Complex Kasumpati, Shimla-171009	99418300121
7.	Sh. Er. Suresh Kapoor	SE- 4th Circle	PWD SE-4th Circle	-	0177-2622422
8.	Sh. Hemraj Bairwa	Director	Youth Services and Sports	Bemloi, Shimla, Himachal Pradesh 171001	1077
9.	Sh. Chander Mohan Sharma	Economics and Statistics Department	Deputy Director	Economics & Statistics Department, Kasumpati, Shimla-171009	01772626205 9418088136
10.	-	Nodal Officer-cum-Executive Engineer	Irrigation & Public Health	U.S.Club, Shimla	0177-2652847 0177-2624302
11.	Sh. Anju Sharma	Directorate of Higher Education, OSD (College)	Education	Municipal Corporation, Shimla	94181-00499

Annexure- 03 (C)

Hospitals in Shimla City

S.#	Name	Name of the Hospital	Designation	Address	Mobile No./Email
1.	Dr. Rajnish Pathania	Indra Gandhi Medical College & Hospital	Principal	Ridge Sanjauli Road, Lakkar Bazar, Shimla	0177-2804251 0177-2651854
2.	Dr. Surekha Chopra	Deen Dayal Upadhyay Hospital	CMO	Cart Road, Near Local Bus Stand, Lower Bazar, Shimla	0177-2657225 cmoshimla@gmail.com
3.	Dr. Ramesh Chauhan	Deen Dayal Upadhyay Hospital	Medical Supdt.	Cart Road, Near Local Bus Stand, Lower Bazar, Shimla	0177-2658941, 9418483962
4.	Dr. Ambika Chauhan	Kamla Nehru Hospital	Medical Supdt/ Radiological Deptt.	NH 22, Milsington Estate, Shimla	0177-2624841 9418028113
5.	Sh. V. Naresh Kumar	Simla Sanitarium & Hospital	-	Chaura Maidan Road, Chaura Maidan, Shimla	9652038143

Annexure- 03 (D)

Blood Banks and Donor Agencies

S.#	Name	Name of the Agency	Woking Hours	Address	Mobile No./Email
1.	Sh. Ajay Srivastava	Umang Foundation	-	-	9816077535
2.	Dr. Shivani	Blood Bank-Indra Gandhi Medical College	24 Hours	Ridge Sanjauli Road, Lakkar Bazar, Shimla	9418488881, 9418026680
3.	-	Blood Bank- DDU	24 Hours	Cart Road, Near Local Bus Stand, Lower Bazar, Shimla	0177-2658940
4.	Sh. Sarbjit Singh	Living Treasure	-	150, Lower Bazar, Shimla	9418061000, 9816861000
5.	Sh. Puneet Sood	Save Life Mission	-	41, Bharari Bazar, Shimla-1	7018766260, 9418005725

Annexure- 03 (E)

Ambulance Services

S.#	Name	Ambulance Services	Address	Mobile No./Email
1.	-	National Ambulance Service	-	108
2.	Sh. Surender Gautam	Red Cross	Distt. Red Cross Society, Near DDU Hospital	0177-2656730
3.	Sh. Manohar Singh	Guru Nanak Seva Society	150, Lower Bazar, Shimla	9816042789
4.	-	Kamla Nehru Hospital	-	0177-2625097
5.	-	Indra Gandhi Medical College Blood Bank	Ridge Sanjauli Rd, lakkar bazar, Shimla, Himachal Pradesh	0177-2804915
6.	-	Medilift Air Ambulance Servies (All over India)	Housing Board Colony Road, Engine Ghar, Sanjauli, Shimla	73670220595

Annexure- 04 (A)

IDRN Resources - General Department, Municipal Corporation Shimla

Title	Details
Department's or Agency's Name	General Department, MC Shimla
Contact Person's Name	Sh. Dharmendra Thakur
Contact Person's Designation	Purchase Assistant
Telephone No.	0177-2802771-75 Ext. 238
Mobile No.	7018756152
Email Address	–

Item Code	Item Name	Item Quantity and Unit	Specify location
176	ABC Type (4 Kg)	10 Nos	Shimla
177	Carbon Dioxide (4 Ltrs)	17 Nos	Shimla
178	Carbon Dioxide (4.5 Ltrs)	17 Nos	Shimla

Annexure- 04 (B)

IDRN Resources - Health Department, Municipal Corporation Shimla

Title	Details
Department's or Agency's Name	Health Department, MC Shimla
Contact Person's Name	Dr. Chetan Chauhan
Contact Person's Designation	Corporation Health Officer
Telephone No.	–
Mobile No.	9459302515
Email Address	choshimla@gmail.com

Item Code	Item Name	Item Quantity and Unit	Specify location
330	Shovel	28 No.	MC Health Store
144	Dumper	03 Nos	Parking
173	Pump	02 Nos	Parking
389	Gum Boots	28 pair	MC Health Store
347	Office Building	01 No.	MC Shimla, The Mall
252	Four Wheel Drive Vehicle	1 No.	Parking
362	Motor cycle	02 Nos	Parking
287	Body Bags	90 Nos	MC Health Store
368	Mask	43738 Nos	MC Health Store
369	Hand Gloves	504 Pair	MC Health Store
370/371	Sanitizer Spray	37 Nos	MC Health Store
376	PPE Kits	847 Nos	MC Health Store
378	N95 Mask	1355 Nos	MC Health Store
381	Surgical Gloves	9790 Pairs	MC Health Store
382	Face Shield	05 Nos	MC Health Store
383	Goggles	02 Nos	MC Health Store

Item (Skill) Code	Item (Skill) Name	No. of Person Available	Prior experience in emergency response	Prior training in emergency response
229	General Physician	01	Yes	Yes
235	Paramedics	01	No	No
236	Lab Technician	01	No	No

Annexure- 04 (C)

IDRN Resources - Road & Building Department, Municipal Corporation Shimla

Title	Details
Department's or Agency's Name	Road & Building Department, MC Shimla
Contact Person's Name	Sh. Gopesh Behl
Contact Person's Designation	Assistant Engineer
Telephone No.	0177-2802771-75 Ext. 238
Mobile No.	7018074689
Email Address	behlgopeshmcs@gmail.com

Item Code	Item Name	Item Quantity and Unit	Specify location
104	Electrical Drill	1 No.	Shimla
330	Shovel	80 Nos	Shimla
331	Spade	1 No.	Shimla
332	Crow Bar	1 No.	Shimla
335	Basket	5 No.	Shimla
336	Pick Axe	1 No.	Shimla
357	Rope	50 Mtrs	Shimla
358	Bucket	4 Nos	Shimla
329	Al. Ladder	1 No.	Shimla
	Earth Mover (Robot)	2 No.	Shimla
	Small Tipper Mazda	1 No.	Shimla
	4 Wheel Drive Pick Up Vehicles	3 Nos	Shimla
	Loader JCB Machine	1 No.	Shimla
	Road Roller (Small)	2 No.	Shimla
	Road Roller (Big)	1 No.	Shimla

Annexure- 05

Roles and Responsibilities of Departments of the Municipal Corporation Shimla

Overall responsibilities of all the departments of the MC Shimla:

1. Establishing interagency mechanisms for coordination and networking activities regards to information and knowledge management, training and capacity building, collaborative advocacy, response and accountability at all levels in pre, during and post phases of disaster management.

2. Establishing protocols for cooperation and ensure access to the affected areas with support of the DDMA Shimla.

3. Conducting community centric hazard and vulnerability analysis at all levels related to once respective departments and develop disaster management planning and mainstreaming activities.

4. Formation of the Task Forces for any type of disaster and for the monsoon and snowfall seasons annually.

5. Maintenance of Database of respective departments as well as a centralised repository of the datasets pertaining to the Municipal Corporation Shimla.

All departments shall constitute their internal committees for Capacity Building of their staff during peace time and Evaluation and Response at the time of any disaster within the city. All the concerned departments should coordinate with the City Disaster Management Committee of the Municipal Corporation, Shimla.

S. #	Department	Roles and Responsibilities
1.	Road and Building	▫ Detailed damages and needs assessment of the affected area ▫ To ensure provision of proper road connectivity and transportation facilities through debris removal ▫ Rebuild and rehabilitate the dispersed community affected by the incidence of the disaster through providing temporary housing, restoration of critical infrastructure, clearance of debris within MC boundaries
2.	Health	▫ Training of staff and Field communities in new techniques and procedures for health, WASH practices, trauma counselling, psycho-socio care, especially dealing with PwD, elderly, women and children. ▫ Developing awareness material for the community ▫ Coordinate and liaison with DDMA, Red Cross, and Civil Defence volunteers to spread awareness among the community and response ▫ Undertake proper collection and disposal of garbage from affected communities and relief centres

		▫ Maintenance of cleanliness of the wards and nallahs ▫ Ensure suitable vaccination to prevent disease outbreak ▫ Recovery activities seek actions including distribution of emergency food and water ▫ Procurement / stock availability of portable equipment's for field ▫ Providing Psycho-social care to the disaster survivals
3.	SJPNL Water	▫ Providing of Potable water for drinking and water to relief camps, households and emergency centre and Hospitals ▫ Set up RO plants / water purification plants or other suitable facilities for immediate water supply ▫ Assess, prioritise and develop work plan for restoration of water supply
4.	SJPNL Sewerage	To ensure provision of proper drainage and sanitation facilities
5.	Architect Planning	▫ Reconstruction of Houses damaged / destroyed should be reconstructed in the disaster hit areas with seismic designs of houses ▫ Monitor the entire process of reconstruction being incorporated as per MC Bye-Laws and Department of TCP
6.	Property Tax	▫ To undertake detailed damage assessment of the properties ▫ Specific recovery plan to be made in consultative process of MC DM Committee and DDMA
7.	Estate Branch	▫ To undertake detailed damage assessment of the properties. ▫ Specific recovery plan to be made in consultative process of MC DM Committee and DDMA
8.	Information Technology	▫ Assess, prioritize and develop work plan for the restoration of telecommunication services
9.	Veterinary Public Health Office	▫ Provide first aid and medical treatment to the injured animals ▫ Establish animal shelters where ever required with fodder in association with Animal Husbandry department ▫ Prepare a record of details of the animal carcasses retrieved ▫ Transport unidentified or unclaimed carcasses to the designated site for disposal ▫ Follow suggested guidelines for burial of carcasses or composting

Annexure- 06

Emergency Support Function - Dead Body Removal during Epidemics/COVID-19

S. #	Emergency Support Function (ESF)	Primary Agency	Responsibilities of Primary Agency	Secondary Agency	Responsibilities of Secondary Agency
1.	Health Department	DDMA Shimla	• Formation of Committee for disposal of the unclaimed/ epidemic effected dead bodies as per Incident Response System. • Nodal Officer in the Incident Response System will activate all other stake-holders associated with Disposal of the Dead. • Arrange for Mass Cremation Burials with support of Police and Forest Department • Undertake Videography of the unclaimed dead bodies. • In case of Unidentified dead bodies –prepare an inventory, photograph, finger print, DNA sample and fill dead body identification form. • Handover the identified bodies to the Kith and Kin in case of identified bodies. • The constituted committee to undertake last rites of unclaimed/unidentified dead bodies as per established religious practices and monitor the last rites. • Dead Body van to be provided by Health Department/CMO, Shimla or hired by concerned SDMs in case of unavailability of the van.	Municipal Corporation Shimla	• Formation of Committee for disposal of the unclaimed/ unidentified dead bodies affected under epidemic. • Maintain a record of the details of the bodies cremated/buried in the Dead Body Inventory Register under the Health Department, after receiving details from the DDMA. • Arrangements for preparation of pyre will be done by Committee with the help of NGOs. • Cremation of unclaimed / unidentified bodies shall be organized by involving the crematorium staff after proper handing over procedure of the dead bodies by the Police/SDM/DDMA. • The handing over of the dead body in the dead body bags shall be done at the site of cremation/ burial by the concerned officer of the DDMA/ District Health Office/Hospital staff to MC Staff deployed by the committee at the cremation/burial site. • Excavation of grave by MC Staff shall be done in case of Muslim/Christian and little children.

S. #	Emergency Support Function (ESF)	Primary Agency	Responsibilities of Primary Agency	Secondary Agency	Responsibilities of Secondary Agency
1.	Health Department	DDMA Shimla	• Priests for final rituals to be provided by the concerned SDM. • Adequate police personnel to be deployed by Police department at the cremation/ burial site for the final rituals. • Ashes to be collected and handed over to Kith and Kin by the concerned SDM. • Preserve the bodies of foreign nationals (if any) by embalming or chemical methods and then place in body bags or in coffins with proper labeling. • Handing over and transportation of such bodies shall take place through the Ministry of External Affairs, or through the Consular offices of the concerned countries and other actors such as International Committee of the Red Cross if required.	Municipal Corporation Shimla	• The sanitization process shall be undertaken by MC Staff at the site of death/crematorium/burial area after completing of the rituals, including dead body vehicle. • The crematorium staff/cremation team should use full complement of PPE (coveralls, head cover, shoe cover, mask, goggles/face shield). • Large gathering at the crematorium/burial ground should be avoided as social distancing measure, as it is possible that close family contacts may be symptomatic and/or shedding the virus. • The MC staff carrying the body from the dead body vehicle at the gate of cremation site to pyre/burial site shall be incentivized.

Annexure- 07

Standard Operating Procedures - Dead Body Removal during Epidemics / COVID-19

Nodal Agency: District Disaster Management Authority, Shimla

Secondary Agency: Municipal Corporation Shimla

Standard Operating Procedures

The COVID dead bodies will be disposed of as per the "COVID-19: GUIDELINES ON DEAD BODY MANAGEMENT" issued by Government of India, Ministry of Health & Family Welfare, Directorate General of Health Services (EMR Division) on 15.03.2020 and subsequently the "MANAGEMENT OF DEAD BODIES OF COVID PATIENTS AND FINAL RITES IN DISTRICT SHIMLA, (HP) Guidelines issued by District Magistrate Shimla on dated May 19th, 2020.

Following would be the protocol for the disposal of dead bodies under conditions of COVID-19 pandemic/epidemics:

- Nodal officer of MC shall activate the Dead Body Management Committee formed at MC Shimla for disposal of the dead bodies as per Emergency Support Function (ESF) and as per Himachal Pradesh Epidemic Disease (Covid-19) (Amendment) Regulation 2020.
- The Committee shall coordinate with the Committee of DDMA for cremation / burial procedure to be followed as per ESF.

1. Eventualities:

There will be various eventualities which will occur and which have been considered here and protocol laid down below for the final management-

(i) The first eventuality will be when the dead body of the COVID-19 patient is unclaimed;

(ii) The second eventuality can be when the dead persons relatives are not in a position to perform the final rites due to their being far-of or them e s being quarantined or in isolation;

(iii) When the death happens outside the district/sub-division but the body is brought to Shimla for cremation/burial or death takes place in Shimla and relatives take the body for last rites.

2. Cremation/Burial Grounds:

In Shimla town, the notified cremation ground will be:

(a) **Hindus-** Kanlog Cremation Ground (one pyre at the top most stage)

(b) **Muslims-** Burial Ground below Old Barrier

(c) **Christians-** Cemetery area, Sanjauli

(d) **Small Children-** Will be buried in demarcated area below Totu Bangal Colony

3. Eventualities and disposal of dead bodies there of:

- **Last/Final Rites of unclaimed body:** Unclaimed dead body of COVID-19 patient will be handed over by the Sr. M.S/ Hospital In-charge to the Municipal Corporation, Shimla/police following all the infection control protocol as per guidelines issued v letter No. NHMHP-IDSP/1/2020-IDSP-Section-NATIONAL HEALTH MISSION-HP-Part (3)-2632 dated 10-03-2020 by the National Health Mission Himachal Pradesh and observing all requisite codal formalities.
- **Last Rites where relatives unable to attend:** There will be situations when the relatives are at a far-away location or are themselves quarantined/in isolation. If they are in isolation themselves then Sr. M.S., IGMC, Shimla should take their statement as to what they want to do with the body or if they are in a far-away location then SMS will contact the SDM/Executive Magistrate of that area and get in writing from the relatives as to how they intend doing the last rites at the earliest.
- **When relatives take the body for last rites/When body brought from outside Shimla to perform last rites:** When the relatives are in Shimla and take the body for performing last rites then the body will be handed over by the hospital to the relatives who will also follow the protocol. There may be a possibility that a COVID-19 casualty is brought from outside the district and in this eventuality the barrier in charge will inform concerned SDM and the body will be taken to the nearest cremation/burial ground.

In the first two possibilities the following will be the protocol:

- **Removal of the dead body from the Isolation Room/Mortuary area to the dead body van:**

  The Sr. M.S./Hospital In-charge shall follow the guidelines mentioned for disposal of bodies while dealing with the dead body and will also ensure all infection control and prevention measures are in place. Two personnel from the Hospital will shift the body from Mortuary Room to dead body van on bier and will accompany the body to the cremation/burial ground with full PPE kit. The dead body van will be provided by the Health Department/CMO, Shimla or if not available then hired by concerned SDMs with proper partition.

- **Handling of the dead body at crematorium/burial ground:**

  All the process at the crematorium/burial ground will be completed under the overall supervision of an Executive Magistrate who will ensure the proper social/physical distancing norms at the spot. Two personnel from Kanlog Cremation round and burial grounds will be present at the crematorium/burial ground with full PPE Kit. These two personnel along with the two personnel accompanying the dead body van from Hospital will carry the dead body from the Van and place it on the pyre /burial pit/grave. After this the two personnel from Hospital, accompanying the dead body will depart from the crematorium/burial ground.

  All the arrangements for preparation of Pyre will be done by the Municipal Corporation, Shimla with the help of NGOs and the managing committee. In case of burial then the MC, Shimla will have pits dug for lowering the body as per protocol in case of Muslims, Christians and small children.

  In the third possibility when the relatives are performing the last rites it will still be under the supervision of the Executive Magistrate. All COVID-19 protocols for disposal of dead bodies will be followed and MC Shimla will provide coveralls and other PPE kits to the relatives who will be handling the body for lighting the pyre.

The priests for the final rituals will be arranged by the concerned local Sub-Divisional Magistrate. S.P. Shimla will ensure that adequate police personnel are present at the location right from the arrival of the body to its final cremation. MC, Shimla will ensure that after the last rites are over the entire area will be properly sanitized.

The personnel from Municipal Corporation Shimla shall remain present till the completion of the cremation of the dead body. The four personnel (two from Hospital and two from cremation/burial ground) who are physically dealing with dead body will be incentivized @ Rs.2,000/- per body by the Municipal Corporation, Shimla. They will also be covered under "Pradhanmantri Garib Kalyan Package Insurance Scheme".

The ashes of the dead body will be collected and handed over to the relatives of the deceased and the arrangements will be made by concerned Sub-Divisional Magistrate in this regard.

4. MC shall maintain a record of the details of the bodies cremated/buried in the Dead Body Inventory Register under the Health Department, after receiving details from DDMA as per Dead Body Identification form (Annexure 4- NDMA Guidelines of Dead in the Aftermath of Disasters).

5. In case of disposal of infectious corpse from site of death the MC authorities shall by notice in writing prohibit the removal of corpses from the place where the death occurred except for the purpose of being burnt, buried or from being conveyed to a mortuary.

6. Power to call for information regarding burning or burial ground, the Commissioner may, by notice in writing, require the owner or person incharge of any building or burial grounds, cremation ground or electric crematorium to supply such information as may be specified in the notice concerning the condition, management or position of such ground as per MC Act (Amended) 2016.

7. Large gathering at the crematorium/ burial ground should be avoided as social distancing measure, as it is possible that close family contacts may be symptomatic and/or shedding the virus.

Other general conditions under epidemics:

8. Large gathering at the crematorium/ burial ground should be avoided as social distancing measure, as it is possible that close family contacts may be symptomatic and/or shedding the virus.

9. Burial site shall be located away from habitation and have adequate space around the site to for plantations and to prevent excavations.

10. For removal of corpses the Commissioner may by public notice prescribe routes by which alone corpses may be removed to burning or burial grounds as per MC Act (Amended) 2016.

11. Place the dead body in leak-proof plastic body bag and decontaminate the exterior of the body bag with 1% hypochlorite. The body bag can be wrapped with mortuary sheet or sheet provided by the family members.

12. Body will be either handed over to the relatives or taken to mortuary.

13. The health worker/ crematorium staff/ cremation team should use full complement of PPE (coveralls, head cover, shoe cover, mask, goggles / face shield).

14. All staff involved in the cremation of dead bodies shall be sensitized about the risk/ non-risks posed by the epidemic.

15. The sanitization process shall be undertaken by MC Staff at the site of death / crematorium / burial area after completing of the rituals.

16. Sanitization of the vehicle carrying the dead body shall be done.

17. The funeral/ burial staff and family members should perform hand hygiene after cremation/ burial.

18. Viewing of the dead body by unzipping the face end of the body bag (by the staff using standard precautions) may be allowed, for the relatives to see the body for one last time.

19. Bathing, Kissing, Hugging, etc. of the body should not be allowed.

20. The Bio-Medical Waste generated from hospitals/quarantine centres/homes to be disposed off in bio-hazard bags as per guidelines of Bio-Medical Waste Management rules of Ministry of Health and Family Welfare.

21. The MC staff carrying the body from the dead body vehicle at the gate of cremation site to pyre/ burial site shall be incentivized.

Under conditions of unclaimed bodies:

1. Unclaimed dead body will be handed over by the Sr. M.S./ Hospital In-Charge to the Municipal Corporation, Shimla/ Police after following all the infection control protocols as per guidelines issued vide letter no. NHMHP-IDSP/1/2020-IDSP-SECTION-National Health Mission-HP-Part (3)-2632 dated 10-03-2020 by the National Health Mission Himachal Pradesh and observing all requisite codal formalities.

2. The unidentified dead bodies shall be handed over to the Urban Local bodies along with a death certificate (NDMA Guidelines, Pg. 27)

3. Cremation of unclaimed / unidentified bodies shall be organized by involving the crematorium staff after proper handing over procedure of the dead bodies by the Police/ Health Department.

4. Rest of the SOPs shall remain similar as under COVID-19/ Epidemic and general conditions mentioned above.

Annexure- 08

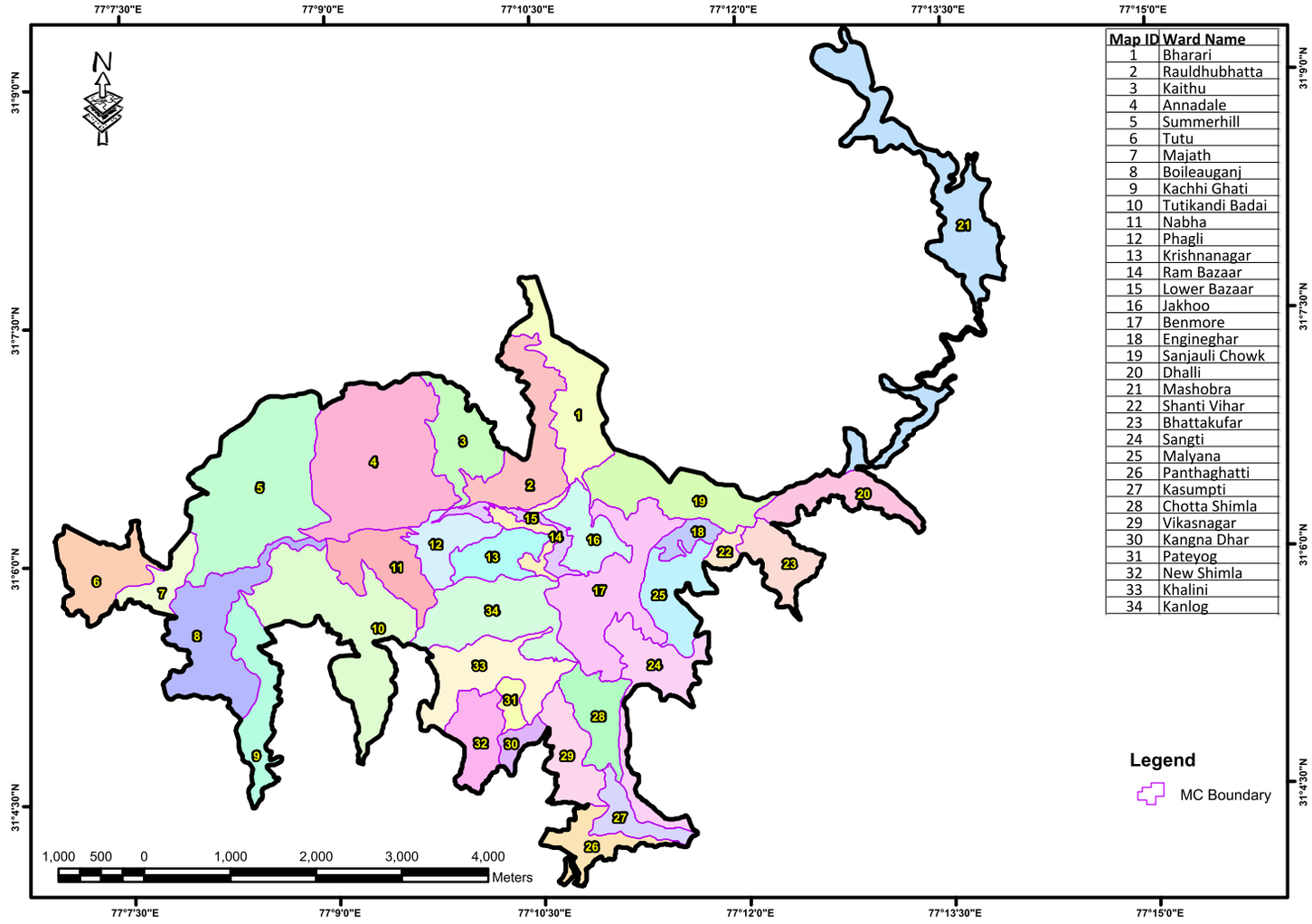
Studies and Plans conducted by Disaster Management Cell at MC Shimla for Resilience and Capacity Building under the USAID-GoI-UNDP Project

S. #	Name of Study/Plan/Report	Year	Prepared By
1.	Greenhouse Gas Emissions Inventory for Shimla City	**2014**	ICLEI Local Governments for Sustainability
2.	Review of Early Warning System, Shimla	**2014**	TARU Leading Edge Pvt. Ltd.
3.	Action Plan for Mainstreaming DRR and CCA into Sectoral Development Plan of Municipal Corporation Shimla	**2015**	Mr Jyotiraj Patra (Consultant) MCS
4.	Rapid Visual Survey (RVS) Study of Important Buildings, Transportation and Communication System for Shimla City	**2016**	Department Of Civil Engineering National Institute Of Technology (NIT) Hamirpur 177 005
5.	City Resilience Index Shimla, India	**2016**	The Rockefeller Foundation
6.	Knowledge Attitude and Practices (KAP) survey among wards of Shimla City	**2016**	UNDP project under Climate Risk Management in Urban areas
7.	Hazard Risk Vulnerability Analysis of Shimla city (HRVA)	**2016**	TARU Leading Edge Pvt. Ltd.
8.	Managing Shimla's Water Challenges in an Uncertain Future	**2016**	City Links
9.	Baseline Assessment Report Shimla	**2017**	GeoHazards Society, India
10.	Urban Resilience Baseline Study, Shimla City	**2017**	Indian Institute for Human Settlements (IIHS), Delhi
11.	Review of the status of EWS in Shimla City (2014 Vs 2018)	**2018**	Geo Climate Risk Solutions Pvt. Ltd. New Delhi
12.	Identification, Plan and Development of Post-Earthquake Safe Shelter for Shimla City	**2018**	Department of Civil Engineering, National Institute of Technology (NIT) Hamirpur 177 005
13.	Disaster Management Plan of IGMC Hospital, Shimla	**2019**	GeoHazards Society, India
14.	Evacuation Plan MC Main Building	**2019**	City Project Coordinator, UNDP Project MC Shimla
15.	Understanding Existing Gaps and Challenges in Disaster Risk Reduction, Shimla (LGSAT)	**2019**	Shri Rajeev (Consultant) UNDP
16.	Preparation of Private School disaster Management Plans (15 Schools)	**2019**	By school authorities under guidance from SCERT Solan
17.	Final Project Report – Structural Safety Audit	**2019**	GeoHazards Society, India
18.	Inclusion of Disability in City Disaster Management Plan (CDMP) of Shimla	**2020**	Knowledge links

19.	Inclusion of Disability In City District Disaster Management Plan(DDMP) of Shimla	**2020**	Knowledge links, Delhi
20.	Disability Inclusive Investment Plan (DIIP) of Shimla	**2020**	Knowledge links, Delhi
21.	Ward Disaster Management plans for 25 wards of Shimla city	**2020**	Knowledge links, Delhi
22.	Preparation of Guidelines for establishment of Emergency Operation Centre (EOC) - Review of Best Practices of EOC	**2020**	Resilience Innovation Knowledge Academy (RIKA) India Private Limited
23.	Preparation of Guidelines for establishment of Emergency Operation Centre (EOC)	**2020**	Resilience Innovation Knowledge Academy (RIKA) India Private Limited
24.	Micro Mapping of essential utilities services within wards of Shimla City (Mobile app by name of SUR available on Google Play store)	**2021**	Himalayan Association for Research Innovation, Shimla
25.	Fire Disaster Management Plan for Shimla City	**2021**	Doers Shimla
26.	Disaster Management Business Continuity Plan for Vyapar Mandal Shimla City	**2021**	Himalayan Association for Research Innovation, Shimla
27.	Structural Safety Audit for Selected Schools of Shimla city (under process)	**2021**	National Institute of Technical Teachers Training and Research, Chandigarh

Annexure- 09

Map of Municipal Corporation Shimla (34 Wards)



Map ID	Ward Name
1	Bharari
2	Rauldhubhatta
3	Kaithu
4	Annadale
5	Summerhill
6	Tutu
7	Majath
8	Boileauganj
9	Kachhi Ghati
10	Tutikandi Badai
11	Nabha
12	Phagli
13	Krishnanagar
14	Ram Bazaar
15	Lower Bazaar
16	Jakhoo
17	Benmore
18	Engineghar
19	Sanjauli Chowk
20	Dhalli
21	Mashobra
22	Shanti Vihar
23	Bhattakufar
24	Sangti
25	Malyana
26	Panthaghatti
27	Kasumpti
28	Chotta Shimla
29	Vikasnagar
30	Kangna Dhar
31	Pateyog
32	New Shimla
33	Khalini
34	Kanlog

Source: HAFRI Shimla (2021)

Annexure- 10

Natural Water Springs (Bowaris) in Shimla City
(Non-potable water for Domestic Use)

S. #	Name of the Bowari
1.	Old Barrier, Near Petrol Pump
2.	Police Line, Kaithu
3.	Mahamaya Hotel, Cart Road
4.	Bemloe, Near Bemloe Bus Stop
5.	Ram Nagar Bypass
6.	Dhingu Bowari
7.	Shiv Mandir, Sec-III, New Shimla
8.	Near Cremation Ground, Panthaghati
9.	Near Kanungo Building, Anji, Vikasnagar
10.	Shiv Mandir, Andhari, Summer Hill
11.	Near Jakhu Ropeway
12.	Khalini Near Forest Colony
13.	Jhanjhidi
14.	Bushal, Kaithu

Source: Atal Mission for Rejuvenation and Urban Transformation (AMRUT), 2021

Developed by:

doers

https://doers.ngo