

भारत सरकार / GOVERNMENT OF INDIA
भारतीय भूवैज्ञानिक सर्वेक्षण / GEOLOGICAL SURVEY OF INDIA



कर्नाटक राज्य के चिकमंगलुरु और दक्षिण कन्नड़ जिले में स्थलाकृतिक मानचित्र संख्या 48
ओ / 07 और 48 ओ / 08 के आंशिक हिस्सों में वृहद पैमाने पर (1: 50,000) भूस्खलन
संवेदनशीलता का मानचित्रण

MACRO – SCALE (1:50,000) LANDSLIDE SUSCEPTIBILITY MAPPING IN PARTS
OF TOPOSHEET NOS. 48O/07 AND 48O/08, CHIKMANGALURU AND DAKSHIN
KANNAD DISTRICTS, KARNATAKA

मद कोड सं: एम 4 एल एस एस एम/ एन सी/ एस आर/रा.ई – क. एवं गो./2017/12200
FSP Code No: M4LSSM/NC/SR/SU-KG/2017/12200

कार्य सत्र / Field Season: 2017 – 2018

द्वारा / by

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राज्य इकाई: कर्नाटक एवं गोवा / State Unit: Karnataka & Goa
बेंगलुरु / Bengaluru
2018

इस प्रतिवेदन का कोई हिस्सा महानिदेशक, भारतीय भूवैज्ञानिक सर्वेक्षण की पूर्व लिखित अनुमति के
बिना प्रतिलिपित नहीं किया जाना चाहिए

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Tanvi Gupta, Geologist
Sunandan Basu, Geologist

Project: NLSM
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2018

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PARTS OF TOPOSHEET NOS. 48O/07 AND 48O/08, CHIKMANGALURU
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By

Tanvi Gupta, Geologist

Sunandan Basu, Geologist

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(कार्य सत्र: 2017-18)

द्वारा

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सारांश

राष्ट्रीय भूस्खलन संवेदनशीलता मानचित्रण (एनएलएसएम) एक बहुत महत्वाकांक्षी और साथ ही महत्वपूर्ण योजना है जो भारतीय भूवैज्ञानिक सर्वेक्षण द्वारा 2014 में संपूर्ण भारत में इस उद्देश्य के साथ प्रारम्भ किया गया है ; (i)- उच्च समाधानी सुदूर संवेदी आँकड़े और क्षेत्र आगत का उपयोग करते हुए भूस्खलन की विस्तृत सूची का आंकड़ाकोष (ii)- स्थानिक आंकड़े और भू-कारणों को आगत मानचित्र के तौर पर इस्तेमाल करते हुए भूस्थल मानचित्र के आधार पर 1:50,000 पैमाने पर और (iii)- बहु-वर्गीय सूची का उपयोग करते हुए अधोचित्र प्रणाली के जीआईएस स्तर पर भूस्खलन संवेदनशीलता मानचित्रण । भारतीय भूवैज्ञानिक सर्वेक्षण के दक्षिण क्षेत्र के कोड सं: एम 4 एल एस एस एम/ एन सी/एस आर/ राई -क. एवं गो./2017/12200 वार्षिक कार्यक्रम 2017-2018 के अन्तर्गत स्थलाकृतिक मानचित्र संख्या 48ओ/07 और 48ओ/08 के दक्षिण कन्नड़ और चिकमंगलुरु जिले के राष्ट्रीय भूस्खलन संवेदनशीलता मानचित्रण (एनएलएसएम) का कुल 1498 वर्ग किलोमीटर क्षेत्र निष्पादित किया गया । अध्ययन क्षेत्र भारतीय सर्वेक्षण के स्थलाकृतिक मानचित्र संख्या 48ओ/07 और 48ओ/08 के आंशिक भागों के अन्तर्गत निहित है ।

भौगोलिक दृष्टि से इस क्षेत्र में पहाड़ी इलाके और समतल भूमि द्वारा प्रतिनिधित्व मिश्रित स्थलाकृति है जो पश्चिमी भाग में 1892 मीटर समुद्र के स्तर के ऊपर कुद्रे मुख हेड के पास से लेकर दक्षिणी भाग में मुंडाजे होले के तट पर 111 मीटर समुद्र के स्तर के ऊपर है । अध्ययन क्षेत्र के पश्चिमी, दक्षिण पश्चिमी और

दक्षिण पूर्वी भाग अधिकतर उबड़ - खाबड़ हैं जो पश्चिमी घाट के मालनाद क्षेत्र का हिस्सा हैं, जो निचली एवं माध्यम दर्जे की विभाजित पहाड़ी ढलानों के रूप में प्रदर्शित है। शहरीकरण के रूप में काफी मानवी यह स्तक्षेप, नए आवास, सड़कतंत्र और खनन गतिविधियों की स्थापना धीरे-धीरे और लगातार क्षेत्र की प्राकृतिक भूगोल को संशोधित कर रही है। यह क्षेत्र तुंगा नदी, भद्रा नदी, नेत्रावती नदी, अनियुरहोल, मुंडाजहोल और उनकी सहायक नदियों द्वारा जलनिकसित जाता है। क्षेत्र का जल निकासी पैटर्न प्रकृति में रेडियल से उप-द्रुमाकृति से द्रुमाकृतिक है, और कुछ जगहों पर जल निकासी पैटर्न समानांतर हो जाता है।

भूगर्भिक रूप से, अध्ययन क्षेत्र सर्गुरगुप, प्रायद्वीपीय नाइसिक जटिल (पीजीसी-1), बाबाबूदान और चित्रदुर्गा संघ की चट्टानों को उजागर करता है, जिसमें ग्रेनाइट, क्वार्ट्ज शिराये, डोलेराइट भित्तियाँ अंतर्वेधित हैं। उष्णकटिबंधीय मौसम के उच्च तापमान के कारण, कुछ स्थानों पर लाटराइटेशन पाया जाता है। इस क्षेत्र में बाबाबुदान संघ की चट्टानें अच्छी तरह विकसित हुई हैं जिस कारण इस क्षेत्र को बाबाबुदान संघ के प्रकारक्षेत्र के रूप में जाना जाता है।

एसओपी के अनुसार, एनएलएसएम कार्यक्रम को तीन अलग-अलग हिस्सों में विभाजित किया जा सकता है, जैसे। (i) पूर्व-क्षेत्रीय अध्ययन, (ii) फील्ड सत्यापन और (iii) पोस्ट फील्ड अध्ययन। पूर्व-क्षेत्रीय अध्ययन के दौरान, पूर्व-क्षेत्र विषयगत मानचित्र गूगल अर्थ छवियों और डीईएम डेटा से तैयार किए जा रहे हैं। फील्ड सत्यापन चरण में क्षेत्र के सभी सुलभ स्थानों पर पूर्व फील्ड मानचित्रों का सत्यापन शामिल है। पोस्ट-फील्ड स्टडीज के दौरान, फील्ड इनपुट के अनुसार पूर्व फील्ड मानचित्र अद्यतन किए जाते हैं। कार्य क्षेत्र में डेटा संचालित मॉडलिंग करने के लिए पर्याप्त भूस्खलन डेटा न होने के कारण सभी पूर्व फील्ड मानचित्र अद्यतन करने के बाद ज्ञान संचालित विधि (एएचपी) का उपयोग करके पूर्ण भूस्खलन संवेदनशीलता मानचित्र तैयार किया गया है। वर्तमान एफएसपी एनएलएसएम एसओपी के दिशानिर्देशों के अनुसार किया गया था।

पूर्व-फील्ड विषयगत मानचित्र जैसे कि भू-आकृति मानचित्र, भूमि उपयोग व भूमि आवरण मानचित्र, रेगोलिथ मोटाई मानचित्र, ढलान मोर्फोमेट्री मानचित्र (ढलान कोण, ढलान वक्रता और ढलान पहलू), अपवाह मानचित्र और भूस्खलन वस्तुसूची मानचित्र गूगल अर्थ में डिजिटाइज करके और डीईएम डेटा में कुछ स्थानिक विश्लेषक प्रक्रिया का उपयोग करके तैयार किये गए थे।

नियमित अंतराल पर पूर्व-फील्ड विषयगत मानचित्र जैसे कि भूमि उपयोग भूमि आवरण, भू-आकृति, शैल लक्षण, संरचना, उपरिभार प्रकार, रेगोलिथ मोटाई की

जांच/ सत्यापन और अद्यतन करने के लिए फील्ड कार्य किया गया था। इसके अतिरिक्त फील्ड कार्य के दौरान दर्जित भूस्खलन के लिए 41 बिंदु भू-मापदंडों को दर्ज करके अद्यतन भूस्खलन सूची डेटाबेस बनाया गया।

विभिन्न सड़क खंडों पर 115 भूस्खलन दर्ज किए गए। सभी भूस्खलन का मूल कारण ढलान संशोधन और मानसून के दौरान भारी बारिश हैं। 115 भूस्खलन में से 75 भूस्खलन राष्ट्रीय राजमार्ग एनएच -73 पर कोठीघरे उज्जिरे रोड सेक्शन (चारमाडी घाट सेक्शन) में दर्ज किए गए हैं। अधिकांश भूस्खलन प्रकृति में उथले अनुवाद मलबे की स्खलन हैं।

पोस्ट-फील्ड अवधि के दौरान, पूर्ण भूस्खलन संवेदनशीलता मानचित्र तैयार करने के लिए क्षेत्रीय इनपुट के अनुसार विषयगत मानचित्र अपडेट किए गए। कार्यक्षेत्र में पर्याप्त भूस्खलन संख्या में कमी होने के कारण भूस्खलन संवेदनशीलता विश्लेषण के लिए हेरिस्टिक (अप्रत्यक्ष ज्ञान संचालित) विधि अपनाई गयी है। अंतिम भूस्खलन संवेदनशीलता मानचित्र के अनुसार, क्षेत्र का 63% भाग निम्न संवेदनशीलता क्षेत्र के अंतर्गत आता है, इसके बाद 28% और 9% क्षेत्रफल क्रमशः मध्यम और उच्च संवेदनशीलता क्षेत्र के अंतर्गत आता है। अध्ययन क्षेत्र में दर्ज 115 भूस्खलनों में से 66 (57%) भूस्खलन उच्च संवेदनशीलता वाले क्षेत्रों में आता है, इसके बाद 38 (33%) और 11 (10%) भूस्खलन क्रमशः मध्यम और निम्न संवेदनशीलता क्षेत्रों में पड़ते हैं। इसलिए, पूरी तरह से, 115 भूस्खलनों में से, कुल 104 (90%) भूस्खलन उच्च और मध्यम संवेदनशीलता क्षेत्र के अंतर्गत आता है जो इंगित करता है कि ज्ञान संचालित विधि द्वारा प्राप्त अंतिम संवेदनशीलता मानचित्र हमारे वर्तमान अध्ययन क्षेत्र के साथ पूरी तरह फिट (उचित) है।

**MACRO – SCALE (1:50,000) LANDSLIDE SUSCEPTIBILITY MAPPING IN
PARTS OF TOPOSHEET NOS. 48O/07 AND 48O/08, CHIKMANGALURU
AND DAKSHIN KANNAD DISTRICTS, KARNATAKA**

(FSP CODE: M4LSSM/NC/SR/SU-KG/2017/12200)

(FIELD SEASON: 2017 – 2018)

By

**Tanvi Gupta, Geologist
Sunandan Basu, Geologist**

ABSTRACT

National Landslide Susceptibility Mapping (NLSM) is a very ambitious as well as important programme of GSI launched all over India in 2014 with the objective to prepare (i) landslide inventory database using high resolution remote sensing data and field inputs, (ii) toposheet wise 1:50,000 scale spatial database for geo-factors of landslide for use as input maps and (iii) landslide susceptibility map using multi class index overly method in a GIS platform. National Landslide Susceptibility Mapping (NLSM) of 1498 sq. km area was carried out in parts of Chikmangaluru and Dakshin Kannad districts, Karnataka under the annual programme of Geological Survey of India, Southern Region, vide FSP code no: M4LSSM/NC/SR/SU-KG/2017/12200 for the field season 2017 – 18. The study area covers two Survey of India toposheet, viz. 48O/07 and 48O/08.

Physiographically the area has a mixed topography represented by both hilly areas and flat terrain with altitude ranging from 1892 m above the mean sea level in the western part near Kudremukh head to 111 m above mean sea level on the bank of Mundaje Hole in the southern part of the area. The western, south western and south eastern part of the study area are mostly rugged that forms part of Malnad region of Western Ghats represented by lowly to moderately dissected hilly slopes. Considerable human interference in the form of urbanization, establishment of new dwellings, road network and mining activity is slowly and continuously modifying the physiography of the area. The area is drained by Tunga River, Bhadra River, Netravathi River, Aniyurhole, Mundajehole and their tributaries. The drainage pattern of the area is dendritic to sub – dendritic to radial in nature except at few places where

the drainage pattern becomes parallel.

Geologically, the area exposes rocks belonging to Sargur Group, Peninsular Gneissic Complex – I (PG – I), Bababudan Group and Chitradurga Group of rocks intruded by granite, quartz veins and dolerite dykes. Due high degree of tropical weathering, laterization is observed at a few places. The area is known as the type area for Bababudan Group of rocks which are well developed here.

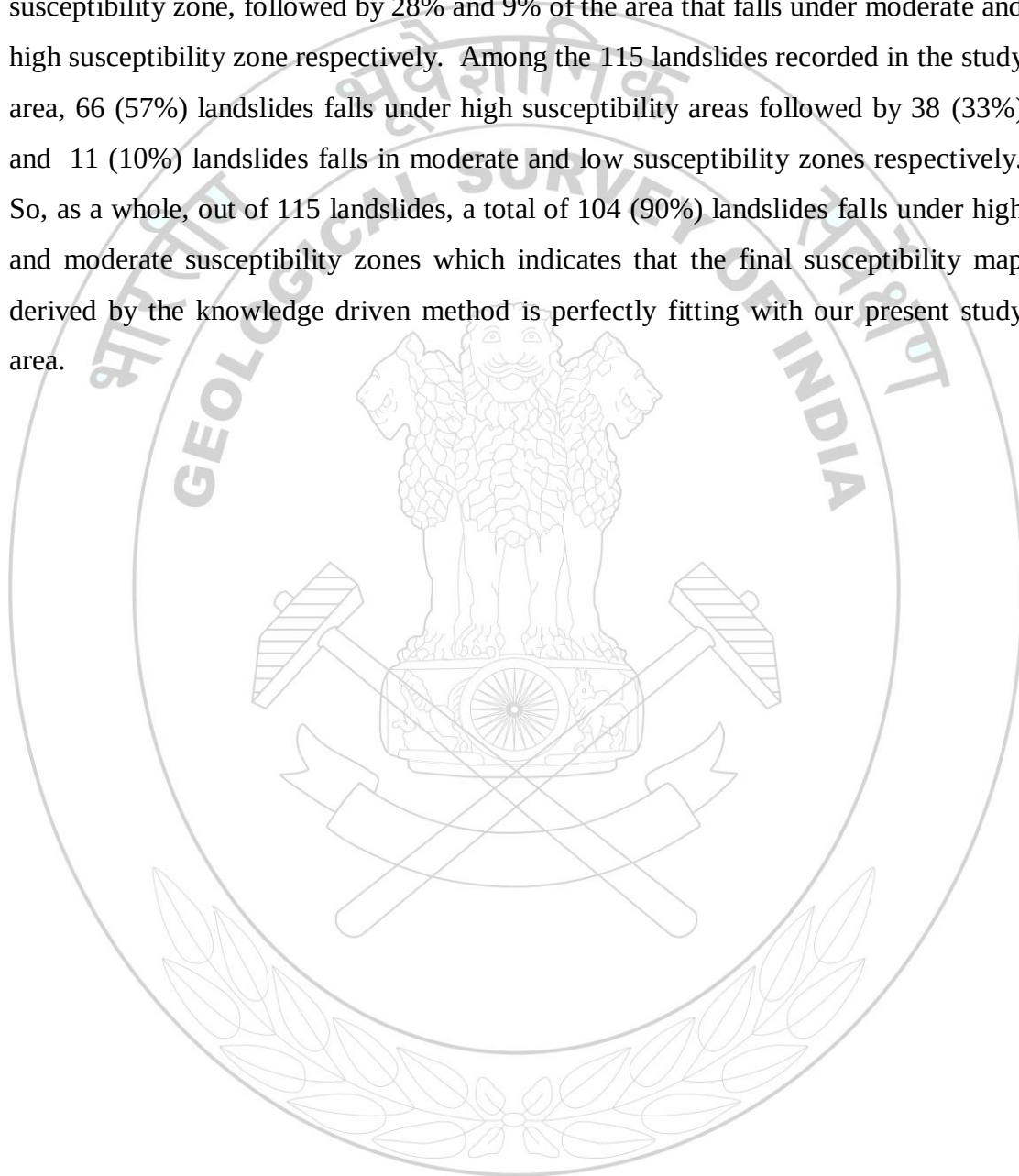
As per the SOP, NLSM programme can be divided into three different parts, viz. (i) pre – field study, (ii) field validation and (iii) post field study. During pre – field studies, pre – field thematic maps are being prepared from google earth imageries and DEM data. Field validation stage includes validation of the pre field maps at all accessible locations at the field. During post – field studies, the pre – field maps are updated as per field inputs. Once all the modifications in the pre – field maps are attended, final landslides susceptibility map is generated using the knowledge driven method (AHP) of modelling as the area does have adequate landslide data to perform data driven modelling. The present FSP was carried out as per the guidelines of the NLSM SOP.

Pre – field thematic maps such as geomorphological map, land use – land cover map, slope forming material map, regolith thickness map, slope morphometry map (Slope Angle, Slope Curvature and Slope Aspect) and drainage maps along with landslide inventory maps were prepared by digitizing features / classes in google earth imageries and some spatial analyst procedures using DEM data in Arc-GIS.

Field work was carried out to check / validate and update pre – field maps such as land use land cover, geomorphology, slope forming material, regolith thickness etc. at regular intervals. Apart from this, landslides inventory of the area was updated by recording the 41 parameter datasheet for all the recorded landslides.

115 landslides were recorded along different road sections and the root cause of all the landslides are slope modification and heavy rainfall as triggering factor during monsoons. Out of 115 landslides, 75 nos. of landslides are recorded along the NH – 73 in Kothighere – Ujire road section (Charmadi Ghat section). Majority of the slides are shallow translational debris slide in nature.

During the post – field period, the thematic maps were updated as per the field inputs for preparation of the final landslide susceptibility map. As the area lacks adequate nos. of landslides for performing data driven method of modelling, heuristic (indirect knowledge driven) method is adopted for landslide susceptibility analysis. As per the final landslide susceptibility map, 63% of the area falls under low susceptibility zone, followed by 28% and 9% of the area that falls under moderate and high susceptibility zone respectively. Among the 115 landslides recorded in the study area, 66 (57%) landslides falls under high susceptibility areas followed by 38 (33%) and 11 (10%) landslides falls in moderate and low susceptibility zones respectively. So, as a whole, out of 115 landslides, a total of 104 (90%) landslides falls under high and moderate susceptibility zones which indicates that the final susceptibility map derived by the knowledge driven method is perfectly fitting with our present study area.



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CHAPTER – 1

INTRODUCTION

1.1 Background Information

Geological Survey of India (GSI) has been carrying out landslide susceptibility zonation / mapping on macro scale (1:50,000 / 25,000) since last 3 to 4 decades. However, compared to the available landslide-prone areas in India (~0.42 million sq. km spreading over 1112 toposheet of Survey of India on 1:50,000 scale, excluding the permafrost regions), the target achieved so far by GSI (~119,080 sq. km till FS 2016 – 17) is quite less. This warrants GSI, being the nodal agency for landslide studies in India, to impart maximum stress towards completion of this basic data generation work on landslides by aiming to complete the remaining task at a much faster pace than what has been followed by GSI so far. This matter was deliberated in detail at the Regional Workshop on Landslide Disaster Management at Shillong on 22 – 23 November, 2013 and the Joint Secretary, Ministry of Mines has also advised GSI to revamp and fasten its endeavour of the important task for completing the remaining targets of landslide susceptibility mapping / zonation as early as possible.

Accordingly, since FS 2014 – 15, GSI undertook a national programme on landslide susceptibility mapping – Macro scale (1:50,000) National Landslide Susceptibility Mapping (NLSM) with an aim to cover the remaining targets expeditiously.

Landslides are one of the common natural as well as man-made hazards in India. Out of the 0.42 million sq. km (12.6% of land area) landslide prone areas of the country, 0.034 million sq. km falls in parts of Karnataka & Goa state. Mostly the western parts of Karnataka and Goa districts are vulnerable to landslides.

The National Landslide Susceptibility Mapping (NLSM) programme of Geological Survey of India (GSI) was launched with the following objectives:

- (i) To prepare landslide inventory database using high resolution remote sensing data and field inputs.
- (ii) To prepare Toposheet-wise 1:50,000 scale spatial database for geofactors of landslides for use as input maps.
- (iii) To prepare landslide susceptibility map using multi-class index overlay method in a GIS platform.

1.2 Study Area

Karnataka is a state situated in south western part of India. Karnataka is bounded by Goa in the north - west, Maharashtra in the north, Telengana in north-east, Andhra Pradesh in the east, Tamil Nadu in south - east, Kerela in south & south - west and Arabian Sea and Laccadive Sea in the western part. Karnataka possesses a total stretch of around 300 km of coast line between Mangalore, Dakshin Kannada, Karwar and Uttar Kannada district.

The area under study covers parts of Chikmangaluru and Dakshin Kannada districts of Karnataka, hence the entire area comes under the administrative jurisdiction of Chikmangaluru and Dakshin Kannada districts. The study area falls in Survey of India toposheets 48O/07 and 48O/08. These two toposheet covers an area of 1498 sq. km. The toposheet 48O/07 is bounded by longitude 75°15' 00" E to 75°30' 00" E and Latitude 13° 15' 00" N to 13° 30' 00" N whereas the toposheet 48O/08 is bounded by longitude 75°15' 00" E to 75°30' 00" E and Latitude 13° 00' 00" N to 13° 15' 00" N (Refer: Plate – 1). The entire area falls under parts of Sringeri, Koppa, Narasimharajapura, Chikmangaluru, Mudigere (Chikmangaluru district) and Beltangari (Dakshin Kannada district) taluks. The important localities situated in the study area are Sringeri, Jayapura, Balehonnuru, Magundi, Kalasa, Hornadu, Charmadi, Ujire etc. The area can be accessed by Road, Rail, Sea and Air. Most of the area is well connected by National Highway (NH), State Highways (SH) and all

weathered metal roads except the western and south western part of the area, because of the presence of Charmadi Ghat section. NH – 73 passes through the southern part of the area in south west – north east direction. Even though this road is named as national highway, the road is narrow at places in the Charmadi Ghat section (Ujire – Kothighere stretch). NH – 169 passes through the north western part of the study area (Sringeri – Koppa stretch). Apart from the NH, the area is well connected by state highways such as SH – 106 (Hornadu – Kothighere stretch), SH – 66 (Magundi – Kudremukh stretch) and SH – 27 (Balehonnuru – Sringeri stretch). Moreover, the area is also very well connected by several metalled and non-metalled roads. The nearest railway station is Sakleshpur which comes under operations of South Western Railway. Nearest international airport is located at Mangaluru and sea port is located at Panambur.

1.3. Physiography and Drainage

Physiographically the area has a mixed topography represented by both hilly areas and flat terrain with altitude ranging from 1892 m above the mean sea level in the western part near Kudremukh head to 111 m above mean sea level on the bank of Mundaje Hole in the southern part of the area. Majority of the study area (except some areas in the north eastern, north western and south western part) are mostly rugged terrain that forms the part of Malnad region of Western Ghats represented by lowly to moderately dissected topography with high hills and linear ridges and valleys. Some of the prominent peaks of the area are Kanchiganatti ($\Delta 1439$ m), Mertiparvata ($\Delta 1659$ m) and Kotihola Gudda ($\Delta 1892$ m) m above mean sea level. Considerable human interference in the form of urbanization, establishment of new dwellings, road network and mining activity is slowly and continuously modifying the physiography of the area.

The area receives an average annual rainfall of around 3000 mm. The area is drained by Tunga River, Bhadra River, Netravathi River, Aniyurhole, Mundajehole and their tributaries. Tunga River and its tributaries drain the northern and north western part while Bharda River and its tributaries drain the central part of the study area. Netravathi River, Aniyurhole, Mundajehole and their tributaries drain the southern part of the study area. The drainage pattern of the area is dendritic to sub – dendritic to radial in nature except at few places where the drainage pattern becomes

parallel.

1.4 Present Work

National Landslide Susceptibility Mapping (NLSM) of 1498 sq. km area was carried out in parts of Chikmangaluru and Dakshin Kannada district, Karnataka under the Annual Programme of Geological Survey of India, Southern Region, vide FSP code no: M4LSSM/NC/SR/SU-KG/2017/12200 for the field season 2017 – 18. The study area covers two Survey of India toposheet, viz. 48O/07 and 48O/08. The nature and target of work envisaged for Field Season Programme of 2017 – 18 and the achievements are given in Table – 1.

Table – 1: Nature, quantum of work and achievement

Nature of work	Target for FS 2017 – 18	Achievement for FS 2017 – 18
1. Pre-field preparation		
i. Preparation of Thematic maps (in GIS on scale 1:50,000)		
(a) Slope Forming Material map	1498 sq. km	1498 sq. km
(b) Geomorphology & Lineament map	1498 sq. km	1498 sq. km
(c) Slope Morphometry (slope, aspect & curvature) map	1498 sq. km	1498 sq. km
(d) Land use – Land cover map	1498 sq. km	1498 sq. km
(e) Drainage map	1498 sq. km	1498 sq. km
(f) Regolith thickness map	1498 sq. km	1498 sq. km
ii. Preparation of Landslide Inventory Map	1498 sq. km	1498 sq. km
2. Field-based studies		
(i) Field-checking of all thematic maps	1498 sq. km	1498 sq. km
(ii) Field checking and collection of landslide inventory attributes (41 point geo -parametric sheet)	1498 sq. km	1498 sq. km (115 Landslides)
3. Post-field studies & modelling		
(i) Updation of thematic and inventory maps in GIS	1498 sq. km	1498 sq. km
(ii) Landslide susceptibility modelling and finalization of landslide susceptibility map in GIS	1498 sq. km	1498 sq. km
4. Collection of rainfall data from available rain stations	1498 sq. km	1498 sq. km (Collected available data)

The fieldwork was carried out from 20th September 2017 to 17th February 2018. Table – 2 gives a briefing of total man days spent for the current item. Total

169 man days were spent in the field, which also includes six days of field supervision by Shri. J. Srihari, Director. The post field landslide susceptibility modelling was carried out in SU: K & G, Bengaluru.

Table – 2: Details of man days spent for the current item

Name and Designation	2017				2018		Total (Days)
	Sep	Oct	Nov	Dec	Jan	Feb	
Tanvi Gupta, Geologist	3	-	25	14	21	17	80
Sunandan Basu, Geologist	3	-	25	17	23	15	83
J. Srihari, Director	-	-	3	-	-	3	6

1.5 General Geology

Geologically, the area exposes rocks belonging to Sargur Group, Peninsular Gneiss – I (PG – I), Bababudan Group and Chitradurga Group of rocks intruded by granite, quartz veins and dolerite dykes. The area is known as the type area for Bababudan Group of rocks which are well developed here (Refer: Plate – 2). The brief descriptions of the lithounits are given below (after geological note of compiled 1:50000 geological map of GSI).

➤ **Sargur Group:**

Sargur Group are mostly seen in the western segment of the area as envelopes of varying dimensions within PG – I and it consists banded magnetite quartzite, kyanite – muscovite schist, & amphibolite.

➤ **Peninsular Gneissic Complex (PGC):**

PGC is represented by granite & granite gneiss and is occupying major part of the area. The gneisses are medium to coarse grained, mesocratic consists quartz, plagioclase and biotite. They also exhibit migmatitic banding at places.

❖ **Dharwar Supergroup**

The Dharwar Supergroup in the area is represented by Bababudan Group of rocks and Chitradurga Group of rocks.

➤ **Bababudan Group:**

Bababudan Group of rocks is represented by Kudremukh Formation, Kodachadri Formation, Kalasapura Formation, Santhaveri Formation and Mullaingiri Formation in the study area. Kudremukh and Kodachadri Formations are exposed in the central part of the area while Kalasapura, Santhaveri and Mullaingiri Formations are exposed in the eastern part of the area.

Kudremukh Formation consists of amphibolite, meta basalt, quartzite, banded magnetite quartzite & metaultramafite. Amphibole is fine to medium grained, dark green in colour, amygdular occurring as small lensoidal body along with meta basalt 2 km south west of Venigudda Δ 1026 m hill. Meta basalt is the major litho unit in this segment of the Western Ghat schist belt. Meta basalt is fine grained, greenish in colour consisting chlorite, actinolite, epidote and plagioclase. Quartzites occur as small linear / lensoidal body in the eastern margin of the schist belt and exposed at the top of Δ 1157 m hill. Persistent bands of banded magnetite quartzite occurring along with meta basalt confined to the central part of the area. Metaultramafites occurs as linear folded bands in western part and as tabular bodies within meta basalt near the eastern margin of the schist belt. Meta ultramafites is greyish green in colour, fine grained consisting talc – actinolite – tremolite and chlorite.

Kodachadri Formation consists of banded magnetite quartzite and chlorite schist with bands of banded magnetite quartzite and is exposed in south western corner near Jambale.

Kalasapura Formation consists of amphibolite occur along the eastern margin as linear bands and as lensoidal bodies within meta basalt of Mullaingiri Formation. Amphibolite is fine grained, dark green, consists hornblende, plagioclase and minor amounts of quartz and biotite.

Santhaveri Formation consists of meta basalt and bands of magnetite quartzite are confined to western margin of the Bababudan schist belt in this segment. Metabasalt is fine grained, consists chlorite, actinolite, epidote and plagioclase.

Mullaingiri Formation is represented by meta basalt, banded magnetite quartzite, carbonaceous phyllite and ferruginous phyllite. Metabasalt occupy the central part of the schist belt and is fine grained, schistose consists chlorite, actinolite,

epidote and plagioclase. A small lensoidal body of limestone is exposed along the western margin of the schist belt in the south eastern part of the area. Limestone is fine to medium grained, grey coloured, consists mainly recrystallized calcite. A lensoidal body of carbonaceous phyllite is present within ferruginous phyllite which is exposed 1.5 km east of Maduguni.

➤ **Chitradurga Group:**

Chitradurga Group is represented by Jhandimatti and Joladhal Formations in the study area.

Jhandimatti Formation occupies the central part of the area and consists of conglomerate, amphibolite, banded magnetite quartzite, chlorite schist and garnet biotite schist. A small band of conglomerate is exposed in the southern part of the area south of Basarikatte at the contact of Kudremukh and Jhandimatti Formations. Amphibolite occurs as small outcrops in the eastern margin of the belt in the northern part of the area. Amphibolite is fine grained, dark green consists of hornblende, plagioclase and minor amounts of quartz and biotite. Amphibolite is followed by banded magnetite quartzite and chlorite schist. Chlorite schist is major unit in this segment. It is fine grained, light green, well foliated and mostly consists of quartz – chlorite. Chlorite schist is followed by garnet biotite schist in this segment.

Joldhal Formation consists of ferruginous phyllites and banded magnetite quartzite. Ferruginous phyllite is fine grained, well foliated, fissile and confined to the central part of the schist belt. Iron and manganese quartzite occurs as persistent bands within phyllites.

➤ **Younger Intrusive:**

Younger Intrusive Granites: Granite intruding into PG – I and schist belts is observed in the central part of the area. It is grey coloured, mesocratic and coarse grained rock. It consists of quartz, plagioclase and minor amounts of biotite. It is exposed near Hornadu and Galigandi.

Basic Intrusive: Basic intrusive is represented by dolerite and gabbro dykes trending in north west – south east and north – south directions. Dolerite is fine to medium grained; dark green consists mainly of pyroxenes and plagioclase.

Acidic Intrusive: Acid intrusive is represented by quartz veins and intrusive granite in the central part of the area.

➤ **Laterite:**

Due to high degree of tropical weathering laterization is observed in few places in the study area. The laterites are reddish in colour and rich in ferric / aluminium oxides. The lateritic weathering profiles exhibits three zones viz. duricrust, underlying clays and bottom saprolite unit. Variation in mineralogy and texture of the parent rock has resulted in the Formation of ferruginous, manganiferous and aluminous laterite. Laterite body is exposed in the south western part of the study area.

❖ **Structure:**

Bedding (S_0) in banded magnetite quartzite, schistosity (S_1) in schist rocks and gneissosity (S_1) in gneisses are the major planar features. The bedding in banded magnetite quartzite is striking in north – south direction and dipping easterly in Shimoga schist belt rocks, north west – south east in Western ghat schist belt, north – south to north north east – south south west dipping steep to west in Bababudan belt. A major synformal fold plunging towards south is recorded within Shimoga belt in the southern part. Gneissosity in gneiss varies from north – south to $N10^\circ W$ to $S10^\circ E$ with steep dips towards east.

❖ **Economic importance:**

Iron ore occurrences were recorded in banded magnetite quartzite in the southern part of Shimoga schist belt. Incidences of clay ore reported in PG – I at 2 km east of Settihalli ($13^\circ 26' 30'' N$, $75^\circ 17' 20'' E$). Corundum occurrences are recorded within PG – I in the western part of the area. Kyanite occurrences are reported within kyanite – muscovite schist, 3 km south of Sringeri ($13^\circ 25' 00'' N$, $75^\circ 15' 05'' E$), 2 km south of 1103 hill and just south of Kalasa. In addition, granite, gneisses and dolerites are being quarried for construction purpose.

Table – 3: *Regional Stratigraphy of the study area*

Age	Supergroup	Group	Formation	Lithology
Cenozoic				Laterite
Palaeo-proterozoic		Younger Intrusive	Acid Intrusive	Quartz vein
			Basic Intrusive	Gabbro
				Dolerite
			Younger granite	Granite
Archean	Dharwar Supergroup	Jaldhal		Banded magnetite quartzite Ferruginous phyllite
		Chitradurga		Garnet biotite schist Chlorite schist
		Jhandimatti		Banded magnetite quartzite Amphibolite Conglomerate
		Mullainagiri		Meta basalt Banded magnetite quartzite Carbonaceous phyllite Ferruginous phyllite
		Shantaveri		Banded magnetite quartzite Meta basalt
		Kalaspura		Amphibolite
		Bababudan		Banded magnetite quartzite Chlorite schist
		Kodachadri		
		Kudremukh		Meta ultramafic rock Banded magnetite quartzite Quartzite Meta basalt Amphibolite
	Peninsular Gneissic Complex	Peninsular Gneiss – I	Granitoid	Granite
			Gneisses	Granite Gneiss
		Sargur		Banded magnetite quartzite Kyanite muscovite schist Amphibolite

(After 1:50,000 compiled geological map, GSI)

1.6 Methodology

For a qualitative landslide susceptibility mapping, the following methodology was adopted, which is shown as a flow diagram in Diagram – 1 & 2. In literature, there are many methods of predictive mapping of landslide susceptibility. However, application of any of the prevalent methods warrants utmost care and prudence by the landslide scientists because landslides are product of interaction of several geo-environmental spatial factors. For modelling, Multi Class Index Overlay Method is adopted using heuristic (knowledge driven) techniques where individual ratings for geofactor classes and weights of geofactor are determined with the prior knowledge of the terrain and after discussion with the local experts. Once the initial ratings are fixed, LOFS (Landslide Occurrence Favourability Score) is determined using Analytical Hierarchy Process (AHP) after preparing the pair wise qualitative comparison matrix of all factors (Saaty, 1977). In NLSM the above methodology was carried out on GIS platform.

National Landslide Susceptibility Mapping (NLSM) includes three components; such as pre-field mapping, field validation and post field updation & landslide susceptibility modelling.

Pre-field mapping:

During pre-field period, landslide inventory and different thematic pre-field maps were prepared using different source data. The pre-field maps are as follows:

(i) **Landslide inventory:** Landslide inventory is prepared using old reports, multi temporal Google imagery and LISS III / LISS IV data as source data in Arc – GIS software (Refer: Plate – 11).

(ii) **Slope Morphometry (Slope Angle, Curvature and Aspect):** Slope Morphometry (Slope Angle, Curvature and Aspect) pre-field maps (Refer: Plate – 3, 4 & 5) were prepared using Carto DEM (freely downloadable from bhuvan portal; bhuvan.nrsc.gov.in) data as one of the input data sources. Though the NLSM is carried out on 1: 50,000 scale, and as the difference of slope angle is relatively lesser in Southern India compared to the mighty Himalayas, to get precise coarse resolution in Slope Angle and Curvature map, the slope morphometry maps were prepared from its original 30 m X 30 m resolution data.

(iii) **Drainage map:** Drainage pre-field map was prepared using Carto DEM of 30 m X 30 m resolution (Refer: Plate – 6).

(iv) **Land Use Land Cover map (LULC):** Land Use Land Cover (LULC) pre-field map was prepared using multi temporal google imagery and Arc – GIS base map (Refer: Plate – 7.1).

(v) **Geomorphology map:** Geomorphology pre-field map was prepared using multi temporal Google imagery, Arc – GIS base map and 1:50,000 scale NGLM legacy map (Refer: Plate – 8.1).

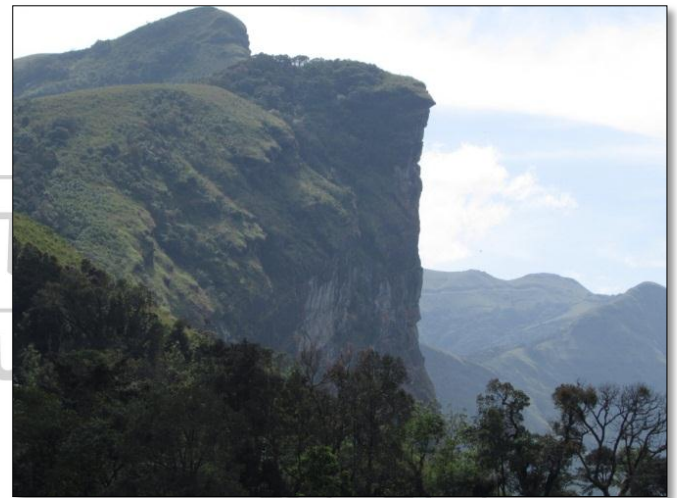
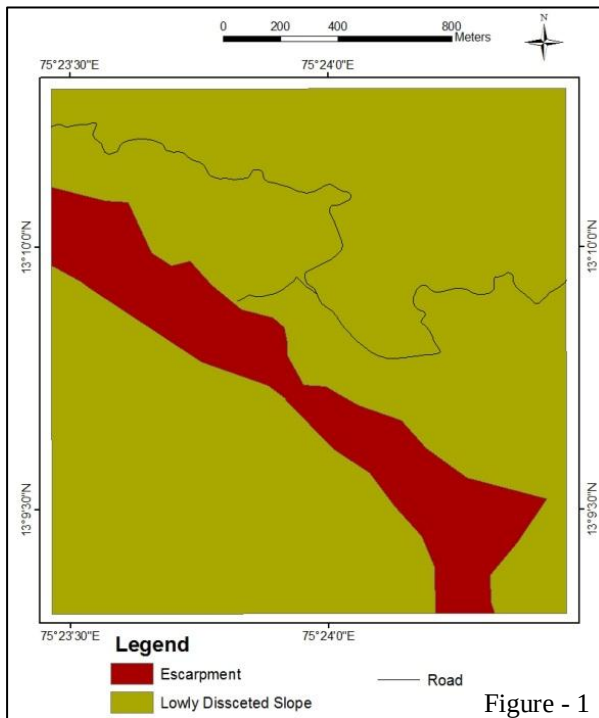
(vi) **Slope Forming Material map (SFM):** Slope Forming Material (SFM) pre-field map was prepared using multi temporal Google imagery, Arc – GIS base map, 1:50,000 scale geological legacy map and proxies from LULC and geomorphology maps (Refer: Plate – 9.1).

(vii) **Regolith Thickness map:** Regolith Thickness pre-field map was prepared using multi temporal Google imagery, proxies from geomorphology map and slope map (Refer: Plate – 10.1).

Field validation of thematic maps:

During the field validation period, all the pre-field maps were validated in the field by visiting all the assessable locations and the modifications, if any, are recorded. The landslide points from pre – field landslide inventory are also checked and if any new slides are encountered in the field the existing landslide inventory is updated. The example shows the field validation of the pre – field thematic maps.

Figure – 1 is an example from pre – field geomorphology map where the area near Maidadi village in TS no 48O/08 is marked as escarpment during pre – field mapping. The map was validated in field and the photograph shows the view of the escarpment from the road. In this way, the pre – field geomorphology map is validated at all accessible locations and likewise all thematic maps are validated during field work.



View of Escarpment near Maidadi in TS no 48008.

Figure - 1

Post field updation and landslide susceptibility modelling:

After the field validations are complete, all the thematic maps and landslide inventory were updated as per the field inputs. The example shows the post field updation of pre – field thematic maps as per field inputs.

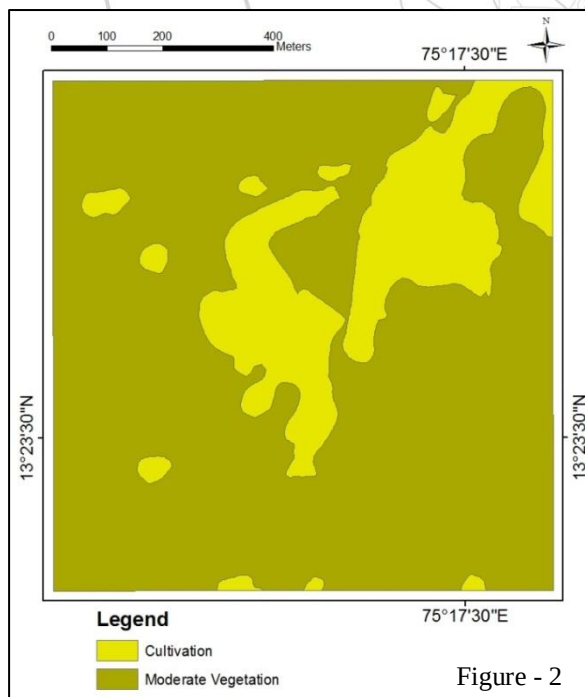


Figure - 2

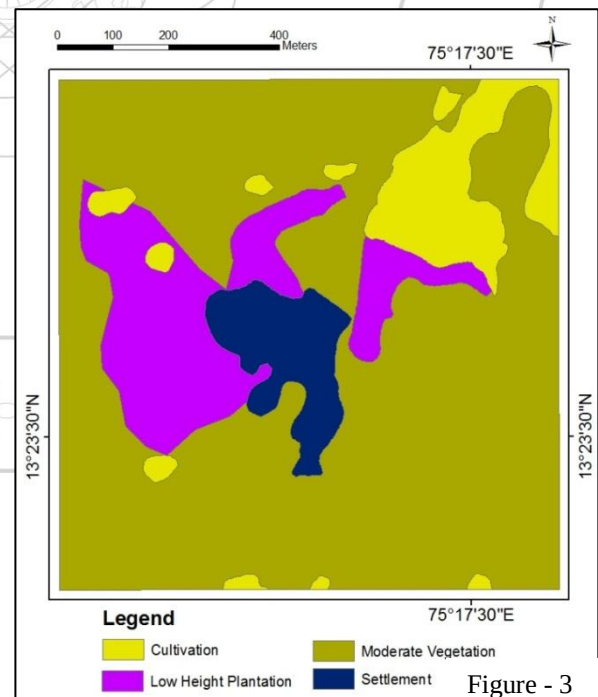


Figure - 3

Figure – 2 is the pre – field land use land cover map from TS no 48O/07. During the field work, field data was collected from the area and as per the field inputs the pre – field map is updated during the post field period. Figure – 3 shows the post field (updated) land use land cover map for the same area. In Figure – 2, only two land use land cover classes i.e. cultivation and moderate vegetation are mapped during pre – field mapping but after the updation of the pre – field maps as per field inputs, four land use land cover classes are present i.e. cultivation, moderate vegetation, plantation (LHP) and settlement. In this way, the pre field land use land cover map is updated as per field inputs and likewise all the thematic maps are updated as per field inputs.

Subsequent to the updation of the thematic maps and landslide inventory, heuristic (knowledge driven) techniques were adopted for modelling and generation of final susceptibility map of the area. For modelling using heuristic (knowledge driven) techniques, initial individual ratings for geofactor classes and weights of geofactors are fixed with the knowledge of terrain and with discussion with local experts for the entire area. Later the LOFS (Landslide Occurrence Favourability Score) is calculated using Analytical Hierarchy Process (AHP) after preparing the pair wise qualitative comparison matrix of all factors (Saaty, 1977). The steps of landslide susceptibility modelling (Refer: Diagram – 2) using heuristic (knowledge driven) process is as below:

- A total of eight factor maps, viz., Slope Angle, Aspect, Curvature and Drainage (derived from 30 m Carto DEM), Geomorphology and Land use – Land cover (prepared using multi-temporal Google imageries and SPOT images), Slope Forming Material and Regolith Thickness (through field-based studies and GSI 1:50,000 Geological Map as base maps) were prepared for susceptibility analysis. Besides these maps, Landslide Inventory map was also prepared using old inventory data from reports/ notes/ archives of GSI and new landslides augmented in the field.
- All the above eight maps were used for assessment of factor class ratings. However, only six thematic maps (except aspect and drainage) were considered for validation of Landslide Susceptibility Map (LSM) of the study area, due to the absence of identified factor classes in a particular map.

- All the thematic maps are converted to raster keeping field as “class” and output cell size as “50” (as NLSM is a 1:50,000 scale mapping) in GIS.
- Once all the ratings for geofactor classes and weights of geofactors are fixed, LOFS is calculated using pair wise comparison matrix and fraction rating.
- After calculation of LOFS for all the geofactor classes, LOFS maps of the geofactors are prepared in GIS.
- Once all the LOFS maps are prepared, raw landslide susceptibility score map is prepared using weighted multi class index overlay method in GIS.
- After raw landslide susceptibility score map is prepared classified landslide susceptibility map is prepared and determination of break values was carried out by assigning weightages (30% is the boundary between low to moderate susceptibility and 50% is the boundary between moderate to high susceptibility).

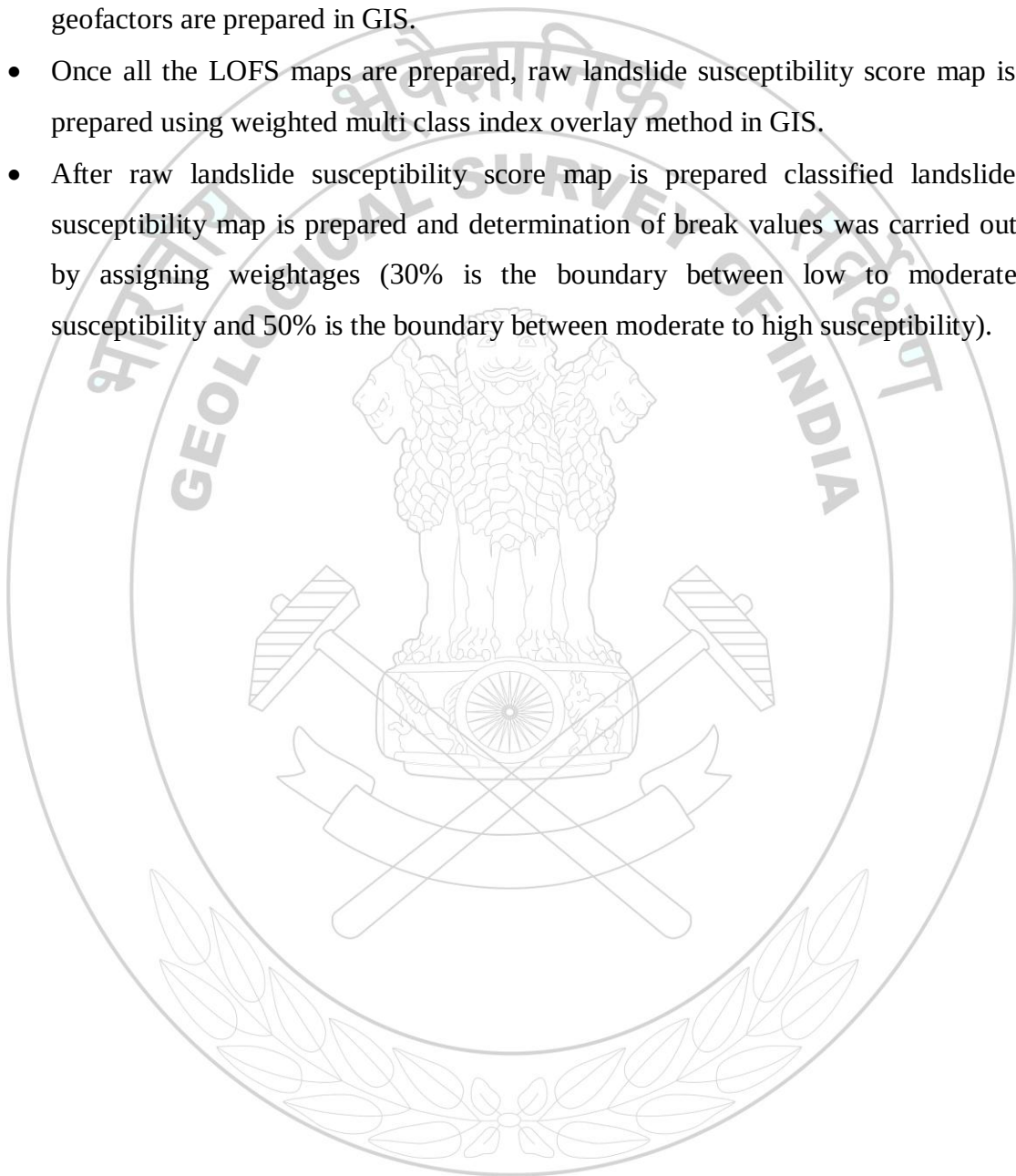
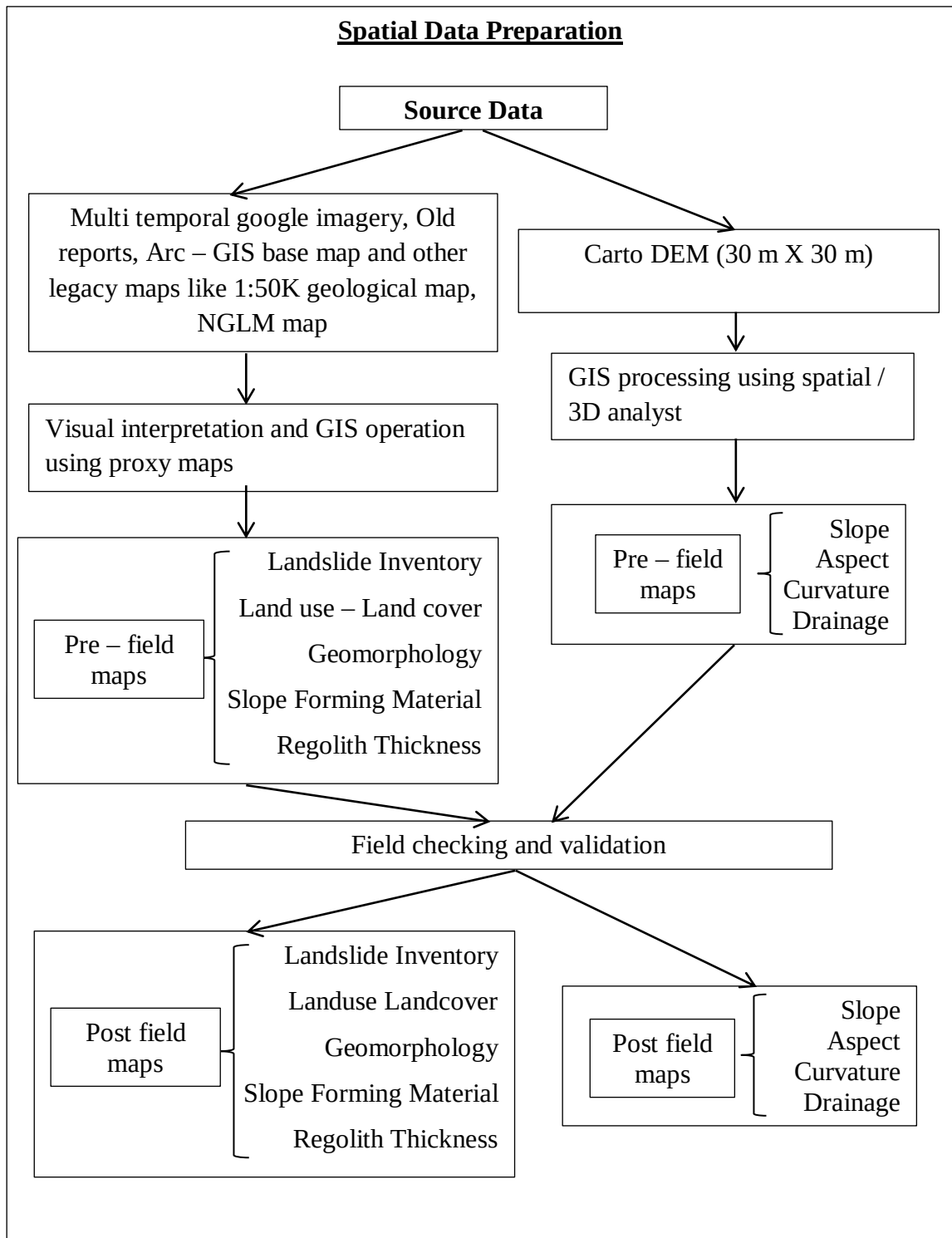
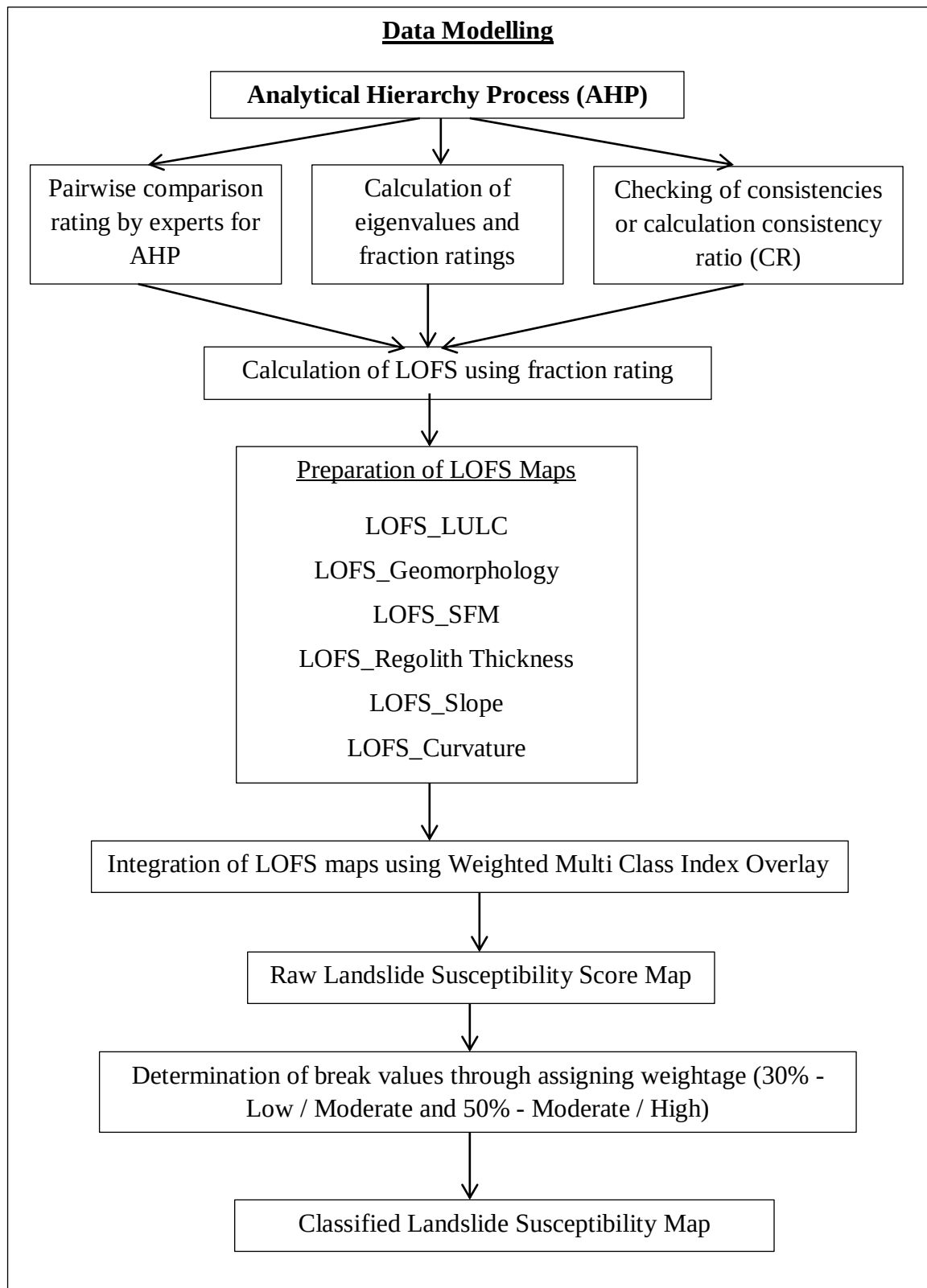


Diagram – 1: *Flow diagram showing process of Landslide Susceptibility Mapping*



*Diagram – 2: Flow diagram showing process of knowledge driven modeling for
Landslide Susceptibility Mapping*



1.7 Acknowledgements

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CHAPTER – 2

PREVIOUS WORK ON LANDSLIDE STUDIES

2.1 Landslides

Landslides are one of the very common natural as well as man-made hazards in India. Mostly the western part of the Karnataka state is vulnerable to landslides. Our present study area, being a part of the western Karnataka, has also been affected by landslide events rather frequently especially during monsoons. Moreover, Geological Survey of India, being the nodal agency for landslide studies in India, has been working in the area for few years for preparing landslide inventory and landslide hazard zonation. Additionally, few site specific and post disaster studies had also been taken up.

The present study area covers parts of Chikmagalur and Dakshin Kannada districts, Karnataka.

During FS 2008 – 09, Maruthi K.V; Pradhan U.P and Mishra A.K carried out “Landslide inventory along NH & SH of ghat roads in Chikmagalur, Coorg and Shimoga districts, Karnataka”. In this report among the various road sections, parts of Kothighere to Kalasa and Kothighere to Charmudi Ghat section comes under present study area. The authors recorded total 69 nos. of landslides along these road sections. As per their observation, all the landslides were rainfall triggered, shallow debris slide in nature. The cut slope height and angle plays a very important role as a root cause for the initiation of the landslides. The average overburden thickness recorded in the area was 4 – 5 m mostly consisting of soil and weathered rock. The authors recommended for proper drainage management system, as several blockages were found and suggested to avoid vertical slope cut in future and to construct retaining wall as per site conditions.

During FS 2008 – 09 and 2009 – 10, Mishra A.K; Pradhan U.P and Maruthi K.V carried out “Landslide hazard zonation on macro scale of Charmudi ghat section from Charmudi to Kotigehara, Kotigehara to Kalasa and Sakleshpur to Uppinangadi in Dakshin Kannada and Chikmagalur districts, Karnataka”. In this report, the Charmadi Ghat section from Charmadi Ghat to Kothighere and parts of Kothighere to Kalasa and Chikmagalur district boundary to Belthangdy road section comes under

present study area. . The authors recorded total 98 nos. of landslides along these road sections. As per their observation, majority of the slides are debris slides occurred due to cutting of the natural slope for making road. The vertical cut slopes have failed due to heavy rain in the ghat section during monsoon. After the landslide hazard zonation analysis, it was observed that 18% of the area falls under very low hazard zone, 59% of the area falls under low hazard zone while 23% of the area falls under moderate hazard zone. The authors recommended for proper drainage management system as several blockages were found and suggested to avoid vertical slope cut in future and to construct retaining wall as per site conditions.

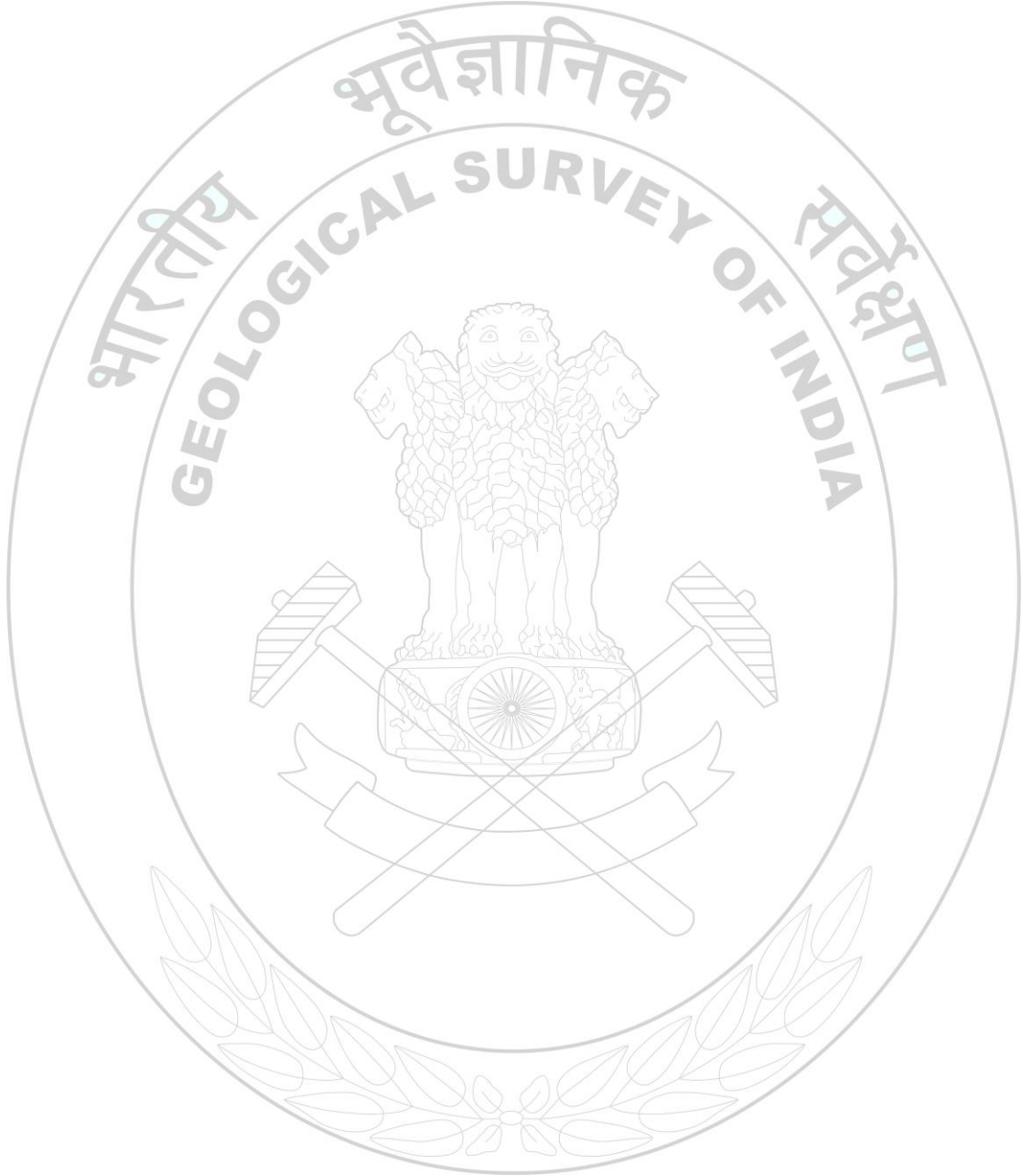
During FS 2009 – 10, Maruthi K.V and Mishra A.K carried out “Landslide inventory along NH & SH of ghat roads in Chikmagalur, Coorg, Dakshina Kannada, Udupi and Shimoga districts, Karnataka”. In this report among the various road sections, parts of Chikmagalur district boundary to Belthangdy, Aldur to Balehonnur and Balehonnur to Koppa comes under present study area. The authors recorded total 42 nos. of landslides along these road sections. As per their observation, all slides studied were caused due to human interference with natural slopes. The main cause of landslides in Western Ghats are toe cutting of hill slopes for the construction of road, modification for human settlement, highly weathered rock mass and high amount of rainfall during monsoons. All landslides are shallow debris slide in nature. The authors recommended for proper drainage management system as several blockages were found and suggested to avoid vertical slope cut in future and to construct retaining wall as per site conditions.

Apart from the landslide inventory and landslide hazard zonation studies, Maruthi K.V and Mishra A.K carried out “Preliminary post disaster study of the Landslide at Malvantige village, Belthangady taluk, Dakshina Kannada district, Karnataka” during FS 2008 – 09 and “Detailed site specific investigation of the landslide at Neriya, Belthangady taluk, Dakshina Kannada district, Karnataka” during FS 2009 – 10.

So, combining historical landslide data from all the previous works, data for a total of 102 nos. of landslide were collected for preparation of the pre – field landslide inventory.

2.2 Landslide Susceptibility

In the present study area no landslide susceptibility studies had been taken up previously. Landslide inventory study (FS 2008 – 09 and FS 2009 – 10), Landslide hazard zonation study (FS 2009 – 11), post disaster study (FS 2008 – 09) and site specific studies (FS 2009 – 10) were carried out.



CHAPTER – 3

LANDSLIDE INVENTORY

The generation of a landslide inventory is a tedious work as landslides occur individually and have to be identified, mapped and inventoried. Landslide inventories contain basic information about landslides such as location, classification, morphology, volume, run-out distance, activity and date of occurrence / activity, etc. Landslide inventory can be prepared through various methods such as detailed geomorphologic studies, mapping from remote sensing data and topographic maps, historical archive studies and interviews. In this study, satellite images and previous reports of Geological Survey of India are used as the main source for obtaining a multi-temporal landslide inventory.

3.1 Data Source

Landslides leave discernible signs on slopes, most of which can be recognized, classified and mapped in the field or from photo-interpretation (Varnes, 1978; Hansen, 1984). These signatures are mostly visible as morphological changes such as changes in slope type, break in slopes, hummocky surfaces, etc. These morphological signs are interpreted here to determine important landslide information such as type of failure, the surface area, cause and the run-out distance. Detailed and systematic field work was carried out to generate the 41-point attribute data for landslides.

Preparation of the landslide inventory commenced with the search of archival data sources, particularly published and unpublished reports of GSI. The SPOT images available as a base map (up to the resolution of 30cm) and high resolution Google imageries of different time periods (from 2002 to 2017) were used as the main sources for generating the multi-temporal landslide inventory.

3.2 Inventory Mapping

The following steps were used for mapping a landslide and building its inventory attribute.

- In Google Earth, every segment of the study area was viewed for all available time frames. As the study area falls under thick forest of Western Ghats, it is very difficult to identify landslides in Google imagery or Arc – GIS base map. Most of the slides are very small in dimensions and should ideally be represented as a

point on 1:50,000 scale. But for better representation, the slides are represented as polygons and in the process, few slide dimensions may be little bit exaggerated. Once the landslide is identified, the same is digitized as a polygon.

- The mapped polygon is then saved as .kml file and later imported to Arc GIS, wherein it is stored as polygon shapefile or geodatabase with WGS 1984 UTM projection (43N).
- The landslide polygons are then corrected with the help of the ESRI base map. Any shift in the spatial location of the polygon, due to shift in the multi-temporal images of Google Earth data, is adjusted manually. Few landslides were also mapped directly from SPOT data and scanned geo referenced toposheet in Arc GIS.
- For each landslide polygon, the attributes such as name, state, district, taluka, toposheet number, initiation and reactivation year based on dates of Google Earth images, slide type, slide material, length, width, surface area, cause, land use and element at risk is attached. Archival data were used for naming and defining the cause of the landslides.
- A systematic and detailed field check was then carried out to validate the pre – field map at all the accessible locations. The morphological signatures left by landslides on slopes were used to identify the shape of landslides.
- After identifying the landslides in the field, the morphological parameters (landslide scar length, width and depth) were noted carefully after measuring them in the field using a meter tape. Additional data such as landslide type, run – out distance, present land use – land cover, geology, regolith thickness, probable cause and damage details were also added to the inventory as per the 41 point geo parametric data sheets for landslides. The volume of mapped landslides was recalculated by multiplying the morphological parameters. Any new landslides identified were plotted in the topographic maps and were digitized as polygons and entered in a geodatabase of Arc GIS.

3.3 Spatial Distribution of Landslides

In total, 102 landslides were identified during the pre-field mapping from previous GSI report inputs. But during the field work few landslides were removed from the pre-field data base as those slides were not traceable in the field.

Additionally, few new landslides observed in the field were recorded as a part of the landslide inventory. All these landslides were recorded along different road sections in the study area. Landslides were classified as either “debris/earth slide”, “debris flows”, “rock slide” or “rock flows” following the classification proposed by Varnes (1978).

During the field work, 115 confirmed landslides were identified. All the landslides are located adjacent to the road and probably might have resulted as a combination of removal of toe material for the formation of road and heavy rainfall during the monsoons. Landslides caused under natural conditions are very rare. Most of the landslides are smaller in dimensions, initiated due to the cut slopes and are found to have no run-out as the road provided a horizontal base for accumulation of the slide material (debris / rock).

The spatial distributions of mapped landslides are given in Plate No – 11, whereas detailed inventory of 115 landslides as per 41 point geo parametric data sheet are given as Annexure – 2.

3.3.1 Landslide along road sections

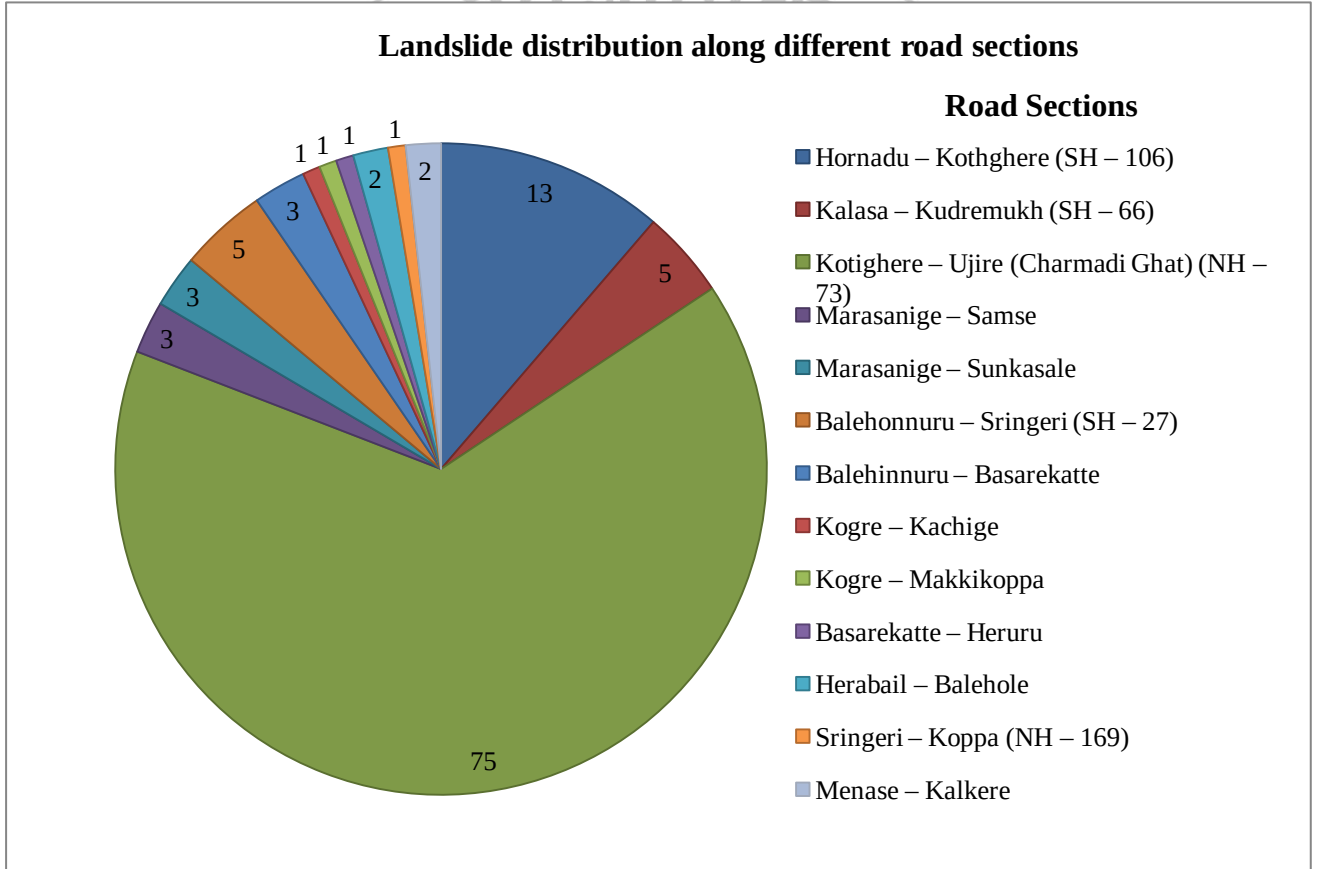
In the present study area, all the landslides are identified adjacent to different road sections only. The root cause for these may be toe cutting of the slope, vertical or near vertical cut slopes which are left unsupported and become prone to failure during heavy rains. Table – 4 shows the no. of landslides recorded along different road sections in the study area.

Table – 4: No. of landslides along different road sections

Sl. No	Road Section	No. of landslides	%
1.	Hornadu – Kothghere (SH – 106)	13	11.30
2.	Kalasa – Kudremukh (SH – 66)	5	4.35
3.	Kotighere – Ujire (Charmadi Ghat) (NH – 73)	75	65.22
4.	Marasanige – Samse	3	2.61
5.	Marasanige – Sunkasale	3	2.61
6.	Balehonnuru – Sringeri (SH – 27)	5	4.35
7.	Balehinnuru – Basarekatte	3	2.61
8.	Kogre – Kachige	1	0.87
9.	Kogre – Makkikoppa	1	0.87
10.	Basarekatte – Heruru	1	0.87
11.	Herabail – Balehole	2	1.74

Sl. No	Road Section	No. of landslides	%
12.	Sringeri – Koppa (NH – 169)	1	0.87
13.	Menase – Kalkere	2	1.74
Total		115	

Figure – 4: Pie diagram showing distribution of landslides along different road sections



From Figure – 4, it can be easily seen that the Kotighere – Ujire (Charmadi Ghat) (NH – 73) road stretch have encountered 75 nos. of landslides in an approx. 20 km stretch. So, this road section is the worst effected by landslides among all the road sections in the study area.

The landslides can be sub divided based on different parameters. The tables and figure below shows brief classification of landslides based on different parameters.

Table – 5: Classification of landslides based on “Activity”

Sl. No	Type of Activity	No. of landslides	Percentage (%)
1.	Active	59	51
2.	Reactivated	12	10
3.	Suspended	27	24
4.	Dormant	16	14
5.	Stabilized	1	1
Total		115	

Figure – 5: Pie diagram showing landslide classification based on “Activity”

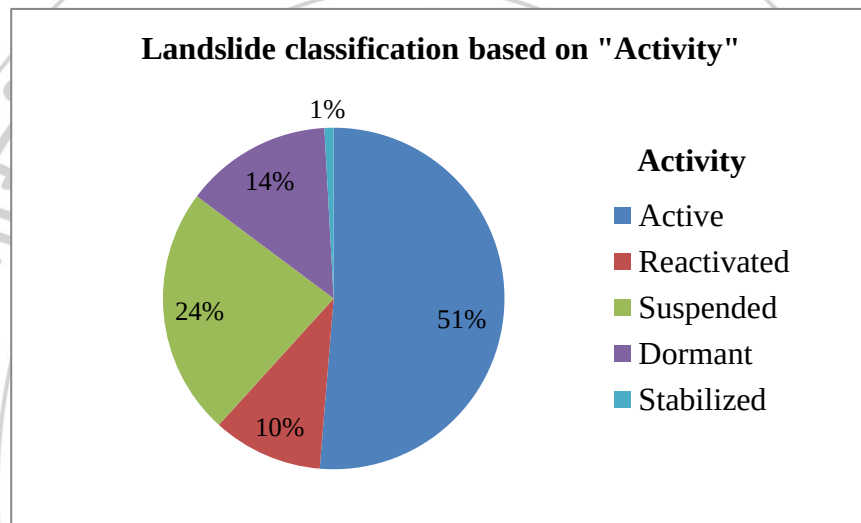


Table – 6: Classification of landslides based on “Material”

Sl. No	Type of Material	No. of landslides	Percentage (%)
1.	Debris	103	90
2.	Rock	12	10
Total		115	

Figure – 6: Pie diagram showing landslide classification based on “Material”

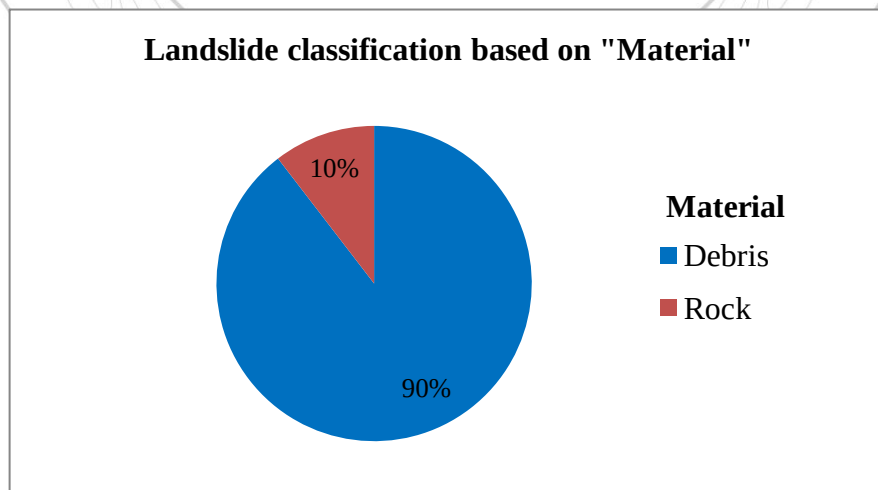


Table – 7: *Classification of landslides based on “Failure Depth”*

Sl. No	Failure Depth	No. of landslides	Percentage (%)
1.	Shallow (< 5 m)	111	97
2.	Deep (> 5 m)	4	3
Total		115	

Figure – 7: *Pie diagram showing landslide classification based on “Failure Depth”*

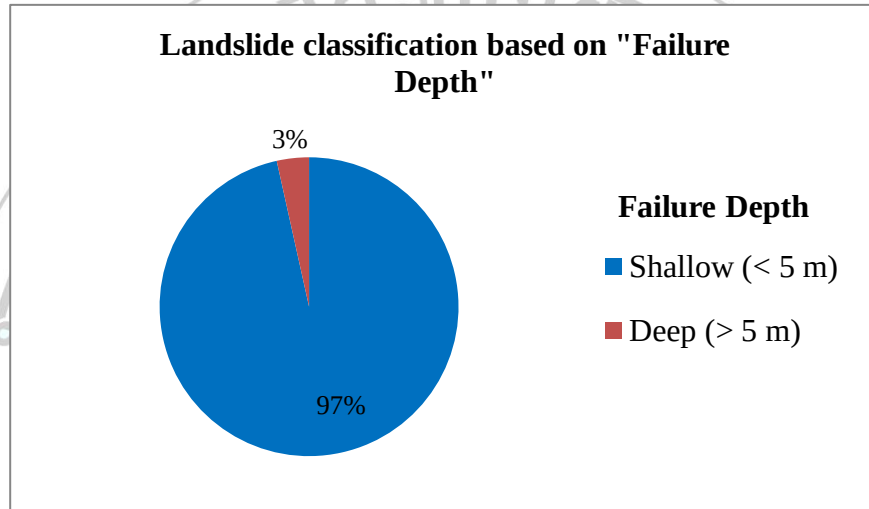
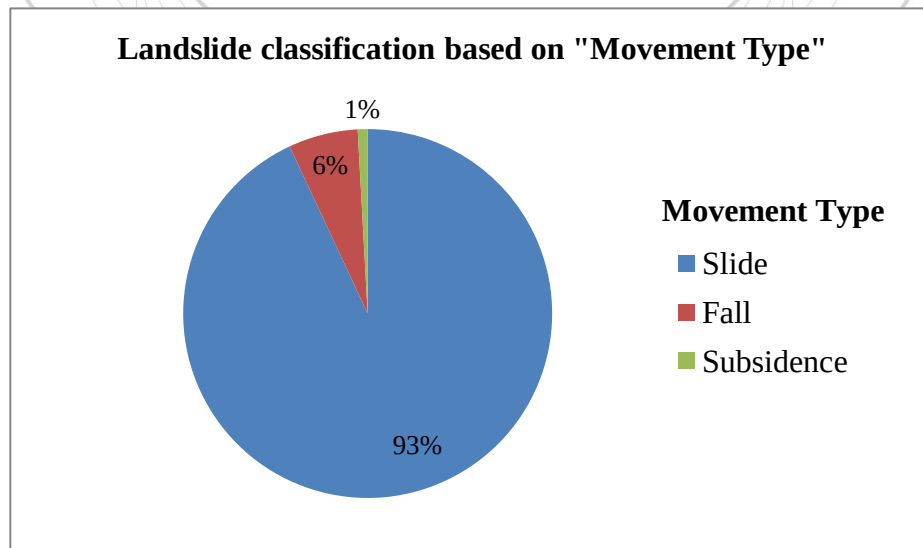


Table – 8: *Classification of landslides based on “Movement Type”*

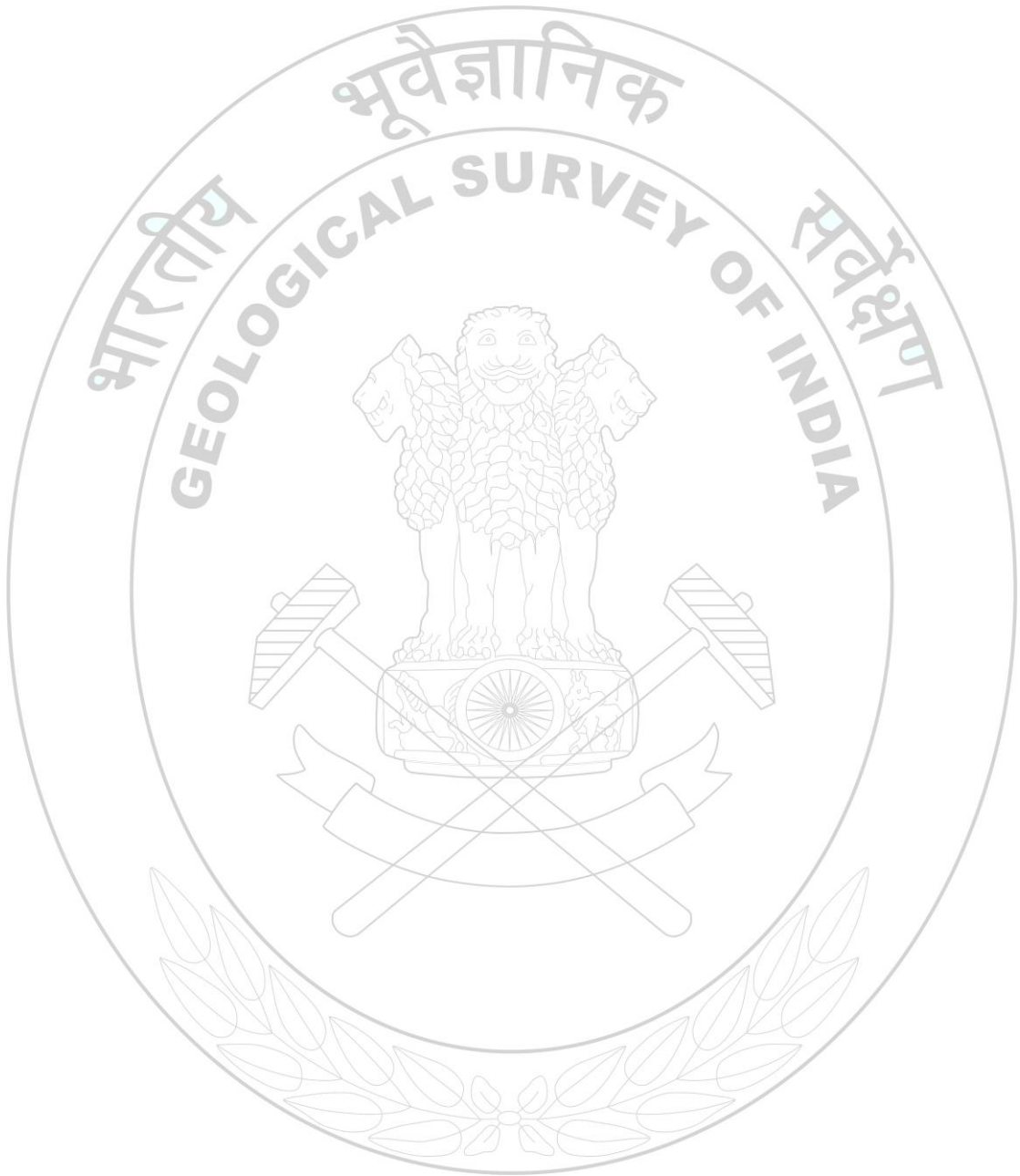
Sl. No	Movement Type	No. of landslides	Percentage (%)
1.	Slide	107	93
2.	Fall	7	6
3.	Subsidence	1	1
Total		115	

Figure – 8: *Pie diagram showing landslide classification based on “Movement Type”*



3.3.2 Landslide on natural slopes

In the study area no landslides have been recorded over the natural slopes.



CHAPTER – 4

LANDSLIDE SUSCEPTIBILITY ANALYSIS

This chapter deals with the material and methods of landslide susceptibility analysis using the Weighted Multiclass Index Overlay method, as recommended in the Standard Operating Procedure (SOP) of NLSM.

4.1 Background

Landslide susceptibility is a qualitative estimate of the spatial distribution of landslides, which exist or potentially may occur in an area. Although it is expected that landslides will occur more frequently in the most susceptible areas, however, in the susceptibility analysis, no time frame and magnitude of event are explicitly taken into account. A susceptibility map therefore gives only the qualitative estimation that the mapping unit (e.g., a pixel, slope unit or facet) will be affected by a future landslide source. Therefore, using the term “landslide hazard analysis” instead of “landslide susceptibility analysis”, for methods of spatial prediction of landslide-prone areas may not be correct.

In GIS based knowledge - driven methods such as Weighted Multiclass Index Overlay, individual ratings for geofactor classes and weights of geofactor are determined with the knowledge of the terrain and after discussion with the local experts. Once the initial ratings are fixed, LOFS is determined using Analytical Hierarchy Process (AHP) after preparing the pair wise qualitative comparison matrix of all factors (Saaty, 1977).

4.2 Selection of Preparatory Factors

For susceptibility mapping, the selection of preparatory factors for landslides depends on the scale of analysis, the characteristics of the study area, the landslide type, the failure mechanisms and prior knowledge of the main causes of landslides (Guzzetti et al., 1999; Glade and Crozier, 2005). A systematic overview of the important preparatory factors required for susceptibility mapping in different scales is given in van Westen et al. (2008). A prior knowledge of the main causes of landslides in the area of interest is essential in selecting the most relevant factor out of the many known preparatory factors that can “theoretically” cause landslides (Ghosh and Carranza, 2010).

In the study area, landslides are mostly debris slides along road corridors and are relatively small in size. Out of the six thematic maps, two are related to terrain morphometry derived from DEM and four are field based maps prepared from remote sensing data. A brief description of the significance and mapping techniques for each factor is given below.

4.3 Thematic Layers

Landslides occur when the shearing stress along the failure plane exceeds the shearing strength of rock/debris mass (Varnes, 1978). This can be affected by the changes in various parameters such as i) physical state of slope such as slope angle and slope curvature, ii) lithology or physical characteristics of slope forming mass, iii) spatial variation in thickness of regolith, iv) geomorphological forms and processes, v) land use/cover including road and other physical features mappable on 1:50,000 scale. Based on the estimation of above pre-disposing geo-factors, the following factors and its possible factor classes are considered for preparation of geo-factor databases for the GIS-based analysis of landslide susceptibility. As per the data model, some of the geo-factor themes are categorical (e.g., geomorphology, land use - land cover etc.) and others represent continuous data (e.g., slope, curvature etc.). These spatial factor maps are prepared using various source data and employing different mapping techniques which are detailed below.

4.3.1 Slope Morphometry

➤ Slope Angle

Slope Angle geofactor map has highest importance for NLSM modelling, which is carried out by using Analytical Hierarchy Process (AHP). In the scale of 0 to 9, within the geofactors, this particular geofactor is given 9 weightage by the experts. A geofactor map having weightage 9, creates very high impact on the final susceptibility map.

The slope angle map of the study area was derived from Carto DEM of 30 m resolution using GIS. For depiction purpose, the slope map is finally reclassified into 5 classes (Refer: Plate – 3).

The Slope angle of this area varies between 0° and 69° . 60.88% of the study area are covered by gentle slope ($<15^{\circ}$), 27.67% of the study area covered by slope between 15° to 25° , 9.29% of the area are covered by slope between 25° to 35° , high

slope like 35° to 45° covers 1.75% area and only 0.42% area is covered by slope >45°. The areas having slope between 25° to 35° were found to be most prone to slope failures. The slope angle classes, area coverage and LOFS are shown in Table – 9.

Table – 9: Slope angle classes with LOFS ratings

Sl. No	Slope Angle Class	No. of Pixels	Area (sq. km)	% Coverage	LOFS
1.	> 15°	980602	911.51	60.88	0.16
2.	15° - 25°	445626	414.23	27.67	0.46
3.	25° - 35°	149568	139.03	9.29	1
4.	35° - 45°	28110	26.13	1.75	0.28
5.	> 45°	6814	6.33	0.42	0.16

➤ Slope Curvature

Slope Curvature geofactor map is of lowest importance for NLSM modelling, which is carried out by using Analytical Hierarchy Process (AHP). In the scale of 0 to 9, within the geofactors, this particular geofactor is given 2 weightage by the expert. A geofactor map having weightage 2, creates very low impact on the final susceptibility map.

Slope curvature was also derived from Carto DEM of 30 m resolution using GIS. A positive curvature represents upwardly convex surface, while a negative curvature indicates that the surface is upwardly concave at a given pixel. The concave hill slopes are areas having high soil moisture content and receive more surface run-off but the overburden material is less or absent. Whereas most of the convex hill slope are having good amount of overburden material. So failures can be expected to occur more frequently in those convex hill slope areas than the slopes that are concave along the contour. The curvature maps were finally reclassified into three classes viz, concave, flat and convex (Refer: Plate – 4). A total of 47.42 % of the map area is falling under concave and 45.36 % area comes under convex curvature slopes respectively, while only 7.22 % area falls under flat category. The slope curvature classes, area coverage and LOFS are shown in Table – 10.

Table – 10: Slope curvature classes with LOFS ratings

Sl. No	Slope Curvature Class	No. of Pixels	Area (sq. km)	% Coverage	LOFS
1.	Concave	763819	710.00	47.42	0.41
2.	Flat	116321	108.13	7.22	0.17
3.	Convex	730580	679.11	45.36	1

4.3.2 Land use - Land cover (LULC)

Land use – Land cover geofactor map has 2nd highest importance for NLSM modelling, which is carried out by using Analytical Hierarchy Process (AHP). In the scale of 0 to 9, this particular geofactor is given 8 weightage by the experts.

During the field work total of 115 landslides were mapped in this area and all the landslides are related to modification of slope. So it is very clear that land use - land cover geofactor has a major importance on landslides of this area.

A geofactor map having weightage 8, create a major impact on the final susceptibility map. So stepwise methodology was followed and necessary modification was done with utmost care before finalization of this map. The pre-field land use - land cover (LULC) map was prepared from the google earth imageries from 2014 to 2016, following the normal digitizing procedure in google earth. The scale level around 300 m was maintained for demarcating the boundaries of different classes. At the time of demarcating extensive slope cut polygon difficulties were faced as the true width of such areas is less than 50 m. However considering the importance of this areas in mind, creation of a polygon of minimum width of little over 50 m is attempted where ever possible and by combining adjacent polygon into a single polygon. This has at places resulted in inclusion of Moderate Vegetation / Thick Vegetation areas in extensive slope cut polygons. Knowingly this discrepancy has been ignored in order to highlight the importance of extensive slope cut polygon in localising landslides.

The obtained pre-field LULC map was validated in the field at all accessible locations and all necessary corrections and modifications were carried out in the boundary and nomenclature of the LULC classes. In this way the post field LULC map of the study area was prepared. Plate – 7.2 shows the final LULC map of the study area. The LULC classes, area of coverage for pre – field as well as post field maps and LOFS are shown in Table – 11.

Table – 11: LULC classes with LOFS ratings

Sl. No	LULC Class	Pre – field Map		Post Field Map			LOFS
		Area (sq. km)	%	No. of Pixels	Area (sq. km)	%	
1.	Barren	106.08	7.084	56980	142.61	9.523	0.06
2.	Cultivation	142.39	9.508	24843	62.20	4.153	0.09
3.	Extensive Slope Cut	0	0	127	0.37	0.025	1
4.	Fallow Land	0.54	0.036	133	0.32	0.021	0.06
5.	Plantation (HHP)	122.31	8.167	61922	154.74	10.333	0.2
6.	Plantation (LHP)	3.46	0.231	91949	229.84	15.347	0.14
7.	Quarry	0	0	32	0.08	0.006	0.29
8.	Settlement	25.88	1.728	14900	37.32	2.492	0.07
9.	Settlement on modified slope	0	0	21	0.06	0.004	0.56
10.	Sparse Vegetation	32.15	2.147	1097	2.74	0.183	0.2
11.	Moderate Vegetation	824.46	55.053	242034	604.83	40.387	0.29
12.	Thick Vegetation	230.99	15.424	101228	253.15	16.904	0.56
13.	River	9.15	0.611	3672	9.15	0.611	0
14.	Water body	0.18	0.012	69	0.18	0.012	0

Brief description of the different land use land cover classes present in the study area are given below:

Barren: The barren class in the study area refers to barren slopes with rock exposers (refer Photo – 13).

Cultivation: Cultivation in the study area refers to agricultural lands (refer Photo – 7). The different agricultural varieties are rice, wheat, ragi, maize and different vegetables.

Extensive Slope Cut: Extensive Slope Cut in the study area refers to vertical to near vertical slope cuts along road sections (refer Photo – 6). In some places, extensive slope cut is observed adjacent to houses constructed on the hill slopes.

Fallow Land: Fallow land in the study area refers to the land which is barren or left empty without any infrastructural development or forest cover or any other land use land cover classes.

Plantation (HHP & LHP): Plantation in the study area is of two types, i.e. high height plantation (HHP) and low height plantation (LHP). The HHP class refers to

plantations like coconut, bettle nut, acacia, eucalyptus, rubber etc. whereas LHP class refers to plantations like tea, coffee, pepper and other tropical spices (refer Photo – 7 & 8).

Quarry: Quarry in the study area refers to places from where mining activities are going on or were going on. Both the active and rejected mining areas are considered under this class.

Settlement: Settlement in the study area refers to the clusters of houses / villages / townships where people live.

Settlement on modified slope: Settlement on modified slope in the study area refers to any houses / cluster of houses that are constructed modifying the natural hill slopes.

Vegetation (Sparse, Moderate and Thick): Vegetation in the study area is of three types, i.e. sparse vegetation, moderate vegetation and thick vegetation. This demarcation from sparse to moderate to thick vegetation is based on the density of the vegetation in the increasing order.

4.3.3 Geomorphology

Geomorphology geofactor map is of moderate importance for NLSM modelling, which is carried out by using Analytical Hierarchy Process (AHP). In the scale of 0 to 9, within the geofactors, this particular geofactor is given 4 weightage by the experts. A geofactor map having weightage 4, creates a moderate impact on the final susceptibility map.

The pre - field geomorphology map was prepared from google earth imagery following normal digitizing procedure in google earth. The scale level of around 900 m was maintained for demarcating the boundaries of different classes. Different geomorphological landforms observed in the present study area are structural hill situated in the western, south western and southern eastern part of the study area as Lowly Dissected Slope and Moderately Dissected Slope. Apart from the hilly areas, the northern, north eastern and eastern part of the study area is mostly Rolling Plain, i.e. slightly undulating surface and hence do not have direct impact on occurrences of landslides. Within the geomorphology classes, the areas having moderately dissected slope were found to be most prone to landslides.

The obtained pre – field geomorphology map was validated in the field at all accessible locations and all necessary correction and modifications were carried out in the boundary and nomenclature of the geomorphology class. In this way the post field geomorphology map of the study area was updated and finalized. Plate – 8.2 shows

the final geomorphology map of the study area. The geomorphology classes, area of coverage for pre – field as well as post field maps and LOFS are shown in Table – 12.

Table – 12: Geomorphology classes with LOFS ratings

Sl. No	Geomorphology Class	Pre – field Map		Post Field Map			LOFS
		Area (sq. km)	%	No. of Pixels	Area (sq. km)	%	
1.	Escarpment	7.56	0.505	2704	6.74	0.450	0.08
2.	Lowly Dissected Slope	1027.33	68.599	305533	763.67	50.993	0.19
3.	Moderately Dissected Slope	323.36	21.592	129208	323.22	21.583	0.4
4.	Rolling Plain	110.86	7.403	148264	370.70	24.753	0
5.	Valley Fill	19.15	1.279	9557	23.93	1.598	0
6.	River	9.15	0.611	3672	9.15	0.611	0
7.	Water body	0.18	0.012	69	0.18	0.012	0

Brief description of different geomorphology classes present in the study area are given below:

Escarpment: Escarpment in the study area refers to high angle hill slopes ($>45^\circ$) which are most of the cases barren rock slopes in nature (refer Photo – 11).

Dissected Slope (Lowly and Moderately): The dissected hill slopes in the study area are of two types i.e. lowly dissected slope (refer Photo – 10) and moderately dissected slope (refer Photo – 9). This demarcation from low to moderate is based on the intensity dissections on hill slope in the increasing order.

Rolling Plain: Rolling plain in the study area refers to undulating plains / cluster of small mounds which cannot be mapped separately in 1:50000 scale.

Valley Fill: Valley fill in the study area refers to the valley areas surrounded by hills from different sides (refer Photo – 12) and filled by the materials came down from the upslope of the hills.

4.3.4 Slope Forming Material (SFM)

Slope Forming Material geofactor map has 3rd highest importance for NLSM modelling, which is carried out by using Analytical Hierarchy Process (AHP). In the scale of 0 to 9, within the geofactors, this particular geofactor is given 6 weightage by the experts. A geofactor map having weightage 6 creates a relatively high impact on the final susceptibility map.

The pre – field SFM map was prepared from proxies from LULC, Geomorphology, Geological map and few inputs from google earth imagery.

The obtained pre-field SFM map was validated in the field at all accessible locations and all necessary correction and modifications were carried out in the boundary and nomenclature of the SFM class. In this way the final SFM map of the study area was prepared. Plate – 9.2 shows the final SFM map of the study area. The SFM classes, area of coverage for pre – field as well as post field maps and LOFS are shown in Table – 13.

Table – 13: SFM classes with LOFS ratings

Sl. No	SFM Class	Pre – field Map		Post Field Map			LOFS
		Area (sq. km)	%	No. of Pixels	Area (sq. km)	%	
1.	In-situ soil	1333.44	89.039	536889	21.60	1.443	0.24
2.	Transported Soil	19.15	1.279	Class not present in updated map			0.15
3.	Weathered Rock	135.67 (Mapped as “Rock”)	9.059 (Mapped as “Rock”)	196	0.48	0.032	0.54
4.	Amphibolite			614	0.60	0.040	0.24
5.	Banded magnetite quartzite			1026	1.53	0.102	0.07
6.	Carbonaceous phyllite			39	2.55	0.170	0.24
7.	Dolerite			22	0.08	0.006	0.07
8.	Ferruginous phyllite			661	0.05	0.003	0.24
9.	Granite			11721	1.65	0.110	0.07
10.	Granite gneiss			8643	29.36	1.960	0.07
11.	Laterite			220	1342.18	89.623	0.24
12.	Meta-ultramafite			909	2.26	0.151	0.07
13.	Metabasalt			28003	70.04	4.677	0.07
14.	Quartz-chlorite schist			10	0.03	0.002	0.07
15.	Quartz vein			196	0.48	0.032	0.54
16.	River	9.15	0.611	3672	9.15	0.611	0
17.	Water body	0.18	0.012	69	0.18	0.012	0

4.3.5 Regolith Thickness

Regolith Thickness geofactor map is of moderate importance for NLSM modelling, which is carried out by using Analytical Hierarchy Process (AHP). In the scale of 0 to 9, within the geofactors, this particular geofactor is given 4 weightage by the expert. A geofactor map having weightage 4, creates a moderate impact on the final susceptibility map.

The pre – field Regolith Thickness map was prepared from proxies from LULC, Geomorphology and Slope map and few inputs were also taken from google earth imagery.

The obtained pre – field Regolith Thickness map was validated in the field in all accessible locations and all necessary corrections and modifications were carried out in the boundary and nomenclature of the Regolith Thickness class. In this way the post field Regolith Thickness map of the study area was prepared. Plate –10.2 shows the final Regolith Thickness map of the study area. The regolith thickness classes, area of coverage for pre – field as well as post field maps and LOFS are shown in Table – 14.

Table – 14: *Regolith Thickness classes with LOFS ratings*

Sl. No	Regolith Thickness Class	Pre – field Map		Post Field Map			LOFS
		Area (sq. km)	%	No. of Pixels	Area (sq. km)	%	
1.	< 0.5 m	135.67	9.059	58377	146.08	9.754	1
2.	0.5 – 5 m	1352.60	90.318	528335	1320.87	88.200	0.32
3.	5 – 10 m	0	0	8554	21.31	1.423	0.14
4.	River	9.15	0.611	3672	9.15	0.611	0
5.	Water body	0.18	0.012	69	0.18	0.012	0

4.4 Landslide Susceptibility Analysis

4.4.1 Procedure

Susceptibility is the propensity of an area to generate landslides. In mathematical form, landslide susceptibility is the probability of spatial occurrence of known slope failures, given a set of geo-environmental conditions (Guzzetti et al., 2005). In this study, a qualitative landslide susceptibility map was prepared by using the Weighted Multi-class Index Overlay method, as recommended in the SOP of NLSM.

The landslide susceptibility modelling can be divided into the following main themes:

- Preparation of landslide inventory and geofactor maps and preparation of GIS-based database of the geofactor maps.
- All the thematic maps are converted to raster keeping field as “class” and output cell size as “50” (as NLSM is a 1:50,000 scale mapping) in Arc – GIS software.
- Heuristic (knowledge driven) technique modelling requires fixation of individual ratings for geofactor classes and weights of geofactors for the entire area. So, these initial ratings for geofactor classes and weights of geofactors are fixed with the knowledge of terrain and after discussion with experts.
- Once all the ratings for geofactor classes and weights of geofactors are fixed, LOFS is calculated using pair wise comparison matrix and fraction rating
- After calculation of LOFS for all the geofactor classes, LOFS maps of the geofactors are prepared using GIS software.
- Once all the LOFS maps are prepared, raw landslide susceptibility score map is prepared using weighted multi class index overlay method in GIS software.
- After raw landslide susceptibility score map is prepared, a classified landslide susceptibility map is prepared and determination of break values are carried out by assigning weightage (30% is the boundary between low to moderate susceptibility and 50% is the boundary between moderate to high susceptibility).

4.4.2 Selection of Mapping Unit

After the selection of appropriate preparatory factors, the next step is selection of mapping units for the GIS based susceptibility analysis and for selecting a mapping unit importance must be given to the type of landslides in the area, mapping scale and scope of the work.

In this study, the mapping scale is 1:50,000 and preparing slope-units at this scale often do not match with the local geo-environmental setting related to slope instability. One way to overcome this is to resize the slope-units according to the present landslide size by partitioning a river basin into nested subdivisions, coarser for larger landslides and finer for smaller failures (Guzzetti et al., 1999). But, for application purposes this approach is not suitable for small and shallow landslides (Montgomery and Dietrich, 1994). Furthermore, even with GIS it is still difficult to

manually digitize irregular mapping units of a very small size e.g., the slope unit of area < 1000 sq. m.

Therefore, in this work, a *pixel* was selected as the basic mapping unit for the susceptibility modelling so that the smallest landslide can be represented by a single pixel. Further, it will support the minimum resolution of Carto DEM which is also of 30 m resolution. As an additional advantage, a pixel based mapping unit can facilitate very fast computation and processing of the raster data set in GIS and it is also the commonly used unit in the raster based analysis (Carrara et al., 1992). Hence, the 1500 sq. km study area was converted into an equal-area grid by rasterizing the polygon map using a 50 m X 50 m pixel size. But as the slope angle difference is relatively lesser in Southern India compared to the mighty Himalayas, to get precise coarse resolution in Slope Angle and Slope Curvature map, the slope morphometry maps were prepared from its original 30 m X 30 m pixel resolution.

4.4.3 Landslide Occurrence Favourability Score (LOFS)

Landslides on a particular place depend on interaction between various geofactors. In the present study area, for a qualitative landslide susceptibility analysis, for modelling, Multi Class Index Overlay Method is adopted using heuristic (knowledge driven) techniques. In heuristic (knowledge driven) technique, individual ratings for geofactor classes and weights of geofactors are determined with the knowledge of the terrain and after discussion with the local experts. Once the initial ratings are fixed, Landslide Occurrence Favourability Score (LOFS) is determined using Analytical Hierarchy Process (AHP) after preparing the pair wise qualitative comparison matrix of all factors (Saaty, 1977).

For determination of LOFS using AHP, for each geofactor one comparison matrix is calculated for the pair wise qualitative comparison of all the geofactor sub classes. In the comparison matrix, fraction rating is calculated for all the geofactor sub classes. Once all the fraction ratings are determined, maximum value within the fraction ratings is identified. Then all the fraction rating values are divided with the maximum fraction rating value to determine the LOFS for the geofactor sub classes. In this way, as the fraction ratings are divided with the maximum fraction rating value, the LOFS values are arranged in ascending order (Refer: Annexure – 1).

4.4.4 Integration of Data

Figure – 1 shows the steps followed in this analysis for calculating the factor class ratings and inter predictor weights of factor maps using AHP.

- Following the methodological process shown in Diagram – 1, all the maps such as LULC, Geomorphology, SFM and Regolith Thickness are digitized as a polygon shape file and converted into raster maps keeping output cell size as 50m × 50m.
- The Carto DEM derivatives such as slope angle and slope curvature are reclassified into categorical variables. Slope angle map is reclassified into five classes (<15°, 15° to 25°, 25° to 35°, 35° to 45° and >45°), whereas slope curvature map is reclassified into three classes (concave, flat and convex).
- For each geofactor class, Landslide Occurrence Favourability Score (LOFS) is determined using a pair wise comparison matrix.
- Once the LOFS values for geofactor sub classes are determined, all the LOFS values against the sub classes are compiled. Then the LOFS attributes are joined in the raster map attribute table. Finally LOFS map of the geofactor is prepared in GIS, using raster map of the geofactor as “input raster” and “geofactor_LOFS\$.LOFS” as lookup field.
- For determination of Predictor Weight for the geofactor, one comparison matrix is calculated for the pair wise qualitative comparison of all the geofactors. In the comparison matrix, fraction weight is calculated for all the geofactors. Once all the fraction weights are determined, minimum value within the fraction ratings is identified. Then all the fraction weight values are divided with the minimum fraction weight value to determine the Predictor Weight or weight of geofactors. In this way, as the fraction weights are divided with the minimum fraction weight value, the Predictor Weight or weight values will be one or more than one. For each geofactor, consider the nearest whole number as its Predictor Weight or weight.
- Raw Landslide Susceptibility Score Map in GIS, is generated using the formula -
Susc Score = (LOFS_Factor1*weight of Factor1 + LOFS_Factor2*weight of Factor2 + LOFS_Factor3*weight of Factor3 + + LOFS_Factor_n*weight of Factor_n) / Sum of inter – predictor weight.
- In this type of knowledge-driven models, classification break values can be determined on the basis of the logic applied while giving mutual comparison

expert driven ranking. It is always thought by any expert that rank value for any factor class is ≥ 5 , and it is considered that the particular factor class has higher likelihood in influencing the landslides. This rank value of “5” in a scale of “0” to “9” comes after 50% of the absolute difference values ($9-0 = 9$; 50% of 9 is 4.5). That is why this 50% cut-off margin or weightage can be used to determine the break raster value between “Moderate” and “High” susceptibility classes (*BrMH*). Similarly, when rank value for any factor class is ≤ 3 (lower than 30% of the absolute difference value of 9), and it is considered that the particular geofactor class has lesser likelihood in influencing any landslides. Accordingly, 30% cut-off margin or weightage can be used to determine the break values between “Low” and “Moderate” susceptibility classes (*BrLM*).

Using the above logic the required break values can be determined by solving the following formula:

$$\mathbf{BrMH} = [(Abs\ Diff\ LOFS\ Factor1*50)*weight\ of\ Fcator1 + (Abs\ Diff\ LOFS\ Factor2*50)*weight\ of\ Fcator2 + (Abs\ Diff\ LOFS\ Factor3*50)*weight\ of\ Fcator3 + \dots + (Abs\ Diff\ LOFS\ Factor_n*50)*weight\ of\ Fcator_n] / Sum\ of\ inter - predictor\ weight$$

$$\mathbf{BrLM} = [(Abs\ Diff\ LOFS\ Factor1*30)*weight\ of\ Fcator1 + (Abs\ Diff\ LOFS\ Factor2*30)*weight\ of\ Fcator2 + (Abs\ Diff\ LOFS\ Factor3*30)*weight\ of\ Fcator3 + \dots + (Abs\ Diff\ LOFS\ Factor_n*30)*weight\ of\ Fcator_n] / Sum\ of\ inter - predictor\ weight$$

- Once break values (*BrMH* and *BrLM*) are calculated, Classified Landslide Susceptibility Map is prepared by reclassifying the Raw Landslide Susceptibility Score Map. For reclassification, three classes are chosen and in break values, 2nd topmost value is given as the first value (Class 1), 1st topmost value is given as the second value (Class 2) and third value (Class 3) is given as one. Now the Raw Landslide Susceptibility Score Map is classified into the following categories: Class 1 stands for “Low Susceptibility”, Class 2 stands for “Moderate Susceptibility” and Class 3 stands for “High Susceptibility”.

CHAPTER – 5

LANDSLIDE SUSCEPTIBILITY MAP

5.1 Discussion and Susceptibility Map

The landslide susceptibility map (Refer: Plate – 12) of toposheet nos. 48O/07 and 48O/08 was prepared using weighted multiclass index overlay method. The susceptibility is expressed in terms of the relative proneness to initiation of a landslide in a pixel (the mapping unit) under the given geo - environmental conditions. Table – 15 shows the area coverage and percentage with respect to different susceptibility classes for the present study area.

Table – 15: Landslide Susceptibility classes with area coverage

Sl. No	Landslide Susceptibility Class	No. of Pixels	% Coverage
1.	Low	379028	63.14 (~63)
2.	Moderate	165862	27.63 (~28)
3.	High	55368	9.22 (~9)

In the present study area, 63 % of the area falls under low susceptibility class, 28 % of the area falls under moderate susceptibility class whereas only 9 % area falls under high susceptibility class.

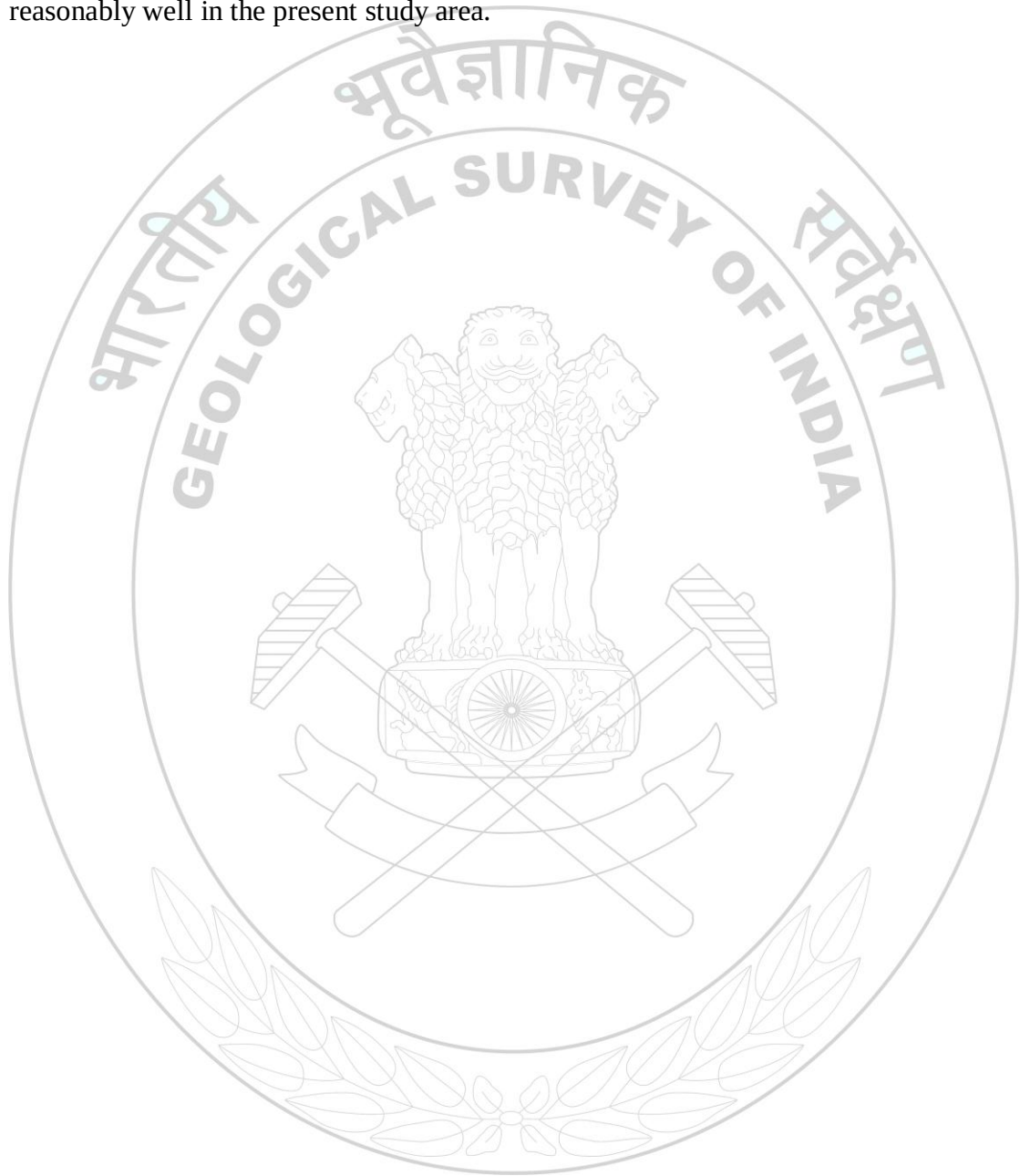
The majority of the areas situated in the north western, north eastern, eastern and southern side of the study area falls under low susceptibility class with small patches of areas with moderate and high susceptibility class within it. On the other hand, areas situated in western, south western and south eastern side of the study area falls under moderate susceptibility class with considerable patches of areas with high susceptibility class within it. Almost all the major localities of the study area like Sringeri, Jayapura, Balehonnuru, Magundi, Kalasa, Hornadu, Charmadi etc. comes under low susceptibility class. Localities like Balehole, Kogre, Samse, Hirebail, Kelgur etc. comes under moderate susceptibility class. Very few localities like Basarekatte come under high susceptibility class. One important road corridor i.e. Kotighere – Ujire (NH – 73) (Charmadi Ghat) road section falls under moderate to high susceptibility class mostly in the study area.

The distribution of the susceptibility classes shows a very clear indication. In the landslide susceptibility modelling, the slope angle, land use – land cover and geomorphology map played a major role in generation of the final landslide

susceptibility map. The northern part of the study area is having relatively gentle topography falls under dominantly low susceptibility class with small patches of moderate susceptibility class within it. Slope angle wise the majority of the area falls under $<15^\circ$ slope angle class. Geomorphologically most of these areas come under dominantly rolling plain class. Land use – land cover wise the western part of the study area shows classes like Plantation (both HHP & LHP), cultivation, settlement etc. All these geofactor classes have relatively lower ratings within the individual geofactor map, thus the LOFS values of these geofactor classes are towards lower side. So, in the landslide susceptibility modelling, while carrying out data integration, these lower LOFS values contribute for the overall low susceptibility class of the area. On the contrary, the western, south western and south eastern side of the study area, part of which comes under “Charmadi Ghat” section of the Western Ghats, shows rugged topography and slope angle wise these areas have higher slope classes (slope range varies from approx. 0° to 69°). Geomorphologically, most of this area comes under lowly dissected slope and moderately dissected slope class. In land use – land cover map the dominant classes are thick vegetation, barren, Plantation (LHP) along with extensive slope cut. Lowly dissected slope has moderate rating within geomorphology whereas, Plantation (LHP) & thick vegetation have moderate rating and barren has low rating in land use – land cover geofactor. On the other hand the extensive slope cut is having the highest rating within land use – land cover geofactor. Moderately dissected slope has relatively higher rating in geomorphology geofactor and dominant slope angle classes (15° to 25° , 25° to 35° and 35° to 45°) of these area has relatively higher ratings within slope angle geofactor. Moreover, within the geofactor classes, slope angle and land use – land cover has highest and 2nd highest weightage. So, these higher ratings of the geofactor classes contribute to the higher LOFS values for these geofactor classes within the individual geofactor. Similarly, the higher weightage of the geofactors contribute to the higher predictor weight or weight of the particular geofactor within the all the geofactors. So, in the landslide susceptibility modelling, while carrying out data integration, these higher LOFS and predictor weight of geofactor classes and geofactors respectively, contribute to the overall high to moderate susceptibility class of the area.

Although there is no provision of direct validation of the pre-field map in the field, an attempt was made to determine the success rate of the landslide susceptibility map by overlapping the landslide points on the landslide susceptibility map in GIS

software. In this exercise, it was observed that out of total 115 landslides, 66 landslides (57%) falls within the high susceptibility class followed by 38 landslides (33%) under moderate susceptibility class and 11 landslides (10%) under low susceptibility class. So, overall 90% of the landslides fall under high and moderate susceptibility class which clearly indicates that the landslide susceptibility model fits reasonably well in the present study area.



CHAPTER – 6

SUMMARY AND RECOMMENDATIONS

Macro scale (1:50,000) landslide susceptibility mapping in Survey of India toposheet no. 48O/07 and 48O/08, covering parts of Chikmangaluru and Dakshin Kannada districts, Karnataka for an area of 1498 sq. km, was carried out during field season 2017 – 18. In this study, a qualitative landslide susceptibility map was prepared by using the weighted multi class index overlay method, as recommended in the SOP of NLSM. The mapping unit used is a pixel of 50 m x 50 m grid. The outcome of the study is enumerated below:

- A multi – temporal landslide inventory map of the study area is prepared using old reports data, multi temporal google imagery from 2002 to 2016, LISS III / LISS IV data and field inputs. Most of the landslides are smaller in dimension and are due to slope modification i.e. toe cutting of the slope (extensive slope cut) for road construction and are found in the vicinity of roads.
- The prepared landslide inventory map of the study area contains a total of 115 nos. of landslides.
- The landslides in the study area are very small in dimension, hence, ideally can not to be taken into consideration for a 1:50,000 scale map. Though in google earth with high resolution the landslides are mapped as polygon but when representing in 1:50,000 scale landslide inventory map (Refer: Plate – 11) the landslides are represented as point only, as the polygons are not visible in 1:50,000 scale.

Heuristic (knowledge driven) technique modelling requires fixation of individual ratings for geofactor classes and weights of geofactors for the entire area. So, these initial ratings are fixed with the knowledge of terrain and with discussion with local experts for Analytical Hierarchy Process (AHP).

Once all the ratings for geofactor classes and weights of geofactors are fixed, LOFS is calculated for all classes using pair wise comparison matrix and fraction rating and LOFS maps of the geofactors are prepared using GIS software.

Based on the landslide characteristics, a total of eight factor maps, viz., Slope Morphometry (Slope Angle, Slope Aspect, Slope Curvature) and Drainage (derived

from Carto DEM of 30 m resolution), Geomorphology, Land use – Land cover, Slope Forming Material and Regolith Thickness maps (prepared from google imagery) were prepared for susceptibility analysis. All the above eight maps were used for assessment of factor class ratings. However, only six thematic maps (except aspect and drainage) were considered for validation of Landslide Susceptibility Analysis (LSA) of the study area due to the absence of identified factor classes in a particular map. The detail study of the thematic map and landslide inventory map shows the following:

- In the Slope Morphometry maps, in case of slope angle, approx. 61% of the area is occupied by slope angle class of $<15^\circ$ followed by slope class of 15° to 25° which occupies approx. 28% of the area. In case of slope curvature, Concave and Convex class covers most of the area with area coverage of 47% and 45% respectively.
- In the Land use - Land cover map, moderate vegetation occupies approx. 40% of the area followed by thick vegetation and plantation (LHP) which occupies 17% and 15% of the area respectively.
- In the Geomorphology map, lowly dissected slope occupies 51% area followed by rolling plain and moderately dissected slope that occupies 25% and 22% of the area respectively.
- In Slope Forming Material map, 90% of the area is occupied by in-situ soil class.
- In Regolith Thickness map, 88% of the area is covered by 0.5 m – 5 m thickness class.

For understanding the relative importance of every geofactor that is specific to the terrain, inter-predictor weights were calculated for the six geofactors. Analysis of the inter-predictor weights has shown that:

- Slope Angle class has the maximum importance amongst all the geofactors.
- Land use – Land cover class has the second most importance followed by Slope Forming Material, Geomorphology and Regolith Thickness classes in descending order amongst all the geofactors.
- Slope Curvature class has the least importance amongst all the geofactors.

Using these six geofactor classes, the final Landslide Susceptibility Map (LSM) is generated. Analysis of the LSM has shown that:

- About 63% of the area falls under low susceptibility class, 28% of the area falls under moderate susceptibility class, whereas only 9% area falls under high susceptibility class.
- The majority of the areas situated in the north western, north eastern, eastern and southern side of the study area falls under low susceptibility class with small patches of areas with moderate and high susceptibility class within it. On the other hand, areas situated in western, south western and south eastern side of the study area falls under moderate susceptibility class with considerable patches of areas with high susceptibility class within it.
- Almost all the major localities of the study area like Sringeri, Jayapura, Balehonnuru, Magundi, Kalasa, Hornadu, Charmadi etc. comes under low susceptibility class. Localities like Balehole, Kogre, Samse, Hirebail, Kelgur etc. comes under moderate susceptibility class. Very few localities like Basarekatte come under high susceptibility class.
- One important road corridor i.e. Kotighere – Ujire (NH – 73) (Charmadi Ghat) road section falls mostly under moderate to high susceptibility class in the study area.
- Most of the areas that fall under high susceptibility class are mostly devoid of any major localities due to presence of the Charmadi Ghat section and thick forest.

Usability of the output map

The final landslide susceptibility map is useful for:

1. Perspective planning for future developmental activities (like construction of new projects) in the classified low susceptibility zones.
2. Identification and delineation of target areas for meso - scale (1:5,000/10,000) or detailed site specific studies.
3. The landslide inventory database along with the landslide susceptibility map can meaningfully serve as a contributing parameter for the geo-hazard assessment and evaluation of the area.

4. The landslide susceptibility map when combined with temporal data can be effectively used for assessing the landslide hazard and risk scenario of the area.

Limitations

Every methodology tends to have its own limitations and constraints. Similarly, during the study, a few constraints in terms of the methodology adopted for this study were also identified which are enumerated below:

- The mapping of the nature and extent of the slope forming material based on observations at accessible stretches may not depict the true picture on all hill slopes. Subsequently, the regolith thickness map is very subjective since the regolith thickness along a slope is visually estimated on the basis of its exposure in a section and extrapolated to adjacent areas considering the terrain morphology.
- The assumption of the methodology that the relations between spatial factors and past / present landslides are relevant to the occurrence of future landslides may not always hold true in nature.
- The Landslide Susceptibility Map (LSM) is prepared considering the slope conditions prevalent at the time of study. However, the dynamicity of the studied hill slopes is greatly increased by the rapidly changing land use – land cover pattern through the augmentation of new settlements, deforestation, alignment of new roads and widening of the existing ones, etc. Therefore, the generated LSM may require periodic updation and re-evaluation.
- The susceptibility map is only valid under the given set of geo-environmental conditions taken as input in the susceptibility modelling. Any changes in the spatial distribution of the geo-environmental factors can affect the susceptibility of the area.
- Limitations in understanding the terrain and its landslide characteristics thereby affecting the selection of preparatory factors are also probable.

In spite of the above, the generated landslide susceptibility map of the area is the first level spatial database on regional scale which can form the basis of landslide hazard and risk evaluation indicating the vulnerability and the elements at risk.

General Recommendations

- Landslide Susceptibility Mapping (LSM) studies are very important and user friendly in order to identify landslide susceptible zones. Potential landslide zones / areas can be studied on meso scale such as 1:10000 or 1:5000 scales. Keeping in view of the severity of the problem, the studies can be taken up on meso scale.
- The landslide susceptibility map (LSM) is generally meant for regional application because the information shown is on 1:50,000 scale; however they are still of considerable significance from the point of specific land use and urban planning. Nevertheless, it is recommended that a detailed site-specific study may be duly conducted before planning and execution of the civil construction works. Areas falling under high susceptibility class should be given due attention while executing civil constructions.
- The recommendations suggested in this report should be conveyed to concerned agencies such as civil work departments, national highway and state highway authorities.
- As already mentioned, most of the landslides are developed due to human interferences such as construction of roads, building, some engineering structures etc. disturbing the natural slope without proper understanding to the slope cutting. If large vertical to sub vertical slopes without proper benching will be left as such for long time, they would tend to fail especially during rainy seasons. So, this kind of vertical to sub vertical slope cutting may be avoided.
- In upslope of landslide prone zone, drainage lines / rain water should be diverted to other area through catch water drain (CWD) and toe drain. Drainage holes may be driven in the slope to remove percolating water.
- To suggest remedial / mitigation measures are of utmost importance because it is worthwhile to put forward suitable and adequate preventive measures once we find some problems. In general, Geo jute / Geo textile may be used to protect the slopes. Besides, if possible, retaining wall / gabion wall may be constructed to protect the slope as well.
- The assessment of the landslide susceptibility is extremely important for such high vulnerable areas because it gives basic construction standards for new roads or buildings, helps to assess the impact of future landslides and can also be used to locate key facilities like hospitals, fire stations, etc. As a general recommendation,

if end users intend to use only the susceptibility map for land use planning, then no public or personal utility projects should be considered in high susceptible areas, strict building safety regulations should be followed in moderate susceptible areas and constructions with simple slope stability measures be allowed in low susceptible areas. This is a general recommendation related to the landslide susceptibility based on the present land use condition. However the susceptibility values can be lowered if proper mitigation measures are adopted such that a high susceptible area can be made less vulnerable to landslides. Therefore, it is recommended that the susceptibility map should be interpreted accordingly and the degree of susceptibility or hazard in response of mitigation measures should be worked out judiciously. In this regard cost - benefit analysis may be carried out for better planning.

- Disaster Risk Reduction (DRR) approach should be adopted to minimise the damage caused by such natural calamity like landslide. India is one of the signatory of SENDAI FRAMEWORK (2015 – 2030), hence the findings of the report should be conveyed to concerned agencies for mitigation and remedial works.
- In the event if a disaster strikes, then loss would be immense if buildings are not safely and properly located. The only economical way of reducing “at least” the loss of life is by making people aware of the inherent risk. Therefore, it is recommended that more priority should be given in increasing awareness amongst people through Community Based Disaster Management Programme (CBDMP).
- The awareness should include information about the potential danger, its identification and its communication; the physical significance of hazard and inherent uncertainties; ways to reduce landslide risk and the available local mitigation options.
- The villages or communities located in and around high susceptible areas should be given priority in holding CBDMP.

Detailed Recommendations

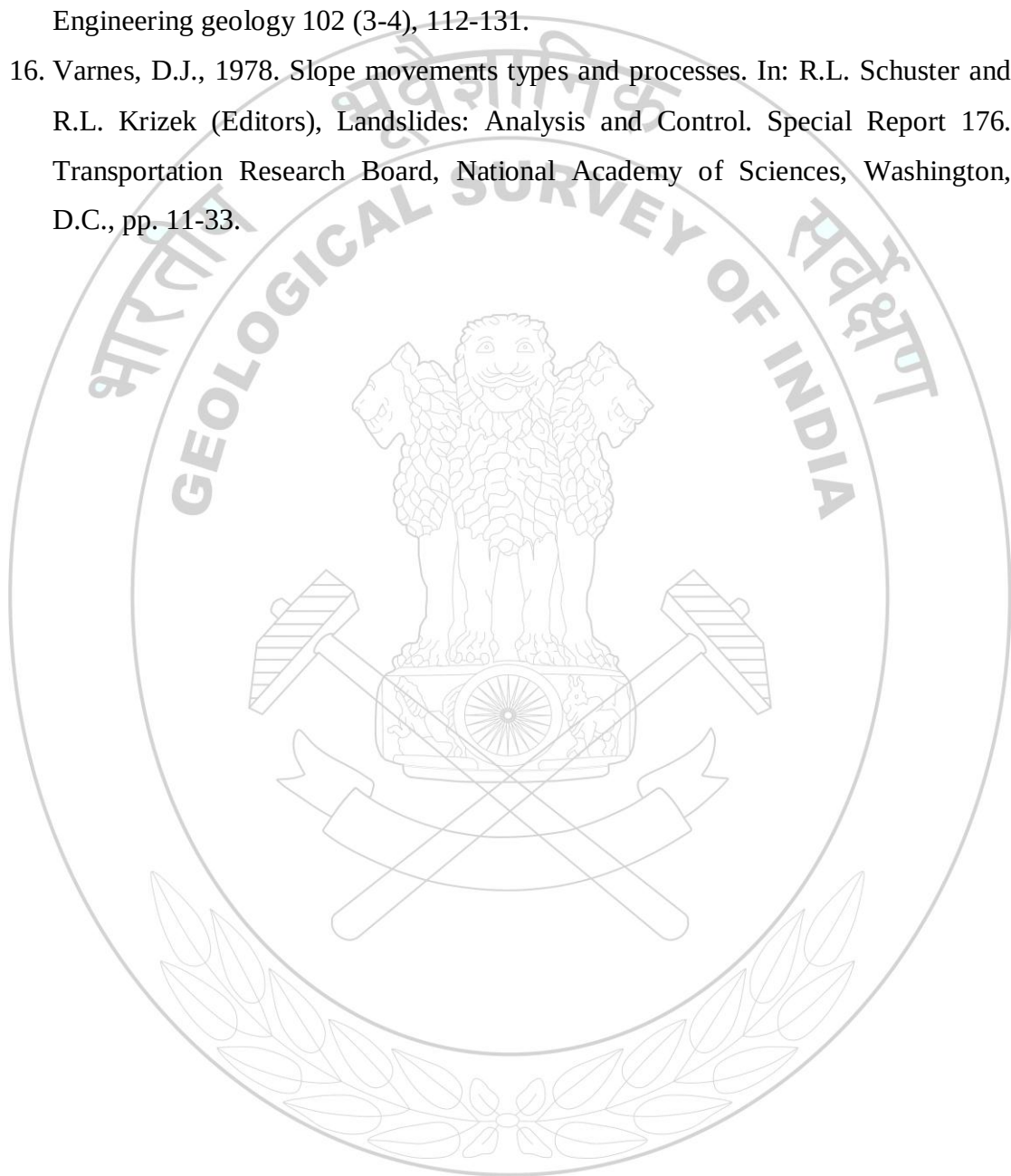
Based on the evaluation of the geofactors and understanding their relative importance that are specific to the terrain, as well as considering the scale of the study and the observations made in the field, the following generic recommendations are suggested:

- Future developmental planning like expansion of township, development of infrastructure, etc., may be carried out in the designated low susceptibility zones, i.e. in and around localities like Sringeri, Jayapura, Balehonnuru, Magundi, Kalasa, Hornadu, Charmadi etc.
- The areas situated in western, south western and south eastern side of the study area falls under moderate susceptibility class with considerable patches of areas under high susceptibility class within it. So, construction of public or personal utility projects should be avoided in moderate to highly susceptible areas.
- One major road corridor of the study area is NH – 73 connecting Mangaluru to Tumkuru passes through the area. An approx. 30 km stretch of this very important communication corridor falls within the study area. A conclusion derived from the generated Landslide Susceptibility Map (LSM) indicates that a stretch of 20 km (from east of Charmadi to west of Kotighere) of the road corridor falls under mostly moderate susceptibility zones along with few stretches of both high and low susceptibility zones. The area is part of Western Ghats of Karnataka and locally known as Charmadi Ghat section. Regular monitoring may be taken up for these road corridors to avoid future slope failures.
- 75 nos. of landslide incidences have been recorded in the Charmadi Ghat of 20 km road corridor and all of the landslides are result of the toe cutting of the slope for road construction. Moreover, most of the landslides are active or reactivated in nature, with few landslides in suspended or dormant condition. A detail site specific study of this road stretch may be taken up to get an idea about the actual conditions leading to sliding and to suggest remedial measures.
- Charmadi Ghat of 20 km road corridor is showing low angle valley side dipping major joint at many places. Joint spacing varies from 80 cm to 1.5 m and joint continues for long distance. Planer failure from this valley side dipping joints in future may not be ruled out. So, there is a big risk of the road to get damaged if the planer failure takes place. Hence, a detailed study may be taken up to get an idea about the actual field conditions and to suggest proper remedial measures.

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LOCALITY INDEX

Sl. No	Village Name	Toposheet No	Latitude (N)	Longitude (E)
1	Baggunji	48O07	13° 26' 34.392" N	75° 20' 3.437" E
2	Balehole	48O07	13° 16' 5.033" N	75° 25' 31.741" E
3	Balehonnuru	48O07	13° 21' 9.832" N	75° 27' 32.278" E
4	Ball	48O08	13° 0' 43.170" N	75° 25' 36.756" E
5	Bandihalla	48O07	13° 24' 51.309" N	75° 28' 48.719" E
6	Bannuru	48O07	13° 20' 6.026" N	75° 29' 31.004" E
7	Basarikatte	48O07	13° 18' 29.705" N	75° 23' 6.484" E
8	Bedagaru	48O07	13° 20' 33.948" N	75° 24' 22.884" E
9	Bilalkoppa	48O07	13° 18' 43.400" N	75° 21' 43.829" E
10	Billagadde	48O07	13° 29' 41.251" N	75° 15' 20.042" E
11	Charmadi	48O08	13° 2' 58.223" N	75° 24' 52.082" E
12	Galigandi	48O08	13° 11' 21.186" N	75° 22' 8.408" E
13	Ganapatikatte	48O07	13° 27' 13.047" N	75° 27' 59.812" E
14	Gangankudrige	48O08	13° 12' 52.238" N	75° 22' 49.723" E
15	Herur	48O07	13° 23' 14.710" N	75° 17' 49.417" E
16	Heruru	48O07	13° 21' 57.023" N	75° 24' 20.047" E
17	Hirebail	48O08	13° 11' 50.597" N	75° 24' 32.180" E
18	Horandu	48O08	13° 14' 56.814" N	75° 22' 3.660" E
19	Hosakoppa	48O07	13° 29' 57.756" N	75° 26' 3.538" E
20	Hosakoppa	48O07	13° 28' 52.204" N	75° 18' 22.771" E
21	Indabettu	48O08	13° 4' 5.458" N	75° 20' 40.730" E
22	Jamalabad	48O08	13° 1' 36.536" N	75° 17' 13.415" E
23	Javali	48O08	13° 10' 17.368" N	75° 28' 57.109" E
24	Jayapura	48O07	13° 24' 15.499" N	75° 22' 6.689" E
25	Kachige	48O07	13° 23' 9.427" N	75° 19' 23.154" E
26	Kajur	48O08	13° 6' 38.679" N	75° 22' 27.507" E
27	Kalasa	48O08	13° 13' 56.206" N	75° 21' 19.910" E
28	Kavadi	48O07	13° 27' 11.839" N	75° 16' 16.002" E
29	Kelagur	48O08	13° 9' 55.160" N	75° 27' 43.372" E
30	Killur	48O08	13° 6' 9.383" N	75° 21' 48.237" E
31	Kuchur	48O08	13° 4' 7.960" N	75° 22' 40.792" E
32	Lokanatapur	48O07	13° 25' 22.925" N	75° 21' 53.989" E
33	Magundi	48O07	13° 16' 20.772" N	75° 29' 0.507" E
34	Maidadi	48O08	13° 10' 11.653" N	75° 23' 38.672" E
35	Makkikoppa	48O07	13° 24' 0.548" N	75° 21' 42.209" E
36	Malleshvara	48O08	13° 13' 17.906" N	75° 15' 4.274" E
37	Manjotti	48O08	13° 1' 34.787" N	75° 18' 35.634" E
38	Megur	48O07	13° 20' 29.891" N	75° 18' 10.739" E

Sl. No	Village Name	Toposheet No	Latitude (N)	Longitude (E)
39	Melantabettu	48O08	13° 0' 20.701" N	75° 15' 31.876" E
40	Melpal	48O07	13° 26' 6.561" N	75° 25' 26.019" E
41	Menasahadya	48O07	13° 17' 48.866" N	75° 18' 11.150" E
42	Menase	48O07	13° 25' 13.979" N	75° 15' 59.311" E
43	Mura	48O08	13° 3' 13.742" N	75° 19' 24.630" E
44	Nadumane	48O08	13° 3' 39.184" N	75° 25' 49.111" E
45	Narve	48O07	13° 28' 59.061" N	75° 19' 57.036" E
46	Nellibidu	48O08	13° 12' 12.826" N	75° 17' 10.803" E
47	Parabettu	48O08	13° 1' 44.074" N	75° 15' 41.924" E
48	Samshe	48O08	13° 11' 7.901" N	75° 19' 39.134" E
49	Shantigarma (Kogre)	48O07	13° 20' 14.695" N	75° 20' 55.001" E
50	Sigodu	48O07	13° 20' 48.990" N	75° 25' 44.109" E
51	Sike	48O07	13° 22' 27.064" N	75° 28' 20.215" E
52	Somantadka	48O08	13° 1' 41.052" N	75° 22' 40.329" E
53	Sringeri	48O07	13° 25' 30.816" N	75° 15' 19.339" E
54	Sulugodu	48O07	13° 26' 41.383" N	75° 18' 55.309" E
55	Surikasale	48O08	13° 9' 33.129" N	75° 26' 54.605" E
56	Talagur	48O08	13° 13' 19.024" N	75° 29' 19.839" E
57	Tekkur	48O07	13° 22' 46.415" N	75° 15' 26.268" E
58	Totaduru	48O07	13° 17' 48.388" N	75° 23' 46.387" E
59	Tuppuru	48O07	13° 25' 1.885" N	75° 26' 12.888" E
60	Ujre	48O08	13° 0' 28.975" N	75° 20' 25.507" E

SYNOPSIS OF WORK DONE

1	Title of the report	Macro – scale (1:50,000) Landslide Susceptibility Mapping in parts of toposheet nos. 48O/07 and 48O/08, Chikmangaluru and Dakshin Kannad districts, Karnataka.	
2	FSP Code No	M4LSSM/NC/SR/SU-KG/2017/12200	
3	Field Season	2017 – 18	
4	Date of Commencement	20 th September 2017	
5	Date of Completion	17 th February 2018	
6	Officers associated with the investigation and no. of days spent in the field	Tanvi Gupta, Geologist (80 days) Sunandan Basu, Geologist (83 days)	
7	Quantum of work done		
	1. Pre-field preparation		
	(i) Slope Forming Material map	1498 sq. km	
	(ii) Geomorphology & Lineament map	1498 sq. km	
	(iii) Slope Morphometry (slope, aspect & curvature) map	1498 sq. km	
	(iv) Land use - Land cover map	1498 sq. km	
	(v) Drainage map	1498 sq. km	
	(vi) Regolith thickness map	1498 sq. km	
	(vii) Preparation of Landslide Inventory Map	1498 sq. km	
	2. Field-based studies		
	(i) Field-checking of all thematic maps	1498 sq. km	
	(ii) Field checking and collection of landslide inventory attributes (41 point geo – parametric sheet)	1498 sq. km (115 Nos.)	
	3. Post-field studies & modelling		
	(i) Updation of thematic and inventory maps in GIS	1498 sq. km	
	(ii) Landslide Susceptibility modelling and finalization of landslide susceptibility map in GIS.	1498 sq. km	
	4. Collection of rainfall data from available rain stations	1498 sq. km (Collected available data)	
8	Expenditure		
	Wages (Rs.)	57,400.00	
	OC (Rs.)	32,378.00	
	Total (Rs.)	89,778.00	

FIVE POINT PROFORMA

Title of the report: <i>Macro – scale (1:50,000) Landslide Susceptibility Mapping in parts of toposheet nos. 48O/07 and 48O/08, Chikmangaluru and Dakshin Kannad districts, Karnataka.</i>	
1. Background of the investigation at whose instance or with what particular objective in view the investigation was undertaken	The item was taken up as per the annual programme of GSI for FS 2017 – 18 to prepare seamless landslide susceptibility map.
2. Whether the item of investigation was included in the approved programme for the year concerned. If so, particulars, such as item No. page reference etc. may be given.	Yes. M4LSSM/NC/SR/SU-KG/2017/12200
3. Date of commencement of the investigation with month and year, and exact number of days spent by the officer(s) in the field in connection with the investigation.	20 th September 2017 2 officers spent total 163 man days at the field 1. Tanvi Gupta, Geologist – 80 days 2. Sunandan Basu, Geologist – 83 days
4. Brief comments by Director / Supervisory officer on the conclusion and recommendation by the author(s) with suggestion for implementing the same.	I fully agree with the conclusions drawn and recommendations made by the authors.
5. Please state specifically how the results of the investigation were achieved compared with the objective for which it was undertaken	The objective of the investigation is fully achieved.
Date: Place: Bengaluru	Shri J. Srihari Director



Photo – 1: Active debris slide (Slide Name: KAR/CKM/48O08/2017/001) along Kalasa – Kotighere road section in TS no 48O/08 (Latitude - $13^{\circ} 13' 22.64''$ N, Longitude - $75^{\circ} 21' 59.47''$ E).



Photo – 2: Active debris slide (Slide Name: KAR/CKM/48O08/2017/013) along Kalasa – Kudremukh road section in TS no 48O/08 (Latitude - $13^{\circ} 13' 37.07''$ N, Longitude - $75^{\circ} 21' 11.93''$ E).



Photo – 3: Reactivated rock slide (Slide Name: KAR/CKM/48O08/2017/017) along Kalasa – Kudremukh road section in TS no 48O/08 (Latitude - $13^{\circ} 12' 38.17''$ N, Longitude - $75^{\circ} 15' 31.84''$ E).



Photo – 4: Active debris slide (Slide Name: KAR/CKM/48O08/2017/053) along Kotighere – Ujire road section in TS no 48O/08 (Latitude - $13^{\circ} 4' 44.61''$ N, Longitude - $75^{\circ} 28' 11.12''$ E).



Photo – 5: Active debris slide (Slide Name: KAR/CKM/48O08/2017/077) along Kotighere – Ujire road section in TS no 48O/08 (Latitude - $13^{\circ} 4' 36.88''$ N, Longitude - $75^{\circ} 27' 22.63''$ E).



Photo – 6: Extensive Cut Slope near Kalasa along Kalasa – Kotighere road section in TS no 48O/08.



Photo – 7: Cultivation and High Height Plantation (HHP) (LULC) near Samse in TS no 48O/08.



Photo – 8: Plantation (LHP) (LULC) near Kealgur in TS no 48O/08.

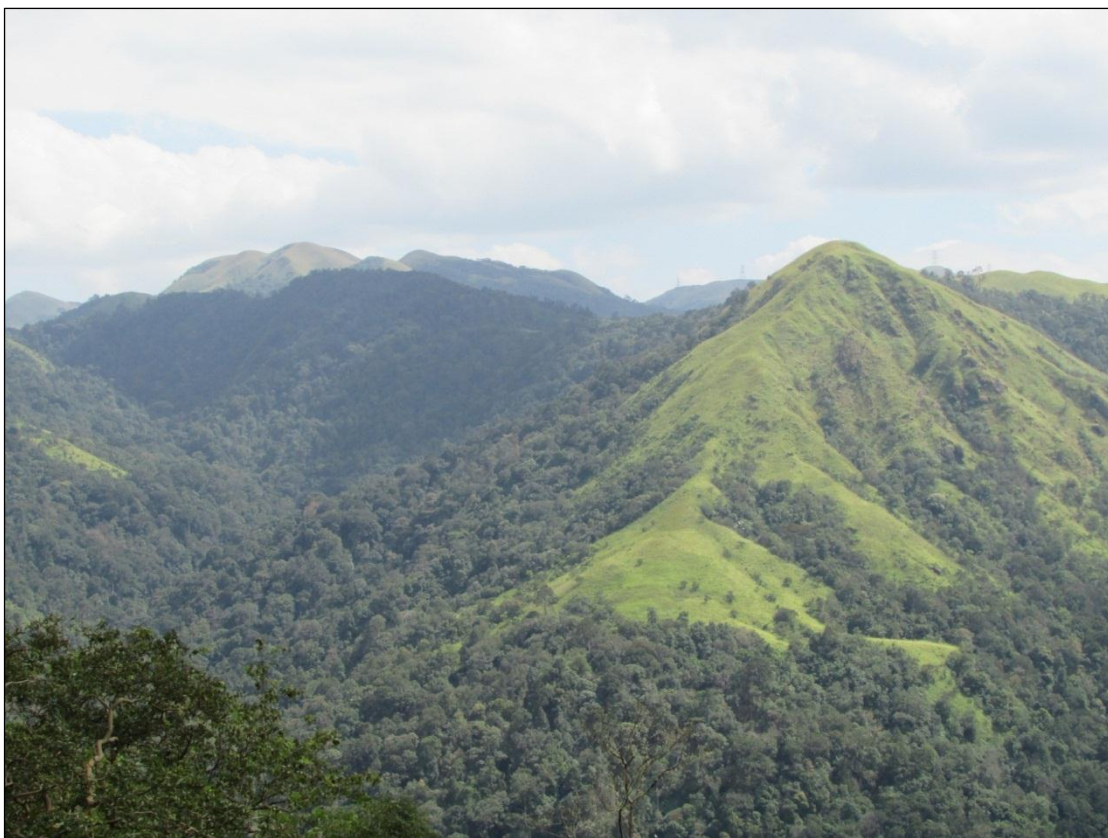


Photo – 9: View of Moderately Dissected Slope (MDS) (Geomorphology) covered by Thick Vegetation and Barren patches (LULC) near Kode Kallu in TS no 48O/08.



Photo – 10: View of Lowly Dissected Slope (LDS) (Geomorphology) near Kudremukh in TS no 48O/08.



Photo – 11: View of Escarpment (Geomorphology) near Maidadi in TS no 48O/08.



Photo – 12: View of Valley Fill (Geomorphology) covered with Cultivation (LULC) near Javali in TS no 48O/08.



Photo – 13: Rock (SFM) is exposed along hill slope (LULC: Barren and RT is $<0.5\text{m}$) near Jenu Kallu in TS no 48O/08.



Photo – 14: Valley side dipping jointed rock (granite gneiss) exposed along Charmudi Ghat section in TS no 48O/08.

Annexure – 1: LOFS Calculations

Geofactor: Land Use Land Cover (LULC)

Rank of LULC Classes

SI No	Class Name	Code	Rank
1	Barren	B	1
2	Barren Sand	BS	0
3	Cultivation	CL	2
4	Extensive Slope Cut	ESC	9
5	Fallow Land	FL	1
6	Moderate Vegetation	MV	5
7	Plantation (HHP)	HHP	4
8	Plantation (LHP)	LHP	3
9	Quarry	QR	5
10	Settlement	S	1
11	Settlement on modified slope	SM	7
12	Swamp	SW	0
13	Thick Vegetation	TV	4
14	Sparse Vegetation	SV	7
15	Water body	WB	0
16	Salt Pan	SP	0

Geofactor: Land Use Land Cover (LULC)

Matrix of Pairwise Ratings of LULC Class

LULC	B	CL	ESC	FL	MV	HHP	LHP	QR	S	SM	TV	SV
B	1.00	0.50	0.11	1.00	0.20	0.25	0.33	0.20	1.00	0.14	0.25	0.14
CL	2.00	1.00	0.13	2.00	0.25	0.33	0.50	0.25	2.00	0.17	0.33	0.17
ESC	9.00	8.00	1.00	9.00	5.00	6.00	7.00	5.00	9.00	3.00	6.00	3.00
FL	1.00	0.50	0.11	1.00	0.20	0.25	0.33	0.20	1.00	0.14	0.25	0.14
MV	5.00	4.00	0.20	5.00	1.00	2.00	3.00	1.00	5.00	0.33	2.00	0.33
HHP	4.00	3.00	0.17	4.00	0.50	1.00	2.00	0.50	4.00	0.25	1.00	0.25
LHP	3.00	2.00	0.14	3.00	0.33	0.50	1.00	0.33	3.00	0.20	0.50	0.20
QR	5.00	4.00	0.20	5.00	1.00	2.00	3.00	1.00	5.00	0.33	2.00	0.33
S	1.00	0.50	0.11	1.00	0.20	0.25	0.33	0.50	1.00	0.14	0.25	0.14
SM	7.00	6.00	0.33	7.00	3.00	4.00	5.00	3.00	7.00	1.00	4.00	1.00
TV	4.00	3.00	0.17	4.00	0.50	1.00	2.00	0.50	4.00	0.25	1.00	0.25
SV	7.00	6.00	0.33	7.00	3.00	4.00	5.00	3.00	7.00	1.00	4.00	1.00
Sum Column	49.00	38.50	3.00	49.00	15.18	21.58	29.50	15.48	49.00	6.96	21.58	6.96

Geofactor: Land Use Land Cover (LULC)

Estimated Eigen values, fraction rate and LOFS for LULC classes

LULC	B	CL	ESC	FL	MV	HHP	LHP	QR	S	SM	TV	SV	Sum Rows	Frac Weight	LOFS
B	0.0204	0.0130	0.0370	0.0204	0.0132	0.0116	0.0113	0.0129	0.0204	0.0205	0.0116	0.0205	0.2128	0.0177	0.0626
CL	0.0408	0.0260	0.0417	0.0408	0.0165	0.0154	0.0169	0.0161	0.0408	0.0239	0.0154	0.0239	0.3184	0.0265	0.0937
ESC	0.1837	0.2078	0.3332	0.1837	0.3293	0.2780	0.2373	0.3229	0.1837	0.4309	0.2780	0.4309	3.3994	0.2833	1.0000
FL	0.0204	0.0130	0.0370	0.0204	0.0132	0.0116	0.0113	0.0129	0.0204	0.0205	0.0116	0.0205	0.2128	0.0177	0.0626
MV	0.1020	0.1039	0.0666	0.1020	0.0659	0.0927	0.1017	0.0646	0.1020	0.0479	0.0927	0.0479	0.9899	0.0825	0.2912
HHP	0.0816	0.0779	0.0555	0.0816	0.0329	0.0463	0.0678	0.0323	0.0816	0.0359	0.0463	0.0359	0.6759	0.0563	0.1988
LHP	0.0612	0.0519	0.0476	0.0612	0.0220	0.0232	0.0339	0.0215	0.0612	0.0287	0.0232	0.0287	0.4644	0.0387	0.1366
QR	0.1020	0.1039	0.0666	0.1020	0.0659	0.0927	0.1017	0.0646	0.1020	0.0479	0.0927	0.0479	0.9899	0.0825	0.2912
S	0.0204	0.0130	0.0370	0.0204	0.0132	0.0116	0.0113	0.0323	0.0204	0.0205	0.0116	0.0205	0.2322	0.0194	0.0683
SM	0.1429	0.1558	0.1111	0.1429	0.1976	0.1853	0.1695	0.1938	0.1429	0.1436	0.1853	0.1436	1.9143	0.1595	0.5631
TV	0.0816	0.0779	0.0555	0.0816	0.0329	0.0463	0.0678	0.0323	0.0816	0.0359	0.0463	0.0359	0.6759	0.0563	0.1988
SV	0.1429	0.1558	0.1111	0.1429	0.1976	0.1853	0.1695	0.1938	0.1429	0.1436	0.1853	0.1436	1.9143	0.1595	0.5631

Geofactor: Land Use Land Cover (LULC)

Estimation of consistency vector (CV), consistency index (CI) and consistency ratio (CR) for LULC classes

[illegible]

Geofactor: Geomorphology

Rank of Geomorphology Classes

Sl No	Class Name	Code	Rank
1	Denudational Slope	DS	9
2	Escarpment	ESC	2
3	Mound	MOUND	2
4	Colluvial Foot Slope	CFS	3
5	Lowly Dissected Slope	LDS	4
6	Moderately Dissected Slope	MDS	6
7	Highly Dissected Slope	HDS	8
8	Piedmont Slope	PIED SLOPE	4
9	Ridge - top	RT	0
10	Tidal Flat	TF	0
11	Colluvial Plain	CP	0
12	Plateau Top (Flat)	PT	0
13	Rolling Plain	RP	0
14	Valley Fill	VF	0
15	Alluvial Plain	AP	0
16	Beach	BE	0
17	Pediment – Pediplain Complex	PPC	0
18	Hilltop	HT	0
19	Water body	WB	0

Geofactor: Geomorphology

Matrix of Pairwise Ratings of Geomorphology Class

GEOM	DS	ESC	MOUND	CFS	LDS	MDS	HDS	PIED SLOPE
DS	1.00	8.00	8.00	7.00	6.00	4.00	2.00	6.00
ESC	0.13	1.00	1.00	0.50	0.33	0.20	0.14	0.33
MOUND	0.13	1.00	1.00	0.50	0.33	0.20	0.14	0.33
CFS	0.14	2.00	2.00	1.00	0.50	0.25	0.17	0.50
LDS	0.17	3.00	3.00	2.00	1.00	0.33	0.20	1.00
MDS	0.25	5.00	5.00	4.00	3.00	1.00	0.33	3.00
HDS	0.50	7.00	7.00	6.00	5.00	3.00	1.00	5.00
PIED SLOPE	0.17	3.00	3.00	2.00	1.00	0.33	0.20	1.00
Sum Column	2.48	30.00	30.00	23.00	17.17	9.32	4.19	17.17

Estimated Eigen values, fraction rate and LOFS for Geomorphology classes

GEOM	DS	ESC	MOUND	CFS	LDS	MDS	HDS	PIED SLOPE	Sum Rows	Frac Weight	LOFS
DS	0.4038	0.2667	0.2667	0.3043	0.3495	0.4293	0.4778	0.3495	2.8477	0.3560	1.0000
ESC	0.0505	0.0333	0.0333	0.0217	0.0194	0.0215	0.0341	0.0194	0.2333	0.0292	0.0819
MOUND	0.0505	0.0333	0.0333	0.0217	0.0194	0.0215	0.0341	0.0194	0.2333	0.0292	0.0819
CFS	0.0577	0.0667	0.0667	0.0435	0.0291	0.0268	0.0398	0.0291	0.3594	0.0449	0.1262
LDS	0.0673	0.1000	0.1000	0.0870	0.0583	0.0358	0.0478	0.0583	0.5543	0.0693	0.1947
MDS	0.1010	0.1667	0.1667	0.1739	0.1748	0.1073	0.0796	0.1748	1.1447	0.1431	0.4020
HDS	0.2019	0.2333	0.2333	0.2609	0.2913	0.3220	0.2389	0.2913	2.0729	0.2591	0.7279
PIED SLOPE	0.0673	0.1000	0.1000	0.0870	0.0583	0.0358	0.0478	0.0583	0.5543	0.0693	0.1947

Geofactor: Geomorphology

Estimation of consistency vector (CV), consistency index (CI) and consistency ratio (CR) for Geomorphology classes

[illegible]

Geofactor: Slope Forming Material (SFM)

Rank of SFM Classes

SI No	Class Name	Code	Rank
1	Compact Slide Debris	CSD	3
2	In – situ Soil	IS	4
3	Colluvium	CL	5
4	Loose Slide Debris	LSD	8
5	Rock Class Type – I	R - I	1
6	Rock Class Type – II	R - II	2
7	Rock Class Type – III	R - III	4
8	Transported Soil	TS	3
9	Weathered Rock	WR	6
10	Salt	SL	0
11	Water	WT	0
12	Alluvium	AL	0
13	Barren Sand	BS	0

Geofactor: Slope Forming Material (SFM)

Matrix of Pairwise Ratings of SFM Class

SFM	CSD	IS	CL	LSD	R – I	R – II	R – III	TS	WR
CSD	1.00	0.50	0.33	0.17	3.00	2.00	0.50	1.00	0.25
IS	2.00	1.00	0.50	0.20	4.00	3.00	1.00	2.00	0.33
CL	3.00	2.00	1.00	0.25	5.00	4.00	2.00	3.00	0.50
LSD	6.00	5.00	4.00	1.00	8.00	7.00	5.00	6.00	3.00
R - I	0.33	0.25	0.20	0.13	1.00	0.50	0.25	0.33	0.17
R - II	0.50	0.33	0.25	0.14	2.00	1.00	0.33	0.50	0.20
R - III	2.00	1.00	0.50	0.20	4.00	3.00	1.00	2.00	0.33
TS	1.00	0.50	0.33	0.17	3.00	2.00	0.50	1.00	0.25
WR	4.00	3.00	2.00	0.33	6.00	5.00	3.00	4.00	1.00
Sum Column	19.83	13.58	9.12	2.58	36.00	27.50	13.58	19.83	6.03

Estimated Eigen values, fraction rate and LOFS for SFM classes

SFM	CSD	IS	CL	LSD	R – I	R – II	R – III	TS	WR	Sum Rows	Frac Weight	LOFS
CSD	0.0504	0.0368	0.0366	0.0645	0.0833	0.0727	0.0368	0.0504	0.0414	0.4730	0.0526	0.1506
IS	0.1008	0.0736	0.0548	0.0774	0.1111	0.1091	0.0736	0.1008	0.0552	0.7566	0.0841	0.2409
CL	0.1513	0.1472	0.1097	0.0967	0.1389	0.1455	0.1472	0.1513	0.0829	1.1706	0.1301	0.3727
LSD	0.3025	0.3681	0.4388	0.3869	0.2222	0.2545	0.3681	0.3025	0.4972	3.1409	0.3490	1.0000
R - I	0.0168	0.0184	0.0219	0.0484	0.0278	0.0182	0.0184	0.0168	0.0276	0.2143	0.0238	0.0682
R - II	0.0252	0.0245	0.0274	0.0553	0.0556	0.0364	0.0245	0.0252	0.0331	0.3073	0.0341	0.0978
R - III	0.1008	0.0736	0.0548	0.0774	0.1111	0.1091	0.0736	0.1008	0.0552	0.7566	0.0841	0.2409
TS	0.0504	0.0368	0.0366	0.0645	0.0833	0.0727	0.0368	0.0504	0.0414	0.4730	0.0526	0.1506
WR	0.2017	0.2209	0.2194	0.1290	0.1667	0.1818	0.2209	0.2017	0.1657	1.7077	0.1897	0.5437

Geofactor: Slope Forming Material (SFM)

Estimation of consistency vector (CV), consistency index (CI) and consistency ratio (CR) for SFM classes

[illegible]

Geofactor: Regolith Thickness

Rank of Regolith Thickness Classes

Sl No	Class Name	Code	Rank
1	< 0.5 m	< 0.5 m	0
2	0.5 m – 5 m	0.5 m – 5 m	7
3	5 m – 10 m	5 m – 10 m	4
4	> 10 m	> 10 m	2

Matrix of Pairwise Ratings of Regolith Thickness Class

Regolith Thickness	0.5 – 5 m	5 – 10 m	> 10 m
0.5 – 5 m	1.00	4.00	6.00
5 – 10 m	0.25	1.00	3.00
> 10 m	0.17	0.33	1.00
Sum Column	1.42	5.33	10.00

Geofactor: Regolith Thickness

Estimated Eigen values, fraction rate and LOFS for Regolith Thickness classes

Regolith Thickness	0.5 – 5 m	5 – 10 m	> 10 m	Sum Rows	Frac Weight	LOFS
0.5 – 5 m	0.705882	0.75	0.6	2.055882	0.685294	1.0000
5 – 10 m	0.176471	0.1875	0.3	0.663971	0.221324	0.3230
> 10 m	0.117647	0.0625	0.1	0.280147	0.093382	0.1363

Estimation of consistency vector (CV), consistency index (CI) and consistency ratio (CR) for Regolith Thickness classes

Regolith Thickness	0.5 – 5 m	5 – 10 m	> 10 m	Sum Rows	CV
0.5 – 5 m	0.685294	0.885294	0.560294	2.130882	3.109442
5 – 10 m	0.171324	0.221324	0.280147	0.672794	3.039867
> 10 m	0.114216	0.073775	0.093382	0.281373	3.013123
Sum CV					9.162433
Mean Consistency Vector (Mean CV) = Total CV/ Nos. Of factor class (9.162433/3) =					3.054144
Consistency Index (CI) = (Mean CV - No. Of criteria/ factor class) / (No. Of factor class - 1) =					0.027072
Consistency Ratio (CR) = CI/ RI = 0.027072 / 0.58 =					0.0467

Geofactor: Slope Angle

Rank of Slope Angle Classes

Sl No	Class Name	Code	Rank
1	< 15°	< 15°	4
2	15° - 25°	15° - 25°	6
3	25° - 35°	25° - 35°	8
4	35° - 45°	35° - 45°	5
5	> 45°	> 45°	4

Matrix of Pairwise Ratings of Slope Angle Class

Slope Class	< 15°	15° - 25°	25° - 35°	35° - 45°	> 45°
< 15°	1.00	0.33	0.20	0.50	1.00
15° - 25°	3.00	1.00	0.33	2.00	3.00
25° - 35°	5.00	3.00	1.00	4.00	5.00
35° - 45°	2.00	0.50	0.25	1.00	2.00
> 45°	1.00	0.33	0.20	0.50	1.00
Sum Column	12.00	5.17	1.98	8.00	12.00

Geofactor: Slope Angle

Estimated Eigen values, fraction rate and LOFS for Slope Angle classes

Slope Class	< 15°	15° - 25°	25° - 35°	35° - 45°	> 45°	Sum Rows	Frac Weight	LOFS
< 15°	0.083333333	0.064516129	0.100840336	0.0625	0.083333333	0.394523132	0.078904626	0.1631
15° - 25°	0.25	0.193548387	0.168067227	0.25	0.25	1.111615614	0.222323123	0.4597
25° - 35°	0.416666667	0.580645161	0.504201681	0.5	0.416666667	2.418180175	0.483636035	1.0000
35° - 45°	0.166666667	0.096774194	0.12605042	0.125	0.166666667	0.681157947	0.136231589	0.2817
> 45°	0.083333333	0.064516129	0.100840336	0.0625	0.083333333	0.394523132	0.078904626	0.1631

Estimation of consistency vector (CV), consistency index (CI) and consistency ratio (CR) for Slope Angle classes

[illegible]

Geofactor: Slope Curvature

Rank of Slope Curvature Classes

Sl No	Class Name	Code	Rank
1	< -0.1	Concave	4
2	-0.1 – 0.1	Flat	2
3	> 0.1	Convex	6

Matrix of Pairwise Ratings of Slope Curvature Class

Slope Curvature	Concave	Flat	Convex
Concave	1.00	3.00	0.33
Flat	0.33	1.00	0.20
Convex	3.00	5.00	1.00
Sum Column	4.33	9.00	1.53

Geofactor: Slope Curvature

Estimated Eigen values, fraction rate and LOFS for Slope Curvature classes

Slope Curvature	Concave	Flat	Convex	Sum Rows	Frac Weight	LOFS
Concave	0.230769	0.333333	0.217391	0.781494	0.260498	0.4113
Flat	0.076923	0.111111	0.130435	0.318469	0.106156	0.1676
Convex	0.692308	0.555556	0.652174	1.900037	0.633346	1.0000

Estimation of consistency vector (CV), consistency index (CI) and consistency ratio (CR) for Slope Angle classes

Slope Curvature	Concave	Flat	Convex	Sum Rows	CV
Concave	0.260498	0.318469	0.211115	0.790082	3.032969
Flat	0.086833	0.106156	0.126669	0.319658	3.011202
Convex	0.781494	0.530782	0.633346	1.945621	3.071973
Sum CV					9.116144
Mean Consistency Vector (Mean CV) = Total CV/ Nos. Of factor class (9.116144/3) =					3.038715
Consistency Index (CI) = (Mean CV - No. Of criteria/ factor class) / (No. Of factor class - 1) =					0.019357
Consistency Ratio (CR) = CI/ RI = 0.019357 / 0.58 =					0.0334

Geofactor Maps

Weightage of Geofactor Maps

Sl No	Factor Map Name	Code	Weightage
1	Slope	SLP	9
2	Curvature	CUR	2
3	Slope Forming Material	SFM	6
4	Land Use Land Cover	LULC	8
5	Geomorphology	GEOM	6
6	Regolith Thickness	RT	4

Matrix of Pairwise Ratings of Factor Map

Factor Class	SLP	CUR	SFM	LULC	GEOM	RT
SLP	1.00	8.00	4.00	2.00	4.00	6.00
CUR	0.13	1.00	0.20	0.14	0.20	0.33
SFM	0.25	5.00	1.00	0.33	1.00	3.00
LULC	0.50	7.00	3.00	1.00	3.00	5.00
GEOM	0.25	5.00	1.00	0.33	1.00	3.00
RT	0.17	3.00	0.33	0.20	0.33	1.00
Sum Column	2.29	29.00	9.53	4.01	9.53	18.33

Factor Map

Estimated Eigen values, fraction rate and Weight for Factor Map

Factor Class	SLP	CUR	SFM	LULC	GEOM	RT	Sum Rows	Frac Weight	Weight
SLP	0.43636	0.27586	0.41958	0.49881	0.41958	0.32727	2.37747	0.396245271	12.86527835 ~ 13
CUR	0.05455	0.03448	0.02098	0.03563	0.02098	0.01818	0.18480	0.030799588	1 ~ 1
SFM	0.10909	0.17241	0.10490	0.08314	0.10490	0.16364	0.73807	0.123011111	3.993920696 ~ 4
LULC	0.21818	0.24138	0.31469	0.24941	0.31469	0.27273	1.61107	0.268510868	8.718001981 ~ 9
GEOM	0.10909	0.17241	0.10490	0.08314	0.10490	0.16364	0.73807	0.123011111	3.993920696 ~ 4
RT	0.07273	0.10345	0.03497	0.04988	0.03497	0.05455	0.35053	0.058422051	1.896845233 ~ 2

Estimation of consistency vector (CV), consistency index (CI) and consistency ratio (CR) for Factor Map

[illegible]

Annexure – 2: 41 Point Geo-parametric Data Format for Landslides

1	Name	KAR/CKM/48O08/2017/001	KAR/CKM/48O08/2017/002
2	Longitude (DMS)	75° 21' 59.470" E	75° 22' 12.280" E
3	Latitude (DMS)	13° 13' 22.645" N	13° 13' 14.469" N
4	Toposheet No	48O08	48O08
5	Village Name	South East of Kalasa	South East of Kalasa
6	Road	Kalasa - Kotighere (SH - 106)	Kalasa - Kotighere (SH - 106)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Moderate	Moderate
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	Moderate
22	Risk	Moderate	Moderate
23	Landslide Length (m)	15	4
24	Landslide Width (m)	52	25
25	Landslide Height (m)	7	2
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Deep Seated (>5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Suspended
31	Landslide Distribution	Retrogressive & Widening	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Deep translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	30°	35°
36	Downslope	55°	65°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes and plantation	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/003	KAR/CKM/48O08/2017/004
2	Longitude (DMS)	75° 22' 33.284" E	75° 22' 36.566" E
3	Latitude (DMS)	13° 12' 57.385" N	13° 12' 56.247" N
4	Toposheet No	48O08	48O08
5	Village Name	North West of Gangankudrige	North West of Gangankudrige
6	Road	Kalasa - Kotighere (SH - 106)	Kalasa - Kotighere (SH - 106)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Moderate	Moderate
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	4	6
24	Landslide Width (m)	14	10
25	Landslide Height (m)	2	2
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Suspended	Dormant
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	25°	30°
36	Downslope	75°	65°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/005	KAR/CKM/48O08/2017/006
2	Longitude (DMS)	75° 22' 40.211" E	75° 23' 30.119" E
3	Latitude (DMS)	13° 12' 53.014" N	13° 11' 48.942" N
4	Toposheet No	48O08	48O08
5	Village Name	Gangankudrige	West of Hirebail
6	Road	Kalasa - Kotighere (SH - 106)	Kalasa - Kotighere (SH - 106)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Meta-basalt
10	Weathering	Moderate	Moderate
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Moderate	Low
22	Risk	Moderate	Low
23	Landslide Length (m)	5	3
24	Landslide Width (m)	13	15
25	Landslide Height (m)	3	2
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Suspended	Suspended
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	25°	25°
36	Downslope	75°	60°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/007	KAR/CKM/48O08/2017/008
2	Longitude (DMS)	75° 23' 52.366" E	75° 24' 6.104" E
3	Latitude (DMS)	13° 11' 48.337" N	13° 11' 56.319" N
4	Toposheet No	48O08	48O08
5	Village Name	West of Hirebail	North West of Hirebail
6	Road	Kalasa - Kotighere (SH - 106)	Kalasa - Kotighere (SH - 106)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Meta-basalt	Meta-basalt
10	Weathering	Moderate	Moderate
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	Moderate
22	Risk	Moderate	Moderate
23	Landslide Length (m)	8	7
24	Landslide Width (m)	10	14
25	Landslide Height (m)	2	3
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Suspended	Active
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	30°	Road
36	Downslope	80°	70°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/009	KAR/CKM/48O08/2017/010
2	Longitude (DMS)	75° 24' 27.859" E	75° 24' 34.404" E
3	Latitude (DMS)	13° 11' 51.847" N	13° 11' 48.068" N
4	Toposheet No	48O08	48O08
5	Village Name	North of Hirebail	South of Hirebail
6	Road	Kalasa - Kotighere (SH - 106)	Kalasa - Kotighere (SH - 106)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Moderate	Moderate
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	18	10
24	Landslide Width (m)	100	13
25	Landslide Height (m)	5	2
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Deep Seated (>5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Suspended
31	Landslide Distribution	Retrogressive & Widening	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Deep translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	30°	35°
36	Downslope	75°	80°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/011	KAR/CKM/48O08/2017/012
2	Longitude (DMS)	75° 25' 9.953" E	75° 27' 7.062" E
3	Latitude (DMS)	13° 11' 29.500" N	13° 10' 3.583" N
4	Toposheet No	48O08	48O08
5	Village Name	South East of Hirebail	North West of Kelagur
6	Road	Kalasa - Kotighere (SH - 106)	Kalasa - Kotighere (SH - 106)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Moderate	Moderate
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Moderate	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	7	9
24	Landslide Width (m)	12	12
25	Landslide Height (m)	2	2
26	Landslide Run Out (m)	Nil	5
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Dormant	Active
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	40°
36	Downslope	60°	65°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Presently covered with plants	Nil

1	Name	KAR/CKM/48O08/2017/013	KAR/CKM/48O08/2017/014
2	Longitude (DMS)	75° 21' 11.931" E	75° 21' 10.708" E
3	Latitude (DMS)	13° 13' 37.075" N	13° 13' 35.059" N
4	Toposheet No	48O08	48O08
5	Village Name	South of Kalasa	South of Kalasa
6	Road	Kalasa - Kudremukh (SH - 66)	Kalasa - Kudremukh (SH - 66)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Moderate	Moderate
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	Moderate
22	Risk	Moderate	Moderate
23	Landslide Length (m)	30	8
24	Landslide Width (m)	65	27
25	Landslide Height (m)	10	3
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Deep Seated (>5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Reactivated
31	Landslide Distribution	Retrogressive & Widening	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Deep translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	20°	15°
36	Downslope	75°	75°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Existing retaining wall should be extended along road and weep holes to be cleaned	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/015	KAR/CKM/48O08/2017/016
2	Longitude (DMS)	75° 18' 35.925" E	75° 17' 42.202" E
3	Latitude (DMS)	13° 11' 22.210" N	13° 11' 38.765" N
4	Toposheet No	48O08	48O08
5	Village Name	West of Samse	West of Samse
6	Road	Kalasa - Kudremukh (SH - 66)	Kalasa - Kudremukh (SH - 66)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Meta-basalt	Meta-basalt
10	Weathering	Moderate	Moderate
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Moderate	Moderate
22	Risk	Moderate	Moderate
23	Landslide Length (m)	4	4
24	Landslide Width (m)	23	11
25	Landslide Height (m)	2	2
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Active
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	30°	30°
36	Downslope	75°	75°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/017	KAR/CKM/48O08/2017/018
2	Longitude (DMS)	75° 15' 31.844" E	75° 29' 43.070" E
3	Latitude (DMS)	13° 12' 38.170" N	13° 7' 9.728" N
4	Toposheet No	48O08	48O08
5	Village Name	West of Jamble	North East of Bidaratale
6	Road	Kalasa - Kudremukh (SH - 66)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Chlorite schist	Granite gneiss
10	Weathering	Moderate	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Moderate	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	20	15
24	Landslide Width (m)	34	23
25	Landslide Height (m)	4	4
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Rock	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Reactivated	Suspended
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	35°
36	Downslope	65°	70°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/019	KAR/CKM/48O08/2017/020
2	Longitude (DMS)	75° 29' 43.363" E	75° 29' 46.968" E
3	Latitude (DMS)	13° 7' 8.348" N	13° 6' 59.238" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Bidaratale	North East of Bidaratale
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Granite gneiss	Amphibolite
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	Moderate
22	Risk	Moderate	Moderate
23	Landslide Length (m)	12	11
24	Landslide Width (m)	28	30
25	Landslide Height (m)	3	4
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Suspended	Suspended
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	40°	35°
36	Downslope	65°	80°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/021	KAR/CKM/48O08/2017/022
2	Longitude (DMS)	75° 29' 48.949" E	75° 29' 48.936" E
3	Latitude (DMS)	13° 6' 52.309" N	13° 6' 51.138" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Bidaratale	North East of Bidaratale
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Moderate	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	12	15
24	Landslide Width (m)	14	52
25	Landslide Height (m)	3	4
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Suspended
31	Landslide Distribution	Retrogressive	Retrogressive & Widening
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	30°
36	Downslope	80°	80°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Retaining wall already constructed but there is no drainage holes	Nil

1	Name	KAR/CKM/48O08/2017/023	KAR/CKM/48O08/2017/024
2	Longitude (DMS)	75° 29' 48.823" E	75° 29' 44.564" E
3	Latitude (DMS)	13° 6' 50.533" N	13° 6' 47.605" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Bidaratale	North East of Bidaratale
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	12	15
24	Landslide Width (m)	15	16
25	Landslide Height (m)	3	3
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Dormant	Reactivated
31	Landslide Distribution	Retrogressive	Widening
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	30°
36	Downslope	65°	65°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/025	KAR/CKM/48O08/2017/026
2	Longitude (DMS)	75° 29' 41.750" E	75° 29' 38.330" E
3	Latitude (DMS)	13° 6' 48.974" N	13° 6' 50.240" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Bidaratale	North East of Bidaratale
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	20	6
24	Landslide Width (m)	50	4
25	Landslide Height (m)	3	2
26	Landslide Run Out (m)	Nil	8
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Dormant	Active
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	30°	35°
36	Downslope	60°	70°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Presently covered with grass	Nil

1	Name	KAR/CKM/48O08/2017/027	KAR/CKM/48O08/2017/028
2	Longitude (DMS)	75° 29' 12.287" E	75° 29' 10.620" E
3	Latitude (DMS)	13° 6' 34.082" N	13° 6' 34.230" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Bidaratale	North East of Bidaratale
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	15	15
24	Landslide Width (m)	22	16
25	Landslide Height (m)	4	4
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Rock
28	Movement Type	Slide	Fall
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Dormant	Dormant
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	35°
36	Downslope	75°	75°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/029	KAR/CKM/48O08/2017/030
2	Longitude (DMS)	75° 29' 0.125" E	75° 28' 56.219" E
3	Latitude (DMS)	13° 6' 14.574" N	13° 6' 0.321" N
4	Toposheet No	48O08	48O08
5	Village Name	South East of Bidaratale	South East of Bidaratale
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	25	15
24	Landslide Width (m)	8	5
25	Landslide Height (m)	3	2
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Rock
28	Movement Type	Slide	Fall
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Suspended	Active
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	30°	35°
36	Downslope	80°	65°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/031	KAR/CKM/48O08/2017/032
2	Longitude (DMS)	75° 28' 53.345" E	75° 28' 51.092" E
3	Latitude (DMS)	13° 5' 54.159" N	13° 5' 51.142" N
4	Toposheet No	48O08	48O08
5	Village Name	South of Bidaratale	South of Bidaratale
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	Rock
17	Thickness	0.5 – 5 m	< 0.5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Low	High
22	Risk	Low	Moderate
23	Landslide Length (m)	8	7
24	Landslide Width (m)	15	23
25	Landslide Height (m)	3	2
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Rock
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Dormant	Dormant
31	Landslide Distribution	Retrogressive	Retrogressive & Widening
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	30°	35°
36	Downslope	80°	65°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/033	KAR/CKM/48O08/2017/034
2	Longitude (DMS)	75° 28' 48.630" E	75° 28' 47.054" E
3	Latitude (DMS)	13° 5' 51.050" N	13° 5' 52.481" N
4	Toposheet No	48O08	48O08
5	Village Name	South of Bidaratale	South of Bidaratale
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	10	8
24	Landslide Width (m)	35	21
25	Landslide Height (m)	4	2
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Rock	Rock
28	Movement Type	Fall	Fall
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Dormant
31	Landslide Distribution	Retrogressive & Widening	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	30°	55°
36	Downslope	60°	70°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Presently covered with grass

1	Name	KAR/CKM/48O08/2017/033	KAR/CKM/48O08/2017/034
2	Longitude (DMS)	75° 28' 48.630" E	75° 28' 47.054" E
3	Latitude (DMS)	13° 5' 51.050" N	13° 5' 52.481" N
4	Toposheet No	48O08	48O08
5	Village Name	South of Bidaratale	South of Bidaratale
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	10	8
24	Landslide Width (m)	35	21
25	Landslide Height (m)	4	2
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Rock	Rock
28	Movement Type	Fall	Fall
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Dormant
31	Landslide Distribution	Retrogressive & Widening	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	30°	55°
36	Downslope	60°	70°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Presently covered with grass

1	Name	KAR/CKM/48O08/2017/035	KAR/CKM/48O08/2017/036
2	Longitude (DMS)	75° 28' 39.676" E	75° 28' 40.981" E
3	Latitude (DMS)	13° 5' 44.002" N	13° 5' 39.113" N
4	Toposheet No	48O08	48O08
5	Village Name	South of Bidaratale	South of Bidaratale
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	8	8
24	Landslide Width (m)	25	10
25	Landslide Height (m)	2	3
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Reactivated	Active
31	Landslide Distribution	Retrogressive & Widening	Retrogressive & Widening
32	Landslide Style	Multiple	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	25°	30°
36	Downslope	70°	65°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Existing retaining wall is damaged	Nil

1	Name	KAR/CKM/48O08/2017/037	KAR/CKM/48O08/2017/038
2	Longitude (DMS)	75° 28' 41.174" E	75° 28' 42.942" E
3	Latitude (DMS)	13° 5' 38.535" N	13° 5' 32.732" N
4	Toposheet No	48O08	48O08
5	Village Name	South of Bidaratale	South of Bidaratale
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	10	18
24	Landslide Width (m)	13	25
25	Landslide Height (m)	3	4
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Dormant
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	30°	25°
36	Downslope	60°	65°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/039	KAR/CKM/48O08/2017/040
2	Longitude (DMS)	75° 28' 44.407" E	75° 28' 31.910" E
3	Latitude (DMS)	13° 5' 30.075" N	13° 5' 27.619" N
4	Toposheet No	48O08	48O08
5	Village Name	South of Bidaratale	South of Bidaratale
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Dolerite	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology		Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	Low
22	Risk	Moderate	Low
23	Landslide Length (m)	15	8
24	Landslide Width (m)	30	20
25	Landslide Height (m)	4	2
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Rock	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Dormant	Suspended
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	30°
36	Downslope	65°	55°
37	Triggering Factor		Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Though the slide is mostly covered with grass, the toe portion of the slide is showing some sign of activity.

1	Name	KAR/CKM/48O08/2017/041	KAR/CKM/48O08/2017/042
2	Longitude (DMS)	75° 28' 31.134" E	75° 28' 25.214" E
3	Latitude (DMS)	13° 5' 27.313" N	13° 5' 12.876" N
4	Toposheet No	48O08	48O08
5	Village Name	South of Bidaratale	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	12	7
24	Landslide Width (m)	22	15
25	Landslide Height (m)	2	2
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Rock	Rock
28	Movement Type	Slide	Fall
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Dormant	Active
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	30°	35°
36	Downslope	70°	70°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	The slide is presently covered with grass.	Nil

1	Name	KAR/CKM/48O08/2017/043	KAR/CKM/48O08/2017/044
2	Longitude (DMS)	75° 28' 26.108" E	75° 28' 26.659" E
3	Latitude (DMS)	13° 5' 11.167" N	13° 5' 10.498" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	20	20
24	Landslide Width (m)	32	26
25	Landslide Height (m)	4	4
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Suspended	Dormant
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	35°
36	Downslope	70°	70°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/045	KAR/CKM/48O08/2017/046
2	Longitude (DMS)	75° 28' 26.563" E	75° 28' 25.341" E
3	Latitude (DMS)	13° 5' 9.718" N	13° 5' 8.357" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Granite gneiss	Dolerite
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	Low
22	Risk	Moderate	Low
23	Landslide Length (m)	12	12
24	Landslide Width (m)	18	25
25	Landslide Height (m)	4	5
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Rock
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Reactivated	Dormant
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	35°
36	Downslope	70°	80°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Though most of the slide is Suspended, few patches shows signs of activity	The slide is presently covered with grass.

1	Name	KAR/CKM/48O08/2017/047	KAR/CKM/48O08/2017/048
2	Longitude (DMS)	75° 28' 24.068" E	75° 28' 22.836" E
3	Latitude (DMS)	13° 5' 7.772" N	13° 5' 7.408" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	5	13
24	Landslide Width (m)	8	25
25	Landslide Height (m)	2	3
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Rock	Debris
28	Movement Type	Fall	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Reactivated
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Multiple
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	35°
36	Downslope	85°	75°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause		Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/049	KAR/DK/48O08/2017/050
2	Longitude (DMS)	75° 28' 20.452" E	75° 28' 12.795" E
3	Latitude (DMS)	13° 5' 5.608" N	13° 5' 2.434" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Granite gneiss	Amphibolite
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	6	10
24	Landslide Width (m)	30	20
25	Landslide Height (m)	2	3
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Reactivated	Suspended
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	30°	30°
36	Downslope	80°	65°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/DK/48O08/2017/051	KAR/CKM/48O08/2017/052
2	Longitude (DMS)	75° 28' 10.645" E	75° 28' 10.259" E
3	Latitude (DMS)	13° 4' 50.833" N	13° 4' 46.692" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Amphibolite	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Moderate	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	8	7
24	Landslide Width (m)	70	45
25	Landslide Height (m)	3	2
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Active
31	Landslide Distribution	Retrogressive & Widening	Retrogressive & Widening
32	Landslide Style	Multiple	Multiple
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	30°	30°
36	Downslope	75°	75°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/053	KAR/CKM/48O08/2017/054
2	Longitude (DMS)	75° 28' 11.118" E	75° 28' 12.571" E
3	Latitude (DMS)	13° 4' 44.610" N	13° 4' 42.990" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Granite gneiss	Amphibolite
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	8	6
24	Landslide Width (m)	28	12
25	Landslide Height (m)	3	3
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Active
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	30°
36	Downslope	80°	80°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/055	KAR/CKM/48O08/2017/056
2	Longitude (DMS)	75° 28' 21.746" E	75° 28' 19.378" E
3	Latitude (DMS)	13° 4' 41.881" N	13° 4' 37.407" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	6	7
24	Landslide Width (m)	14	21
25	Landslide Height (m)	2	3
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Dormant	Active
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	45°	45°
36	Downslope	80°	80°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	The slide is presently covered with grass.	Nil

1	Name	KAR/CKM/48O08/2017/057	KAR/CKM/48O08/2017/058
2	Longitude (DMS)	75° 28' 18.187" E	75° 28' 14.618" E
3	Latitude (DMS)	13° 4' 35.433" N	13° 4' 33.726" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Amphibolite	Amphibolite
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	8	7
24	Landslide Width (m)	60	13
25	Landslide Height (m)	3	2
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Active
31	Landslide Distribution	Retrogressive & Widening	Retrogressive
32	Landslide Style	Multiple	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	35°
36	Downslope	60°	75°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/059	KAR/CKM/48O08/2017/060
2	Longitude (DMS)	75° 28' 13.432" E	75° 28' 17.515" E
3	Latitude (DMS)	13° 4' 33.421" N	13° 4' 33.674" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Amphibolite	Amphibolite
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Moderate	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	6	15
24	Landslide Width (m)	10	32
25	Landslide Height (m)	3	3
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Suspended	Stabilized
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	Road
36	Downslope	80°	70°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Retaining wall with weep holes are constucted. Presently covered with grass.

1	Name	KAR/CKM/48O08/2017/061	KAR/DK/48O08/2017/062
2	Longitude (DMS)	75° 28' 11.723" E	75° 27' 53.112" E
3	Latitude (DMS)	13° 4' 32.517" N	13° 4' 47.038" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Moderate	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	12	12
24	Landslide Width (m)	30	20
25	Landslide Height (m)	4	3
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Active
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	40°
36	Downslope	75°	75°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/DK/48O08/2017/063	KAR/DK/48O08/2017/064
2	Longitude (DMS)	75° 27' 52.414" E	75° 27' 51.107" E
3	Latitude (DMS)	13° 4' 46.378" N	13° 4' 45.712" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Moderately Dissected Slope	Moderately Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Moderate	Moderate
22	Risk	Moderate	Moderate
23	Landslide Length (m)	5	7
24	Landslide Width (m)	13	18
25	Landslide Height (m)	3	4
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Reactivated
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Multiple
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	45°	40°
36	Downslope	75°	75°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/DK/48O08/2017/065	KAR/DK/48O08/2017/066
2	Longitude (DMS)	75° 27' 42.565" E	75° 27' 41.724" E
3	Latitude (DMS)	13° 4' 40.765" N	13° 4' 41.438" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Low	Low
22	Risk	Low	Low
23	Landslide Length (m)	5	4
24	Landslide Width (m)	30	15
25	Landslide Height (m)	4	3
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Suspended	Suspended
31	Landslide Distribution	Retrogressive	Retrogressive & Widening
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	30°	30°
36	Downslope	70°	70°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/DK/48O08/2017/067	KAR/DK/48O08/2017/068
2	Longitude (DMS)	75° 27' 37.587" E	75° 27' 25.710" E
3	Latitude (DMS)	13° 4' 41.095" N	13° 4' 35.443" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Low	Moderate
22	Risk	Low	Moderate
23	Landslide Length (m)	4	7
24	Landslide Width (m)	10	20
25	Landslide Height (m)	2	3
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Active
31	Landslide Distribution	Retrogressive	Retrogressive & Widening
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	40°
36	Downslope	70°	65°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/DK/48O08/2017/069	KAR/DK/48O08/2017/070
2	Longitude (DMS)	75° 27' 24.545" E	75° 27' 24.644" E
3	Latitude (DMS)	13° 4' 32.570" N	13° 4' 29.841" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	8	6
24	Landslide Width (m)	12	10
25	Landslide Height (m)	2	2
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Active
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	35°
36	Downslope	75°	80°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/DK/48O08/2017/071	KAR/DK/48O08/2017/072
2	Longitude (DMS)	75° 27' 26.480" E	75° 27' 28.040" E
3	Latitude (DMS)	13° 4' 29.210" N	13° 4' 30.025" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Moderate	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	7	6
24	Landslide Width (m)	20	30
25	Landslide Height (m)	2	2
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Reactivated
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	35°
36	Downslope	75°	80°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/DK/48O08/2017/073	KAR/DK/48O08/2017/074
2	Longitude (DMS)	75° 27' 30.022" E	75° 27' 31.270" E
3	Latitude (DMS)	13° 4' 30.402" N	13° 4' 31.516" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	6	5
24	Landslide Width (m)	24	20
25	Landslide Height (m)	2	3
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Reactivated	Suspended
31	Landslide Distribution	Retrogressive & Widening	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	35°
36	Downslope	75°	75°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/DK/48O08/2017/075	KAR/DK/48O08/2017/076
2	Longitude (DMS)	75° 27' 22.617" E	75° 27' 21.455" E
3	Latitude (DMS)	13° 4' 30.172" N	13° 4' 32.566" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	15	10
24	Landslide Width (m)	25	24
25	Landslide Height (m)	3	4
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Suspended	Active
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	40°
36	Downslope	75°	75°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/DK/48O08/2017/077	KAR/DK/48O08/2017/078
2	Longitude (DMS)	75° 27' 22.634" E	75° 27' 22.642" E
3	Latitude (DMS)	13° 4' 36.881" N	13° 4' 41.439" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Moderate	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	8	6
24	Landslide Width (m)	18	13
25	Landslide Height (m)	3	2
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Suspended
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	40°	30°
36	Downslope	75°	75°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/DK/48O08/2017/079	KAR/DK/48O08/2017/080
2	Longitude (DMS)	75° 27' 21.628" E	75° 27' 21.251" E
3	Latitude (DMS)	13° 4' 42.838" N	13° 4' 44.217" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Low	Moderate
22	Risk	Low	Moderate
23	Landslide Length (m)	6	6
24	Landslide Width (m)	10	12
25	Landslide Height (m)	2	3
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Active
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	40°	35°
36	Downslope	60°	75°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/DK/48O08/2017/081	KAR/DK/48O08/2017/082
2	Longitude (DMS)	75° 27' 20.380" E	75° 27' 13.715" E
3	Latitude (DMS)	13° 4' 35.410" N	13° 4' 32.272" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	Moderate
22	Risk	Moderate	Moderate
23	Landslide Length (m)	8	5
24	Landslide Width (m)	10	12
25	Landslide Height (m)	2	2
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Active
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	40°	Road
36	Downslope	80°	80°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/DK/48O08/2017/083	KAR/DK/48O08/2017/084
2	Longitude (DMS)	75° 27' 9.680" E	75° 27' 8.967" E
3	Latitude (DMS)	13° 4' 31.572" N	13° 4' 31.068" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Moderate	Moderate
22	Risk	Moderate	Moderate
23	Landslide Length (m)	5	8
24	Landslide Width (m)	15	12
25	Landslide Height (m)	3	2
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Active
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	35°
36	Downslope	75°	75°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/DK/48O08/2017/085	KAR/DK/48O08/2017/086
2	Longitude (DMS)	75° 27' 10.491" E	75° 27' 3.242" E
3	Latitude (DMS)	13° 4' 33.845" N	13° 4' 32.918" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Moderate	Moderate
22	Risk	Moderate	Moderate
23	Landslide Length (m)	12	12
24	Landslide Width (m)	10	18
25	Landslide Height (m)	3	3
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Reactivated
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	30°
36	Downslope	75°	60°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/DK/48O08/2017/087	KAR/DK/48O08/2017/088
2	Longitude (DMS)	75° 27' 0.890" E	75° 26' 59.831" E
3	Latitude (DMS)	13° 4' 30.752" N	13° 4' 28.104" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	Moderate
22	Risk	Moderate	Moderate
23	Landslide Length (m)	5	10
24	Landslide Width (m)	10	17
25	Landslide Height (m)	6	4
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Deep Seated (>5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Reactivated
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Deep translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	45°	40°
36	Downslope	80°	75°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/DK/48O08/2017/089	KAR/DK/48O08/2017/090
2	Longitude (DMS)	75° 26' 57.721" E	75° 26' 43.120" E
3	Latitude (DMS)	13° 4' 28.526" N	13° 4' 12.441" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Nadumane	North East of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Low	Low
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Wet	Wet
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Low	High
22	Risk	Low	Moderate
23	Landslide Length (m)	12	10
24	Landslide Width (m)	20	10
25	Landslide Height (m)	4	3
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Dormant	Active
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	40°	35°
36	Downslope	75°	70°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/DK/48O08/2017/091	KAR/DK/48O08/2017/092
2	Longitude (DMS)	75° 26' 7.265" E	75° 26' 7.210" E
3	Latitude (DMS)	13° 3' 59.382" N	13° 3' 56.730" N
4	Toposheet No	48O08	48O08
5	Village Name	North of Nadumane	North of Nadumane
6	Road	Kotighere - Ujire (NH - 73)	Kotighere - Ujire (NH - 73)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Moderate	Moderate
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Moderate	Moderate
22	Risk	Moderate	Moderate
23	Landslide Length (m)	8	10
24	Landslide Width (m)	20	25
25	Landslide Height (m)	3	4
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Active
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	40°	40°
36	Downslope	80°	80°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/093	KAR/CKM/48O08/2017/094
2	Longitude (DMS)	75° 21' 57.331" E	75° 21' 57.467" E
3	Latitude (DMS)	13° 10' 59.551" N	13° 10' 59.113" N
4	Toposheet No	48O08	48O08
5	Village Name	South of Galigandi	South of Galigandi
6	Road	Marasanige - Samse	Marasanige - Samse
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Meta-basalt	Meta-basalt
10	Weathering	Moderate	Moderate
11	Rock Character	Jointed	Jointed
12	Dip Foliation	42°	Data Not Available
13	Dip Direction Foliation	245°	Data Not Available
14	Dip J1	59°	Data Not Available
15	Dip Direction J1	35°	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Moderate	Moderate
22	Risk	Moderate	Moderate
23	Landslide Length (m)	5	5
24	Landslide Width (m)	10	10
25	Landslide Height (m)	3	3
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Rock	Debris
28	Movement Type	Fall	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Active
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	40°	40°
36	Downslope	80°	80°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/095	KAR/CKM/48O08/2017/096
2	Longitude (DMS)	75° 21' 22.589" E	75° 24' 29.113" E
3	Latitude (DMS)	13° 11' 4.822" N	13° 9' 56.204" N
4	Toposheet No	48O08	48O08
5	Village Name	South West of Galigandi	North of Maidadi
6	Road	Marasanige - Samse	Marasanige - Sunkasale
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Meta-basalt	Meta-basalt
10	Weathering	Moderate	Moderate
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	Rock	In-situ soil
17	Thickness	< 0.5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	15	10
24	Landslide Width (m)	20	36
25	Landslide Height (m)	3	4
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Active
31	Landslide Distribution	Retrogressive & Widening	Widening
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	45°	35°
36	Downslope	75°	80°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2017/097	KAR/CKM/48O08/2017/098
2	Longitude (DMS)	75° 24' 33.658" E	75° 24' 37.776" E
3	Latitude (DMS)	13° 9' 54.460" N	13° 9' 54.173" N
4	Toposheet No	48O08	48O08
5	Village Name	North East of Maidadi	North East of Maidadi
6	Road	Marasanige - Sunkasale	Marasanige - Sunkasale
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Meta-basalt	Meta-basalt
10	Weathering	Moderate	Moderate
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Plantation (LHP)
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	Moderate
22	Risk	Moderate	Moderate
23	Landslide Length (m)	6	10
24	Landslide Width (m)	13	12
25	Landslide Height (m)	3	3
26	Landslide Run Out (m)	Nil	8
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Subsidence
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Active
31	Landslide Distribution	Retrogressive & Widening	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	Road
36	Downslope	80°	75°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Collaspe of filling material due to increasing pore pressure
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O07/2017/099	KAR/CKM/48O07/2017/100
2	Longitude (DMS)	75° 23' 35.482" E	75° 23' 7.614" E
3	Latitude (DMS)	13° 22' 45.196" N	13° 22' 55.743" N
4	Toposheet No	48O07	48O07
5	Village Name	North West of Heruru	North West of Heruru
6	Road	Balehonnuru - Sringeri (SH - 27)	Balehonnuru - Sringeri (SH - 27)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Rolling Plain	Lowly Dissected Slope
9	Rock	Amphibolite	Ferruginous phyllite
10	Weathering	High	High
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	5 – 10 m	5 – 10 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Dry	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Moderate	Moderate
22	Risk	Moderate	Moderate
23	Landslide Length (m)	8	11
24	Landslide Width (m)	10	45
25	Landslide Height (m)	2	4
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Suspended	Suspended
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	30°	35°
36	Downslope	70°	65°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O07/2017/101	KAR/CKM/48O07/2017/102
2	Longitude (DMS)	75° 22' 22.178" E	75° 20' 21.465" E
3	Latitude (DMS)	13° 23' 54.167" N	13° 23' 41.943" N
4	Toposheet No	48O07	48O07
5	Village Name	South of Jayapura	North of Agalagundi
6	Road	Balehonnuru - Sringeri (SH - 27)	Balehonnuru - Sringeri (SH - 27)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Chlorite schist	Granite gneiss
10	Weathering	Moderate	Moderate
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	Moderate
22	Risk	Moderate	Moderate
23	Landslide Length (m)	12	15
24	Landslide Width (m)	23	15
25	Landslide Height (m)	2	4
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Active
31	Landslide Distribution	Retrogressive & Widening	Retrogressive & Widening
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	40°
36	Downslope	80°	85°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O07/2018/103	KAR/CKM/48O07/2018/104
2	Longitude (DMS)	75° 18' 28.920" E	75° 24' 9.687" E
3	Latitude (DMS)	13° 23' 15.750" N	13° 17' 11.149" N
4	Toposheet No	48O07	48O07
5	Village Name	East of Herur	South East of Totaduru
6	Road	Balehonnuru - Sringeri (SH - 27)	Balehole - Basarekatte
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Amphibolite
10	Weathering	Moderate	Moderate
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Moderate	Moderate
22	Risk	Moderate	Moderate
23	Landslide Length (m)	5	8
24	Landslide Width (m)	10	10
25	Landslide Height (m)	2	3
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Active
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	45°	30°
36	Downslope	75°	85°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O07/2018/105	KAR/CKM/48O07/2018/106
2	Longitude (DMS)	75° 23' 39.689" E	75° 21' 6.741" E
3	Latitude (DMS)	13° 17' 38.655" N	13° 19' 24.737" N
4	Toposheet No	48O07	48O07
5	Village Name	South of Totaduru	South of Kogre
6	Road	Balehole - Basarekatte	Basakekatte - Kogre
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Amphibolite	Chlorite schist
10	Weathering	Moderate	Moderate
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	15	10
24	Landslide Width (m)	17	12
25	Landslide Height (m)	4	2
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Suspended	Active
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	45°	45°
36	Downslope	80°	85°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O07/2018/107	KAR/CKM/48O07/2018/108
2	Longitude (DMS)	75° 18' 12.596" E	75° 21' 30.569" E
3	Latitude (DMS)	13° 19' 38.741" N	13° 21' 21.597" N
4	Toposheet No	48O07	48O07
5	Village Name	North East of Sallolli	North of Kogre
6	Road	Kogre - Kachige	Kogre - Makkikoppa
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Chlorite schist
10	Weathering	Moderate	Moderate
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	8	8
24	Landslide Width (m)	12	12
25	Landslide Height (m)	3	2
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Suspended	Suspended
31	Landslide Distribution	Retrogressive	Retrogressive
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	35°	40°
36	Downslope	85°	85°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O07/2018/109	KAR/CKM/48O08/2018/110
2	Longitude (DMS)	75° 24' 9.470" E	75° 25' 5.728" E
3	Latitude (DMS)	13° 20' 30.208" N	13° 13' 16.159" N
4	Toposheet No	48O07	48O08
5	Village Name	South West of Bedagadu	North of Hirebail
6	Road	Basakekatte - Heruru	Hirebail - Balehole
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Lowly Dissected Slope
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Moderate	High
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Moderate	High
22	Risk	Moderate	Moderate
23	Landslide Length (m)	15	10
24	Landslide Width (m)	25	15
25	Landslide Height (m)	4	2
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Suspended	Active
31	Landslide Distribution	Retrogressive	Retrogressive & Widening
32	Landslide Style	Multiple	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	40°	35°
36	Downslope	80°	85°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2018/111	KAR/CKM/48O07/2018/112
2	Longitude (DMS)	75° 25' 7.013" E	75° 16' 11.479" E
3	Latitude (DMS)	13° 13' 41.546" N	13° 26' 47.011" N
4	Toposheet No	48O08	48O07
5	Village Name	North of Hirebail	South of Kavadi
6	Road	Hirebail - Balehole	Sringeri - Koppa (NH - 169)
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Lowly Dissected Slope	Rolling Plain
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Moderate	High
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	High	Moderate
22	Risk	Moderate	Moderate
23	Landslide Length (m)	10	15
24	Landslide Width (m)	12	45
25	Landslide Height (m)	2	4
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Active
31	Landslide Distribution	Retrogressive & Widening	Retrogressive & Widening
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	45°	35°
36	Downslope	85°	85°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Retaining wall with weep holes
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O07/2018/113	KAR/CKM/48O07/2018/114
2	Longitude (DMS)	75° 19' 4.064" E	75° 19' 4.030" E
3	Latitude (DMS)	13° 26' 34.039" N	13° 26' 51.200" N
4	Toposheet No	48O07	48O07
5	Village Name	South East of Sulugodu	North East of Sulugodu
6	Road	Menase - Kalkere	Menase - Kalkere
7	Geomorphic Process	Gravitational	Gravitational
8	Geomorphic Form	Rolling Plain	Rolling Plain
9	Rock	Granite gneiss	Granite gneiss
10	Weathering	Moderate	Moderate
11	Rock Character	Jointed	Jointed
12	Dip Foliation	Data Not Available	Data Not Available
13	Dip Direction Foliation	Data Not Available	Data Not Available
14	Dip J1	Data Not Available	Data Not Available
15	Dip Direction J1	Data Not Available	Data Not Available
16	Overburden Type	In-situ soil	In-situ soil
17	Thickness	0.5 – 5 m	0.5 – 5 m
18	Land use	Extensive Slope Cut	Extensive Slope Cut
19	Hydrology	Damp	Damp
20	Erosion	Toe erosion	Toe erosion
21	Susceptibility	Low	Moderate
22	Risk	Low	Moderate
23	Landslide Length (m)	8	15
24	Landslide Width (m)	14	30
25	Landslide Height (m)	3	4
26	Landslide Run Out (m)	Nil	Nil
27	Landslide Material	Debris	Debris
28	Movement Type	Slide	Slide
29	Failure Depth	Shallow Seated (<5m)	Shallow Seated (<5m)
30	Landslide Activity	Active	Suspended
31	Landslide Distribution	Retrogressive	Retrogressive & Widening
32	Landslide Style	Single	Single
33	Landslide Mechanism	Shallow translational failure	Shallow translational failure
34	Landslide Initiation	No Data	No Data
35	Upslope	30°	30°
36	Downslope	80°	85°
37	Triggering Factor	Rainfall	Rainfall
38	Casualties	No Data	No Data
39	Geo Scientific Cause	Extensive Cut Slope	Extensive Cut Slope
40	Remedial Measures	Retaining wall with weep holes	Heights of the retaining wall to be increased and new weep holes to be provided.
41	Remarks	Nil	Nil

1	Name	KAR/CKM/48O08/2018/115	
2	Longitude (DMS)	75° 21' 5.596" E	
3	Latitude (DMS)	13° 14' 13.621" N	
4	Toposheet No	48O08	
5	Village Name	North West of Kalasa	
6	Road	Hornadu - Kalasa (SH - 106)	
7	Geomorphic Process	Gravitational	
8	Geomorphic Form	Lowly Dissected Slope	
9	Rock	Granite gneiss	
10	Weathering	Moderate	
11	Rock Character	Jointed	
12	Dip Foliation	Data Not Available	
13	Dip Direction Foliation	Data Not Available	
14	Dip J1	Data Not Available	
15	Dip Direction J1	Data Not Available	
16	Overburden Type	In-situ soil	
17	Thickness	0.5 – 5 m	
18	Land use	Extensive Slope Cut	
19	Hydrology	Damp	
20	Erosion	Toe erosion	
21	Susceptibility	Low	
22	Risk	Low	
23	Landslide Length (m)	8	
24	Landslide Width (m)	36	
25	Landslide Height (m)	2	
26	Landslide Run Out (m)	Nil	
27	Landslide Material	Debris	
28	Movement Type	Slide	
29	Failure Depth	Shallow Seated (<5m)	
30	Landslide Activity	Active	
31	Landslide Distribution	Retrogressive & Widening	
32	Landslide Style	Single	
33	Landslide Mechanism	Shallow translational failure	
34	Landslide Initiation	No Data	
35	Upslope	35°	
36	Downslope	80°	
37	Triggering Factor	Rainfall	
38	Casualties	No Data	
39	Geo Scientific Cause	Extensive Cut Slope	
40	Remedial Measures	Retaining wall with weep holes	
41	Remarks	Nil	

Annexure – 3: Field Data Collection Sheet

Location No	Toposheet No	Locality / Village	Latitude (N)	Longitude (E)	Geomorphological Process	Geomorphological Form	Rock Type	Weathering	Overburden Type	Overburden Thickness	Land use Type	Hydrological Condition	Erosion	Susceptibility Assessment of Slope	Qualitative Risk Assessment
1a	48O/7	Kalasa	13°13'48.15"	75°21'58.00"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
2a	48O/7	E of Konabali	13°13'31.16"	75°22'00.91"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
3a	48O/7	SE of Konabali	13°13'13.20"	75°22'15.23"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
4a	48O/7	W of Gangankudige	13°13'02.84"	75°22'18.20"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Extensive Slope Cut	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
5a	48O/7	W of Gangankudige	13°12'56.22"	75°22'35.30"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Extensive Slope Cut	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
6a	48O/7	S of Gangankudige	13°12'25.34"	75°23'09.86"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
7a	48O/7	W of Marsanige	13°11'57.80"	75°23'25.48"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
8a	48O/7	W of Hirebail	13°11'47.95"	75°23'52.27"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
9a	48O/7	NW of Hirebail	13°11'56.94"	75°24' 08.67"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
10a	48O/7	Hirebail	13°11'53.49"	75°24'31.19"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
11a	48O/7	SE of Hirebail	13°11'31.24"	75°25'07.94"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
12a	48O/7	SE of Hirebail	13°11'06.41"	75°25'10.40"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent

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13a	48O/7	NW of Sampigeekan	13°10'43.38"	75°25'38.68"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
14a	48O/7	NW of Sampigeekan	13°10'27.55"	75°25'56.46"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
15a	48O/7	NW of Sunkasale	13°10'00.06"	75° 26'21.98"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
16a	48O/7	NW of Sunkasale	13°09'37.48"	75° 26'25.78"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
17a	48O/7	W of Kelagur	13°09'50.23"	75°26'53.55"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
18a	48O/7	Kelagur	13°09'59.08"	75°27'30.27"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
19a	48O/7	NE of Kelagur	13°10'10.76"	75°28'06.96"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
20a	48O/7	Javalli	13°10' 9.30"	75°28'50.10"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
21a	48O/7	SE of Javalli	13°09'44.95"	75°29'25.83"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
22a	48O/7	S of Kalasa	13°13'41.11"	75°21'24.37"	Gravitational	Valley Fill	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
23a	48O/7	S of Kalasa	13°13'35.19"	75°21'10.32"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Extensive Slope Cut	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
24a	48O/7	S of Kalasa	13°13'15.11"	75°20'58.66"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
25a	48O/7	E of Karagadde	13°12'45.16"	75°20'40.76"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Meta Stable	Moderate

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26a	48O/7	SE of Karagadde	13°12'18.16"	75°20'20.73"	Gravitational	Valley Fill	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
27a	48O/7	NE of Samshe	13°11'56.33"	75°20'09.80"	Gravitational	Valley Fill	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
28a	48O/7	Samshe	13°11'22.96"	75°19'56.79"	Gravitational	Valley Fill	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
29a	48O/7	W of Samshe	13°11'06.95"	75°19'22.13"	Gravitational	Valley Fill	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
30a	48O/7	W of Samshe	13°11'12.13"	75°18'59.58"	Gravitational	Valley Fill	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
31a	48O/7	W of Samshe	13°11'21.07"	75°18'25.21"	Gravitational	Moderately Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
32a	48O/7	SE of Nellibidu	13°11'24.07"	75°17'59.58"	Gravitational	Moderately Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
33a	48O/7	SE of Nellibidu	13°11'38.81"	75°17'41.61"	Gravitational	Moderately Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
34a	48O/7	SE of Nellibidu	13°11'49.87"	75°17'20.26"	Gravitational	Moderately Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
35a	48O/7	Nellibidu	13°12'10.71"	75°17'08.02"	Gravitational	Moderately Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
36a	48O/7	SE of Jamble	13°12'18.73"	75°16'44.80"	Gravitational	Moderately Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Cultivation	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
37a	48O/7	Jamble	13°12'42.61"	75°16'18.06"	Gravitational	Moderately Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
38a	48O/7	S of Malleshvara	13°12'38.54"	75°15'50.99"	Gravitational	Moderately Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
38b	48O/8	N of Jamble	13°13'21.00"	75°16'40.00"	Gravitational	Moderately Dissected Slope	Meta-basalt	Moderate	Meta-basalt	< 0.5 m	Barren	Damp	Toe erosion by Nala and River	Meta Stable	Moderate

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39a	48O/7	S of Malleshvara	13°12'48.04"	75°15'21.15"	Gravitational	Moderately Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
40a	48O/7	SE of Horaha	13°07'17.95"	75°29'54.28"	Gravitational	Moderately Dissected Slope	Amphibolite	Moderate	Amphibolite	< 0.5 m	Thick Vegetation	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
41a	48O/7	SE of Horatta	13°07'05.85"	75°29'43.04"	Gravitational	Moderately Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Thick Vegetation	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
42a	48O/7	SE of Horatta	13°06'48.62"	75°29'42.31"	Gravitational	Moderately Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Thick Vegetation	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
43a	48O/7	E of Bidaratale	13°06'33.35"	75°29'12.74"	Gravitational	Moderately Dissected Slope	Granite gneiss	Moderate	Granite gneiss	< 0.5 m	Barren	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
44a	48O/7	Jenukallu	13°06'01.33"	75°28'56.50"	Gravitational	Moderately Dissected Slope	Granite gneiss	Moderate	Granite gneiss	< 0.5 m	Barren	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
45a	48O/7	Kode Kallu	13°05'30.21"	75°28'44.79"	Gravitational	Moderately Dissected Slope	Dolerite	Moderate	Dolerite	< 0.5 m	Barren	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
46a	48O/7	S of Kode Kallu	13°05'05.21"	75°28'19.28"	Gravitational	Moderately Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Thick Vegetation	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
47a	48O/7	NW of Banjar	13°04'42.58"	75°28'21.91"	Gravitational	Moderately Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Thick Vegetation	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
48a	48O/7	NW of Banjar	13°04'43.43"	75°28'00.27"	Gravitational	Moderately Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Extensive Slope Cut	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
49a	48O/7	NE of Nadumane	13°04'31.02"	75°27'31.69"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Extensive Slope Cut	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
50a	48O/7	NW of Gandulgadda	13°04'42.46"	75°27'22.13"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Extensive Slope Cut	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
51a	48O/7	NE of Nadumane	13°04'31.97"	75°27'01.18"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Thick Vegetation	Damp	Toe erosion by Nala and River	Meta Stable	Moderate

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52a	48O/7	NE of Nadumane	13°04'07.34"	75°26'30.43"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Thick Vegetation	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
53a	48O/7	NE of Nadumane	13°04'06.37"	75°26'18.19"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Thick Vegetation	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
54a	48O/7	NW of Nodumane	13° 03'56.33"	75°26'07.00"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Cultivation	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
55a	48O/7	Charmudi	13°03'19.25"	75°25'31.92"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Meta Stable	Moderate
56a	48O/7	Charmudi	13°02'54.39"	75°24'51.22"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
57a	48O/7	Koppala	13°01'44.34"	75°24'52.72"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
58a	48O/7	NW of Ball	13°00'55.01"	75°25'18.34"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
59a	48O/7	Aniyur	13°00'35.67"	75°26'14.07"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
60a	48O/7	Alangi	13°01'18.23"	75°27'16.86"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
61a	48O/7	Parapala	13°02'23.07"	75°27'52.36"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
62a	48O/7	Kakkinje	13°02'24.34"	75°24'26.24"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
63a	48O/7	W of Kakkinje	13°02'10.86"	75°23'40.18"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Thick Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
64a	48O/7	E of Mundaje	13°02'01.96"	75°23'10.51"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
65a	48O/7	Somantadka	13°01'47.45"	75°22'38.72"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
66a	48O/7	W od Somantadka	13°01'31.30"	75°22'14.36"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
67a	48O/7	NE of Kalmanja	13°00'58.52"	75°21'41.06"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Thick Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
68a	48O/7	Kalmanja	13°00'22.48"	75°20'52.42"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent

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69a	48O/7	SW of Samse	13°10'59.54"	75°19'2.45"	Gravitational	Moderately Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
70a	48O/7	SW of Samse	13°10'41.94"	75°18'52.85"	Gravitational	Moderately Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
71a	48O/7	N of Mullodi	13°10'16.61"	75°18'43.76"	Gravitational	Moderately Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
72a	48O/7	N of Mullodi	13°10'02.74"	75°18'25.78"	Gravitational	Moderately Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
73a	48O/7	SE of Samse	13°11'13.61"	75°20'10.99"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
74a	48O/7	SE of Samse	13° 10' 48.97"	75°20'25.22"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
75a	48O/7	SE of Samse	13°10'50.28"	75°20'16.91"	Gravitational	Moderately Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
76a	48O/7	SE of Samse	13°10'49.92"	75°20'02.89"	Gravitational	Moderately Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
77a	48O/7	NW of Marasanige	13°12'14.26"	75°23'11.59"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
78a	48O/7	Karakal CE	13°12'04.17"	75°22'51.10"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
79a	48O/7	NE of Galligandi	13°12'02.12"	75°22'32.55"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
80a	48O/7	N of Galligande	13°12'02.30"	75°22'09.53"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
81a	48O/7	N of Galligande	13°11'38.07"	75°22'19.77"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent

Location No	Toposheet No	Locality / Village	Latitude (N)	Longitude (E)	Geomorphological Process	Geomorphological Form	Rock Type	Weathering	Overburden Type	Overburden Thickness	Land use Type	Hydrological Condition	Erosion	Susceptibility Assessment of Slope	Qualitative Risk Assessment
82a	48O/7	S of Galligande	13°11'05.78"	75°22'04.14"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
83a	48O/7	SW of Galligande	13°10'58.02"	75°21'43.72"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
84a	48O/7	S of Idimakki	13°11'04.94"	75°21'21.54"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	Meta-basalt	< 0.5 m	Barren	Damp	Toe erosion by Nala and River	Stable	Low or absent
85a	48O/7	E of Samse	13°11'04.29"	75°21'05.10"	Gravitational	Lowly Dissected Slope	Granite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
86a	48O/7	E of Samse	13°11'09.74"	75°20'55.65"	Gravitational	Lowly Dissected Slope	Granite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
87a	48O/7	E of Samse	13°11'05.86"	75°20'36.57"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
88a	48O/7	E of Samse	13°11'23.13"	75°20'23.33"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
89a	48O/7	Hirebail	13°12'09.32"	75°24'43.70"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
90a	48O/7	NE of Hirebail	13°12'29.58"	75°24'59.88"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
91a	48O/7	S of Malleshvara Gudda	13°12'54.69"	75°25'22.42"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
92a	48O/7	SE of Malleshvara Gudda	13°13'09.59"	75°25'10.63"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
93a	48O/7	Malleshvara Gudda	13°13'39.31"	75°25'06.93"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
94a	48O/7	N of Malleshvara Gudda	13°13'55.59"	75°25'29.01"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent

Location No	Toposheet No	Locality / Village	Latitude (N)	Longitude (E)	Geomorphological Process	Geomorphological Form	Rock Type	Weathering	Overburden Type	Overburden Thickness	Land use Type	Hydrological Condition	Erosion	Susceptibility Assessment of Slope	Qualitative Risk Assessment
95a	48O/7	N of Malleshvara Gudda	13°14'15.28"	75°25'08.71"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
96a	48O/7	S of Karakki	13°14'26.20"	75°25'30.44"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
97a	48O/7	S of Karakki	13°14'52.36"	75°25'28.98"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
98a	48O/7	NW of Karakki	13°15'41.99"	75°25'04.08"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
99a	48O/7	Marsanige	13°11'28.03"	75°23'45.64"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
100a	48O/7	S of Marsanige	13°11'05.54"	75°23'44.94"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
101a	48O/7	NW of Maidadi	13° 10' 47.29"	75°23'30.57"	Gravitational	Lowly Dissected Slope	Banded magnetite quartzite	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
102a	48O/7	NW of Maidadi	13°10'33.26"	75°23'20.96"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
103a	48O/7	Maidadi	13°10'11.83"	75°23'40.93"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
104a	48O/7	SE of Madimakki	13°10'02.19"	75°24'00.95"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
105a	48O/7	SE of Maidadi	13°01'56.76"	75°23'54.53"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
106a	48O/7	SE of Mundalbail	13°01'36.71"	75°23'52.80"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Cultivation	Damp	Toe erosion by Nala and River	Stable	Low or absent
107a	48O/7	SE of Mundalbail	13°01'14.96"	75°23'53.24"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
108a	48O/7	W of Balige	13°09'36.80"	75°25'11.13"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent

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109a	48O/7	W of Balige	13°09'41.16"	75°25'24.65"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
110a	48O/7	NE of Balige	13°09'40.00"	75°25'59.61"	Gravitational	Lowly Dissected Slope	Meta-basalt	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
111a	48O/7	Kalasa	13°13'57.13"	75°22'10.33"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
112a	48O/7	NE of Kalasa	13°14'25.48"	75°22'39.13"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
113a	48O/7	SW of Halluvalli	13°14'51.05"	75°23'03.11"	Gravitational	Valley Fill	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
114a	48O/7	E of Halluvalli	13°15'05.59"	75°23'39.32"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
115a	48O/7	N of Kelagur	13°15'36.55"	75°24'10.43"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
116a	48O/7	Munnarpal	13°14'55.48"	75°24'12.55"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
117a	48O/7	W of Balehole	13°15'51.00"	75°24'39.75"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
118a	48O/7	Balehole	13°16'02.08"	75°25'25.97"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
119a	48O/7	SE of Balehole	13°15'53.41"	75°25'33.16"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
120a	48O/7	E of Balehole	13°15'45.61"	75°26'24.98"	Gravitational	Rolling Plain	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
121a	48O/7	E of Balehole	13°15'37.03"	75°26'58.36"	Gravitational	Rolling Plain	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
122a	48O/7	E of Balehole	13°15'29.41"	75°27'25.48"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent

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123a	48O/7	SW of Magundi	13°15'34.93"	75°27'55.65"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
124a	48O/7	W of Magundi	13°16'00.47"	75°28'12.82"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
125a	48O/7	W of Magundi	13°16'36.06"	75°28'19.18"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
126a	48O/7	Magundi	13°16'31.44"	75°29'06.11"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
127a	48O/7	S of Magundi	13°15'50.60"	75°29'22.34"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
128a	48O/7	S of Magundi	13°15'13.95"	75°29'27.97"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
129a	48O/7	N of Hlluvalli	13°14'35.20" N	75°29'12.18"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
130a	48O/7	S of Hlluvalli	13°13'42.67"	75°29'14.60"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
131a	48O/7	Talagur	13°13'12.38"	75°29'21.98"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
132a	48O/7	S of Talagur	13°12'42.08"	75°29'24.54"	Gravitational	Lowly Dissected Slope	Ferruginous phyllite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
133a	48O/7	S of Talagur	13°12'16.98"	75°29'24.81"	Gravitational	Lowly Dissected Slope	Ferruginous phyllite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
134a	48O/7	N of Niduvale	13°11'39.32"	75°29'41.48"	Gravitational	Lowly Dissected Slope	Ferruginous phyllite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
135a	48O/7	S of Niduvale	13°11'00.53"	75°29'51.70"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
136a	48O/7	W of Madundi	13°16'55.07"	75°29'01.12"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
137a	48O/7	N of Madundi	13°17'28.16"	75°28'52.86"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent

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138a	48O/7	Kesavinamane	13°18'08.92"	75°29'07.75"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
139a	48O/7	N of Kesavinamane	13°18'39.11"	75°29'23.16"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
140a	48O/7	Kudige	13°19'10.91"	75°29'24.49"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
141a	48O/7	N of Kudige	13°19'39.27"	75°29'31.69"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
142a	48O/7	NW of Bannuru	13°20'08.32"	75°29'17.40"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
143a	48O/7	SE of Balehonnuru	13°20'37.35"	75°28'51.90"	Gravitational	Rolling Plain	Ferruginous phyllite	Moderate	In-situ soil	5 – 10 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
144a	48O/7	Balehonnuru	13°20'59.67"	75°28'10.95"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	5 – 10 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
145a	48O/7	E of Balehonnuru	13°20'55.21"	75°28'57.48"	Gravitational	Rolling Plain	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
146a	48O/7	N of Kumbaramane	13°21'14.33"	75°29'34.70"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
147a	48O/7	NW of Sumantatadka	13°02'02.78"	75°22'11.35"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
148a	48O/7	Mundaje	13°02'29.56"	75°22'23.72"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
149a	48O/7	Ramandottetu	13°03'02.27"	75°22'31.04"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
150a	48O/7	S of Kochur	13°03'38.42"	75°22'38.26"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
151a	48O/7	Kadirudi Yavara	13°04'11.26"	75°22'23.48"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
152a	48O/7	Bandaje	13°04'49.36"	75°22'19.97"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
153a	48O/7	N of Bandaje	13°05'31.10"	75°22'15.93"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
154a	48O/7	N of Kukkaru	13°06'20.70"	75°22'18.66"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
155a	48O/7	N of Kajoor	13°07'03.81"	75°22'20.10"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
156a	48O/7	N of Badeguttu	13°07'38.99"	75°22'30.79"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent

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157a	48O/7	Didipe	13°08'22.06"	75°22'27.30"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
158a	48O/7	Anadka	13°08'52.04"	75°22'09.23"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
159a	48O/7	N od Anadka	13°09'18.05"	75°22'17.53"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
160a	48O/7	N of Killur	13°06'50.61"	75°22'00.12"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
161a	48O/7	Killur	13°06'12.87"	75°21'47.78"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
162a	48O/7	S of Killur	13°05'34.29"	75°21'41.23"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
163a	48O/7	N of Bangadipete	13°04'51.84"	75°21'33.75"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
164a	48O/7	SW of Bangadipete	13°04'31.52"	75°21'22.00"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
165a	48O/7	Indubettu	13°04'04.50"	75°20'38.30"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
166a	48O/7	SW of Indubettu	13°03'45.02"	75°20'18.49"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
167a	48O/7	Mura	13°03'29.38"	75°19'30.94"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
168a	48O/7	Parunadka	13°02'43.74"	75°19'13.90"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
169a	48O/7	N of Manjotti	13°02'02.82"	75°18'53.78"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
170a	48O/7	Manjotti	13°01'19.76"	75°18'32.78"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
171a	48O/7	S of Manjotti	13°00'41.38"	75°18'18.45"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
172a	48O/7	N of Belthangadi	13°00'06.50"	75°17'58.01"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
173a	48O/7	N of Kalmanja	13°00'55.10"	75°20'57.26"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
174a	48O/7	N of Kalmanja	13°01'29.41"	75°20'38.66"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent

Location No	Toposheet No	Locality / Village	Latitude (N)	Longitude (E)	Geomorphological Process	Geomorphological Form	Rock Type	Weathering	Overburden Type	Overburden Thickness	Land use Type	Hydrological Condition	Erosion	Susceptibility Assessment of Slope	Qualitative Risk Assessment
175a	48O/7	SE of Nangudi	13°01'55.20"	75°20'12.13"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
176a	48O/7	W of Nanguri	13°02'08.71"	75°19'48.12"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
177a	48O/7	Surya	13°02'13.76"	75°19'15.41"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
178a	48O/7	NE of Nanguri	13°02'23.15"	75°23'9.88"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
179a	48O/7	SE of Indabettu	13°02'59.67"	75° 23'31.88"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Thick Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
180a	48O/7	SE of Indabettu	13°03'37.78"	75°23'43.27"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Thick Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
181a	48O/7	E of Melantabettu	13°03'14.74"	75°15'27.50"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Thick Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
182a	48O/7	NE of Melantabettu	13°00'57.06"	75°16'01.86"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
183a	48O/7	S of Parabettu	13°01'28.57"	75°15'49.36"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
184a	48O/7	Nartikal	13°02'10.27"	75°15'46.67"	Gravitational	Rolling Plain	Laterite	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
185a	48O/7	Billottu	13°02'28.35"	75°15'29.25"	Gravitational	Rolling Plain	Laterite	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
186a	48O/7	Balehonnuru	13°20'40.14"	75°27'30.55"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
187a	48O/7	W of Balehonnuru	13°20'43.72"	75°26'52.47"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Cultivation	Damp	Toe erosion by Nala and River	Stable	Low or absent
188a	48O/7	S of Manglagadu	13°20'43.40"	75°26'18.23"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
189a	48O/7	Sigodu	13°20'44.40"	75°25'45.40"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
190a	48O/7	W of Sigodu	13°21'04.33"	75°25'19.63"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
191a	48O/7	S of Heruru	13°21'17.74"	75°24'46.60"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent

Location No	Toposheet No	Locality / Village	Latitude (N)	Longitude (E)	Geomorphological Process	Geomorphological Form	Rock Type	Weathering	Overburden Type	Overburden Thickness	Land use Type	Hydrological Condition	Erosion	Susceptibility Assessment of Slope	Qualitative Risk Assessment
192a	48O/7	Heruru	13°21'50.00"	75°24'18.65"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	5 – 10 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
193a	48O/7	NW of Heruru	13°22'14.81"	75°23'56.68"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	5 – 10 m	Cultivation	Damp	Toe erosion by Nala and River	Stable	Low or absent
194a	48O/7	SE of Jaladurga	13°22'43.38"	75°23'36.73"	Gravitational	Rolling Plain	Amphibolite	Moderate	In-situ soil	5 – 10 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
195a	48O/7	SE of Jaladurga	13°22'55.60"	75°23'07.10"	Gravitational	Lowly Dissected Slope	Ferruginous phyllite	Moderate	In-situ soil	5 – 10 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
196a	48O/7	Jaladurga	13°23'33.25"	75°22'46.67"	Gravitational	Lowly Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
197a	48O/7	NW of Jaladurga	13°23'48.93"	75°22'24.57"	Gravitational	Lowly Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
198a	48O/7	E of Makkikoppa	13°23'59.33"	75°21'58.68"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Cultivation	Damp	Toe erosion by Nala and River	Stable	Low or absent
199a	48O/7	W of Makkikoppa	13°23'51.39"	75°21'28.90"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
200a	48O/7	W of Makkikoppa	13°23'54.71"	75°20'55.63"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
201a	48O/7	NE of Aglagundi	13°23'47.07"	75°20'35.54"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
202a	48O/7	NE of Aglagundi	13°23'35.82"	75°20'26.41"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
203a	48O/7	Aglagundi	13°23'10.92"	75°19'51.80"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
204a	48O/7	Kachige	13°23'04.74"	75°19'13.18"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
205a	48O/7	W of Kachige	13°22'59.73"	75°18'50.43"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent

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206a	48O/7	N of Mundagodu	13°23'19.92"	75°18'48.48"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
207a	48O/7	E of Herur	13°23'14.29"	75°18'26.75"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
208a	48O/7	E of Herur	13°23'12.51"	75°18'11.31"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
209a	48O/7	NW of Herur	13°23'26.02"	75°17'44.44"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
210a	48O/7	NW of Herur	13°23'40.85"	75°17'12.56"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
211a	48O/7	E of Besur	13°24'06.99"	75°17'09.98"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
212a	48O/7	Bharthinagara	13°24'44.84"	75°16'56.86"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Cultivation	Damp	Toe erosion by Nala and River	Stable	Low or absent
213a	48O/7	E of Menase	13°25'00.76"	75°16'25.49"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
214a	48O/7	SE of Sringeri	13°25'13.91"	75°15'54.17"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Cultivation	Damp	Toe erosion by Nala and River	Stable	Low or absent
215a	48O/7	Sringeri	13°25'29.34"	75°15'28.24"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
216a	48O/7	N of Balehonnuru	13°21'39.45"	75°27'50.35"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
217a	48O/7	N of Kadalamakki	13°22'14.62"	75°28'02.69"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	5 – 10 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
218a	48O/7	Sike	13°22'47.38"	75°28'23.59"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
219a	48O/7	N of Sike	13°23'18.43"	75°28'28.75"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
220a	48O/7	N of Sike	13°23'46.35"	75°28'36.49"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
221a	48O/7	S of Bandihalla	13°24'09.02"	75°28'38.16"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
222a	48O/7	S of Bandihalla	13°24'36.16"	75°28'45.57"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	5 – 10 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
23a	48O/7	N of Bandihalla	13°25'15.63"	75°28'39.79"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent

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224a	48O/7	W of Bandihalla	13°25'01.31"	75°28'08.57"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
225a	48O/7	W of Bandihalla	13°24'42.61"	75°28'01.74"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
226a	48O/7	E of Bintravalli	13°24'45.38"	75°27'35.85"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
227a	48O/7	E of Bintravalli	13°24'57.82"	75°27'16.14"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
228a	48O/7	N of Bintravalli	13°25'19.93"	75°26'57.06"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
229a	48O/7	E of Tuppur	13°25'16.18"	75°26'31.72"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
230a	48O/7	Megaramakki	13°25'41.37"	75°28'31.21"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	5 – 10 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
231a	48O/7	Dasangadde	13°26'09.38"	75°28'37.11"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
232a	48O/7	Toravani	13°26'39.98"	75°28'27.61"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
233a	48O/7	Ganapatikatte	13°27'07.28"	75°28'03.64"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
234a	48O/7	Chikka Agrahara	13°27'37.60"	75°27'57.78"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Thick Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
235a	48O/7	W of Chikka Agrahara	13°27'55.28"	75°27'47.79"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
236a	48O/7	W of Chikka Agrahara	13°28'10.23"	75°27'20.60"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
237a	48O/7	S of Kattinamane	13°28'05.72"	75°26'51.94"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
238a	48O/7	S of Kattinamane	13°28'31.82"	75°26'37.30"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
239a	48O/7	Hakkalumane	13°28'30.28"	75°26'17.77"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent

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240a	48O/7	Kattinamane	13°28'57.33"	75°26'06.30"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
241a	48O/7	Suligar	13°29'30.58"	75°26'17.89"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
242a	48O/7	N of Chikka Agrahara	13°28'18.70"	75°28'11.18"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Thick Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
243a	48O/7	N of Chikka Agrahara	13°28'40.29"	75°28'31.97"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
244a	48O/7	N of Chikka Agrahara	13°29'12.81"	75°28'28.95"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
245a	48O/7	S of Aragi	13°29'29.58"	75°28'44.92"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
246a	48O/7	Aragi	13°29'58.91"	75°29'03.02"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
247a	48O/7	S of Aragi	13°29'31.89"	75°29'07.02"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Thick Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
248a	48O/7	S of Aragi	13°29'09.80"	75°29'07.97"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
249a	48O/7	S of Aragi	13°28'39.46"	75°29'07.73"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
250a	48O/7	S of Aragi	13°28'10.84"	75°29'15.11"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
251a	48O/7	S of Aragi	13°28'01.59"	75°29'46.10"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Thick Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
252a	48O/7	NW of Kichabbinattu	13°27'15.51"	75°28'22.87"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Thick Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
253a	48O/7	NW of Kichabbinattu	13°27'00.29"	75°28'46.83"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Thick Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
254a	48O/7	NW of Kichabbinattu	13°26'35.56"	75°29'10.63"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Thick Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
255a	48O/7	S of Kichabbinattu	13°26'10.00"	75°29'35.64"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Thick Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
256a	48O/7	Kolale	13°25'44.85"	75°29'30.11"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
257a	48O/7	SW of Kolale	13°25'22.44"	75°29'12.70"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	5 – 10 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent

Location No	Toposheet No	Locality / Village	Latitude (N)	Longitude (E)	Geomorphological Process	Geomorphological Form	Rock Type	Weathering	Overburden Type	Overburden Thickness	Land use Type	Hydrological Condition	Erosion	Susceptibility Assessment of Slope	Qualitative Risk Assessment
258a	48O/7	Rambhapuri Math	13°22'09.38"	75°27'14.52"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Cultivation	Damp	Toe erosion by Nala and River	Stable	Low or absent
259a	48O/7	Mensina Kodige	13°22'39.30"	75°26'55.62"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
260a	48O/7	Konamana	13°23'12.26"	75°26'44.23"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
261a	48O/7	Arali Koppa	13°23'34.42"	75°26'26.80"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
262a	48O/7	N of Arali Koppa	13°23'57.70"	75°26'00.87"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
263a	48O/7	S of Tuppuru	13°24'30.50"	75°26'04.58"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
264a	48O/7	Tuppuru	13°25'05.44"	75°26'11.60"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
265a	48O/7	SE of Melpal	13°25'35.80"	75°25'57.36"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
266a	48O/7	Melpal	13°25'58.65"	75°25'34.02"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
267a	48O/7	NW of Melpal	13°26'26.24"	75°25'16.50"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
268a	48O/7	NW of Melpal	13°26'48.79"	75°25'02.18"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
269a	48O/7	Karkeshvara	13°27'26.09"	75°24'49.87"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
270a	48O/7	Karkeshvara	13°27'51.40"	75°24'39.40"	Gravitational	Lowly Dissected Slope	Banded magnetite quartzite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
271a	48O/7	N of Karkeshvara	13°28'17.54"	75°24'41.39"	Gravitational	Lowly Dissected Slope	Ferruginous phyllite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
272a	48O/7	S of Koradihitlu	13°28'50.74"	75°24'42.84"	Gravitational	Lowly Dissected Slope	Ferruginous phyllite	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent

Location No	Toposheet No	Locality / Village	Latitude (N)	Longitude (E)	Geomorphological Process	Geomorphological Form	Rock Type	Weathering	Overburden Type	Overburden Thickness	Land use Type	Hydrological Condition	Erosion	Susceptibility Assessment of Slope	Qualitative Risk Assessment
273a	48O/7	Koradihitlu	13°29'27.06"	75°24'34.72"	Gravitational	Lowly Dissected Slope	Ferruginous phyllite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
274a	48O/7	Nuggi	13°29'41.34"	75°24'21.40"	Gravitational	Rolling Plain	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
275a	48O/7	Nuggi	13°28'55.61"	75°24'21.01"	Gravitational	Rolling Plain	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
276a	48O/7	S of Nuggi	13°28'26.01"	75°24'19.35"	Gravitational	Lowly Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
277a	48O/7	S of Nuggi	13°28'02.10"	75°24'15.96"	Gravitational	Lowly Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
278a	48O/7	S of Nuggi	13°27'30.12"	75°23'59.84"	Gravitational	Lowly Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
279a	48O/7	S of Nuggi	13°27'11.68"	75°24'02.00"	Gravitational	Lowly Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
280a	48O/7	N of Balehole	13°16'45.33"	75°24'54.36"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
281a	48O/7	N of Balehole	13°17'04.75"	75°24'38.67"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
282a	48O/7	NW of Balehole	13°17'06.80"	75°24'13.75"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
283a	48O/7	NW of Balehole	13° 17' 09.44"	75°24'07.31"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
284a	48O/7	S of Totaduru	13° 17' 24.37"	75°23'50.24"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
285a	48O/7	Totaduru	13°17'48.61"	75°23'35.83"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent

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286a	48O/7	Basarikatte	13°18'02.08"	75°23'23.76"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
287a	48O/7	S of Basarikatte	13°18'14.04"	75°23'14.30"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
288a	48O/7	W of Basarikatte	13°18'20.20"	75°22'47.73"	Gravitational	Lowly Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
289a	48O/7	W of Basarikatte	13°18'30.05"	75°22'24.49"	Gravitational	Lowly Dissected Slope	Ferruginous phyllite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
290a	48O/7	S of BilalKoppa	13°18'31.72"	75°21'55.94"	Gravitational	Lowly Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
291a	48O/7	S of BilalKoppa	13°18'25.57"	75°21'40.64"	Gravitational	Lowly Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
292a	48O/7	N of BilalKoppa	13°19'0.86"	75°21'32.69"	Gravitational	Lowly Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
293a	48O/7	Attikodige	13°19'17.94"	75°21'08.54"	Gravitational	Lowly Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
294a	48O/7	S of Kogre	13°19'54.23"	75°20'54.23"	Gravitational	Lowly Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
295a	48O/7	N of Kogre	13°20'26.87"	75°20'53.13"	Gravitational	Lowly Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
296a	48O/7	N of Kogre	13°20'56.65"	75°21'06.33"	Gravitational	Lowly Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
297a	48O/7	S of Guddetotta	13°21'17.59"	75°21'29.69"	Gravitational	Lowly Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
298a	48O/7	N of Guddetotta	13°21'51.01"	75°21'33.70"	Gravitational	Lowly Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent

Location No	Toposheet No	Locality / Village	Latitude (N)	Longitude (E)	Geomorphological Process	Geomorphological Form	Rock Type	Weathering	Overburden Type	Overburden Thickness	Land use Type	Hydrological Condition	Erosion	Susceptibility Assessment of Slope	Qualitative Risk Assessment
299a	48O/7	Tirtikere	13°22'16.75"	75°21'42.84"	Gravitational	Lowly Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
300a	48O/7	S of Makkikoppa	13°22'40.09"	75°21'44.17"	Gravitational	Lowly Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
301a	48O/7	S of Makkikoppa	13°23'06.84"	75°21'46.55"	Gravitational	Lowly Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
302a	48O/7	S of Makkikoppa	13°23'39.70"	75°21'41.77"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
303a	48O/7	Kotetetta	13°20'41.38"	75°20'15.56"	Gravitational	Lowly Dissected Slope	Granite	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
304a	48O/7	Bagalagadde	13°20'34.18"	75°19'42.23"	Gravitational	Lowly Dissected Slope	Granite	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
305a	48O/7	SW of Bagalagadde	13°20'18.73"	75°19'22.69"	Gravitational	Lowly Dissected Slope	Granite	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
306a	48O/7	Karolli	13°20'03.65"	75°18'57.77"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
307a	48O/7	S of Megur	13°19'50.78"	75°18'30.08"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
308a	48O/7	S of Megur	13°19'36.11"	75°18'11.24"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
309a	48O/7	Talavane	13°19'53.06"	75°18'07.10"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
310a	48O/7	Megur	13°20'29.29"	75° 18'11.76"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
311a	48O/7	N of Megur	13°20'56.18"	75°18'09.10"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent

Location No	Toposheet No	Locality / Village	Latitude (N)	Longitude (E)	Geomorphological Process	Geomorphological Form	Rock Type	Weathering	Overburden Type	Overburden Thickness	Land use Type	Hydrological Condition	Erosion	Susceptibility Assessment of Slope	Qualitative Risk Assessment
312a	48O/7	W of Sattikal	13° 21' 10.90"	75°18'30.39"	Gravitational	Lowly Dissected Slope	Granite gneiss	High	Weathered Rock	< 0.5 m	Barren	Damp	Toe erosion by Nala and River	Stable	Low or absent
313a	48O/7	E of Sattikal	13°21'11.37"	75°19'00.54"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
314a	48O/7	S of Heggarukodige	13°21'26.90"	75°19'00.70"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
315a	48O/7	Heggarukodige	13°21'54.24"	75°18'58.74"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
316a	48O/7	S of Kachige	13°22'30.03"	75°18'55.53"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
317a	48O/7	N of Basarikatte	13°18'48.86"	75°23'06.52"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
318a	48O/7	N of Honnugundi	13°19'11.64"	75°23'09.14"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
319a	48O/7	N of Honnugundi	13°19'29.48"	75°23'21.20"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
320a	48O/7	SE of Kugodu	13°19'46.43"	75°23'29.96"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
321a	48O/7	SE of Kugodu	13°19'56.80"	75°24'00.90"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
322a	48O/7	E of Kugodu	13°20'23.31"	75°24'08.84"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
323a	48O/7	SW of Bedagaru	13°20'49.75"	75°24'11.00"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
324a	48O/7	N of Bedagaru	13°20'50.07"	75°24'42.31"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent

Location No	Toposheet No	Locality / Village	Latitude (N)	Longitude (E)	Geomorphological Process	Geomorphological Form	Rock Type	Weathering	Overburden Type	Overburden Thickness	Land use Type	Hydrological Condition	Erosion	Susceptibility Assessment of Slope	Qualitative Risk Assessment
325a	48O/7	N of Bedagaru	13°20'58.29"	75°24'52.76"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
326a	48O/7	SW of Herur	13°23'04.42"	75°17'25.58"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
327a	48O/7	Bolur	13°22'50.79"	75°16'40.30"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Cultivation	Damp	Toe erosion by Nala and River	Stable	Low or absent
328a	48O/7	W of Bolur	13°22'44.09"	75° 15'55.37"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
329a	48O/7	Tekkur	13°22'58.28"	75°15'25.62"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
330a	48O/7	W of Tekkur	13°23'30.20"	75°15'24.10"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
331a	48O/7	Vaikuntapur	13°24'00.55"	75°15'48.07"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
332a	48O/7	S of Kalkatte	13°24'46.23"	75°15'24.67"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
333a	48O/7	N of Sringeri	13°26'17.89"	75°15'27.83"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
334a	48O/7	N of Sringeri	13°26'29.72"	75°15'48.17"	Gravitational	Rolling Plain	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
335a	48O/7	N of Sringeri	13°26'40.99"	75°16'05.07"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
336a	48O/7	Kavadi	13°27'08.58"	75°16'11.67"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
337a	48O/7	SE of Bachinakoppa	13°27'29.49"	75°16'34.30"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
338a	48O/7	Bachanikoppa	13°27'39.05"	75°17'07.64"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
339a	48O/7	NE of Addagadde	13°28'04.49"	75°17'39.34"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
340a	48O/7	Honnegudde	13°28'30.78"	75°17'56.75"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent

Location No	Toposheet No	Locality / Village	Latitude (N)	Longitude (E)	Geomorphological Process	Geomorphological Form	Rock Type	Weathering	Overburden Type	Overburden Thickness	Land use Type	Hydrological Condition	Erosion	Susceptibility Assessment of Slope	Qualitative Risk Assessment
341a	48O/7	Hosakoppa	13°28'55.88"	75°18'29.81"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
342a	48O/7	N of Hosakoppa	13°29'27.65"	75°18'44.71"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
343a	48O/7	Asagodu	13°29'38.13"	75°18'04.30"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
344a	48O/7	N of Jayapura	13°24'22.27"	75°22'33.62"	Gravitational	Lowly Dissected Slope	Chlorite schist	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
345a	48O/7	Matige	13°24'46.98"	75°22'10.08"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Cultivation	Damp	Toe erosion by Nala and River	Stable	Low or absent
346a	48O/7	Loknatapur	13°25'17.89"	75°21'54.08"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
347a	48O/7	N of Lokanatapur	13°25'41.36"	75°21'33.83"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
348a	48O/7	Paladamakki	13°26'10.72"	75°21'12.37"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
349a	48O/7	Tenginamane	13°26'34.59"	75°21'14.57"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
350a	48O/7	S of Kalkere	13°26'58.32"	75°21'07.92"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
351a	48O/7	Kalkere	13°27'20.16"	75°20'47.73"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
352a	48O/7	NW of Kalkere	13°27'36.23"	75°20'32.79"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Extensive Slope Cut	Damp	Toe erosion by Nala and River	Stable	Low or absent
353a	48O/7	SW of Belagola	13°27'40.69"	75°20'04.40"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
354a	48O/7	N of Belagola	13°28'17.45"	75°19'56.53"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent

Location No	Toposheet No	Locality / Village	Latitude (N)	Longitude (E)	Geomorphological Process	Geomorphological Form	Rock Type	Weathering	Overburden Type	Overburden Thickness	Land use Type	Hydrological Condition	Erosion	Susceptibility Assessment of Slope	Qualitative Risk Assessment
355a	48O/7	S of Narve	13°28'44.91"	75°20'04.58"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Cultivation	Damp	Toe erosion by Nala and River	Stable	Low or absent
356a	48O/7	Narve	13°29'12.51"	75°20'00.14"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
357a	48O/7	NE of Narve	13°29'34.27"	75°20'26.32"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
358a	48O/7	N of Narve	13°29'58.60"	75°20'31.49"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
359a	48O/7	N of Narve	13°29'44.45"	75°20'13.21"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
360a	48O/7	E of Kallumakki	13°29'28.41"	75°19'55.31"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
361a	48O/7	Kallumakki	13°29'21.56"	75°19'26.90"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
362a	48O/7	Narsipur	13°29'43.96"	75°19'08.81"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Plantation (LHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
363a	48O/7	NE of Menase	13°25'40.80"	75°16'21.30"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
364a	48O/7	Podubail	13°26'11.95"	75°16'46.07"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
365a	48O/7	NE of Podubail	13°26'29.04"	75°17'06.30"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
366a	48O/7	Sattihalli	13°26'11.94"	75°17'24.15"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
367a	48O/7	E of Sattihalli	13°26'03.42"	75°17'44.21"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
368a	48O/7	E of Sattihalli	13°26'01.96"	75°18'20.32"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
369a	48O/7	W of Sulugodu	13°26'30.23"	75°18'21.92"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent

Location No	Toposheet No	Locality / Village	Latitude (N)	Longitude (E)	Geomorphological Process	Geomorphological Form	Rock Type	Weathering	Overburden Type	Overburden Thickness	Land use Type	Hydrological Condition	Erosion	Susceptibility Assessment of Slope	Qualitative Risk Assessment
370a	48O/7	W of Sulugodu	13°26'46.24"	75°18'33.86"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
371a	48O/7	Sulugodu	13°26'34.16"	75°19'04.49"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
372a	48O/7	N of Sulugodu	13°27'04.81"	75°19'00.72"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
373a	48O/7	N of Uttameshvara	13°26'54.98"	75°19'20.94"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
374a	48O/7	Uttameshvara	13°26'55.12"	75°19'50.10"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
375a	48O/7	Baggunji	13°26'32.98"	75°20'13.30"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
376a	48O/7	W of Baggunji	13°26'22.73"	75°19'39.70"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
377a	48O/7	N of Koragodu	13°26'03.04"	75°19'31.56"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
378a	48O/7	Koragodu	13°25'28.29"	75°19'41.08"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
379a	48O/7	Ettinatti	13°24'51.10"	75°19'38.65"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Cultivation	Damp	Toe erosion by Nala and River	Stable	Low or absent
380a	48O/7	S of Ettinatti	13°24'23.28"	75°19'50.62"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
381a	48O/7	N of Agalagundi	13°23'47.55"	75°20'02.40"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
382a	48O/7	N of Sigodu	13°21'39.15"	75°25'43.98"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
383a	48O/7	Netrakonda	13°22'0.70"	75°25'19.77"	Gravitational	Rolling Plain	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Cultivation	Damp	Toe erosion by Nala and River	Stable	Low or absent
384a	48O/7	Netrakonda	13°21'52.13"	75°25'09.88"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
385a	48O/7	W of Halluvalli	13°15'00.40"	75°22'43.12"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent

Location No	Toposheet No	Locality / Village	Latitude (N)	Longitude (E)	Geomorphological Process	Geomorphological Form	Rock Type	Weathering	Overburden Type	Overburden Thickness	Land use Type	Hydrological Condition	Erosion	Susceptibility Assessment of Slope	Qualitative Risk Assessment
386a	48O/7	W of Halluvalli	13°15'02.44"	75°22'17.20"	Gravitational	Lowly Dissected Slope	Amphibolite	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
387a	48O/7	E of Hebalagundi	13°15'11.37"	75°21'42.19"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
388a	48O/7	Hebalagundi	13°15'27.32"	75°21'21.00"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
389a	48O/7	S of Hornadu	13°15'35.68"	75°20'45.93"	Gravitational	Valley Fill	Granite	Moderate	In-situ soil	0.5 – 5 m	Plantation (HHP)	Damp	Toe erosion by Nala and River	Stable	Low or absent
390a	48O/7	S of Hornadu	13°15'54.46"	75°20'37.53"	Gravitational	Valley Fill	Granite	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
391a	48O/7	Hornadu	13°16'29.52"	75°20'23.25"	Gravitational	Lowly Dissected Slope	Granite	Moderate	In-situ soil	0.5 – 5 m	Cultivation	Damp	Toe erosion by Nala and River	Stable	Low or absent
392a	48O/7	W of Hebbalagundi	13°15'17.58"	75°21'02.31"	Gravitational	Valley Fill	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Moderate Vegetation	Damp	Toe erosion by Nala and River	Stable	Low or absent
393a	48O/7	N of Kundabetta	13°14'54.33"	75°21'04.73"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent
394a	48O/7	Rudrabetta	13°14'31.54"	75°21'02.03"	Gravitational	Lowly Dissected Slope	Granite gneiss	Moderate	In-situ soil	0.5 – 5 m	Settlement	Damp	Toe erosion by Nala and River	Stable	Low or absent

Annexure – 4: Rainfall data for last 20 years

RAIN GAUGE STATION - JAYAPURA													
MONTH	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC	TOTAL
YEAR	(mm)												
1997	0.0	0.0	58.4	67.4	27.4	700.6	1148.8	1228.8	93.0	176.8	24.0	31.0	3556.2
1998	0.0	0.0	0.0	9.6	0.0	634.7	1121.2	607.0	280.0	222.0	94.0	0.0	2968.5
1999	0.0	0.0	0.0	10.0	316.6	490.4	1423.6	518.2	139.3	552.6	0.0	0.0	3450.7
2000	0.0	0.0	0.0	167.2	57.0	1005.0	923.5	622.3	329.6	194.2	0.0	0.0	3298.8
2001	0.0	0.0	0.0	246.0	59.2	629.0	730.9	679.5	216.5	110.8	86.0	0.0	2757.9
2002	0.0	82.0	0.0	159.3	53.2	514.1	618.7	629.5	51.6	154.5	16.0	0.0	2278.9
2003	0.0	0.0	12.8	73.1	0.0	535.9	779.8	666.0	112.6	288.4	0.0	0.0	2468.6
2004	0.0	0.0	27.8	85.3	274.2	791.9	676.1	1000.9	145.6	94.1	9.6	0.0	3105.5
2005	0.0	0.0	0.0	167.2	55.3	518.7	1290.3	1028.5	280.8	466.2	1.0	0.0	3808.0
2006	0.0	0.0	7.4	33.2	246.4	497.3	993.3	897.4	260.9	48.4	262.2	0.0	3246.5
2007	0.0	0.0	0.0	68.2	61.0	812.0	1084.0	1085.4	608.2	176.3	37.4	0.0	3932.5
2008	0.0	82.0	382.2	62.8	48.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	575.8
2009	0.0	0.0	177.1	54.2	189.9	301.8	1551.8	397.6	593.8	273.2	81.7	100.9	3722.0
2010	43.1	0.0	35.6	74.6	58.1	304.2	935.0	646.1	430.2	193.0	214.5	2.8	2937.2
2011	0.0	1.6	0.0	159.4	68.2	684.5	857.4	748.6	394.0	229.9	61.5	0.0	3205.1
2012	0.0	0.0	0.0	177.9	48.8	284.9	501.2	982.2	272.6	33.7	167.2	1.0	2469.5
2013	0.0	64.6	32.8	21.6	94.3	634.1	1725.6	703.1	304.4	85.5	3.2	0.0	3669.2
2014	0.0	0.0	20.5	121.0	176.5	225.1	1298.2	854.2	354.7	139.6	13.2	6.2	3209.2
2015	0.0	0.0	98.3	96.6	213.4	826.5	572.0	438.6	178.6	223.5	135.5	26.6	2809.6
2016	0.0	0.0	98.3	96.6	213.4	826.5	572.0	438.6	178.6	223.5	135.5	26.6	2809.6
2017	0.0	0.0	16.2	23.2	160.8	430.8	604.0	615.7	278.1	113.4	8.6	0.0	2250.8

RAIN GAUGE STATION - BASAREKATTE													
MONTH	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC	TOTAL
YEAR	(mm)												
1997	0.0	0.0	140.6	195.0	138.4	1339.2	2311.2	2074.2	192.0	530.0	35.0	40.0	6995.6
1998	0.0	0.0	0.0	20.8	45.0	536.2	1009.0	611.8	374.6	135.4	88.4	0.0	2821.2
1999	0.0	0.0	0.0	26.2	216.0	346.4	1424.8	295.1	68.2	508.2	0.0	0.0	2884.9
2000	0.0	0.0	0.0	148.8	120.2	633.0	881.9	723.9	306.0	235.6	0.0	0.0	3049.4
2001	0.0	0.0	0.0	256.9	99.2	509.6	614.8	656.0	262.0	110.0	44.0	0.0	2552.5
2002	0.0	72.0	2.0	193.6	123.6	412.5	591.8	999.2	194.8	289.9	75.0	0.0	2954.4
2003	0.0	2.6	0.0	6.4	161.6	9.4	452.0	740.2	680.3	91.6	216.4	0.0	2360.5
2004	0.0	0.0	77.2	119.6	253.4	724.4	701.8	1285.4	195.4	77.4	7.0	0.0	3441.6
2005	0.0	0.0	0.0	256.8	64.4	377.2	1725.0	1031.7	240.0	310.2	10.6	0.0	4015.9
2006	0.0	0.0	0.0	48.8	294.4	519.5	1024.0	994.8	259.6	72.5	180.8	0.0	3394.4
2007	0.0	0.0	0.0	96.2	27.7	791.8	1143.2	977.6	492.9	230.6	56.7	0.0	3816.7
2008	0.0	57.0	286.9	98.7	37.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	479.9
2009	0.0	0.0	125.5	109.0	140.1	205.1	1531.1	323.0	462.7	321.5	123.1	61.3	3402.4
2010	0.0	0.0	21.4	115.2	137.2	249.4	888.7	629.5	555.7	316.3	239.7	1.8	3154.9
2011	0.0	8.9	0.0	141.7	108.4	600.0	843.7	711.9	356.8	235.6	113.4	0.0	3120.4
2012	0.0	0.0	0.0	224.0	9.3	280.9	534.9	1022.0	229.3	41.5	146.5	5.3	2493.7
2013	2.5	15.8	53.5	24.0	220.2	683.3	1810.1	690.0	294.9	104.1	24.4	0.0	3922.8
2014	3.2	0.0	30.5	116.8	248.9	295.0	1243.7	1018.0	341.6	76.4	16.8	40.7	3431.6
2015	0.0	0.0	18.5	266.2	177.1	659.0	570.3	464.6	173.8	99.3	161.2	5.1	2595.1
2016	0.0	0.0	18.5	266.2	177.1	659.0	570.3	464.6	173.8	99.3	161.2	5.1	2595.1
2017	0.0	0.0	8.0	39.1	166.5	468.6	543.4	565.6	232.5	112.3	30.1	0.0	2166.1

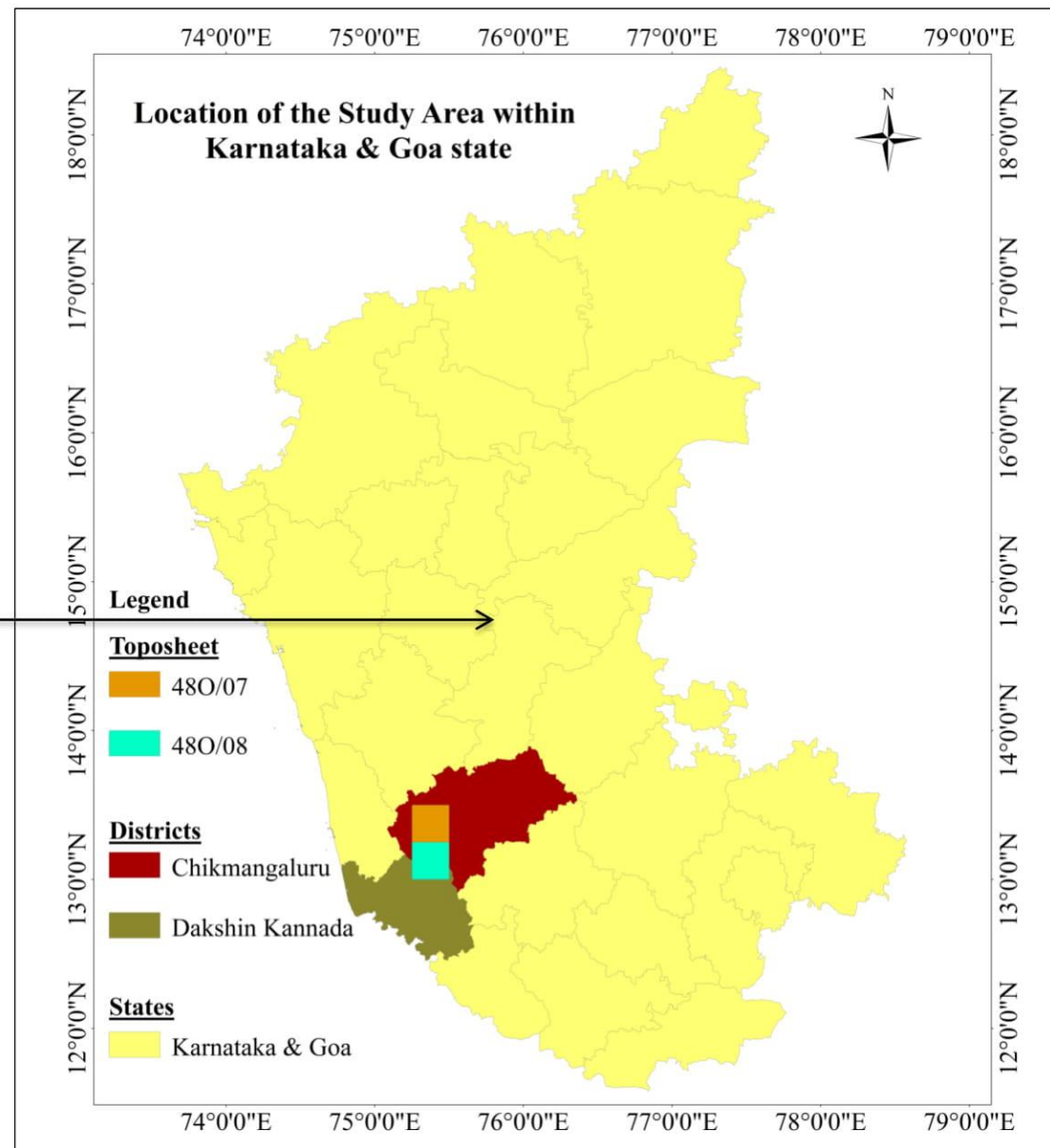
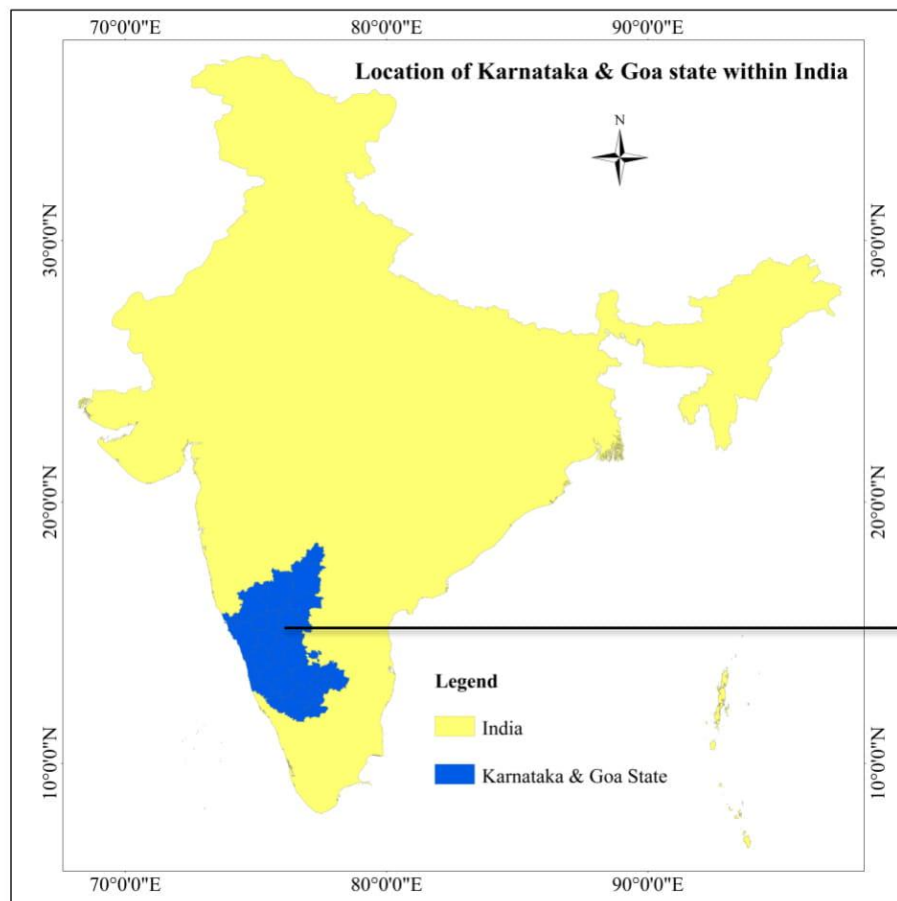
RAIN GAUGE STATION - JAVALI													
MONTH	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC	TOTAL
YEAR	(mm)												
1997	0.0	0.0	21.0	32.0	63.0	498.5	1019.8	820.3	24.7	222.0	117.8	170.8	2989.9
1998	0.0	0.0	4.0	40.0	78.0	588.0	872.0	472.0	581.0	445.4	116.0	0.0	3196.4
1999	0.0	0.0	0.0	13.0	380.0	488.0	1282.0	315.0	138.0	468.0	15.0	0.0	3099.0
2000	3.0	0.0	0.0	60.0	177.0	641.0	806.0	667.0	280.0	227.0	2.0	6.0	2869.0
2001	0.0	0.0	0.0	160.0	149.0	629.0	744.0	485.0	198.0	109.0	66.0	0.0	2540.0
2002	0.0	51.0	0.0	103.0	55.0	336.0	248.0	603.6	116.0	582.0	0.0	0.0	2094.6
2003	0.0	0.0	14.0	84.3	11.2	738.4	586.8	383.0	108.9	175.9	3.0	0.0	2105.5
2004	0.0	0.0	6.0	47.0	404.1	927.5	412.2	869.3	234.4	76.3	22.0	0.0	2998.8
2005	0.0	0.0	0.0	239.3	115.2	438.7	1101.9	717.8	285.8	238.7	11.0	0.0	3148.4
2006	2.0	0.0	0.0	39.2	303.9	845.5	946.4	364.3	343.5	101.0	130.0	0.0	3075.8
2007	0.0	0.0	0.0	111.4	50.9	828.6	1019.2	1014.4	410.6	169.2	40.0	0.0	3644.3
2008	0.0	44.0	246.6	46.0	60.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	397.1
2009	0.0	0.0	24.2	30.9	72.7	297.6	1890.5	226.1	383.5	248.8	134.2	65.0	3373.5
2010	0.0	0.0	0.0	87.7	141.6	546.2	641.5	541.7	292.2	254.8	259.3	10.0	2775.0
2011	2.0	15.3	0.0	121.8	79.3	914.4	658.9	405.5	453.6	233.6	90.6	0.0	2975.0
2012	0.0	0.0	0.0	138.2	72.3	366.1	369.3	797.6	226.2	159.1	107.4	0.0	2236.2
2013	14.0	26.0	56.7	35.2	77.4	553.4	1387.4	499.5	361.7	149.5	19.0	6.0	3185.8
2014	5.0	0.0	16.2	121.9	396.6	285.3	1062.3	657.8	287.8	103.8	31.0	32.0	2999.7
2015	0.0	0.0	6.2	164.3	173.6	1128.8	338.4	203.0	167.1	170.7	176.6	19.0	2547.7
2016	0.0	0.0	6.2	164.3	173.6	1128.8	338.4	203.0	167.1	170.7	176.6	19.0	2547.7
2017	2.0	0.0	42.4	53.0	171.3	535.3	526.2	638.9	272.9	141.6	8.0	0.0	2391.6

RAIN GAUGE STATION - KALASA													
MONTH	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC	TOTAL
YEAR	(mm)												
1997	0.0	0.0	40.4	0.0	0.0	728.8	1437.8	1031.3	0.0	95.8	84.8	41.8	3460.7
1998	0.0	0.0	38.0	12.0	63.6	533.4	1206.8	451.1	396.0	230.9	35.0	0.0	2966.8
1999	0.0	14.2	0.0	47.4	277.8	569.0	1281.9	409.6	107.6	479.4	4.0	0.0	3190.9
2000	0.0	0.0	0.0	41.4	92.6	717.6	949.8	724.8	279.2	105.6	15.2	4.4	2930.6
2001	0.0	0.0	0.0	166.2	70.2	806.0	744.6	401.2	209.4	144.4	37.4	0.0	2579.4
2002	0.0	124.4	0.0	79.9	68.1	354.5	359.9	744.0	92.4	410.0	0.0	0.0	2233.2
2003	0.0	0.0	33.0	60.4	20.0	589.4	648.1	413.2	77.2	219.7	5.2	0.0	2066.2
2004	0.0	0.0	9.0	94.0	301.2	961.4	425.2	693.0	118.2	105.2	48.0	0.0	2755.2
2005	0.0	0.0	0.0	238.4	37.8	575.4	1347.0	821.0	277.6	346.8	26.1	0.0	3670.1
2006	19.6	0.0	14.8	15.4	345.0	701.3	1423.3	826.0	299.6	40.9	122.5	4.0	3812.4
2007	0.0	0.0	0.0	139.3	76.6	986.0	1530.4	980.2	489.6	225.6	19.1	0.0	4446.8
2008	0.0	37.6	284.2	53.1	59.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	434.7
2009	0.0	0.0	39.8	34.4	111.8	237.7	2144.2	362.4	369.1	292.0	169.4	52.8	3813.6
2010	24.8	0.0	2.0	94.4	125.8	365.7	821.0	628.2	276.3	256.4	196.4	22.8	2813.8
2011	0.0	20.4	0.0	131.2	86.0	821.2	794.0	626.0	421.0	202.2	69.4	0.0	3171.4
2012	0.0	0.0	0.0	248.6	13.8	283.0	596.8	960.4	278.8	35.6	75.4	1.2	2493.6
2013	16.2	7.2	24.6	102.0	609.8	818.6	1762.6	702.6	269.2	188.2	15.8	18.0	4534.8
2014	14.4	0.0	2.6	123.0	286.0	317.4	1556.6	826.2	350.2	141.4	47.0	17.8	3682.6
2015	0.0	0.0	51.2	77.4	111.0	1136.9	493.6	274.6	170.6	167.7	134.6	2.0	2619.6
2016	0.0	0.0	51.2	77.4	111.0	1136.9	493.6	274.6	170.6	167.7	134.6	2.0	2619.6
2017	0.0	0.0	4.0	33.2	110.7	617.2	566.4	544.6	295.1	144.5	2.8	0.0	2318.5

RAIN GAUGE STATION - KALASA													
MONTH	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC	TOTAL
YEAR	(mm)												
1997	0.0	0.0	24.2	76.0	77.4	508.0	924.0	656.6	83.0	171.6	109.6	9.8	2640.2
1998	0.0	0.0	10.8	49.6	148.4	305.6	582.2	339.6	286.4	178.8	77.8	0.0	1979.2
1999	0.0	0.0	0.0	0.0	184.0	285.0	116.2	292.4	146.0	309.4	0.0	0.0	1333.0
2000	2.0	0.0	0.0	86.6	40.8	381.9	629.8	513.6	242.0	274.8	4.4	2.0	2177.9
2001	0.0	2.2	0.0	281.2	41.0	362.0	434.6	483.8	168.2	111.4	40.4	0.0	1924.8
2002	0.0	120.4	0.0	140.3	115.6	282.2	281.2	433.4	41.9	263.0	65.6	0.0	1743.6
2003	0.0	0.0	60.2	126.2	8.4	350.8	397.2	302.0	35.4	60.2	0.0	0.0	1340.4
2004	0.0	0.0	23.6	94.0	205.8	400.8	380.4	711.8	63.6	38.2	23.0	0.0	1941.2
2005	6.2	0.0	0.0	253.1	48.6	203.4	833.2	591.6	260.2	324.1	2.6	0.0	2523.0
2006	6.4	0.0	84.6	52.2	129.0	352.6	555.8	475.6	172.8	38.2	193.2	0.0	2060.4
2007	0.0	0.0	18.8	95.0	57.6	377.0	730.6	611.7	286.8	239.0	5.4	1.2	2423.1
2008	0.0	109.4	302.8	49.6	109.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	571.2
2009	0.0	0.0	178.6	48.0	103.6	132.4	955.4	193.8	337.4	158.8	95.8	89.4	2293.2
2010	13.2	0.0	33.4	126.8	60.3	227.8	528.8	347.1	337.2	238.2	222.6	14.5	2149.9
2011	0.0	44.0	9.1	167.9	157.6	329.1	496.1	420.2	223.1	197.1	78.2	0.0	2122.4
2012	0.0	0.0	0.0	225.7	23.2	151.0	281.0	635.2	125.3	79.5	118.3	0.4	1639.6
2013	0.0	26.0	11.8	34.0	131.6	377.3	1059.7	352.3	230.3	40.5	0.6	0.0	2264.1
2014	0.0	0.0	8.4	173.2	196.4	124.4	752.4	581.6	181.5	95.3	9.6	38.0	2160.8
2015	0.0	0.0	19.0	207.4	135.0	396.2	271.4	264.5	191.6	124.6	102.4	12.2	1724.3
2016	0.0	0.0	19.0	207.4	135.0	396.2	271.4	264.5	191.6	124.6	102.4	12.2	1724.3
2017	0.0	0.0	5.8	44.8	137.9	229.0	336.2	395.1	174.7	160.8	13.0	10.6	1507.9

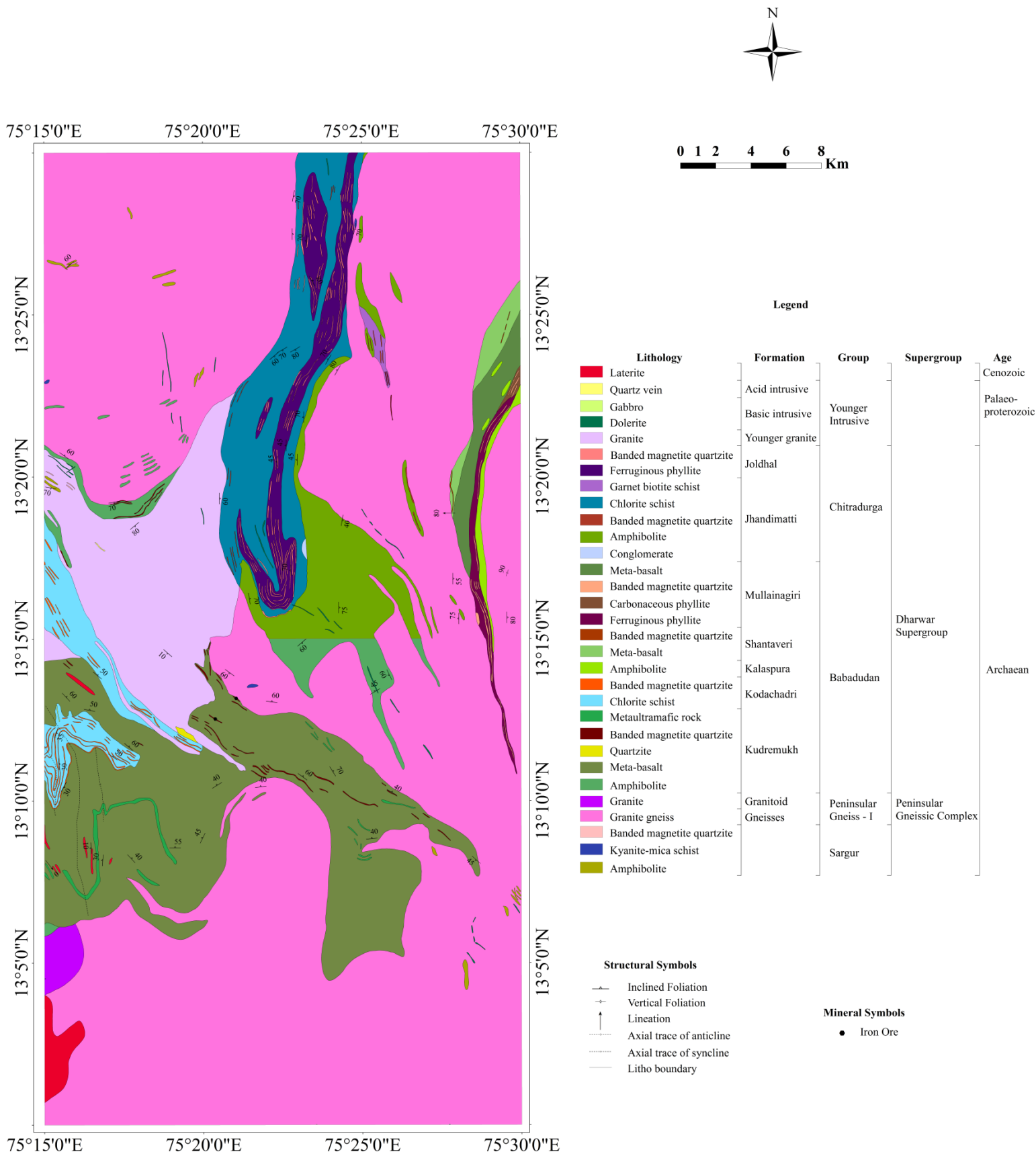
RAIN GAUGE STATION - SRINGERI													
MONTH	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC	TOTAL
YEAR	(mm)												
1997	0.0	0.0	7.1	41.5	64.2	878.6	1667.1	1344.0	97.0	178.9	180.4	51.6	4510.4
1998	0.0	0.0	0.0	2.6	112.0	775.5	1334.6	780.8	486.0	243.9	120.4	0.0	3855.8
1999	0.0	0.0	4.6	6.9	416.6	539.0	1905.1	792.7	217.7	513.4	20.0	0.0	4416.0
2000	19.7	0.0	0.0	99.5	72.0	1018.5	970.8	973.2	314.0	84.5	2.0	2.0	3556.2
2001	0.0	0.0	2.0	324.0	72.9	911.6	995.9	900.9	147.0	98.4	64.7	0.0	3517.4
2002	0.0	51.4	27.0	109.8	20.9	556.9	905.2	1003.5	196.3	300.0	25.7	1.0	3197.7
2003	0.0	0.0	57.2	81.9	0.0	758.3	1109.6	1011.4	220.4	180.8	1.5	0.0	3421.1
2004	0.0	0.0	26.6	28.8	192.5	1017.7	1088.6	1183.7	153.0	67.7	40.2	0.0	3798.8
2005	0.0	0.0	0.0	120.7	37.5	635.3	1628.7	1219.9	395.1	310.6	13.2	1.0	4362.0
2006	2.0	0.0	0.0	17.0	268.7	686.7	1505.0	1410.5	362.7	38.6	230.0	1.0	4522.2
2007	0.0	4.0	0.0	80.4	68.9	979.7	1355.6	1128.4	657.1	211.3	51.5	1.0	4537.9
2008	0.0	43.4	239.4	21.3	7.2	768.6	0.0	0.0	0.0	0.0	0.0	0.0	1079.9
2009	0.0	0.0	166.1	27.1	82.5	270.4	1788.7	582.8	496.2	341.1	174.5	16.2	3945.6
2010	26.1	0.0	2.0	82.7	93.4	438.6	1076.2	696.7	468.2	217.5	250.2	5.0	3356.6
2011	0.0	0.0	10.0	90.3	47.5	984.4	1123.3	996.7	536.0	235.4	81.4	0.0	4105.0
2012	0.0	0.0	0.0	141.3	23.4	485.8	879.8	1192.7	369.8	36.6	134.1	0.0	3263.5
2013	1.0	4.4	8.6	13.2	169.8	857.8	2051.7	978.0	237.7	123.2	36.5	0.0	4481.9
2014	0.0	13.0	2.0	57.6	161.7	459.2	1532.8	1056.8	424.6	123.2	11.0	40.8	3882.7
2015	0.0	0.0	11.6	107.0	198.0	887.0	975.8	570.6	137.2	179.1	153.3	20.4	3240.0
2016	0.0	0.0	11.6	107.0	198.0	887.0	975.8	570.6	137.2	179.1	153.3	20.4	3240.0
2017	0.0	0.0	0.0	16.0	188.6	619.6	799.6	813.6	199.4	65.5	21.2	0.0	2723.5

Location Map of the Study Area



Sl No	TS No	Latitude (N)		Longitude (E)	
		From	To	From	To
1	48O07	13°15'00"	13°30'00"	75°15'00"	75°30'00"
2	48O08	13°00'00"	13°15'00"	75°15'00"	75°30'00"

Geological Map of Toposheet No. 48O/07 and 48O/08, parts of Chikmangaluru and Dakshin Kannada Districts, Karnataka

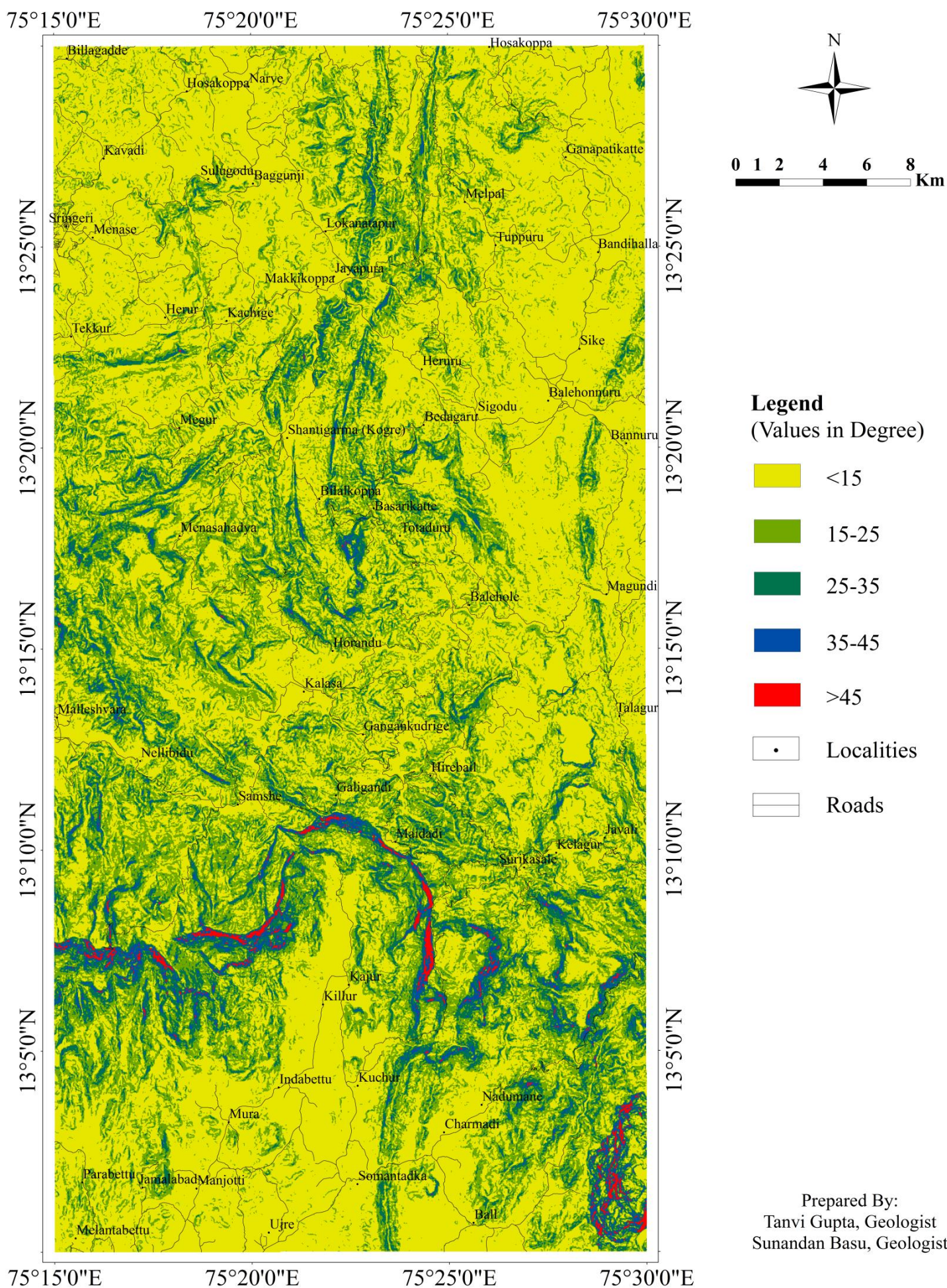


Compiled from 1:50K geological map og GSI.

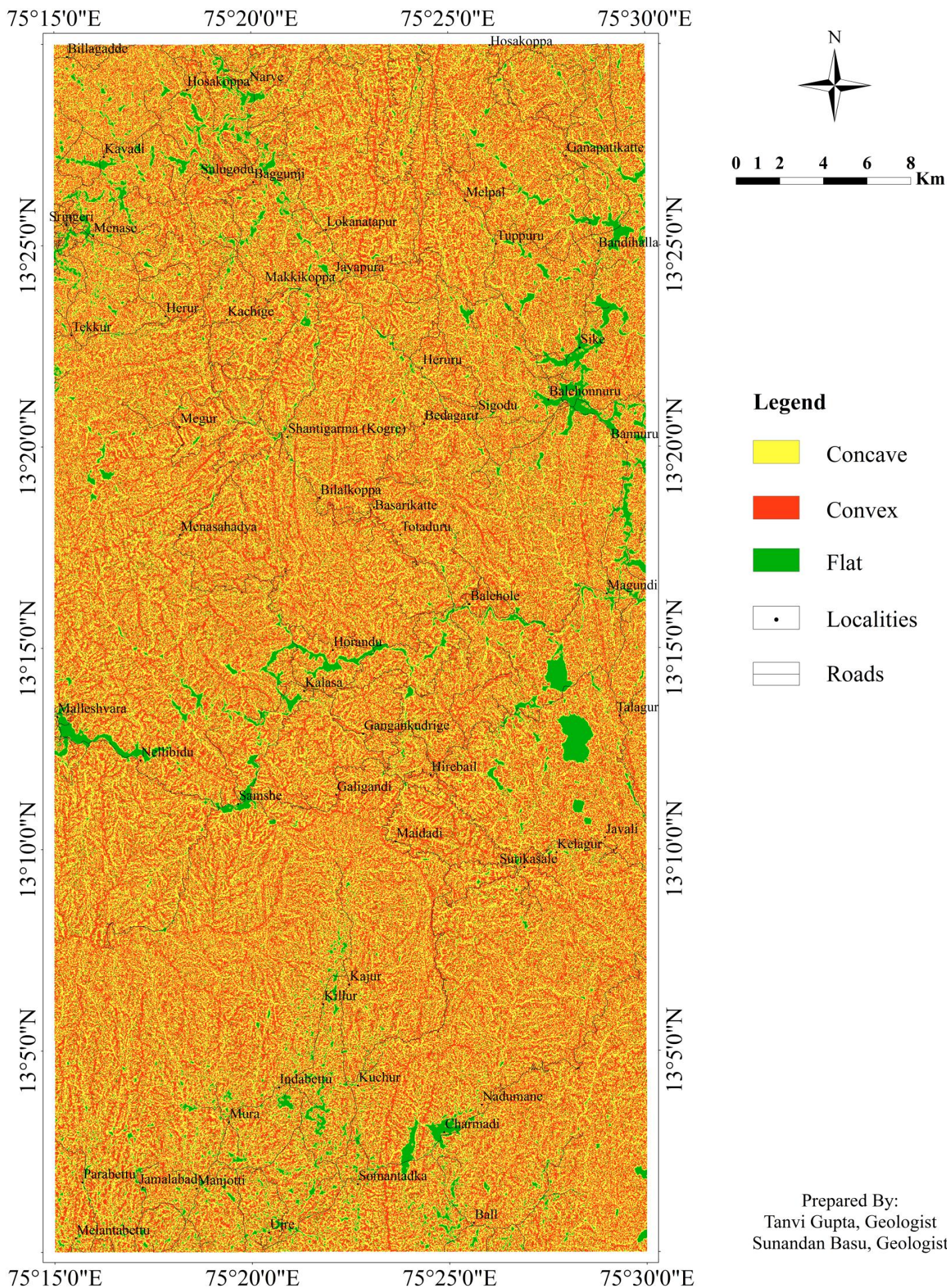
Prepared By:

Tanvi Gupta, Geologist
Sunandan Basu, Geologist

Slope Angle Map of Toposheet No. 48O/07 and 48O/08, parts of Chikmangaluru and Dakshin Kannada Districts, Karnataka

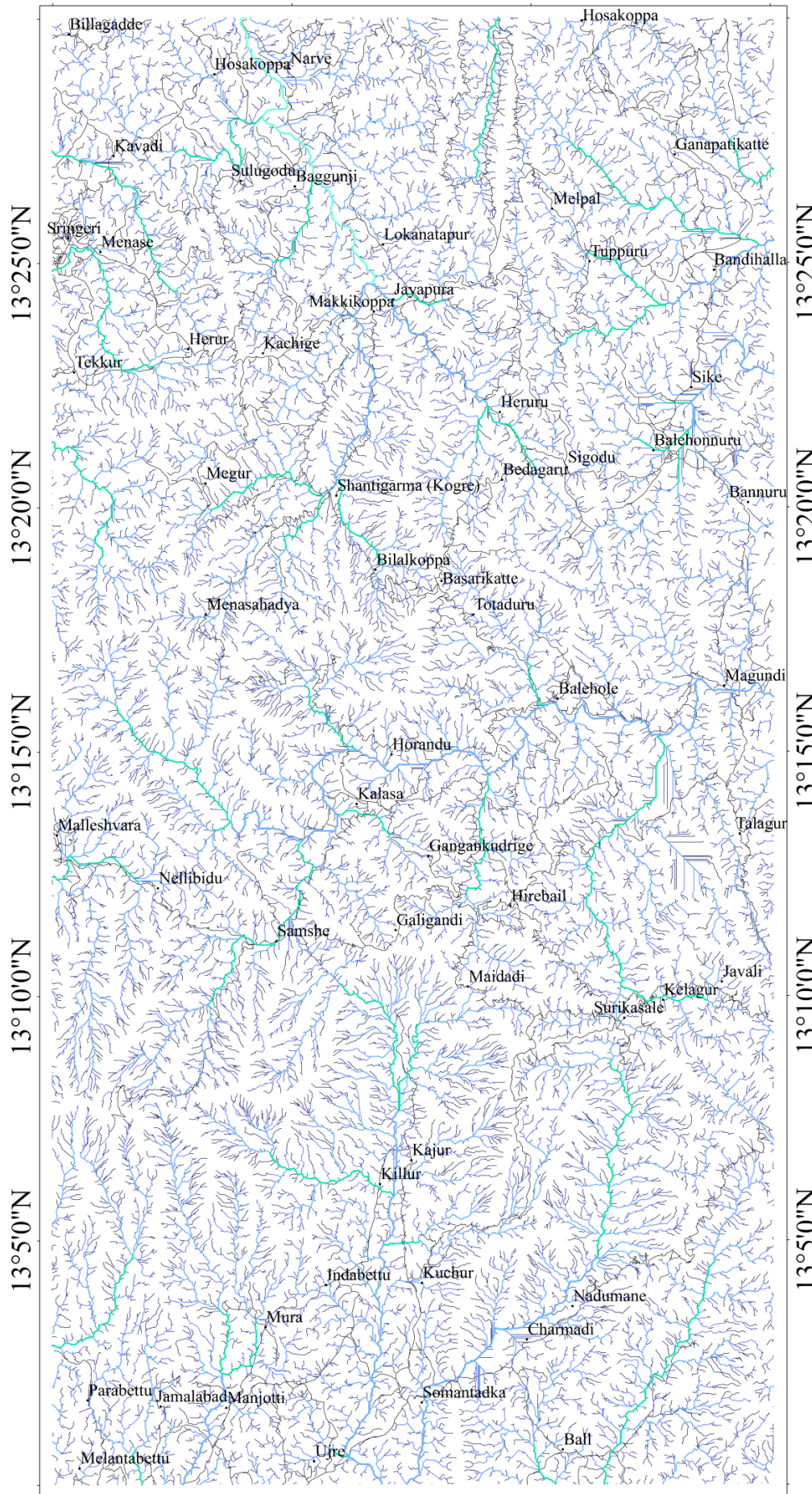


Slope Curvature Map of Toposheet No. 48O/07 and 48O/08, parts of Chikmangaluru and Dakshin Kannada Districts, Karnataka



Drainage Map of Toposheet No. 48O/07 and 48O/08, parts of Chikmangaluru and Dakshin Kannada Districts, Karnataka

75°15'0"E 75°20'0"E 75°25'0"E 75°30'0"E



0 1 2 4 6 8 Km

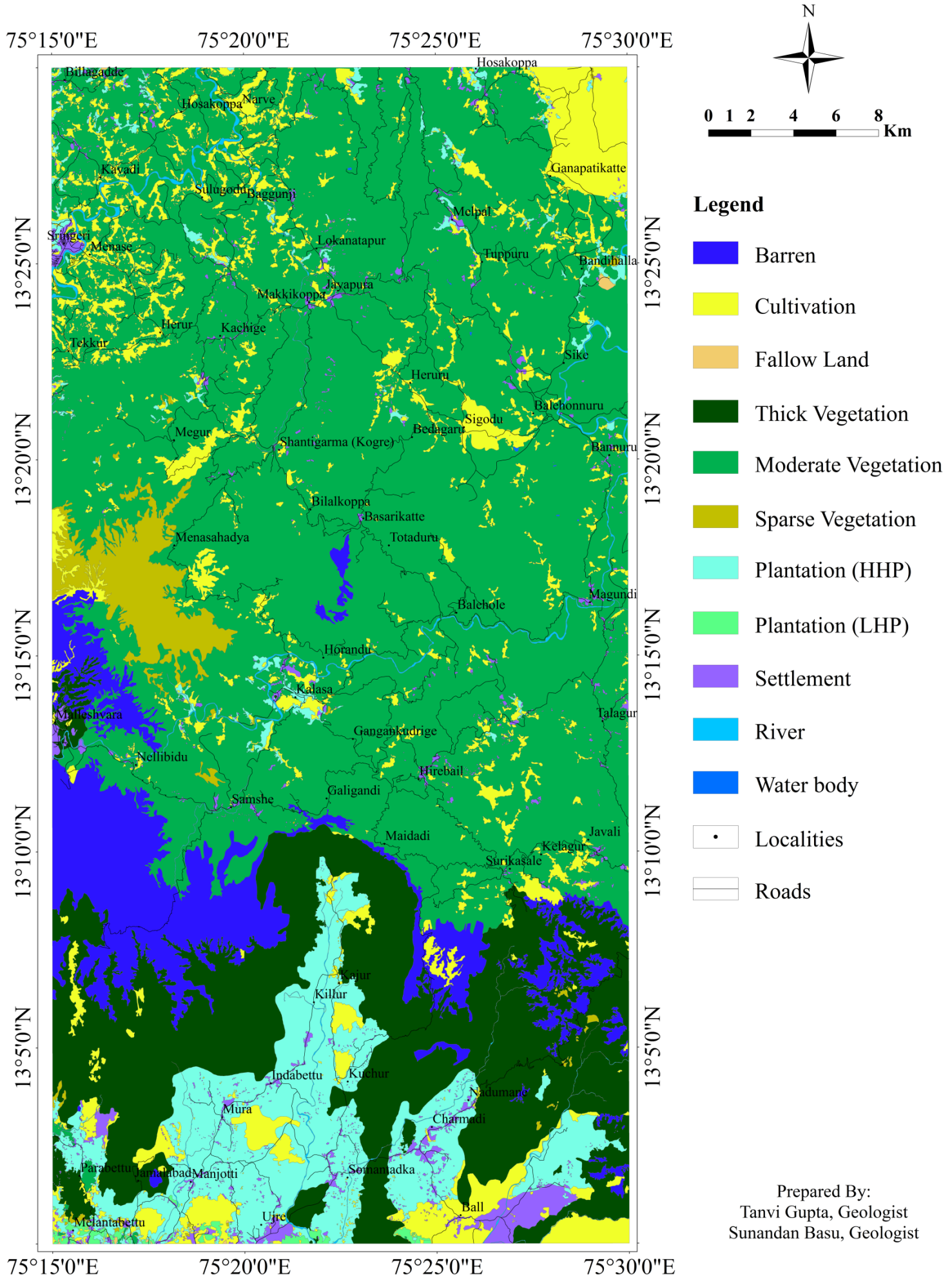
Legend

-  3rd Order
-  4th Order
-  5th Order
-  6th Order
-  7th Order
-  8th Order
-  9th Order
-  Localities
-  Roads

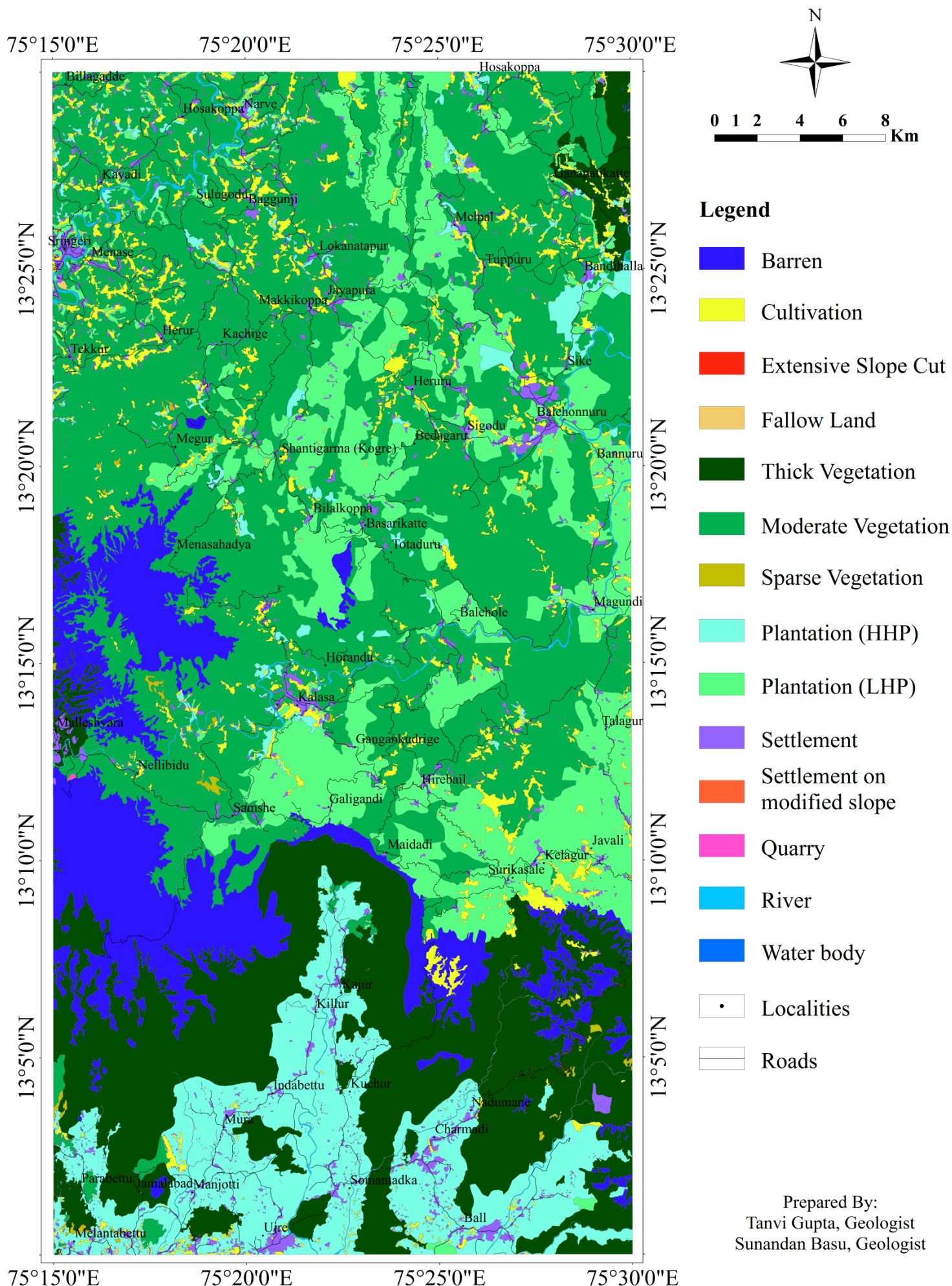
Prepared By:
Tanvi Gupta, Geologist
Sunandan Basu, Geologist

75°15'0"E 75°20'0"E 75°25'0"E 75°30'0"E

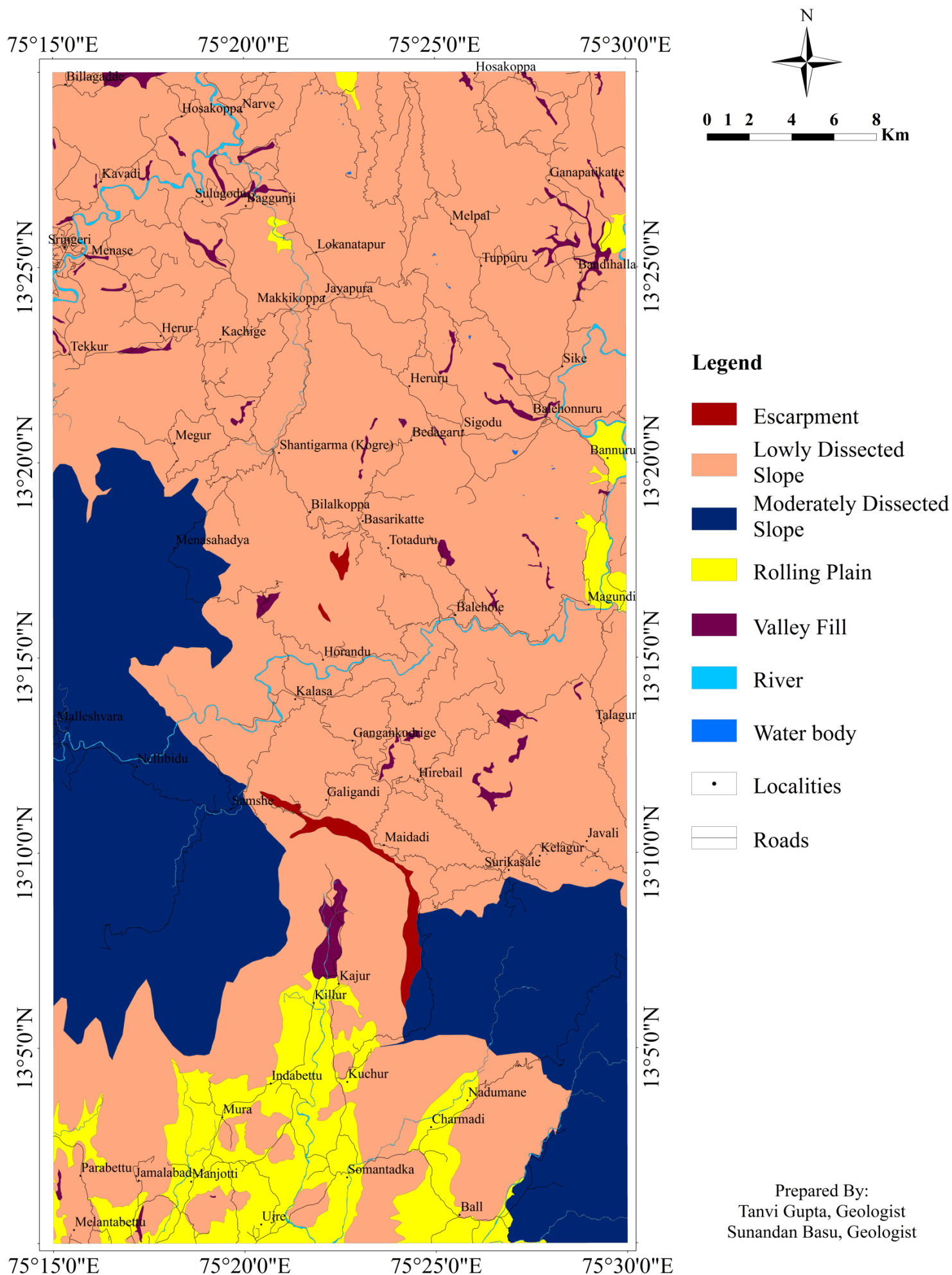
Pre Field Land Use Land Cover Map of Toposheet No. 48O/07 and 48O/08, parts of Chikmangaluru and Dakshin Kannada Districts, Karnataka



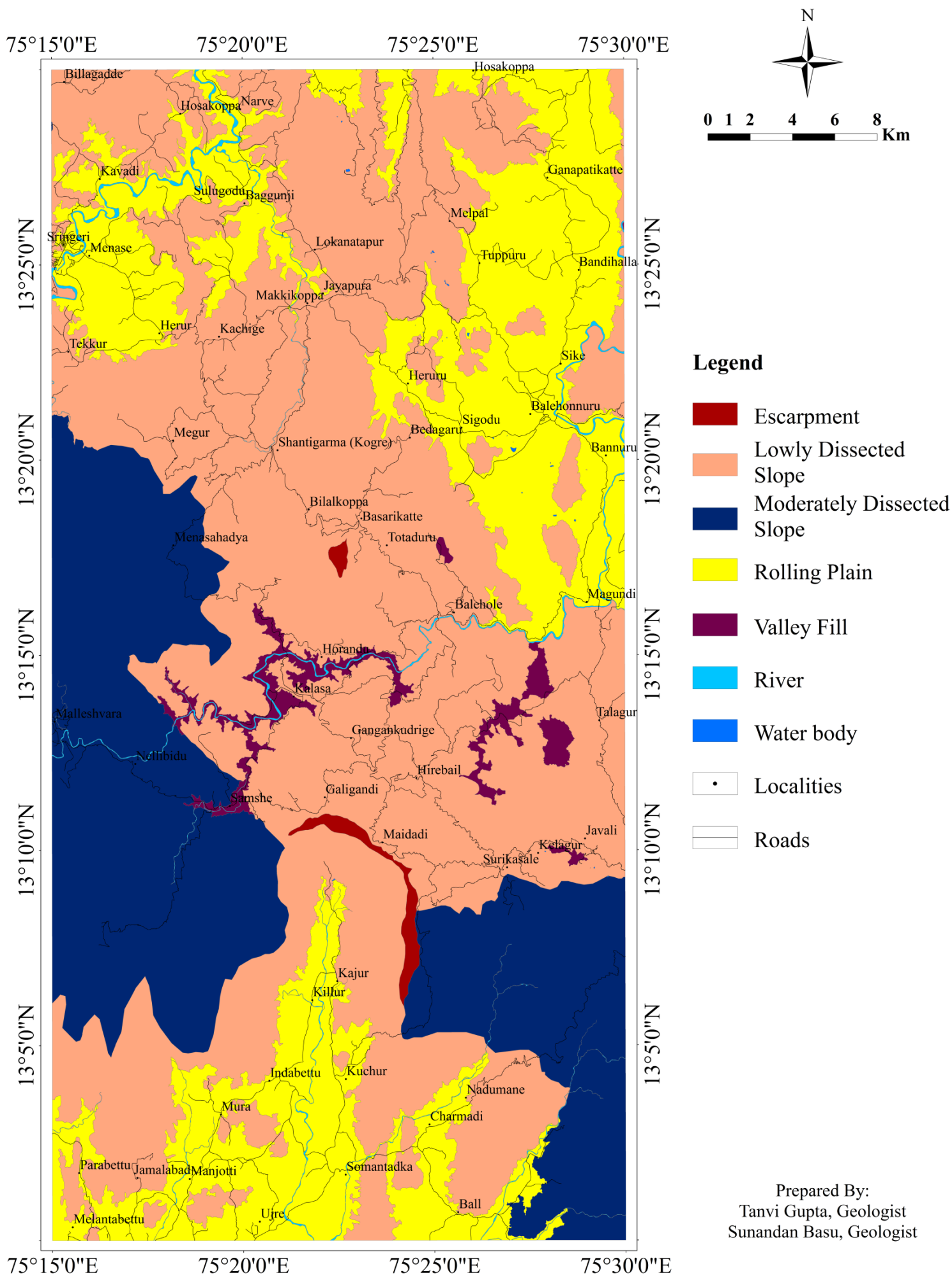
Post Field Land Use Land Cover Map of Toposheet No. 48O/07 and 48O/08, parts of Chikmangaluru and Dakshin Kannada Districts, Karnataka



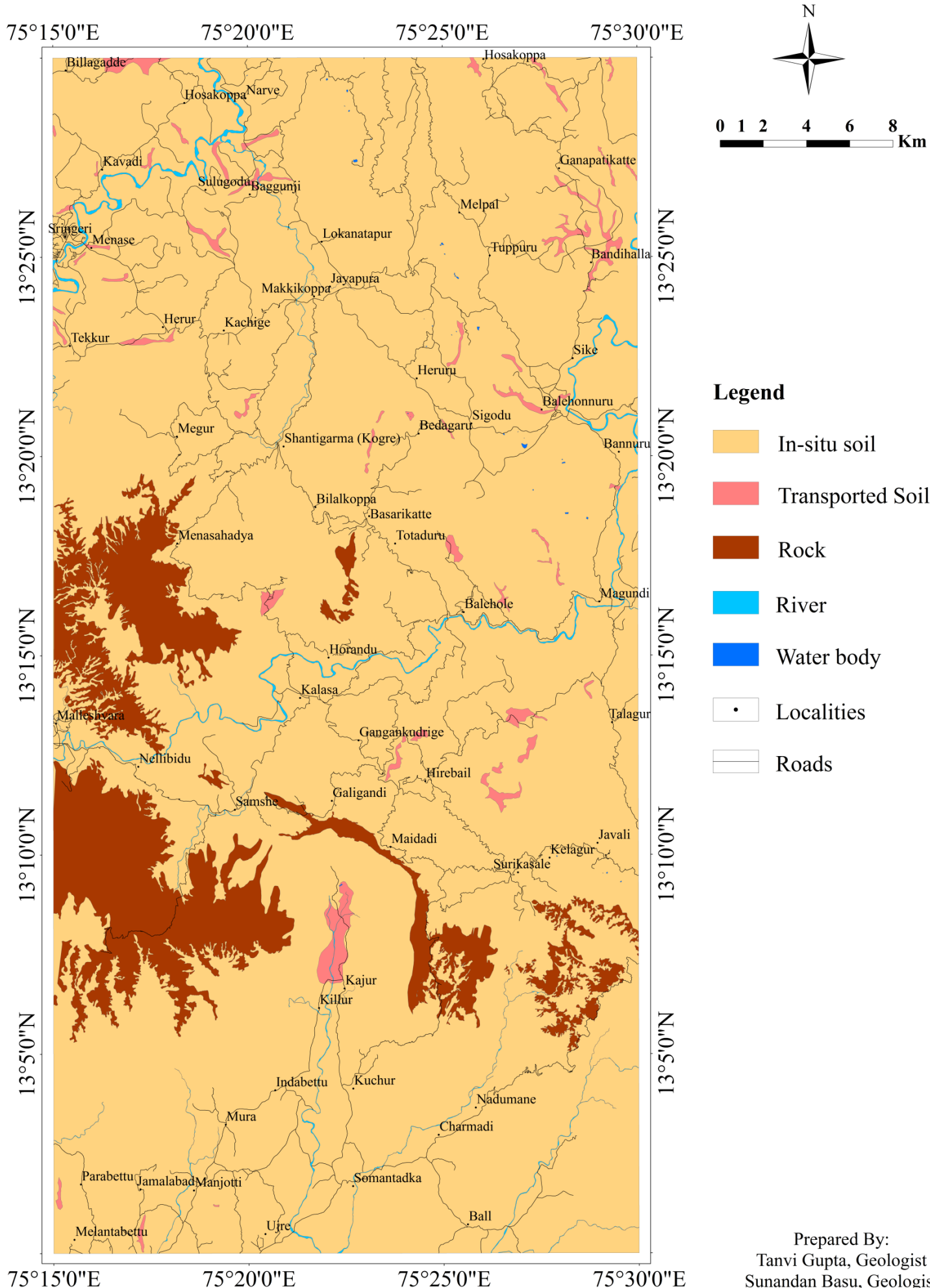
Pre Field Geomorphology Map of Toposheet No. 48O/07 and 48O/08, parts of Chikmangaluru and Dakshin Kannada Districts, Karnataka



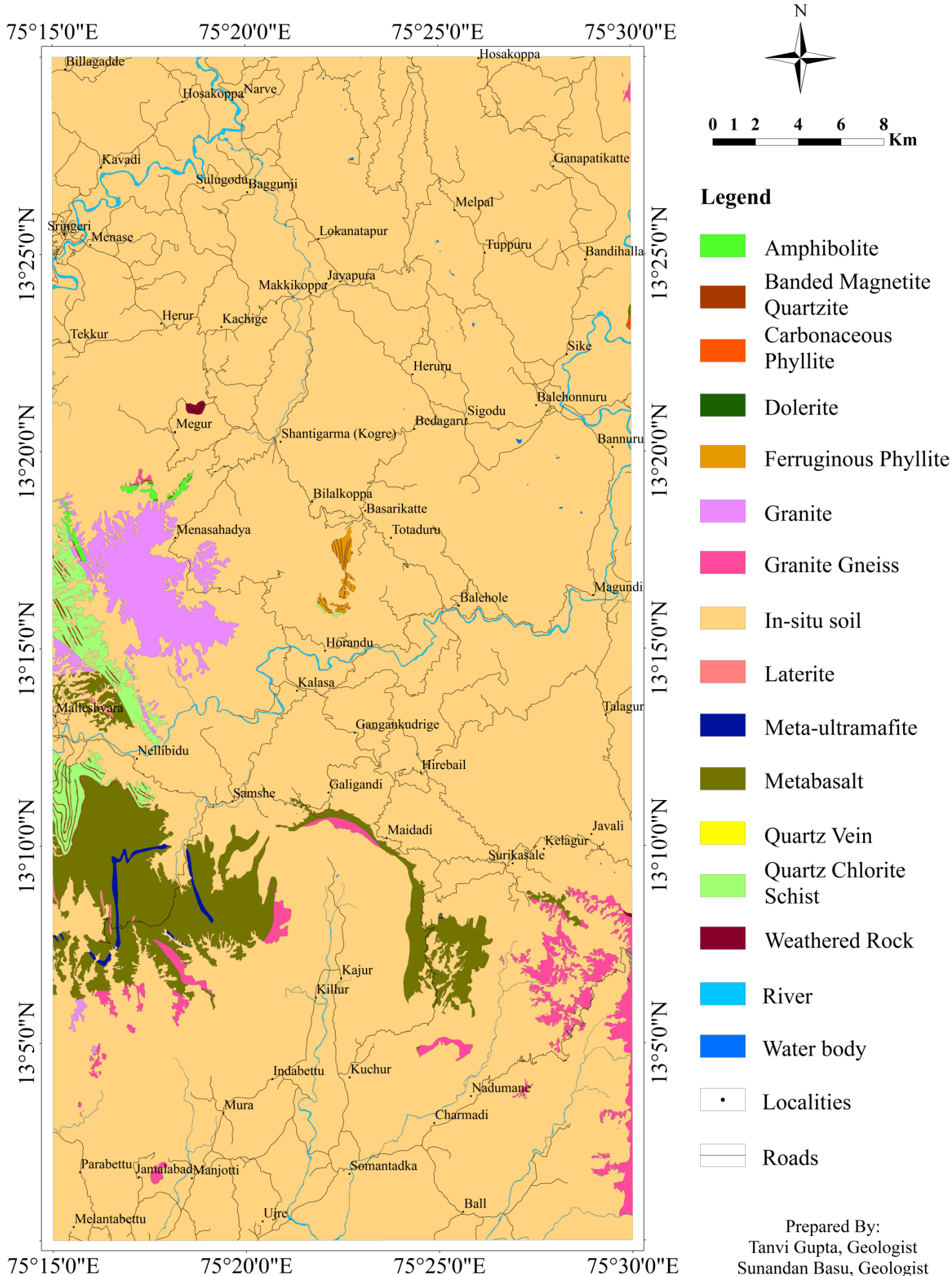
Post Field Geomorphology Map of Toposheet No. 48O/07 and 48O/08, parts of Chikmangaluru and Dakshin Kannada Districts, Karnataka



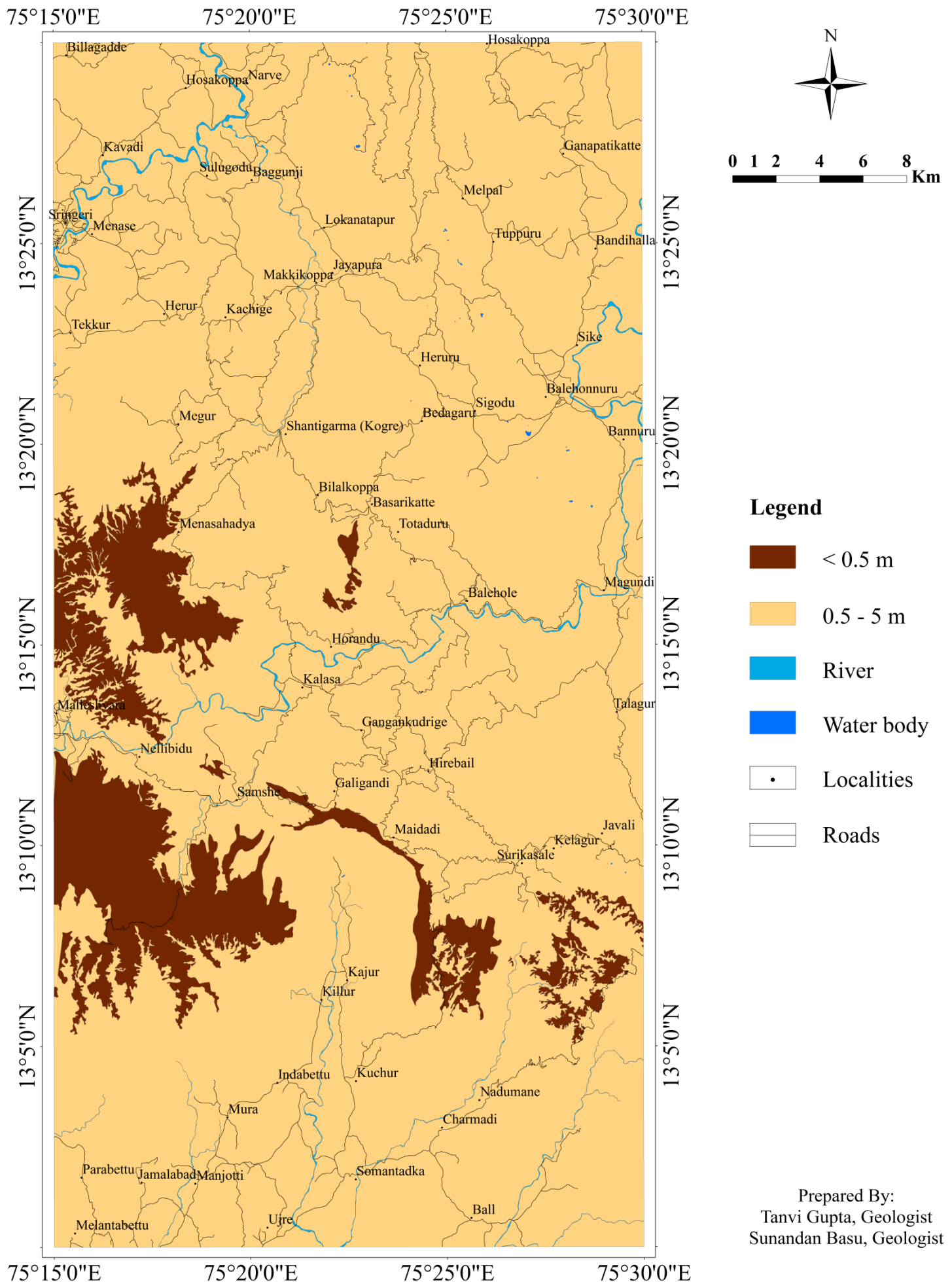
Pre Field Slope Forming Material Map of Toposheet No. 48O/07 and 48O/08, parts of Chikmangaluru and Dakshin Kannada Districts, Karnataka



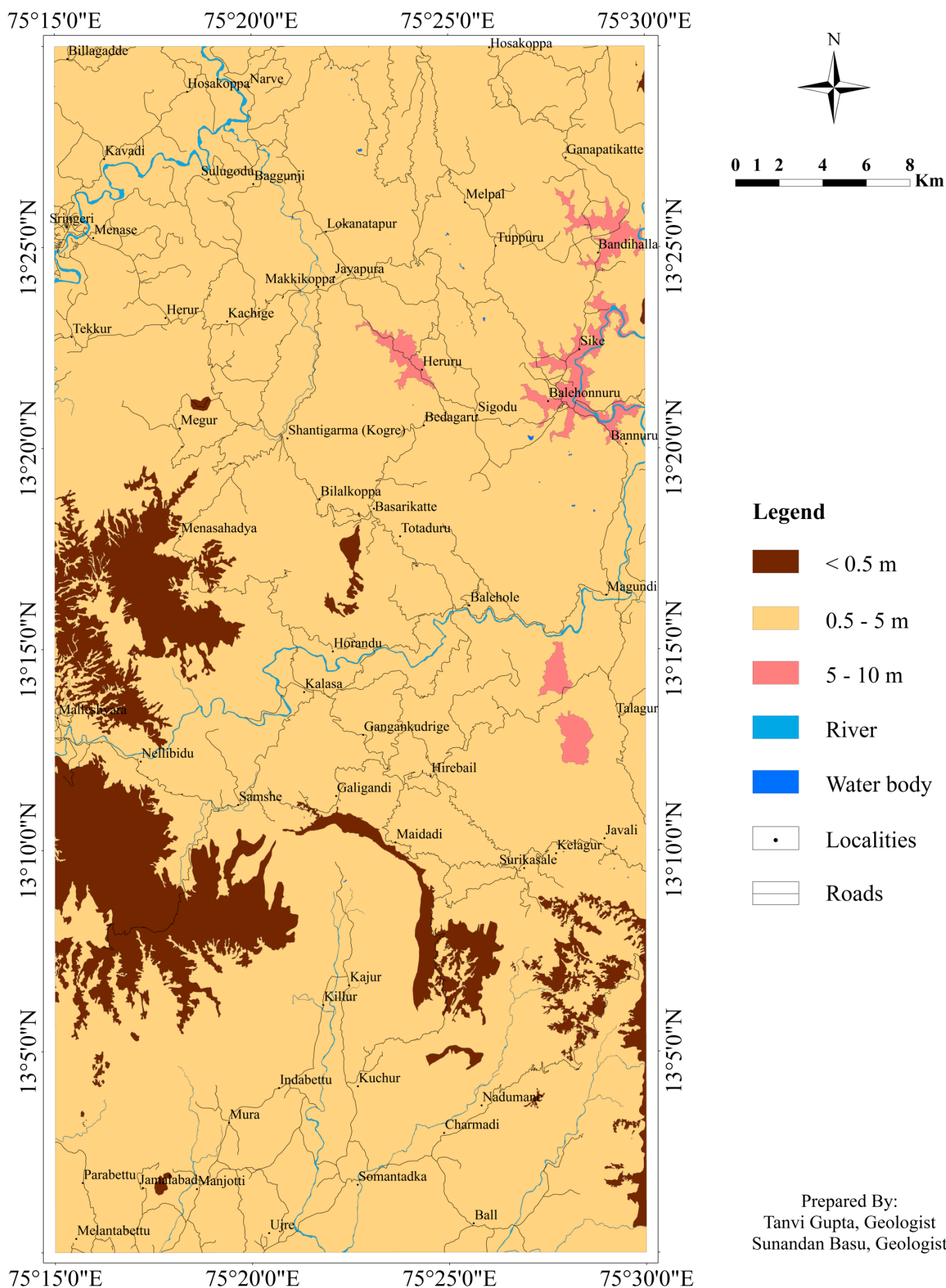
Post Field Slope Forming Material Map of Toposheet No. 48O/07 and 48O/08, parts of Chikmangaluru and Dakshin Kannada Districts, Karnataka



Pre Field Regolith Thickness Map of Toposheet No. 48O/07 and 48O/08, parts of Chikmangaluru and Dakshin Kannada Districts, Karnataka

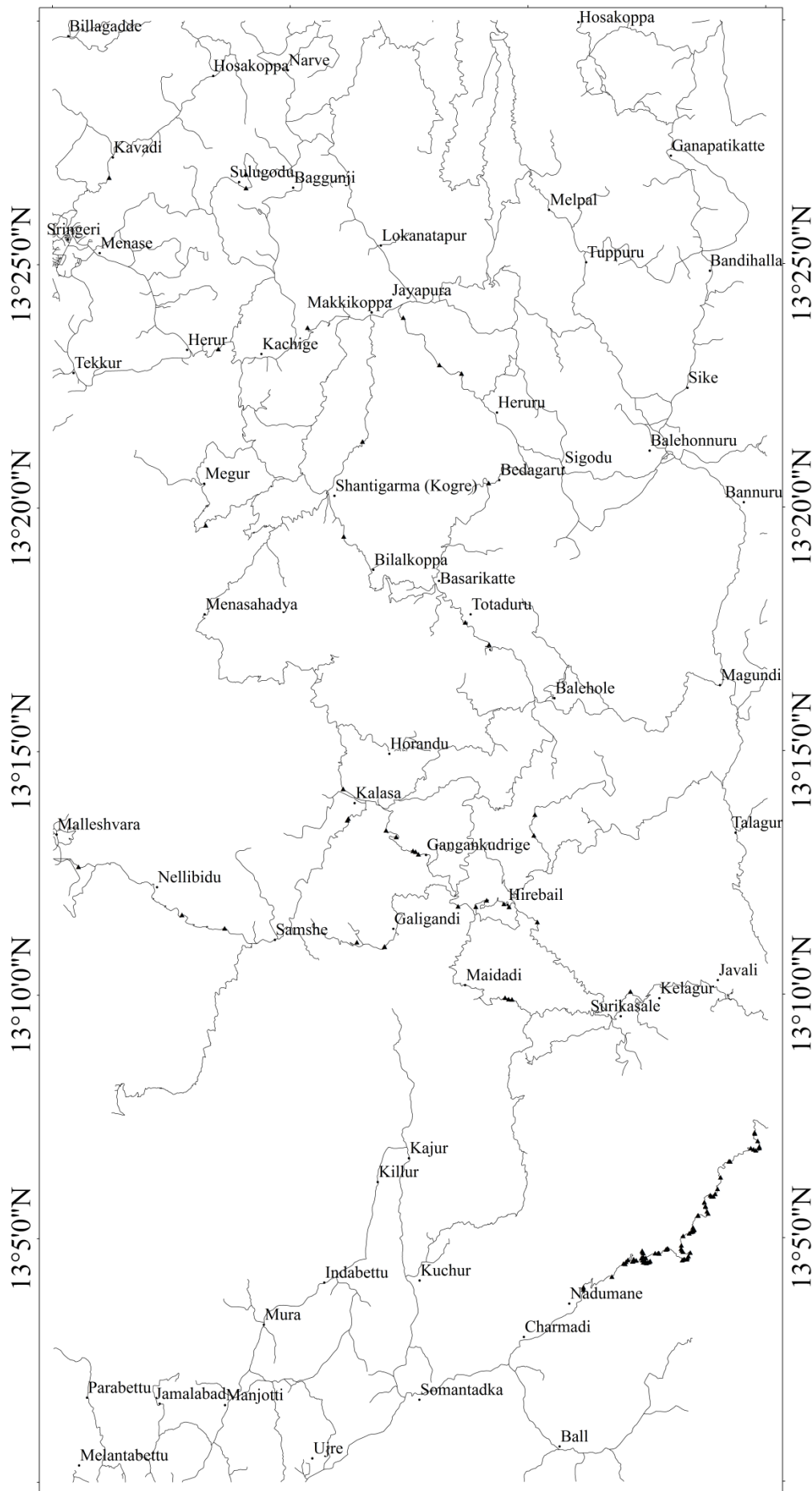


Post Field Regolith Thickness Map of Toposheet No. 48O/07 and 48O/08, parts of Chikmangaluru and Dakshin Kannada Districts, Karnataka



Landslide Inventory Map of Toposheet No. 48O/07 and 48O/08, parts of Chikmangaluru and Dakshin Kannada Districts, Karnataka

75°15'0"E 75°20'0"E 75°25'0"E 75°30'0"E



0 1 2 4 6 8 Km

Legend

-  Landslide Points
-  Localities
-  Roads

Prepared By:
Tanvi Gupta, Geologist
Sunandan Basu, Geologist

75°15'0"E 75°20'0"E 75°25'0"E 75°30'0"E

Landslide Susceptibility Map of Toposheet No. 48O/07 and 48O/08, parts of Chikmangaluru and Dakshin Kannada Districts, Karnataka

