

Report on Identification and Geographical Information System (GIS) Mapping of Open Spaces for Humanitarian Purposes in **Neelakantha Municipality**



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**Report on Identification and Geographical Information
System (GIS) Mapping of Open Spaces for Humanitarian
Purposes in Neelakantha Municipality**



FOREWORD

I am pleased to present the publication, “*Report on Identification and Geographical Information System (GIS) Mapping of Open Spaces for Humanitarian Purposes in Neelakantha Municipality*,” funded by the people of Thailand through the Government of Thailand.

IOM – the United Nations Migration Agency – has been supporting the Government of Nepal with the identification, mapping and protection of open spaces to be used for humanitarian purposes since 2013. Floods, earthquakes and landslides are some of the natural hazards that have resulted in the loss of lives, and damage to properties in the Municipality. Open spaces are identified and mapped with the aim to strengthen emergency preparedness and provide the initial response planning framework for local governments and partner agencies. This gives a starting point from which to provide life-saving assistance to those in immediate need of support, including displaced populations.

IOM is also supporting in creating a module on open spaces into the Building Information Platform Against Disaster (BIPAD), owned by the Government of Nepal. BIPAD will display information on all open spaces, including the spaces of Neelakantha Municipality, identified and verified by IOM in coordination with local levels and the federal government. I am also glad to announce the launch of Open Space Nepal, which is available in Google Play Store for Android phones and AppStore for the iOS version, developed with the purpose of providing guidance for the public in the event of a disaster.

I express sincere gratitude to the Neelakantha Municipality for providing strong leadership that supported in achieving the objectives of the project. Lastly, IOM stands ready to support all three tiers of government to reduce disaster risks and assist vulnerable communities and migrants in building a disaster-resilient society.



Lorena Lando

Chief of Mission of Nepal

International Organization for Migration (IOM)



Ref No.:

NEELAKANTHA MUNICIPALITY OFFICE OF THE MUNICIPAL EXECUTIVE

Dhading, Bagmati Province, Nepal



Foreword

This report “*Identification and Geographical Information System (GIS) Mapping of Open Spaces for Humanitarian Purposes in Neelakantha Municipality*” aims to strengthen the disaster preparedness efforts of Neelakantha Municipality and is in line with the Local Disaster and Climate Resilience Plan (LDCRP, 2075), and Disaster Risk Reduction and Management Act (DRRM 2074).

Dhading District was one of the most hard-hit districts by the 2015 earthquakes. Following the widespread destruction across the district, both governmental and public attention was brought to the role of open spaces in the event of a disaster. Therefore, the identification and Geographic Information System (GIS) mapping of open spaces was in Neelakantha Municipality’s LDCRP which has been successfully completed in collaboration with the International Organization for Migration (IOM) – the UN Migration Agency. This report is prepared after a series of consultation with the municipal officials, field visits and surveys which presents detailed information of all identified open spaces of the Municipality including topography, attribute information, environmental checklist and critical infrastructure. Besides earthquake, Neelakantha Municipality is prone to multiple hazards— dry and wet landslides, floods, fire, among others. Hence, identifying and protecting open spaces serves to capacitate disaster preparedness at a local level. Finally, I would like to express my sincere gratitude to IOM for the support and we hope that through the information compiled and presented in this report, the open spaces can immediately be utilized for humanitarian assistance during a disaster to provide safe temporary shelter and protection for vulnerable groups like women, children, elderly and persons with disabilities among others. I am hopeful that this report would be a steppingstone to strengthen preparedness efforts of the Municipality.

Bhim Prasad Dhungana

Mayor
Mayor

"Base of Prosperous Neelakantha Municipality : Infrastructure including Agriculture, Tourism, Entrepreneurship"
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The “Identification and Geographic Information System (GIS) Mapping of Open Spaces for Humanitarian Purposes in Neelakantha Municipality of Dhading District, Nepal” report is produced as a part of the “People to People Support for Building Community Resilience through Recovery and Reconstruction in Nepal” project, funded by the people of Thailand through the Government of Thailand.

First and foremost, we would like to extend our gratitude to the elected representatives and municipal officials of Neelakantha Municipality, Dhading who actively participated and supported the team in the preparation and validation of this report. Special thanks goes to Bhim Prasad Dhungana, Mayor, Maniraj Bhandari, Deputy Mayor, Bishnu Prasad Rijal, DRR Focal Person, Deepak Koirala, Mayor’s advisor and the ward representatives of all 14 wards for their support and guidance throughout the study period. Similarly, we would like to thank the Project Steering Committee (PSC) members at the federal level represented by the high level officials of the Ministry of Federal Affairs and General Administration, Ministry of Home Affairs and Ministry of Urban Development as well the Local Project Steering Committee (LPSC) members at the municipal level for their valuable inputs and comments during the entire study period.

Equally, we would also like to thank all the individuals from Neelakantha Municipality and the humanitarian actors representing different agencies who took time to share their views and gave their valuable feedback continuously during the consultations, via phone and email, for the validation of the report which greatly helped us in improving the content of the report.

Lastly, we would also like to thank the team of Naxa for the collection and analysis of data, maps and photos of each identified open space. This report would not be possible without the tireless efforts of the team involved.

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LIST OF ACRONYMS AND ABBREVIATIONS

BIPAD	Building Information Platform Against Disaster
CCCM	camp coordination and camp management
DIMS	disaster information management system
DSM	Digital Surface Model
DTM	Digital Terrain Model
GIS	geographic information system
GPS	Global Positioning System
IDP	internally displaced person
IOM	International Organization for Migration
MoFAGA	Ministry of Federal Affairs and General Administration
MoHA	Ministry of Home Affairs
MoUD	Ministry of Urban Development
VDC	Village Development Committee
WASH	water, sanitation and hygiene

EXECUTIVE SUMMARY

In 2015, the Constitution of Nepal was promulgated and the country initiated its federalization process which divided the Government into three tiers: federal, provincial, and local. Before the federalization, 83 identified open spaces were a national-level responsibility and protected through the publishing of a national gazette in 2013 that listed all open spaces. The national gazette also includes provisions for monitoring of 83 open spaces to prevent encroachment of the sites. Since the federalization, the local government is also responsible for the protection of such areas in their urban or rural municipalities.

In this context, IOM – the UN Migration Agency – as co-lead of the Camp Coordination and Camp Management cluster and with support from the Ministry of Urban Development, Ministry of Home Affairs and Ministry of Federal Affairs and General Administration, undertook a survey to identify suitable open spaces in five municipalities of five earthquake affected districts in Bagmati and Gandaki Provinces. The project aims to enhance the decision-making process at a municipal level to mitigate possible losses during a disaster by identifying and updating open spaces. Identification and mapping of open spaces in Neelakantha Municipality of Dhading District is one of the components of the project.

The scope of this study covers a detailed topographical survey of all identified open spaces, collection of attribute information, environmental checklist, collection of data on critical infrastructures around each identified open space and development of various maps. The scope also includes dissemination of the maps through both digital and hard copy platforms as well as installation of map boards at prominent locations within the Municipality. Further, the study promotes the preparation and use of open data for disaster preparedness as the datasets collected during the survey will also be uploaded to the national disaster information management system or Building Information Platform Against Disaster platform developed by the Government of Nepal.

72 locations were suggested as suitable open spaces by local representatives, from which five open spaces have been finalized after a detailed field study and series of interactions with elected local representatives, municipal officials, local stakeholders and humanitarian actors. Most of the suggested locations were not considered suitable due to small area, high gradient and difficult access. The five identified open spaces have a total area of 39,763.57 m² and total usable area of 33,415 m². As per the Sphere Standards (3.5 m² per person), the total usable area can accommodate at least 9,547 displaced persons. The selection of these open spaces is based on the total area with a slope of 0-5°, road accessibility, distance from settlements, availability of water, sanitation and hygiene facilities, market access and availability of other critical facilities near the open spaces. Besides these five finalized open spaces, 51 other locations as suggested by the local population were also surveyed and details on their current land use practice and total usable flat area were collected.

This assessment was conducted as a part of the “People to People Support for Building Community Resilience through Recovery and Reconstruction in Nepal” project, financially supported by the People of Thailand through the Government of Thailand. The project is being implemented in the eight worst 2015 earthquake affected rural and urban municipalities of Bagmati and Gandaki Provinces.

STRUCTURE OF THE REPORT

This report is divided into four chapters. The first chapter is the introductory part of the project which includes details on the background on project development, survey objectives, survey location, the description of open-space selection criteria as per the Sphere Standards and limitations of the study. The second chapter details the open-space identification process for the collection of relevant data and geographic information system (GIS) mapping. The third chapter contains the survey outputs with details of finalized and surveyed open spaces. Conclusion is included in the fourth chapter followed by Annexes.

CHAPTER I INTRODUCTION

I.1 Background

Nepal is prone to a multitude of disasters that cause loss of lives, property and infrastructure. Globally, Nepal ranks fourth, eleventh and thirtieth in terms of its vulnerability to climate change, earthquake and flood risk respectively (United Nations Development Programme, 2019). The 2015 earthquakes and subsequent aftershocks resulted in loss of lives, physical infrastructures and cultural monuments, and left thousands of people homeless. 733 people were reported dead and 952 people were reported as injured in Dhading (National Planning Commission, 2015).

Dhading is one of the worst affected districts by the 2015 earthquakes. It was estimated that more than 20,000 buildings were destroyed and around 15,000 buildings were damaged in the District (OSOCC Assessment Cell, 2015). The data from villages in the northern part of the District could not be collected due to limited road accessibility. Further, the existing roads were also affected by landslides. According to the Displacement Tracking Matrix, Round 2 assessment, conducted by the International Organization for Migration (IOM), there was an estimate of 3,493 internally displaced persons (IDPs) in Dhading (IOM Nepal, 2016). The displaced persons took shelter in temporary settlements and tents for months as their houses were completely or partially destroyed. Several small and large open lands available around the affected areas were used by the IDPs for temporary shelters as well as for relief distribution by various national and international relief organizations.

Dhading District is also vulnerable to landslides (Shelter Cluster Nepal, 2016). Several parts of the district are also vulnerable to landslides and floods due to increasing erratic rainfall patterns, incessant rain during monsoon and climate variability in the district. Every year during the monsoon season, there are reports of damages and loss of lives due to landslides in the District.

With realization of the significance of open spaces during emergency situations, IOM decided to identify and document open spaces that could be used for humanitarian purposes.

The open-space mapping in Neelakantha involved a detailed topographical mapping of all the identified spaces using a drone.¹ The high-resolution images have been useful in the preparation of detailed GIS maps. Moreover, both the aerial images and the maps can be used as baseline data during camp management and effectively plan the construction of temporary shelters during a disaster. This project, the first of its kind in Neelakantha, also focuses on digitally recording and disseminating the data of both the open spaces and critical facilities through static community map boards and digital tools. The datasets will then be made available to all users in an open data format through the disaster information management system (DIMS) or Building Information Platform Against Disaster (BIPAD)² platform, the open space platform for humanitarian assistance and the open space mobile application. The data of open spaces and critical facilities can serve as strong evidence resources to enhance the preparedness of Neelakantha Municipality to plan before, during and after a disaster.

¹ A drone, in technological terms, is an unmanned aircraft. Essentially, a drone is a flying robot that can be remotely controlled or fly autonomously through software-controlled flight plans in their embedded systems, working in conjunction with onboard sensors and GPS. <https://internetofthingsagenda.techtarget.com/definition/drone>

² BIPAD platform can be assessed at <https://bipad.gov.np/>

I.2. Objectives

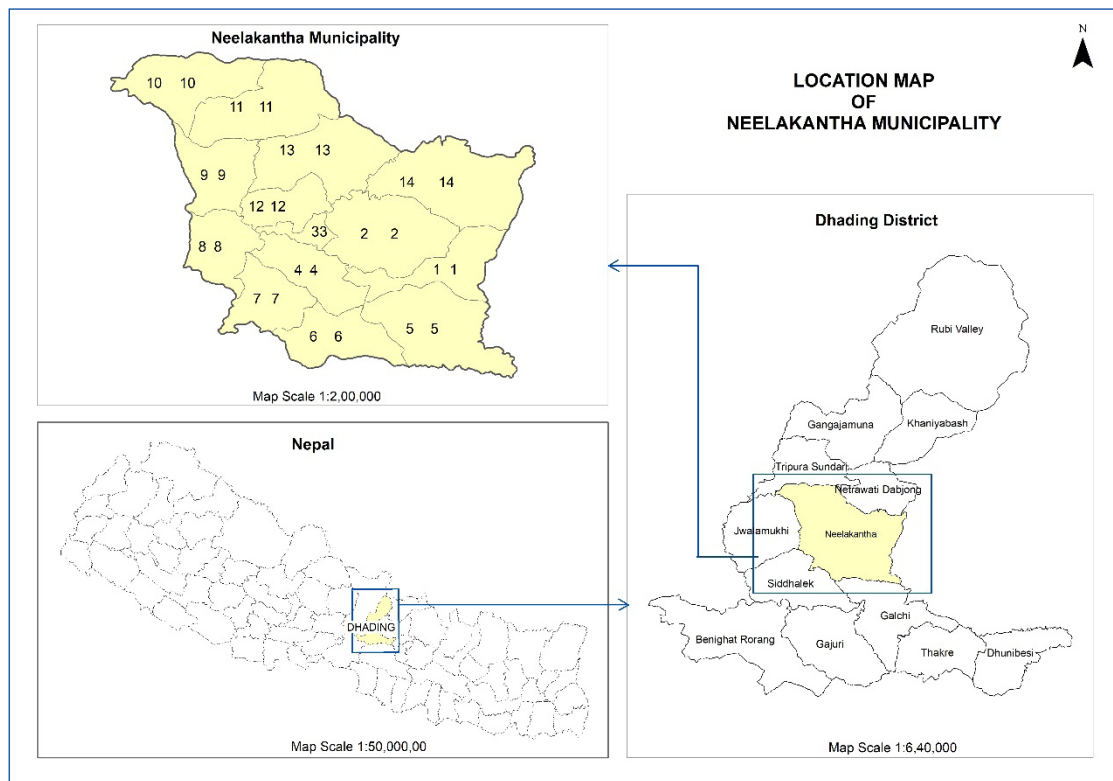
One of the primary objectives of this survey is to identify and map the most appropriate open spaces in Neelakantha Municipality that can be used for humanitarian purposes during a disaster. In this respect, the scope of work is designed to achieve the following objectives:

- (a) Topographical surveying and mapping of open spaces in Neelakantha Municipality:
 - (i) Drone based topographical survey of identified open spaces in Neelakantha Municipality.
 - (ii) High-resolution aerial images of each identified and finalized open spaces showing natural and man-made resources as well as structures within the periphery.
 - (iii) Collection of Global Positioning System (GPS) datasets on critical facilities around the open spaces.
- (b) Collection of attribute data and general environmental assessment:
 - (i) Collection of attribute details (access to market and critical facilities, land use types and so on) of all open spaces.
 - (ii) Collect cadastral and property information as per land records for each identified open space (if available).
 - (iii) Assess different environmental aspects for each open space to study the implications of the interventions during a disaster and in the camp management.
- (c) Dissemination of open-space data and GIS maps:
 - (i) Preparation of GIS maps of each finalized open space along with vicinity maps showing critical facilities around.
 - (ii) Development of a web-based open space platform for humanitarian assistance and an open space mobile application which allows users to locate the nearest open space during an emergency.
 - (iii) Installation of community maps with details of open spaces and critical facilities at specific locations in Neelakantha Municipality.
 - (iv) Dissemination of open spaces and critical facilities data to a wider audience and stakeholders by integrating these datasets in the national DIMS or BIPAD platform.

I.3. Survey location

Neelakantha Municipality is situated in Dhading District of Bagmati Province. The Municipality was established on 8 May 2014 by merging four former Village Development Committees (VDC)s namely Neelakantha, Sankosh, Murali Bhanjyang and Sunaula Bazar. The Municipality was again restructured in the year 2017 by adding three more VDCs, namely Jyamrung, Khalte and Dhuwakot. The Municipality has a total area of 199.85 km² and 15,239 households. The total population in this Municipality is 71,131. The Municipality consists of 14 wards.

Figure 1: Location map of Neelakantha Municipality



The 2015 earthquakes affected 31 districts of which 14 were categorized as severely affected. Dhading is one of these severely affected districts in Nepal (Housing Recovery and Reconstruction Platform, 2018). Besides earthquakes, Dhading is also vulnerable to landslides and floods. As this district is vulnerable to various disasters and anticipating the impacts of such disasters, IOM, as co-lead of the Camp Coordination and Camp Management (CCCM) cluster, undertook a study to identify open spaces in Neelakantha Municipality as well as in four other earthquake affected districts in Bagmati and Gandaki Provinces. Disaster management requires a determined and integrated national effort which needs to be well coordinated at all levels: local, provincial and federal. The identification of open spaces in Neelakantha is primarily to ensure adequate disaster preparedness and effective response by the Municipality and the local community.

1.4. Open-space selection criteria

Identifying a site as an open space signifies a long-term commitment from the concerned authority and the public to preserve and promote these spaces for future use. The survey team thus followed international standards as well as national standards developed by IOM for the selection of a site as an open space for humanitarian purposes. As per the Sphere Standards, there are certain criteria to consider for the selection of a suitable open space (Sphere Association, 2018). The area of an open space, availability of water, sanitation and hygiene (WASH) facilities, distance from critical facilities, accessibility and security are some important parameters for selecting an open space. The environmental suitability of an open space and social and cultural values of different groups of people are also to be taken into consideration during the site selection. Details of these parameters are found in Annex 1 of this document.

However, in the context of a geographically diverse country like Nepal, the international standards may not be feasible for selecting a location as an open space in rural locations. Nepal is extensively diverse in terms of geography and is varied in landscapes. Human settlements in rural areas can be found in the terraced

hillsides, nearby the rivers, mountains or in the plains. With such villages or settlement clusters in varied topography, it is not practical for the people to find an open space which has a large area (more than 3,500 m²) but also located at a distance from their settlements during a disaster. Therefore, it is paramount that the selection of a location as an open space be contextualized as per the geography, area and land surface, population as well as settlement patterns of the region. This survey has included the open spaces which are at least 3,000 m² in area and other locations which can be used during an emergency.

1.5. Limitations

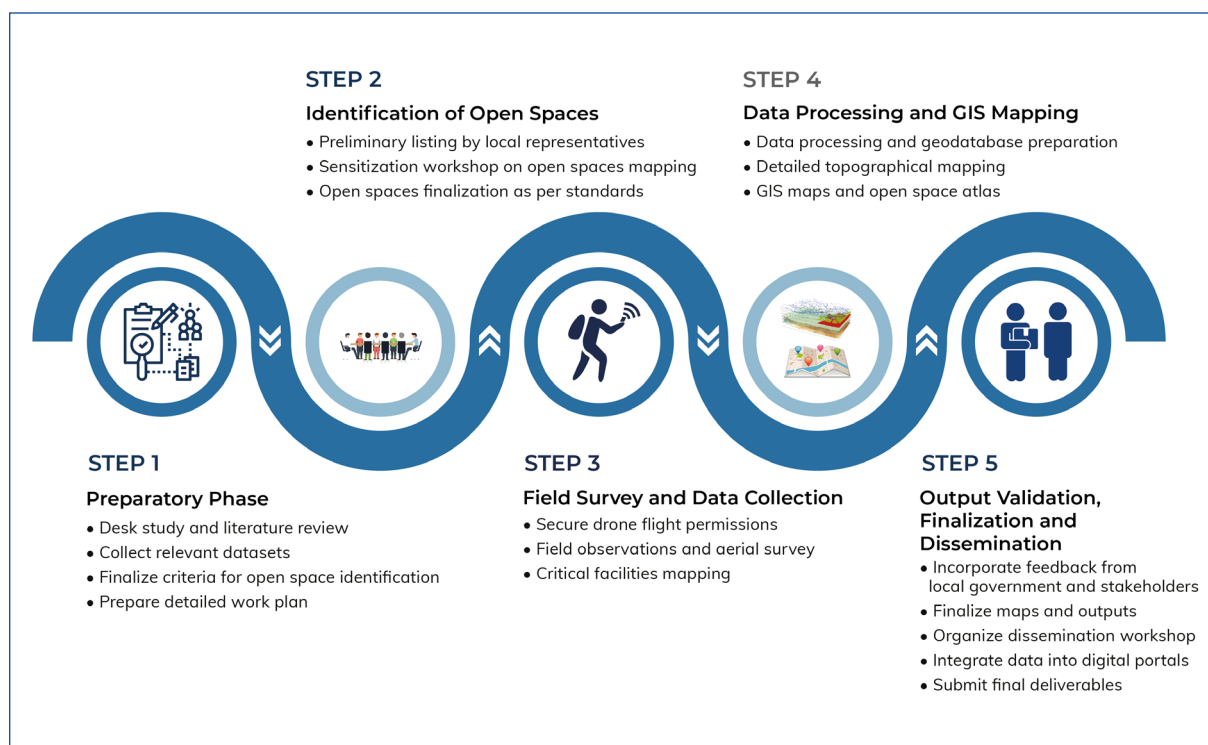
There are a number of limitations of the study which are mentioned below.

- (a) The finalization of open spaces was mainly decided by considering the proximity to the population density in the area.
- (b) There were more open spaces in the Municipality, but the survey was limited to spaces with an area larger than 3,000 m².
- (c) Limited resources during the field survey narrowed the primary data collection as critical facilities could be located nearby the open spaces only and not in the entire Municipality.
- (d) Most of the datasets on critical facilities are based on the inputs provided by respective offices and review of available secondary sources.
- (e) As there is no system for digital record keeping in the Municipality, past studies on open spaces after disasters (if any) might have been missed in this survey.
- (f) Regarding mapping, the evacuation route mapping does not involve extensive GIS analysis and rather it includes the mapping of possible routes based on the available secondary and open-space datasets.
- (g) This survey has only identified and mapped open spaces. No further plans have been formulated regarding the construction of any camps or temporary shelters for IDPs in Neelakantha Municipality.
- (h) Due to the COVID-19 pandemic and travel restrictions to curb the spread of COVID-19, the team could not travel to the District Survey Office of Gorkha for the collection of cadastral information of each of the identified open spaces. Thus, the details of land ownership (public or private), type of tenure and current title holders, cadastral maps, boundary data and parcel numbers could not be included in the report.

CHAPTER 2 OPEN-SPACE IDENTIFICATION PROCESS

The project involved the collection of both primary and secondary data. The primary data collection involved field-based surveys in all identified open spaces and examinations of available critical facilities located near the open spaces. The secondary datasets included review of existing municipal profile and other relevant literature on open-space mapping. Secondary data on risk and hazards, data on disaster occurrence from existing local level and vulnerability and capacity assessment (VCA) reports were also intended for review but were not available in the survey location. Further, applicable datasets such as administrative boundary of survey location and settlement location from the Survey Department were also collected. Considering all the specific requirements in the survey, deliverables expected and time frame, this study was implemented in the following five phases:

Figure 2: Synopsis of open-space identification process



Note: This infographic is made by NAXA based on the data from the 2019 survey.

Step 1. Preparatory phase and desk study

The first step included a desk study and review of relevant past work done by IOM in Kathmandu and the municipalities in the western region of Nepal. The technical team also consulted with IOM for better understanding of the methodologies applied and the outcomes from the previous open-space identification and mapping works. All the relevant datasets including the shapefile of open spaces, attribute data and reports from all relevant past works were collected. Sphere camp standards were used as the baseline for planning further steps. An inception report detailing the scope of work and a detailed work plan to achieve the survey deliverables was prepared and submitted to IOM.

Step 2. Identification of open spaces

The identification of open spaces involved preliminary identification of all open spaces and finalization of the most suitable open spaces through the interaction with locals and a detailed field study.

(a) Preliminary listing of open spaces

The municipal officials shared the preliminary list of all public and private lands which were being used as community gathering spaces, playgrounds and local parks as open spaces available in their community to the technical survey team. The locations mentioned were based on the current use practice of such locations by the public and included several types of locations including community gathering spaces (resting places, chowks), small playgrounds, grazing lands and open areas within office premises as well as other open lands available within and nearby their community.

(b) Interaction with locals and finalization of open spaces

A sensitization workshop was organized in Neelakantha Municipality to introduce the concept of open-space mapping, importance of camp management and the need for identification and preservation of open spaces for disaster preparedness. Based on the criteria for the selection of an open space as explained by the survey team, the local officials ranked the previously shared list of open spaces. 72 participants worked in different groups and assigned certain weight value to different open spaces based on the selection criteria. The open spaces with a total weight value of 13 and more were selected for further field inspection and mapping. The list of preliminarily identified open spaces along with standard weights given to each open space based on standard criteria are listed in Annex 2.

Figure 3: Sensitization workshop in Neelakantha, Dhading



Note: All photos used in this report are owned by IOM Nepal, unless otherwise indicated.

Step 3. Field Survey & Data Collection

(a) Field observations and aerial survey

The technical field survey team in coordination with the municipal officials visited all the open spaces with a weight value of 13 and greater. Based on the observations during the field inspection and the standard open-space criteria, the survey team finalized the open spaces and conducted detailed topographical mapping of each site. An aerial survey using a drone was carried out to capture high-resolution images of each finalized location. In addition to the spatial data collection, the survey team also collected major attribute details such as land type, current land use, nearby settlements/catchment areas, critical facilities, significant features near the site and ownership status of each identified open space. The template used for collection of detailed attribute datasets for each open space is found in Annex 3.

Figure 4: Topographical drone survey in Neelakantha, Dhading



Further, there were other locations that were not listed in the preliminary list provided by the local and municipal officials in Neelakantha Municipality. The technical team also visited all these locations in coordination with the local representatives.

The specifications of the drone survey are listed in the table below.

Table 1: Specifications of the drone survey

Serial number	Specification	Parameters
1	Altitude above ground surface	70-80 m
2	Forward overlap between adjacent images	75%
3	Lateral (sidewise) overlap between adjacent images	70%
4	Spatial resolution of image captured	3 cm

(b) Development of environmental checklist

Finalization of open spaces also requires a proper understanding of the environmental components and potential risks associated with a location selected as an open space. In this regard, an environmental checklist was used based on the previously prepared questionnaire to understand the context, ecosystems, ecological impact and vulnerability of project sites due to construction of project infrastructure. The checklist is found in Annex 4. The checklist helps to ensure that environmental considerations are included in decisions regarding projects that may impact the environment.

Step 4. Data processing and GIS mapping

The collection of attribute data on critical facilities and infrastructures from sectoral office, census department and municipal profile and primary field survey was followed by multi-source data integration. The team of GIS analysts carried out data cleaning, combining spatial datasets with attribute data and conversion of all spatial data layers from different sources to a single standard data system.

(a) Preparation of geodatabase and topographical maps

The project team had collected datasets of critical facilities, local infrastructures like road networks from both the primary and secondary sources. A municipal geodatabase was prepared with all major datasets. The captured aerial images were processed to form a single georeferenced orthophoto image map for each open space using a high configuration computing device and licensed digital photogrammetry software. The image processing was carried out to generate outputs like contour maps, orthophoto maps and digital surface models. After the generation of map outputs from images, the map features were digitized from the high-resolution georeferenced image in a GIS environment. Standard symbology and appropriate color codes were applied to the generalized data to form a detailed topographical map. The information regarding map projection and coordinate system is found in Annex 5 of this document.

(b) Calculation of usable open-space area

The technical team calculated the usable area of each open space by deducting the area occupied by the existing ground objects like trees and vegetation, building structures and slope below 5° from the total area of identified open spaces.

Step 5. Output validation, finalization and dissemination

Due to the COVID-19 pandemic and rise in the number of positive cases, the project was unable to organize face to face programs for disseminating the final reports on open spaces. Alternatively, the draft datasets, open-space report, atlas and final maps were shared with the Municipality. Feedback and comments from municipal officials and other relevant stakeholders were incorporated and the project deliverables was finalized accordingly.

The datasets on the open spaces and critical facilities are being integrated to the BIPAD platform after data validation and finalization from the local stakeholders. A physical GIS map has also been installed in the Municipality premises for sensitizing people on the open spaces and critical facilities. The major outputs of the project include an Open Space Map Atlas and report, an open space platform for humanitarian assistance and a physical hard copy map of the Municipality which has been shared and disseminated to the Municipality and all other relevant stakeholders of the project.

CHAPTER 3 SURVEY OUTPUTS

3.1. High-resolution map products

The aerial images captured from the drone were utilized to generate different kinds of map outputs. At the end of the data processing, the following outputs were generated: high spatial resolution (3 cm) georeferenced orthophoto, digital surface model (DSM),³ digital terrain model (DTM),⁴ contour lines of 1 m interval, 3D model and point cloud. These high-resolution map outputs can be utilized by planners and emergency responders during the camp management related activities, but also use as a major resource for development planning at a municipal level.

3.2. Open space map atlas

The topographical maps of each finalized open space were prepared and compiled as an Open Space Map Atlas along with other details like description of each open space, photographs captured from the ground and a vicinity map where the nearby critical facilities are presented. A map board of the entire Municipality highlighting the detailed information of each finalized open space was also designed for installation within the Municipality.

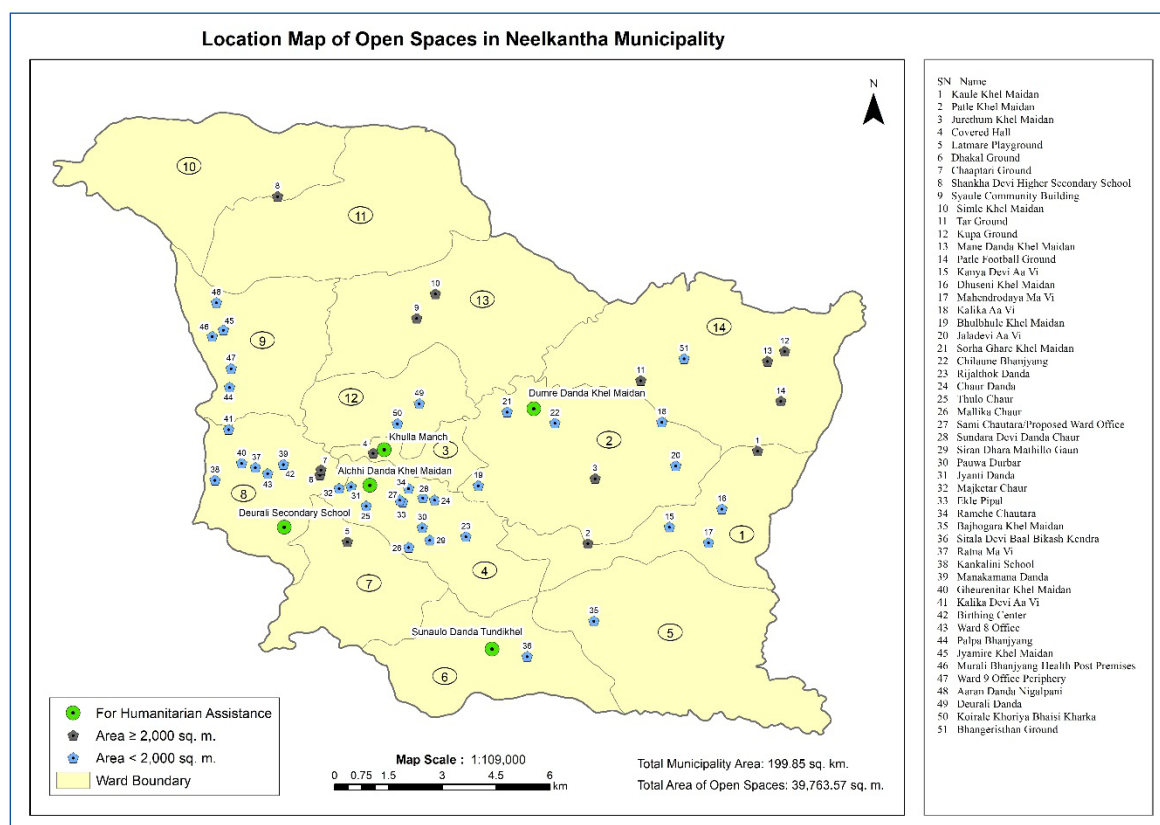
3.3. Open spaces for humanitarian assistance

A preliminary list of 72 open spaces in Neelakantha was shared by the local and municipal officials. The technical team visited 18 locations which were assigned a total weight value of 13 and more during the preliminary workshop. Five locations were finalized as the most suitable open spaces for humanitarian assistance based on the standard selection criteria (minimum area 3,000 m²), slope (less than 5°), access, security and safety, availability of critical facilities and other resources, social and cultural values and environmental suitability. The total usable open-space area is 33,415 m² which can accommodate 9,547 displaced persons during a disaster as per the Sphere Standards which estimates 3.5 m² per person.

³ The DSM represents the elevation of ground surface features which is generated by the software itself but is not recommended for representing ground elevation.

⁴ DTM represents the elevation of bare earth surface excluding the ground features.

Figure 5: Location map of open spaces in Neelakantha Municipality



Note: This figure is made by Naxa on a GIS platform and is based on the data from the 2019 survey.

The list of finalized open spaces in Neelakantha Municipality is mentioned in the table below:

Table 2: Generic details of humanitarian open spaces in Neelakantha Municipality

Serial number	Name of open space	Address (ward number)	Coordinates	Total area (m ²)	Total usable area (m ²)	Approximate capacity (3.5 m ² per person)
1	Dumre Danda Khel Maidan	2	27.922713° 84.935717°	7,761.35	4,040	1,154
2	Khulla Manch	3	27.912463° 84.898223°	8,115.83	7,535	2,152
3	Alchhi Danda Khel Maidan	4	27.903574° 84.894647°	8,666	8,665	2,475
4	Sunaula Bazar Tundikhel	6	27.862537° 84.925293°	10,188.8	10,185	2,910
5	Deurali Secondary School	8	27.893047° 84.873186°	5,031.59	2,990	854

Details of all finalized open spaces, topographical maps, vicinity maps, environmental checklist and relevant attribute information are included in the Open Space Map Atlas.

3.4. Critical facilities

The technical team collected location data and names of critical facilities within the vicinity of each finalized open space. Following is a summary of collected datasets:

- Health facilities (3)
- Educational institutions (20)
- Security forces (3)
- Evacuation centres (1)

Table 3: Available critical facilities near humanitarian open spaces in Neelakantha Municipality

Serial number	Name of open space	List of critical facilities					
		WASH facilities	Health facilities	Educational institutions	Market	Security	Helipad
1	Dumre Danda Khel Maidan	Not available	Dhading District Hospital (6.7 km west)	Shree Saraswati Higher Secondary School (6 km north east)	Dhading Besi (6.5 km north west)	Dhuwakot Prahari Chowki (7.68 km north east)	Not available
2	Khulla Manch	Available	Dhading District Hospital (6.7 km west)	New Dhading Boarding School (460 m west)	Dhading Besi (1 km north west)	District Police Office (270 m south)	Available at Nepal Army Barrack (50 m)
3	Alchhi Danda Khel Maidan	Not available	Dhading District Hospital (675 m west)	Children Park Aa Ma Vi (850 m north)	Dhading Besi (1.1 km south)	District Police Office (2 km north)	Not available
4	Sunaula Bazar Tundikhel	Available	Sunaula Bazar Swasthya Chauki (165 m west)	Shree Bhairavi Higher Secondary School (475 m south)	Sunaula Bazar (7.6 km north east)	Sunaula Bazar Prahari Office (40 m west)	Not available
5	Deurali Secondary School	Available	Dhading District Hospital (3.3 km north east)	Deurali Secondary School	Dhading Besi (3.5 km north east)	District Police Office (5 km north)	Not available

A list of emergency contacts in Neelakantha Municipality is found in Annex 6 of this document.

3.5. Other locations

In the immediate aftermath of the earthquakes in 2015, local people in Neelakantha Municipality used private and public lands and other open areas near their houses and communities as temporary shelters. Some of the open areas were also used by relief distribution agencies. The technical team visited 51 locations identified by the Municipality and measured the total available flat area, collected GPS coordinates, attribute details and photographs for each location during the project period. These locations do not fulfill all the criteria required to consider for humanitarian open spaces, however, they can be used during an emergency. These 51 locations observed during the field survey were broadly grouped into four major categories based on the current land use practice by the local community:

- Category 1: Playgrounds
- Category 2: Picnic spots and parks
- Category 3: Community gathering spots (Chautara, temple, garden, open public land)
- Category 4: Periphery of hospitals, schools, public institutions and other public places

As the finalized open spaces may not be easily accessible to all the scattered communities in the rural wards of the Municipality during a disaster, the school compounds, the periphery of the ward offices, health institutions and various other community buildings' premises near the settlement areas have also been considered for its utilization during an emergency.

The identified locations based on the current land use are listed in Annex 7 of this document.

3.6. Open space platform for humanitarian assistance

Upon finalization, all open spaces datasets will be handed over by IOM to the Government of Nepal and also be published in a public GIS based data platform where the datasets will be stored and updated. This includes the datasets from Neelakantha. The platform mainly consists of the following features:

- (a) Provides information through text as well as audiovisuals regarding the identified open spaces, camp sites, logistics, distribution areas, medical assistance areas and other details.
- (b) Contains an interactive mapping feature where users can select the respective municipalities and find details of each open space like attribute tables, nearest critical facilities and photographs.
- (c) Allows the system admins to view reports regarding open-space encroachment submitted by the public and forward it to the concerned authority for necessary action. The report function contains GPS location, photographs and report messages.
- (d) Allows users to download and view publications regarding camp management, open spaces and its importance, open-space mapping reports and other useful reports and publications related to the open spaces and their role in disaster preparedness and management.
- (e) A humanitarian assistance tab in the web platform and in the mobile app which is enabled only in the event of a disaster. This tab is mainly for various humanitarian agencies to upload details of emergency supplies or relief distribution in a location and notify the public about their humanitarian efforts during and after a disaster.

3.7. Open space mobile application

The open space mobile application was developed to provide the general public with information regarding open spaces and critical facilities so that they can promptly use it during an emergency. The app contains location data of all open spaces in Neelakantha Municipality and users can navigate to each of these open spaces from their locations at the push of a button in the app. The app works both online and offline and can provide multiple routes from user locations to the nearest open space during an emergency.

CHAPTER 4 CONCLUSION

4.1. Conclusion

This report identifies the open spaces suitable for humanitarian purposes in an event of a disaster in Neelakantha Municipality. The surveys and related activities have been implemented as per the plan of action along with necessary consultations and interactions with the ward and municipal officials, local communities, humanitarian actors and relevant stakeholders of the project. IOM supported Neelakantha Municipality to conduct a detailed study on the five suitable open spaces: Dumre Danda Khel Maidan, Khulla Manch, Alchhi Danda Khel Maidan, Sunaula Bazar Tundikhel and Deurali Secondary School. The five identified open spaces in Neelakantha Municipality could be used for accommodating an estimate of 9,547 displaced individuals with basic WASH facilities, easy access to all five open spaces, health and educational facilities and proximity to market and nearby security forces. The national disaster response framework includes specific provisions for security forces and local governments that include evacuation of local populations to safer locations. This report includes open spaces which are at least 3,000 m² in area and are nearby major settlements that could be used for humanitarian purposes.

Based on the past experience of the 2015 earthquakes and landslides, it was found that displaced persons took shelters in these open spaces irrespective of public or private ownership. Therefore, in an event of a disaster, these spaces can be usable for IDPs provided that they are well preserved by the concerned authority. Identification and preservation of open spaces is important as most of the existing infrastructures could be destroyed and human settlements could be damaged in a catastrophic event such as earthquake or landslide. Moreover, the humanitarian efforts to accommodate and support displaced populations post-disaster is likely to be difficult. Besides humanitarian services, open spaces can also be used for a variety of purposes such as cultural events, community activities and sports. Thus, pre-identifying and locating nearby open spaces can strengthen disaster preparedness and management.

The Constitution of Nepal was promulgated in 2015 which led the country to initiate its federalization process, dividing the Government into three tiers: federal, provincial and local. As a result, 753 local governments were formed, allowing for more resources to be allocated to the local level, and the formulation of local disaster management plans and strategies is now among the prioritized local government plans. Disaster preparedness at a local level is crucial to inform and raise public awareness about disaster vulnerability and emergency response. Activities and initiatives for disaster preparedness include the identification, mapping, promotion and protection of open spaces, all of which are crucial initiatives in disaster prone areas of Neelakantha Municipality, Dhading.

CHAPTER 5 ANNEXES

Annex I. Open-space selection criteria

(a) Accessibility

- (i) Accessibility is a critical factor for open-space identification. Some open spaces have restricted road access which impacts the establishment of camps, movement of IDPs to the camps, ensuring food supplies and other camp necessities. Therefore, it is critical in the selection phase that the accessibility of the open spaces in all seasons is considered.
- (ii) The mobility of displaced populations, supply of goods and services, access to critical services (such as hospitals, markets, schools) in the surroundings are ensured while selecting an open space.
- (iii) Access to livelihoods is also considered for open-space identification.

(b) Security

- (i) Security is likely to be a key issue in high density camps. Existing security features are explained as these will assist with open-space identification and camp management.
- (ii) Natural and human induced hazards. Example: Existence of industrial areas in the proximities of the open spaces are avoided.
- (iii) Extreme climatic conditions. Example: Open spaces at risk of flooding, strong winds or landslides are avoided. Similarly, open spaces with high intensity electric wires are also avoided.
- (iv) Environmental and health conditions. Example: Health risks typical for the open spaces are assessed. Malaria zones and cholera high risk areas are avoided.
- (v) Evacuation routes are considered while identifying open spaces.

(c) Access to resources and water

- (i) Availability of and accessibility to water is considered.
- (ii) Water needs to be available in sufficient quantity in all seasons, taking into consideration the level of water during the dry season, as well as the basic needs of the displaced population (calculated as 7.5-15 liters per person per day).

(d) Land availability and topography

- (i) Selection of open spaces considers the Sphere standard, which defines the minimum surface area is 35-45 m² per person.
- (ii) The possibility of site expansion is considered.
- (iii) A gentle terrain slope of 1-5° is considered.
- (iv) Open spaces that could become marshy and waterlogged during rainy seasons should be avoided.
- (v) Open spaces that are excessively rocky should be avoided as they hamper toilet or camp construction.

(e) Environmental concerns

- (i) Open space with sufficient ground cover is suitable for setting up camps as the vegetation provides shade, protects soil erosion and reduces dust.
- (ii) The negative impact of turning an open space into a camp is also considered while selecting an open space.
- (iii) A general environment checklist is filled during the open-space selection process.

(f) Size

The size of the open space and area per capita are important factors in planning for camps. The Sphere Project outlined the Humanitarian Charter and set minimum standards in disaster response. The standards include spaces that should be made available for camp functions such as accommodation, cooking, hygiene, agriculture and schools. The total area required for all camp functions is 45 m² per person. While this should remain the objective for camp density, it is important that the humanitarian community be prepared for a higher influx of displaced population immediately following the disaster. The covered living area is 3.5 m² per person.

Annex II. Preliminary list of identified open spaces with scored weights in Neelakantha Municipality by the local and municipal officials.

Serial number	Name of open space	Ward number	Area	Access	Security	Source availability	Social cultural values	Environmental perspectives	Total
1	Prakash Secondary School	1	1	2	1	2	2	3	11
2	Kafle Khel Maidan	1	2	2	1	2	2	3	12
3	Dhuseni Khel Maidan	1	3	2	1	2	3	3	14
4	Paatle Khel Maidan	1	1	2	1	2	1	3	10
5	Mahendroya Aadharbhut Khel Maidan	1	3	2	1	2	3	3	14
6	Chilaune Vanjyang Basaha	2	3	2	2	2	3	1	13
7	Dumredanda Khel Maidan	2	3	2	2	2	3	2	14
8	Jurethum Khel Maidan	2	2	2	2	1	2	2	11
9	Jaladevi Khel Maidan	2	1	2	2	2	2	2	11
10	Sorhaghar Khel Maidan	2	1	2	2	2	2	2	11
11	Siudibar Khel Maidan	2	1	2	2	2	2	2	11
12	Kalika Khel Maidan	2	1	2	2	2	2	2	11
13	Dhodeni Khel Maidan	2	1	2	2	2	1	2	10
14	Kerabari Khel Maidan	2	1	2	2	1	2	1	9
15	Pipaldanda Chaur	2	1	2	2	2	2	2	11
16	Ijara Aadharbhut Vidhyalaya	3	1	3	3	3	2	3	15
17	Khulla Manch	3	3	3	3	3	2	3	17

18	Kavard Hall Parisar	3	2	3	3	3	1	3	15
19	Alchhidanda Khel Maidan	4	3	3	3	3	3	3	18
20	Banjhogara Khel Maidan	5	3	2	3	2	3	3	16
21	Sunaula bazar Tundikhel	6	3	3	3	3	3	3	18
22	Picnic Spot Maidan	6	3	2	2	2	3	1	13
23	Sitaladevi Prangad	6	1	2	3	3	3	2	14
24	Laatmare	7	1	3	3	2	3	3	15
25	Dumre Danda	7	3	2	2	2	3	3	15
26	Birthing Centre	8	3	3	3	3	1	2	15
27	Deurali Secondary School	8	1	3	3	3	1	2	13
28	Gayatridevi Aadharbhut Vidhyalaya	8	1	3	3	3	1	2	13
29	Kalika Aadharbhut Vidhyalaya	8	1	3	3	3	1	2	13
30	Swawalambi Aadharbhut Vidhyalaya	8	1	3	3	3	1	2	13
31	Kankali Aadharbhut Vidhyalaya	8	1	3	3	3	1	2	13
32	Ward Office	8	1	3	3	3	1	2	13
33	Jyamire Samudayik Bhawan	8	1	3	3	3	1	2	13
34	Sasaaha Samudayik Bhawan	8	1	3	3	3	1	2	13
35	Hatiya Samudayik Bhawan	8	1	3	3	3	1	2	13
36	Magargau Samudayik Bhawan	8	1	3	3	3	1	2	13
37	Muralivanjyang Bhawan	8	1	3	3	3	1	2	13

38	Simalighari	8	1	3	3	2	1	2	12
39	Gheuranitaar	8	1	3	3	2	1	3	13
40	Fusredanda	8	3	3	3	3	2	3	17
41	Manakamana Danda	8	1	3	2	3	2	3	14
42	Deurali	8	1	3	3	3	1	2	13
43	Chaaptaari	8	1	3	3	3	2	3	15
44	Chihandanda Tamang Tol	8	1	3	3	3	1	2	13
45	Jaladevi Aadharbhut Vidhyalaya	9	1	2	2	1	2	3	11
46	Jhagare Aadharbhut Vidhyalaya	9	1	2	2	1	2	3	11
47	Jyamirey Swasthya Chauki	9	1	2	2	1	2	3	11
48	Dharapani Aadharbhut Vidhyalaya	9	1	2	2	1	2	3	11
49	Palpa Saamari Secondary School	9	1	2	2	1	2	3	11
50	Chandeswori Secondary School	9	1	2	2	1	2	3	11
51	Kaflepani Thati Vanjyang	9	1	2	2	1	2	3	11
52	Gola Vanjyang	9	1	2	2	1	2	3	11
53	Aarandanda Nigalpani	9	1	2	2	1	2	3	11
54	Jyamire Vanjyang	9	1	2	2	1	2	3	11
55	Khada Danda	9	1	2	2	1	2	3	11
56	Seuli Bazar	9	1	2	2	1	2	3	11
57	Ward Office	9	1	2	2	1	2	3	11
58	Daighare Aadharbhut Vidhyalaya	9	1	2	2	1	2	3	11
59	Pokhari Danda	9	1	2	2	1	2	3	11
60	Jyamire Khel Maidan	9	1	2	2	1	2	3	11

61	Saalbotey	9	1	2	2	1	2	3	11
62	Pangrey Swasthya Chauki	10	2	2	2	2	2	2	12
63	Saag Khel Maidan	10	1	2	3	3	3	2	14
64	Simle Khel Maidan	11	2	3	2	2	2	1	12
65	Sankhadevi Khel Maidan	11	1	3	3	3	2	2	14
66	Koiralekhoriya Bhaisi Kharka	12	3	3	3	2	3	2	16
67	Deurali Danda	12	3	3	3	3	3	3	18
68	Batuwa Khel Maidan	13	1	3	1	3	3	2	13
69	Seul Samudayik Bhawan	13	1	3	1	1	2	2	10
70	Simle Khel Maidan	13	3	3	1	2	2	2	13
71	Patley Football Khel Maidan	14	3	2	1	2	3	2	13
72	Maane Khel Maidan	14	3	3	3	2	2	3	16

Annex III. Attribute checklist for an open space in Neelakantha Municipality

General site assessment		
Site name		
District	Municipality	Ward
GPS coordinates		Area
Gradient (1 – 5%)		Proximity to Helipad
Proximity to Nepal Army	Proximity to Nepal Police	Proximity to Armed Police Force
Special feature of site		
Significant feature near site (within 500 metres)		
Ownership		
Security		
Access to site		
Access to market		
Trees and vegetation		
WASH facilities		
Health facilities		
Educational infrastructures		
Implementation issues		

Annex IV. Environmental checklist

Environmental checklist	
Is it a protected area?	
Is it a buffer zone of a protected area?	
Is it a cultural heritage site?	
Densely populated area?	
Special area for protection of biodiversity?	
Will the project require temporary or permanent support facilities?	
Are project related ecosystems fragile or degraded?	
Will the project cause an increase in peak and flood flows (including from temporary or permanent waste waters)?	
Will the project cause air, soil or water pollution?	
Will the project cause soil erosion and siltation?	
Will the project cause an increase in waste accumulation?	
Will the project cause hazardous waste accumulation?	
Will the project cause a threat to local ecosystems due to invasive species?	
Will the project cause greenhouse gas emissions?	
Will the project cause use of pesticides?	
Does the project encourage the use of environmentally friendly technologies?	
Other environmental issues, e.g. noise and traffic?	

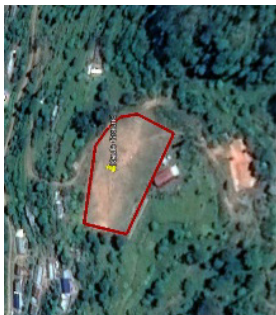


Annex V. Map projection and coordinate system used for the detailed topographical mapping


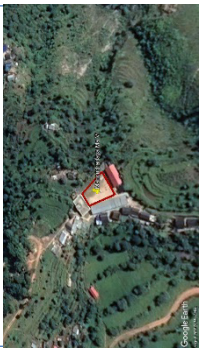


Serial number	Projection and coordinate system	Parameters
1	Coordinate system	WGS_1984_UTM_Zone_45N
2	Projection	Transverse Mercator
3	False easting	500000 metres
4	False northing	0.0 metre
5	Central meridian	84° East
6	Scale factor	0.9996
7	Latitude of origin	0.0
8	Linear unit	Metre
9	Angular unit	Degree (°)
10	Prime meridian	Greenwich (0.0)
11	Datum	D_WGS_1984
12	Spheroid	WGS_1984
13	Semi major axis	6378137.0
14	Semi minor axis	6356752.314245179
15	Inverse flattening	298.257223563

Annex VI. Emergency contacts

Serial number	Emergency service	Name of organization	Phone number
1	Ambulance	District Hospital, Dhading	010-520130
2	Security Force	District Police Office, Dhading	010-520199
3	Fire Brigade	Fire Brigade, Dhading	010-520568


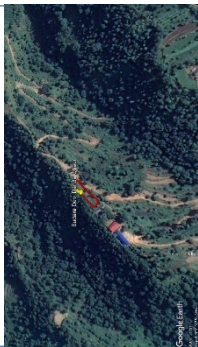
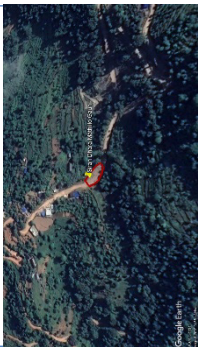
Annex VII. Details of other locations in Neelakantha Municipality:

Serial number	Name	Image	Ward No.	Category	Coordinates	Approximate flat area (m ²)	Elevation (m)	Remarks
1	Kaule Khel Maidan		1	Playground	27.912181° 84.991790°	2,520	1,456	A large sized playground with settlements nearby, can be utilized as a distribution hub during a disaster
2	Patle Khel Maidan		1	Playground	27.88997723° 84.94926781°	5,430	1,316	A large sized playground, located nearby settlements, problem of soil erosion, difficult road access, can be a suitable open space if the ground is maintained properly
3	Kanya Devi Aa. Vi.		1	Periphery of school	27.893113° 84.969665°	1,075	1,210	A small ground within the school premises, can be utilized as a distribution centre during a disaster

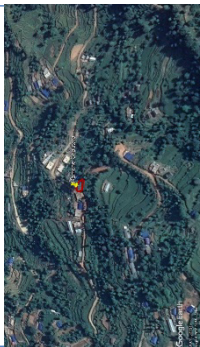
4	Dhuseni Khel Maidan		1	Playground	27.897621° 84.982813°	1,000	1,200	A recently constructed playground, surrounded by vertical cliffs, prone to landslide
5	Mahendrodaya Ma. Vi.		1	Periphery of school	27.889160° 84.979469°	405	1,165	Small sized ground within the school premises, well managed WASH facility is available
6	Jurethum Khel Maidan		2	Playground	27.905262° 84.951061°	2,750	1,560	A recently constructed playground, connected to nearby communities through a village road
7	Kallka Aa. Vi.		2	Periphery of school	27.919396° 84.967759°	1,320	1,195	Open space within the school premises, also has a small playground

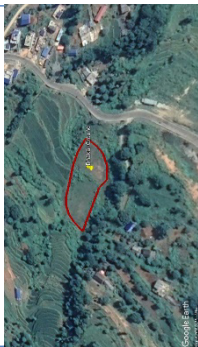

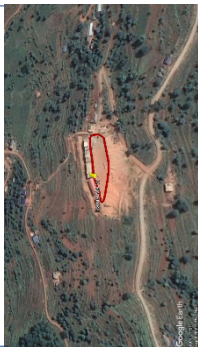

8	Bhulbhule Khel Maidan		2	Playground	27.903470° 84.921810°	1,310	950	Small area, currently being used as a playground by nearby communities
9	Jaladevi Aa. Vi.		2	Periphery of school	27.908447° 84.971246°	1,205	1,336	Small playground within Jaladevi school premises, located nearby settlement
10	Sorha Ghare Khel Maidan		2	Playground	27.921949° 84.928992°	1,050	890	A small sized ground, surrounded by trees, currently being used as a playground
11	Chilaune Bhaniyang		2	Community gathering spot	27.919119° 84.941022°	150	1,035	Small sized open area, located near to Basaha village

12	Covered Hall		3	Periphery of covered hall	27.911629°, 84.895441°	3,580	633	Located near Dhading Besi, the periphery of this area is currently used as a grazing area by the nearby communities, the area gets waterlogged during monsoon due to its landscape, can be used during an emergency if the site is maintained properly
13	Rijalthok Danda		4	Community gathering spot	27.890720° 84.918722°	1,180	1,220	A small sized open land area with no settlements near to its vicinity
14	Chaur Danda		4	Community gathering spot	27.899863° 84.910840°	975	840	A small sized open land area with no settlements near to its vicinity
15	Thulo Chaur		4	Community gathering spot	27.898361° 84.893717°	250	695	A small open flat area used as a community gathering spot


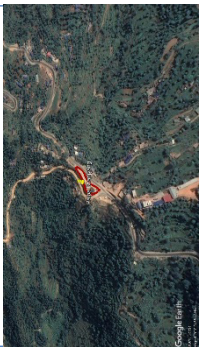
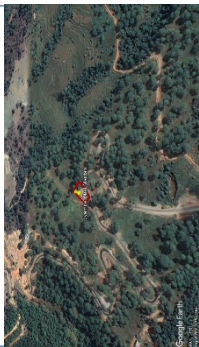

16	Mallika Chaur		4	Community gathering spot	27.888038° 84.904368°	600	1,030	A small sized public ground nearby settlement, located next to a village road
17	Sami Chautara/ Proposed Ward Office		4	Periphery of ward office	27.899873° 84.902120°	550	856	Ward office construction site
18	Sundara Devi Danda Chaur		4	Community gathering spot	27.900432° 84.907900°	500	835	A small sized public land, located far from settlement
19	Siran Dhara Mathillo Gaun		4	Community gathering spot	27.889823° 84.909664°	380	1,105	A small sized ground with few settlements nearby, located right next to a village road

20	Pauwa Durbar		4	Periphery of Pauwa Durbar	27.892972° 84.907739°	330	1,010	Open land within Pauwa Durbar premises
21	Jyanti Danda		4	Community gathering spot	27.903228° 84.889911°	290	675	A public land small in size, located next to the village road
22	Majketar Chaur		4	Community gathering spot	27.902773° 84.886938°	275	593	A small sized open land nearby settlements, currently being used as a community gathering spot
23	Ekle Pipal		4	Community gathering spot	27.899402° 84.902816°	155	865	A public land with no remarkable flat area

24	Ramche Chautara		4	Community gathering spot	27.902780° 84.904343°	150	765	A small sized public land, can be used as a community spot
25	Bajhogara Khel Maidan		5	Playground	27.869551° 84.950780°	1,305	1,135	A playground under construction, the only available open area in ward no. 5, prone to soil erosion
26	Sitala Devi Baal Bikash Kendra		6	Periphery of school	27.860701° 84.934030°	1,385	1,399	An open ground in front of the school, school buildings require repairment
27	Latmare Playground		7	Playground	27.889410° 84.888969°	1,050	750	A public land consisting of a small sized playground, can be utilized as a distribution hub to nearby settlements during a disaster

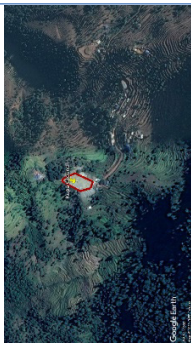

28	Dhakai Ground		8	Community gathering spot	27.906153° 84.882143°	2,180	615	A public ground located near Dhading Besi road, has a significant area to be used as a gathering point as well as a distribution hub
29	Chaptari Ground		8	Playground	27.907465° 84.882392°	2,085	630	A small playground located near Dhading Besi road, can be used as a gathering point as well as a distribution hub during an emergency
30	Ratna Ma. Vi.		8	Periphery of school	27.907969° 84.865967°	1,660	860	Recently constructed school ground, risk of soil erosion on one side
31	Kankalini School		8	Periphery of school	27.904834° 84.855861°	1,345	867	A small sized ground in front of the school, currently being used as a playground

32	Manakamana Danda		8	Community gathering spot	27.90880847° 84.87297832°	650	846	An open area, sloped land, with slope greater than 5°, far from settlement
33	Gheurenitar Khel Maidan		8	Playground	27.909061° 84.862492°	575	936	A small sized playground connected via earthen road
34	Kalika Devi Aa. Vi.		8	Periphery of school	27.917538° 84.859206°	345	906	A small sized ground in front of Kalika Devi school
35	Birthing Centre		8	Periphery of birthing centre	27.908808° 84.872978°	300	747	A small open land in front of a community birthing centre

36	Ward 8 Office		8	Periphery of ward office	27.9064919° 84.86904319°	140	820	The open area in the periphery of ward office, currently being developed as a playground
37	Palpa Bhanjyang		9	Community gathering spot	27.928118° 84.859485°	1,170	950	An open public land nearby a market area, settlements nearby and can be utilized as a distribution hub during a disaster
38	Jyamire Khel Maidan		9	Playground	27.942433° 84.857952°	1,045	1,125	A playground located next to the main road, was utilized as a distribution centre in the past
39	Murali Bhanjyang Health Post Premises		9	Periphery of health post	27.940819° 84.855150°	450	1,100	A small sized ground in front of the health post

40	Ward 9 Office Periphery		9	Periphery of ward office	27.932789° 84.859850°	425	1,045	Periphery of a ward office with a small sized open area
41	Aaran Danda Nigalpani		9	Community gathering spot	27.949312° 84.856204°	930	1,264	A small sized public land located at Aaran Danda, can be utilized as a distribution hub during an emergency
42	Shankha Devi Higher Secondary School		11	Playground	27.975903° 84.871503°	3,175	1,295	A land within Shankha Devi school premises which is being developed into a playground, has no proper road access
43	Deurali Danda		12	Community gathering spot	27.924038° 84.907003°	155	770	A public land located near to village road, no remarkable flat area

44	Koirale Khoriya Bhaisi Kharka		12	Playground	27.918993° 84.901524°	385	735	Small sized area which is currently used as a grazing area by the community
45	Syaule Community Building		13	Periphery of community building	27.945353° 84.906346°	1,165	1,190	A public land where a community building is planned to be constructed
46	Simle Khel Maidan		13	Playground	27.951470° 84.911055°	9,170	1,230	Large area but located very far from settlement clusters, the site is also prone to soil erosion and landslide, has high gradient
47	Tar Ground		14	Playground	27.929777° 84.962529°	2,250	930	An open public land which is currently used as a playground, no settlements near the site

48	Kupa Ground		14	Playground	27.937114° 84.998521°	2,010	1,315	A community playground nearby settlements and a main road, can be utilized as a distribution centre during a disaster
49	Mane Danda Khel Maidan		14	Playground	27.934615° 84.994277°	5,920	1,435	A large sized playground, has a facility of electricity and WASH, surrounded by trees, two telephone towers are located nearby, no proper road access
50	Patle Football Ground		14	Playground	27.924629° 84.997605°	2,500	1,388	A playground located near the settlements, can be utilized as a distribution centre during a disaster
51	Bhangeristhan Ground		14	Playground	27.935243° 84.973368°	1,820	1,100	A small playground located near Guthi Gaun, can be utilized as a distribution centre as well as a site for temporary health camps during a disaster

Note: The aerial images used in the above table are extracted from Google Earth. The details of other locations in this Municipality is based on the data from the 2019 survey.

REFERENCES

Housing Recovery and Reconstruction Platform

- 2018 Gorkha Earthquake: 18 Moderately Affected Districts. Available at https://www.preventionweb.net/files/63268_18moderatelyaffecteddistrictsovervi.pdf

International Organization for Migration

- 2016 Displacement Tracking Matrix: Nepal Earthquakes 2015. Available at <https://displacement.iom.int/system/tdf/reports/Nepal%20Earthquake%202015%2C%20DTM%20Round%209%2C%2030%20December%202016.pdf?file=1&type=node&id=850>

Nepal, National Planning Commission

- 2015 *Nepal Earthquake 2015: Post Disaster Needs Assessment*. Government of Nepal: Kathmandu. Available at https://www.npc.gov.np/images/category/PDNA_volume_BFinalVersion.pdf

OSOCC Assessment Cell

- 2015 Nepal Earthquake District Profile - Dhading. Available from <https://un.info.np/Net/NeoDocs/View/4728>

Shelter Cluster Nepal

- 2016 14 Earthquake affected priority districts Village Development Committees classified by level of landslide hazard based on susceptibility. Available from https://www.sheltercluster.org/sites/default/files/docs/landsliderisk_vdc.pdf

Sphere Association

- 2018 *The Sphere Handbook: Humanitarian Charter and Minimum Standards in Humanitarian Response*. Geneva, Switzerland. Available from <https://spherestandards.org/wp-content/uploads/Sphere-Handbook-2018-EN.pdf>

United Nations Development Programme

- 2019 *Energy, environment, climate and disaster-risk management*. Available from <http://www.np.undp.org/content/nepal/en/home/energy-environment-climate-and-disaster-risk-management/in-depth.html>



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