हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

Agrisearch with a human touch

ICAR - NBSS & LUP

Land Resource and Hydrological Inventory of Mulkod Sub-watershed for Watershed Planning and Development Chitapur Taluk, Gulbarga District, Karnataka (AESR 6.2)

Sujala – III

Karnataka Watershed Development Project- II

Funded by World Bank

ICAR - National Bureau of Soil Survey & Land Use Planning, Regional Centre, Bangalore

Watershed Development Department, Govt. of Karnataka, Bangalore

About ICAR-NBSS&LUP

The ICAR-National Bureau of Soil Survey and Land Use Planning (ICAR-NBSS&LUP), Nagpur, a premier Institute of the Indian Council of Agricultural Research (ICAR), was set up during 1976 with the objective to prepare soil resource maps at national, state and district levels and to provide research inputs in soil resource mapping and its applications, land evaluation, land use planning, land resource management, and database management using GIS for optimising land use on different kinds of soils in the country.

The Bureau has been engaged in carrying out soil resource survey, agro-ecological and soil degradation mapping at the country, state and district levels for qualitative assessment and monitoring the soil health towards viable land use planning. The research activities have resulted in identifying the soil potentials and problems, and the various applications of the soil surveys with the ultimate objective of sustainable agricultural development. The Bureau has the mandate to correlate and classify soils of the country and maintain a National Register of all the established soil series. The Institute is also imparting in-service training to staff of the soil survey agencies in the area of soil survey, land evaluation and soil survey interpretations for land use planning. The Bureau in collaboration with Panjabrao Krishi Vidyapeeth, Akola is running post-graduate teaching and research programme in land resource management, leading to M.Sc. and Ph.D. degrees.

Citation: Rajendra Hegde, B.A.Dhanorkar, S. Srinivas, K.M. Nair, K.V. Niranjana, R.S.Reddy and S.K. Singh (2016). "Land Resource Inventory of Mulkod Sub-watershed for Watershed Planning and Development, Chitapur Taluk, Gulbarga District, Karnataka", Sujala SWS-LRI Atlas No.77, ICAR – NBSS & LUP, RC, Bangalore. p.41.

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PART - A

Land Resource Inventory of Mulkod Sub-watershed for Watershed Planning and Development

Chitapur Taluk, Gulbarga District, Karnataka (AESR 6.2)

CONTENTS

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How to read and use the Atlas

The Land Resource Inventory of Mulkod sub-watershed (Chitapur taluk, Gulbarga district) for Watershed Planning (AESR 6.2) was undertaken to provide comprehensive site- specific cadastral level information useful for farm level planning and integrated development of the area under Sujala – III, Karnataka Watershed Development Project- II.

This atlas contains the basic information on kinds of soils, their geographic distribution, characteristics and classification. The soil map and soil based thematic maps derived from soils data on soil depth, soil gravelliness, slope, land suitability for various crops and land use maps are presented on 1:12,500 scale. The maps of fertility status (soil reaction, organic carbon, available phosphorus, available potassium, available sulphur, available calcium, available copper, available manganese, available zinc, available iron, available boron and salinity (EC) on 1:12,500 scale were derived from grid point sampling of the surface soils from the watershed.

The atlas illustrates maps and tables that depict the soil resources of the watershed and the need for their sustainable management.

The user, depending on his/her requirement, can refer this atlas first by identifying his/her field and survey number on the village soil map and by referring the soil legend which is provided in tabular form after the soil map for details pertaining to his/her area of interest.

The atlas explains in simple terms the different kinds of soils present in the watershed, their potentials and problems through a series of thematic maps that help to develop site-specific plans as well as the need to conserve and manage this increasingly threatened natural resource through sustainable land use management. The Land Resource Atlas contains database collected at land parcel/ survey number level on soils, climate, water, vegetation, crops and cropping patterns, socio-economic conditions, marketing facilities *etc.* helps in identifying soil and water conservation measures required, suitability for crops and other uses and finally for preparing a viable and sustainable land use options for each and every land parcel.

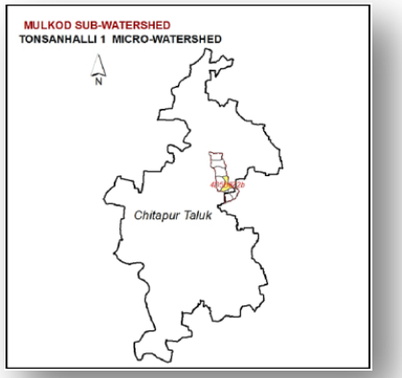
For easy map reading and understanding the information contain in different maps, the physical, cultural and scientific symbols used in the maps are illustrated in the form of colors, graphics and tables.

Physical, Cultural and Scientific symbols used in the Atlas

Each map in the atlas sheet is complemented with the physical, cultural and scientific symbols to facilitate easy map reading.

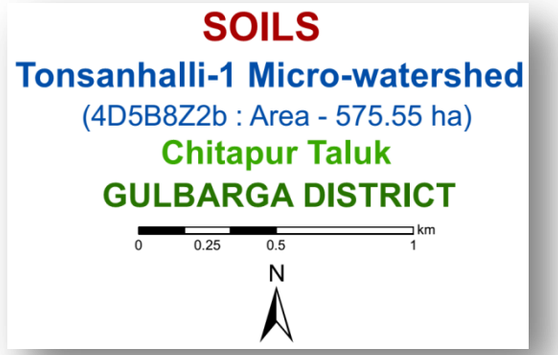
Inset map

Inset provided in each map conveys its strategic location i.e. Taluk, Sub-watershed and Micro-watershed.



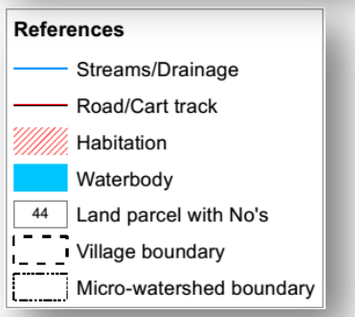
Map title

Map title conveys the relevance of thematic information presented along with a graphical scale, geographical location and watershed details in text form.



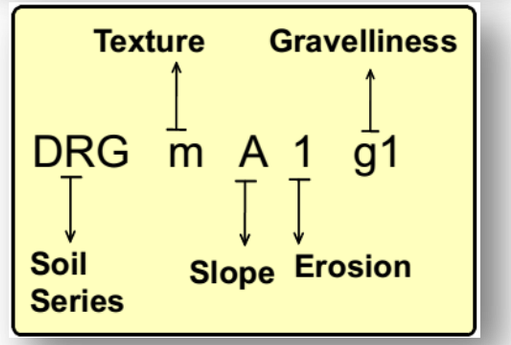
Legends and symbols

*Two legends accompany each map, a **map reference**, which depicts geographic features and a **thematic legend** which portrays spatial information. Picking up the symbol and colour of a particular enables one to go to the legends to obtain the required information.*



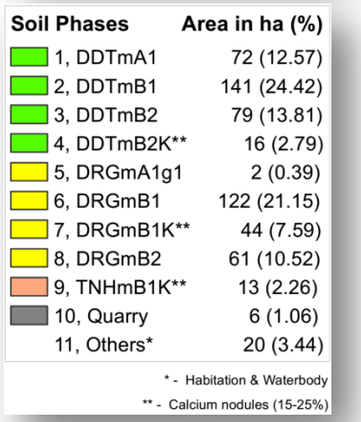
Soil Units

The soil map may be read at different levels. The most detailed level is that of the soil phase. Soil phases are distinguished within soil series mainly based on differences in surface of soil texture, slope, gravelliness , erosion ,etc.



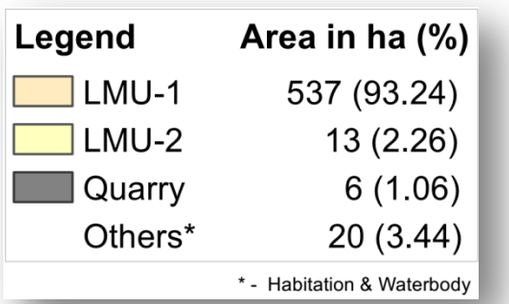
Map colours

Different shades of colours are used as an aid to distinguish the different classes of soils, crop suitability and other maps.



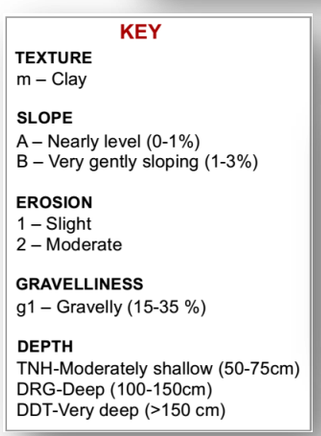
Land Management Units (LMU)

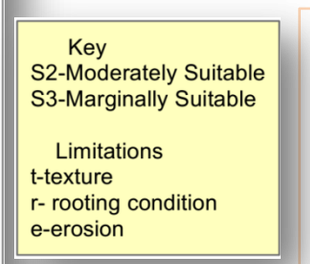
Grouping of similar soil areas based on their soil-site characteristics into management units that respond similarly for a given level of management are designated as land management units



Map key

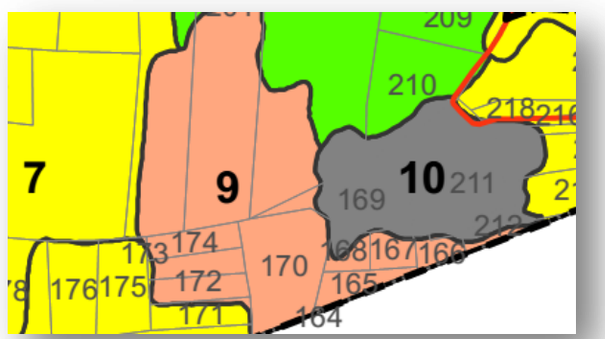
There are many thematic types to be differentiated on the map solely based on colour. Therefore soils and suitability types and their limitations are distinguished by colours with a combination of alpha-numeric characters.





Soil and plot boundaries

Soil units shown on the map are represented by both the color and a numeral. The soil boundaries are superimposed on land parcel with revenue survey number boundaries to visualize its spatial extent.



LAND RESOURCE INVENTORY OF MULKOD SUB-WATERSHED FOR PLANNING
CHITAPUR TALUK, GULBARGA DISTRICT
A pilot study by ICAR-NBSS&LUP, Bangalore

INTRODUCTION

Land is a scarce resource and basic unit for any material production. It can support the needs of the growing population, provided they use land in a rational and judicious manner. But what is happening in many areas of the state is a cause for concern to anyone involved in the management of land resources at the grassroots level. In India the area available for agriculture is about 51 per cent of the total area and more than 60 per cent of the people are still relying on agriculture for their livelihood. The limited land area is under severe stress and strain due to increasing population pressure and competing demands of various land uses. Due to this, every year there is a significant diversion of farm lands and water resources for non-agricultural purposes. Apart from this, due to lack of interest for farming among the farmers in many areas, large tracts of cultivable lands are turning into fallows and this trend is continuing at an alarming rate.

The watershed management programs are aimed at designing suitable soil and water conservation measures, productivity enhancement of existing crops, crop diversification with horticultural species, greening the wastelands with forestry species of multiple uses and improving the livelihood opportunities for landless people.

The objectives can be met to a great extent when an appropriate Natural Resources Management (NRM) plan is prepared and implemented. It is essential to have site specific Land Resources Inventory (LRI) indicating the potentials and constraints for developing such a site specific plan. LRI can be obtained by carrying out detailed characterization and mapping of all the existing land resources like soils, climate, water, minerals and rocks, vegetation, crops, land use pattern, socio-economic conditions, infrastructure, marketing facilities and various schemes and developmental works of the government. From the data collected at farm level, the specific problems and potentials of the area can be identified and highlighted, conservation measures required for the area can be planned on a scientific footing, suitability of the area for various uses can be worked out and finally viable and sustainable land use options suitable for each and every land holding can be prescribed to the farmer and other land users of the area.

Gulbarga popularly known as Kalaburgi is located in the Northern part of the state and lies between 17 ^{o} 35’ and 17^{o} 45’ North latitude and between 76 ^{o} 10’ and 77 ^{o} 45’ east longitude. The district is biggest district in the state covering 8.49 % of the area. It has Bijapur district and Sholapur district of Maharastra on the West, Bidar district and Osmanabad district of Maharastra on the North, Raichur district on the South. The district has total geographical area of 16174 sq. kms. Major food crops grown in the district are pigeon pea, sorghum, bajra, and paddy. Commercial crops are sugarcane and cotton. Oilseed crops are groundnut and sunflower. The district economy is dominantly agricultural and nearly 75 per cent of population living in the rural areas are dependent on agriculture. Major geology in the district comprise of Deccan trap (basalt), followed by limestone. Laterite and shale were also noticed in patches.

As a pilot study, **ICAR-NBSS&LUP, Bangalore** carried out the generation of LRI for the Mulkod sub-watershed in Chitapur Taluk, Gulbarga District was selected for data base generation under batch V of Sujala III project. This sub-watershed encompasses of 7 MWs namely, Arjamga West-1 (4D5B8Z1a), Arjamga West-2 (4D5B8Z1b), Tingli West (4D5B8Z1c), Tonsanhalli-1 (4D5B8Z2b), Tonsanhalli-2 (4D5B8Z2a), Mulkod (4D5B8Z2c) and Shamkhaid (4D5B8Z2d) micro watersheds. Land Resource Inventory (LRI) was generated for two (Tonsanhalli-1 -4D5B8Z2b and Tonsanhalli-2-4D5B8Z2a) among the seven micro-watersheds

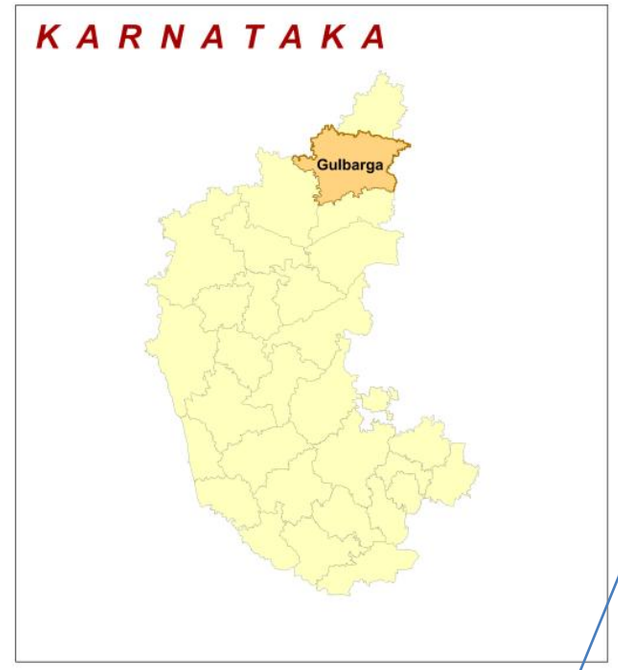
To be continued….

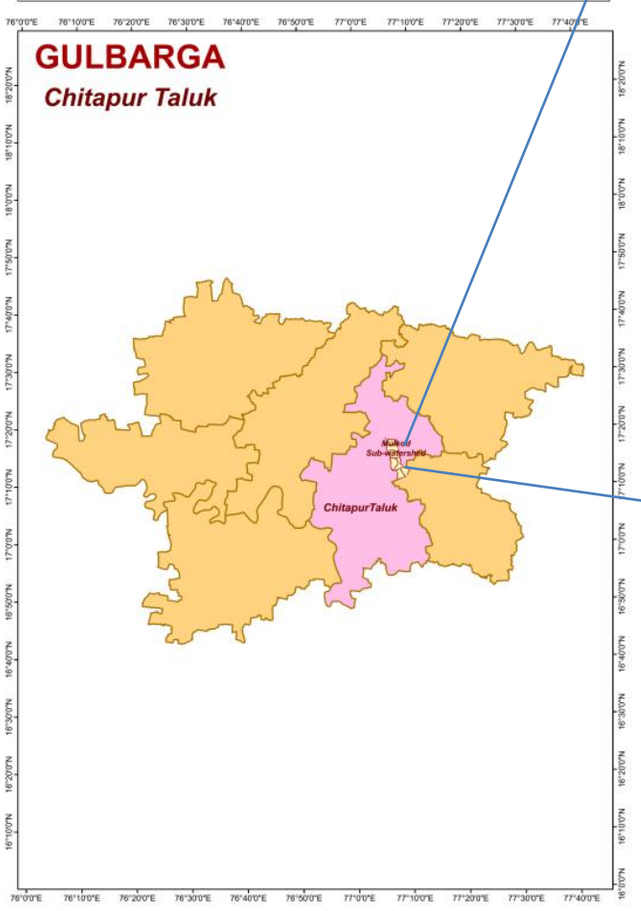
The major landforms identified in the micro-watershed (Tonsanhalli-1 - 4D5B8Z2b and Tonsanhalli-2-4D5B8Z2a) are uplands and low lands. The database was generated by using cadastral map of the village as a base along with high resolution satellite imagery (IRS LISS IV and Cartosat-1). The objectives of the land resource survey, carried out during February-March 2015 in the Mulkod Sub-watershed are indicated below.

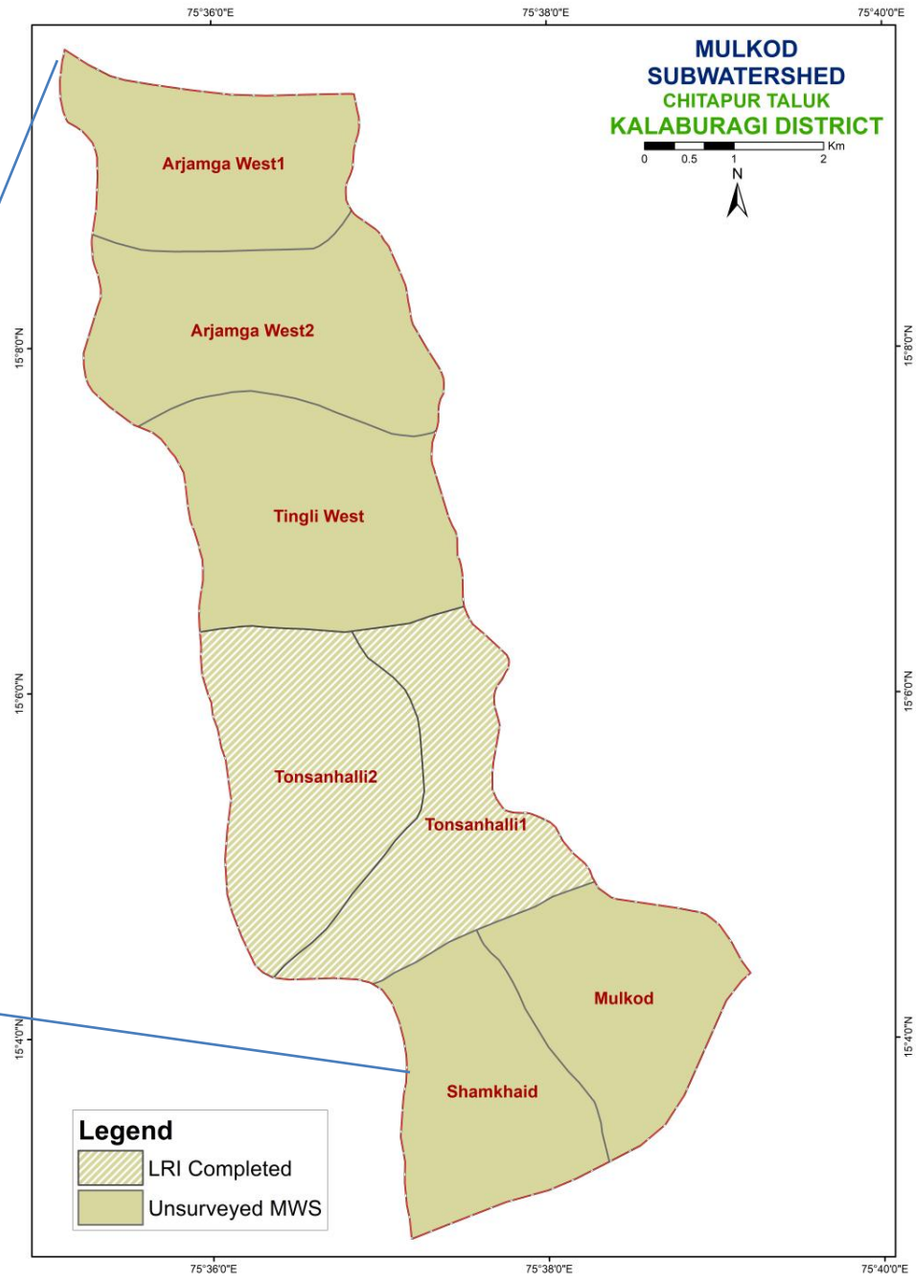
- Detailed characterization of all the land resources like soil, water, land use, cropping pattern and other resources available at parcel level in the village.
- Delineation of homogenous areas based on soil-site characteristics into management units.
- Collection and interpretation of climatic and agronomical data for crop planning.
- Identification of problems and potentials of the area and strategies for their management.
- Assessment of the suitability of land resources for various crops and other uses.
- Establishment of village level digital land resources database in a GIS framework.
- Enable the watershed and other line departments to prepare an action plan for the integrated development of the watershed.

LOCATION AND EXTENT

LOCATION MAP OF MULKOD SUB-WATERSHED







Mulkod sub-watershed (Chitapur Taluk, Kalaburagi District) is located between $17^0$9'54''–17^0 17'55'' North latitudes and $77^0$3'34''- $77^0$10'47'' East longitudes, covering an area of about 4196.37 ha. boundedby Arjamga, Sangai, Mulkod, Mudbol and Invi villages.

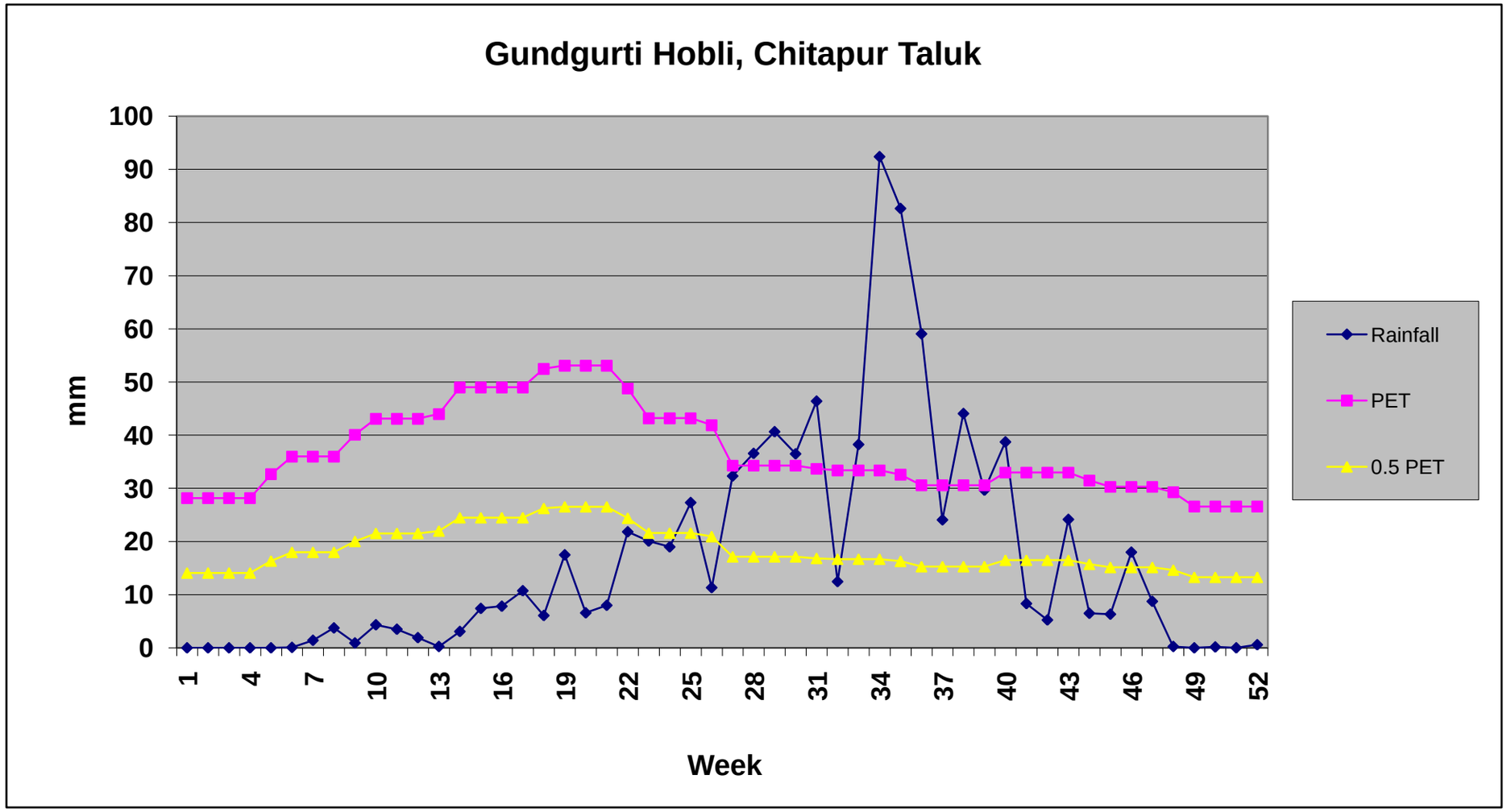
Agro Ecological Sub Region (AESR) 6.2: Central and Western Maharashtra Plateau and North Karnataka Plateau and North Western Telangana Plateau, hot moist semi-arid ESR with shallow and medium loamy to clayey Black soils (medium and deep clayey Black soils as inclusion), medium to high AWC and LGP 120-150 days.

Agro-climatic Zone 2: North-eastern Dry Zone:

The total geographic area of this zone is about 1.76 M ha covering 8 taluks of Gulbarga district and 3 taluks of Raichur. Net cultivated area in the zone is about 1.31 M ha of which about 0.09 M ha are irrigated. The mean elevation of the zone is 300-450 m MSL. The main soil type is deep to very deep soils with small pockets of shallow to medium black soils. The zone is cropped predominantly during rabi due to insufficient rainfall (465-785 mm). The principal crops of the zone are jowar, bajra, oilseeds, pulses, cotton and sugarcane.

NOTE: In this Sub-Watershed, Land Resource Inventory (LRI) was generated for two micro-watersheds (Tonsanhalli-1 - 4D5B8Z2b and Tonsanhalli-2-4D5B8Z2a) among the seven micro-watersheds.

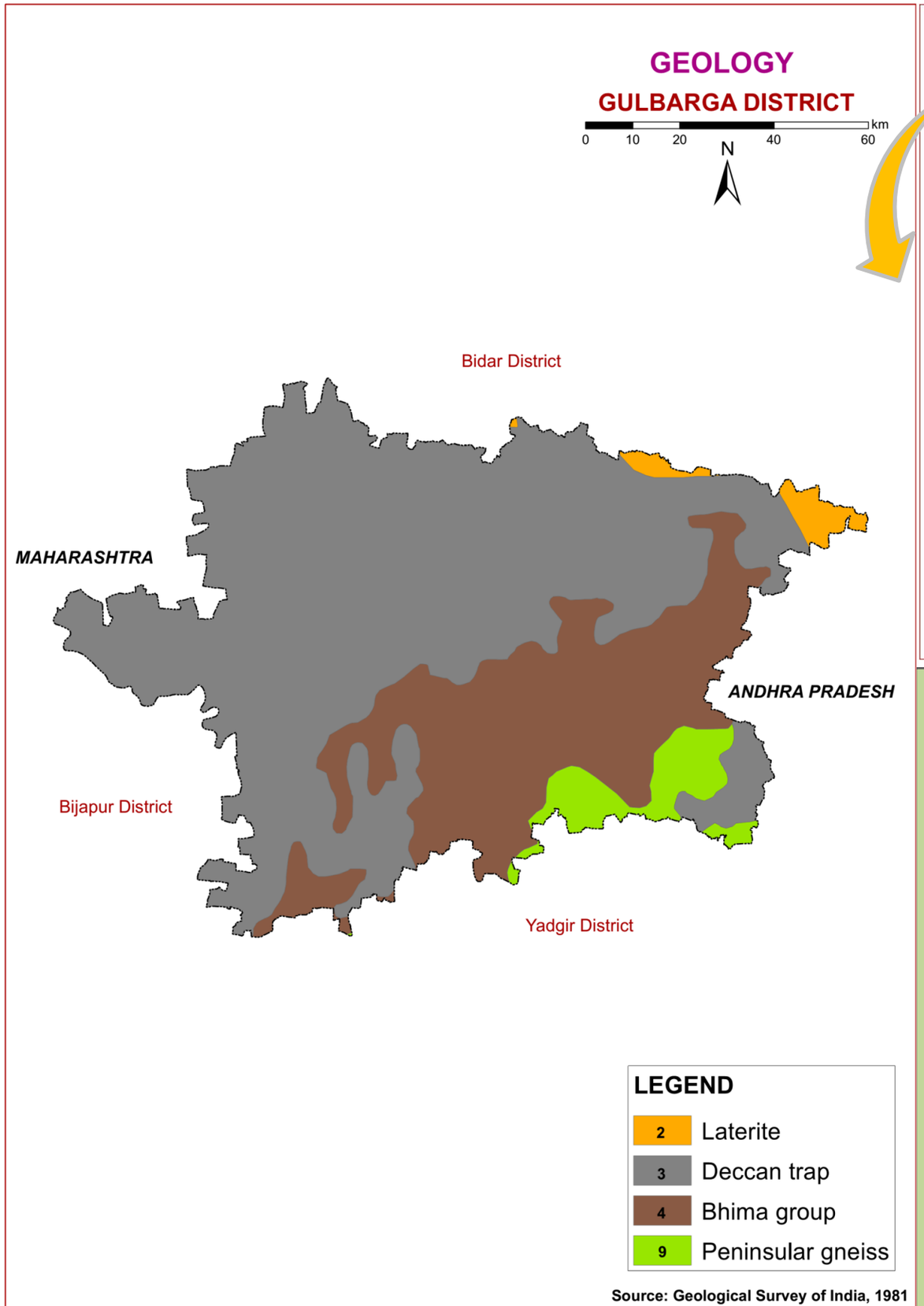
Climate

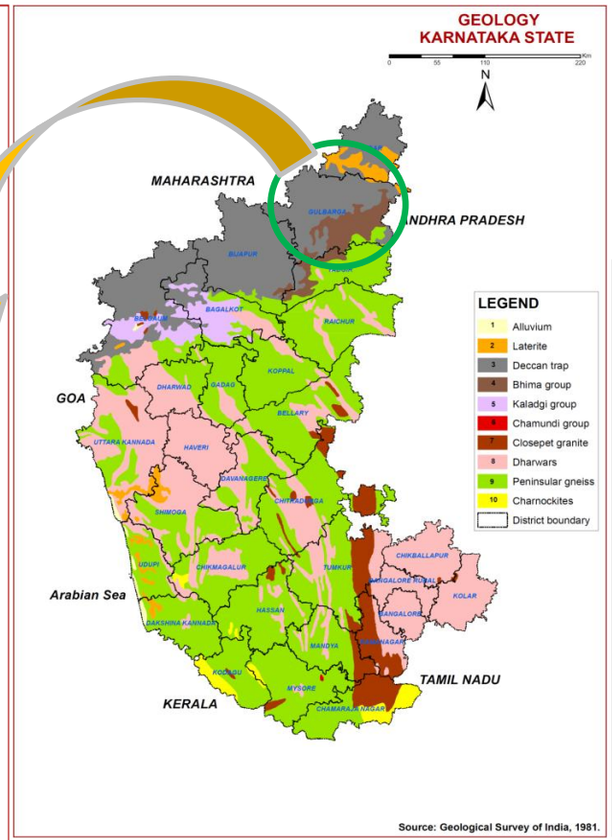


Length of Growing Period (LGP) is varying from June 2nd week to 3rd week of October about 120-150 days and surplus occurs during November which may go either as run off or recharge of ground water

Annual Rainfall : 875 mm. in the Gundgurti hobli, Chitapur taluk

Geology





GEOLOGY - KARNATAKA STATE

Karnataka forms part of the Peninsular Shield, which is an ancient stable block of the earth's crust. The shield is composed of geologically ancient rocks of diverse origin. These rocks have undergone various degrees of metamorphism and crushing. Overlying these ancient rocks are Proterozoic, lete Creteceous to Palaeocene, Palaeocene to Recent, and Recent sediments.

In the stratigraphic succession of rocks in Karnataka the Archaean group is the oldest, followed by Proterozoic, Mesozoic and Cainozoic formations.

GEOLOGY - GULBARGA DISTRICT

Cainozoic Group

The Palaeocene and Recent formations of Karnataka are the laterites and alluvium of marine and riverine origin

Laterite: Laterite is a porous, pitted, clay-like rock with yellow, red, brown, grey and mottled colours, and is composed mainly of hydrated oxides of iron and aluminium.

Mesozoic Group

Towards the end of the Cretaceous Period there was tremendous volcanic activity in the Peninsular part of India with eruption of a series of lava flows which came out through fissures and cracks. This formation is Known as the Deccan Trap.

Deccan Trap: The Deccan Trap covers the whole of Bidar district, and parts of Gulbarga, Bijapur and Belgaum districts, occupying an area of 25,000 sq. km.

Upper Proterozoic Group

Formations of the Upper Proterozoic in Karnataka are closepet granites, Chamundi granites, Kaladgi series and Bhima series.

Bhima series: This series, equivalent to the Kurnool formations, is named after the Bhima river and occurs in Bijapur and Gulbarga districts.

Archaean Group

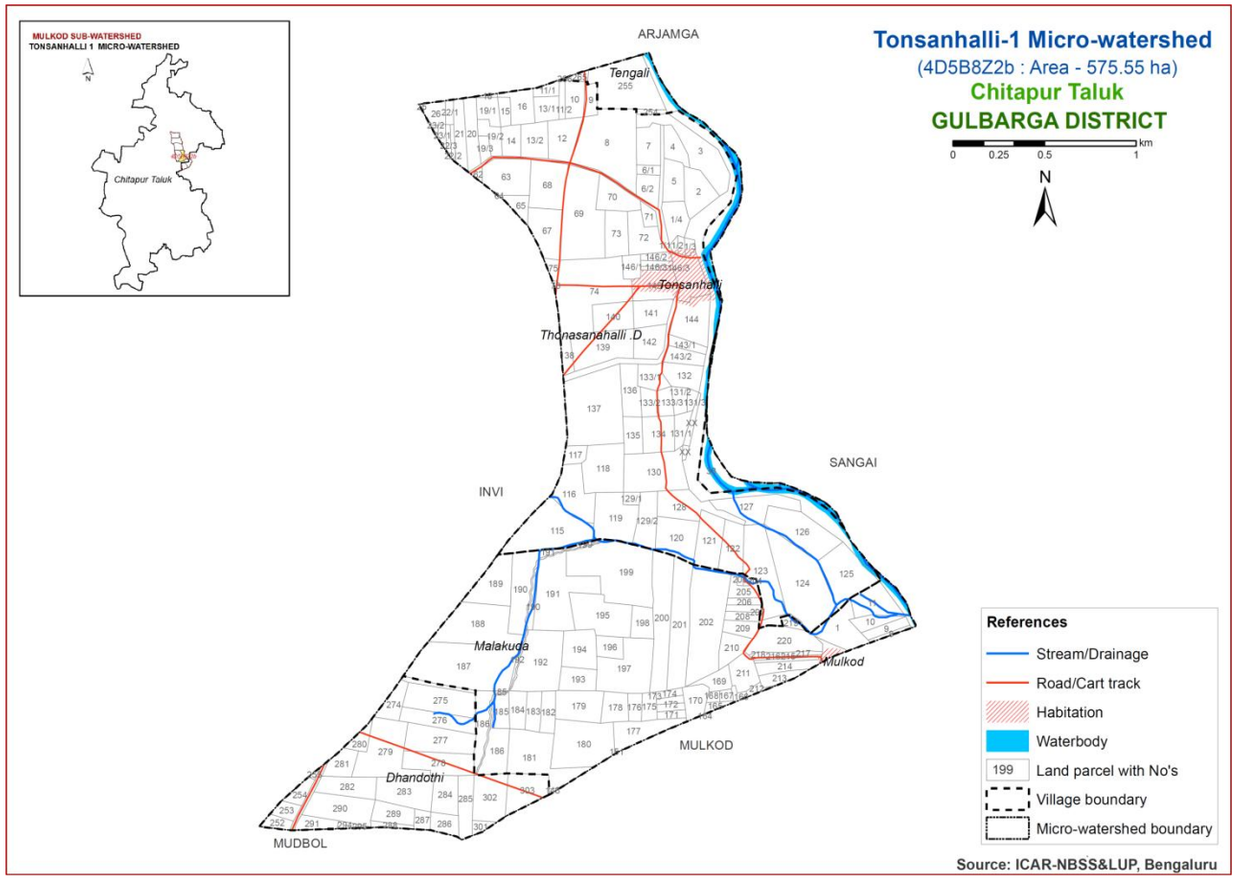
The important formations of this group are Peninsular Gneiss, Dharwar schists, and Charnockites.

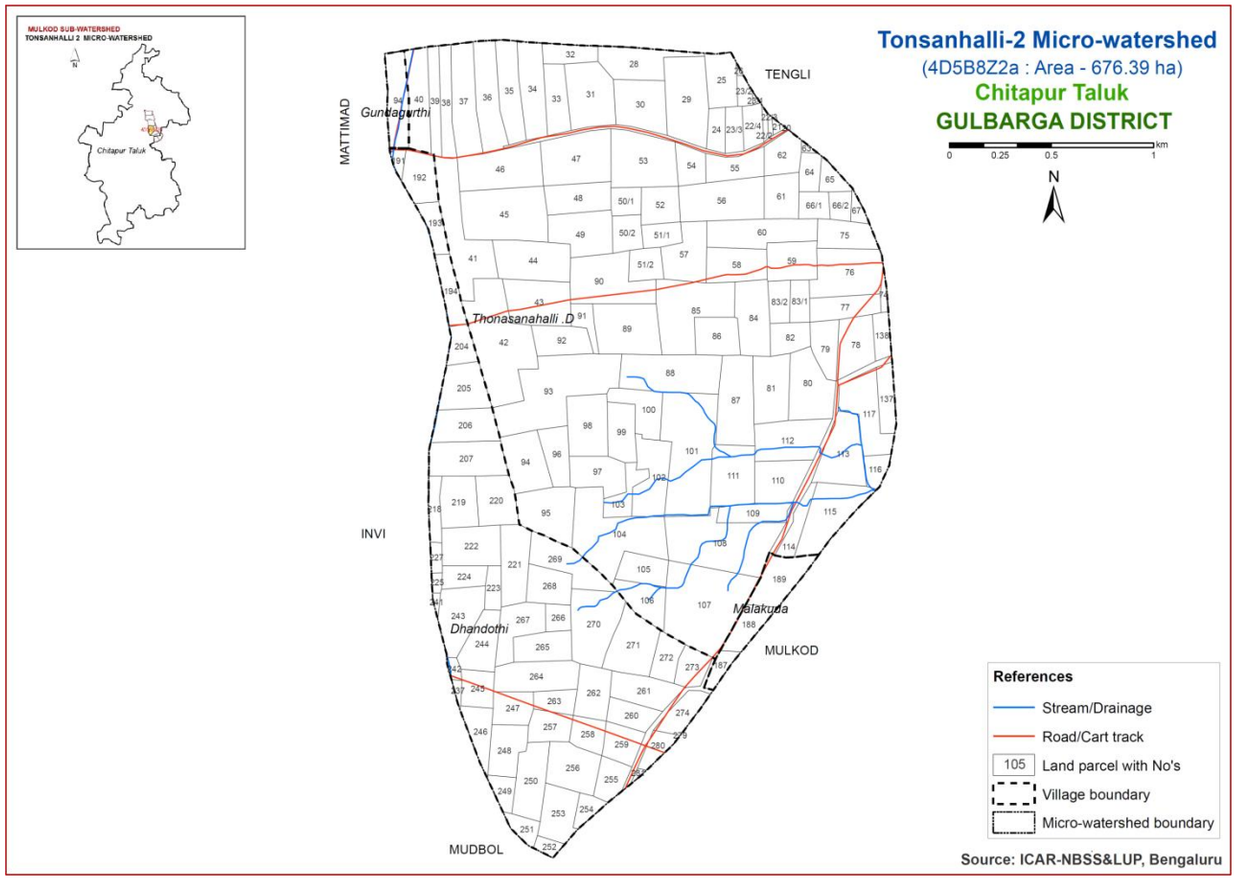
Peninsular Gneiss: Exposed over a large area of Karnataka in all the districts except Bidar is the Peninsular Gneiss which includes granites of all shades with varying composition.

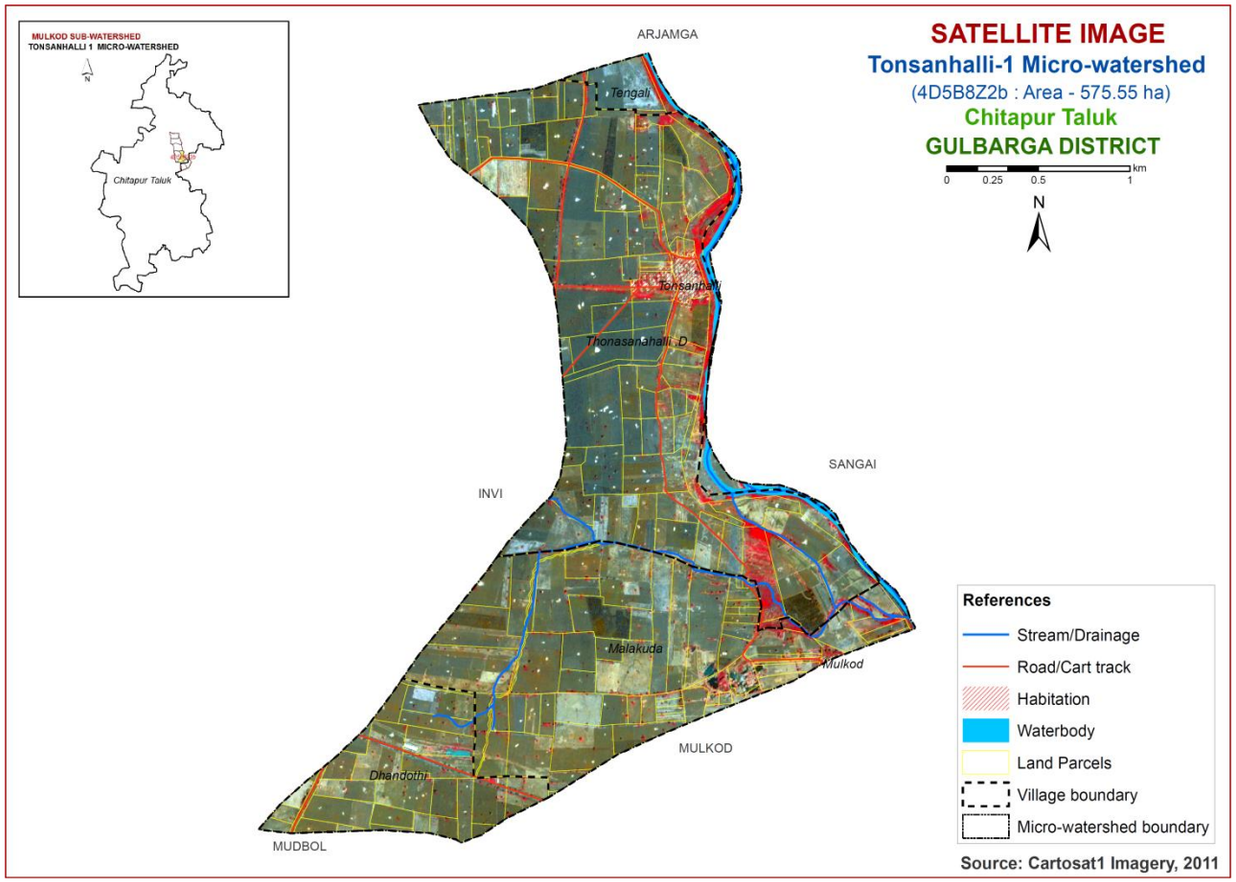
SURVEY METHODOLOGY
Sequence of activities in generation of LRI

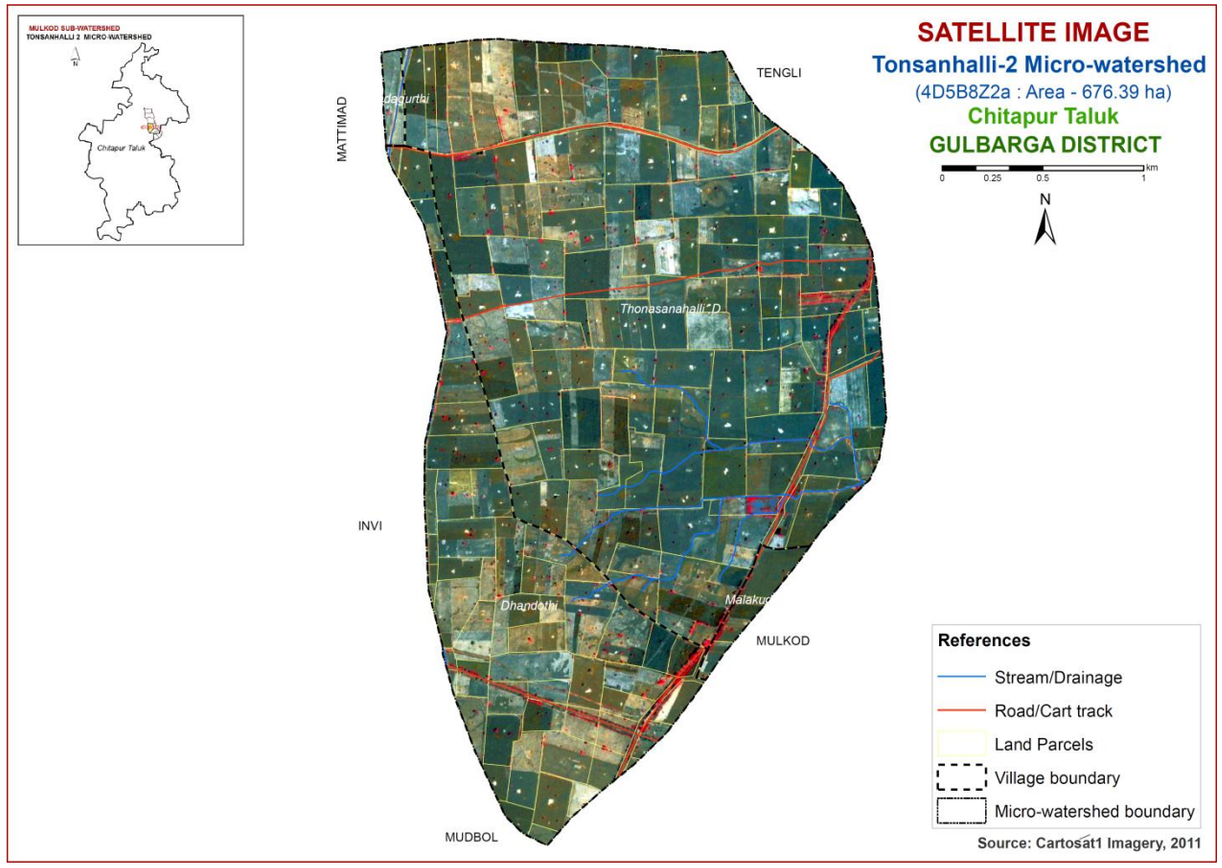
- Traversing the watershed using cadastral maps and imagery as base
- Identifying landforms, geology, land use and other features
- Selecting fields representing land units
- Opening profiles to 2 m depth
- Studying soil and site characteristics
- Grouping similar areas based on their soil-site characteristics into land management units
- Preparation of crop, soil and water conservation plan
- Socio-economic evaluation

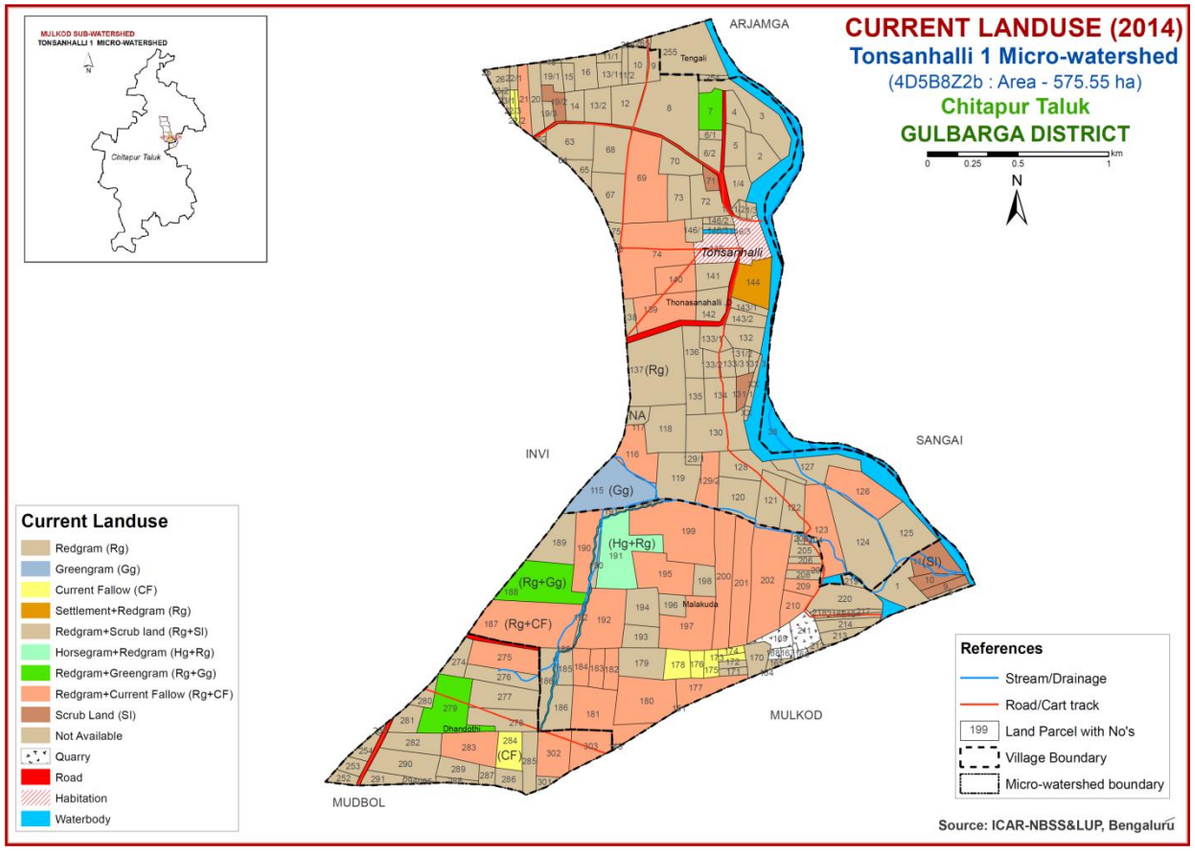
The required site and soil characteristics are described and recorded on a standard proforma by following the protocols and guidelines given in the soil survey manual and field guide. Collection of soil samples from representative pedons for laboratory characterization and collection of surface soil samples from selected fields covering most of the management units for macro and micro-nutrient analysis is being carried out (250m grid intervals). Further processing of data at chemical lab and GIS lab are carried out to generate various thematic maps for each of the study area.

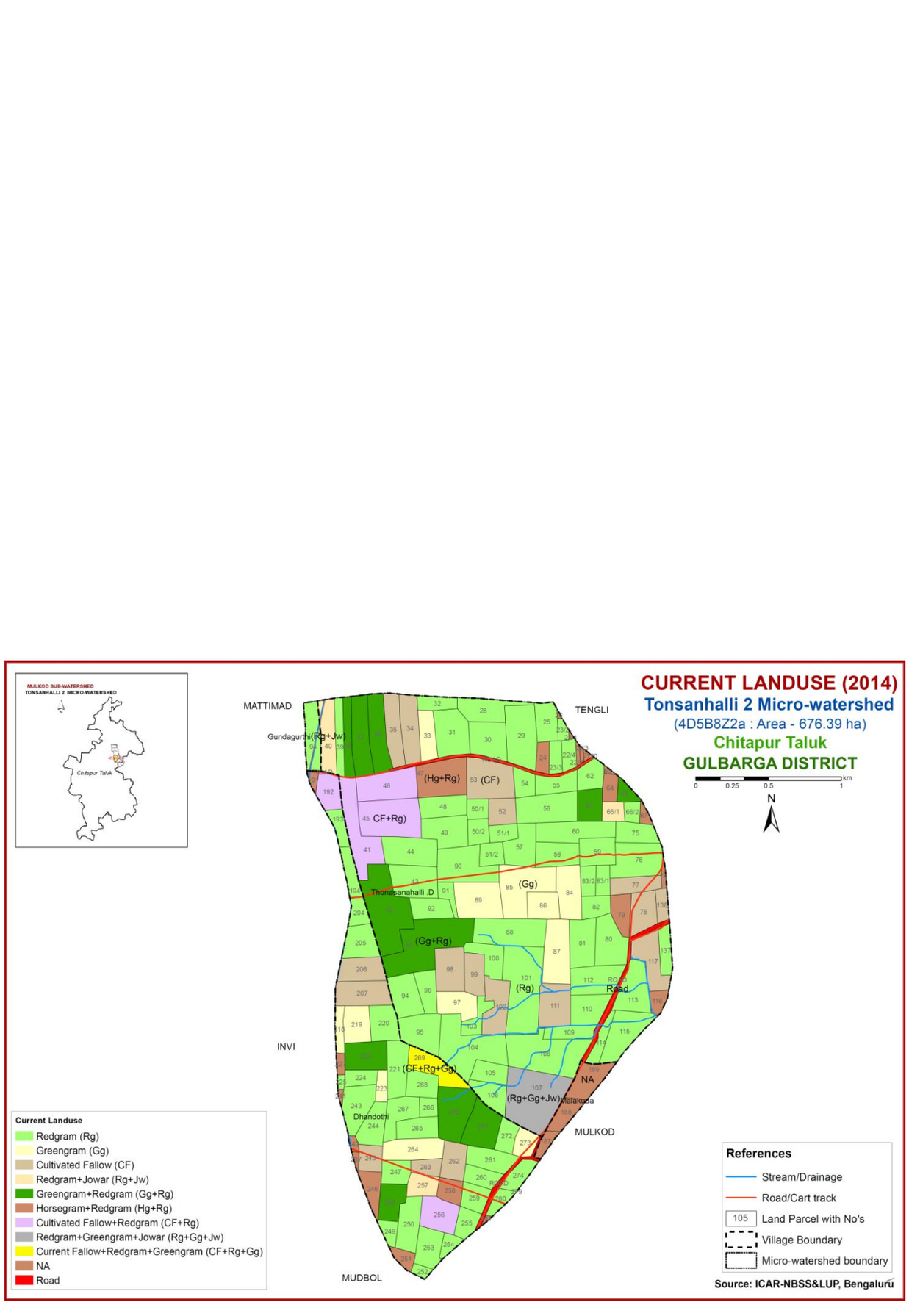

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
SANGAI
INVI
Malakuda
Mulkod
MULKOD
Dhandothi
MUDBOL
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Source: ICAR-NBSS&LUP, Bengaluru


MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
TENGLI
MATTIMAD
Gundagurthi
Thonasanahalli .D
INVI
Malakuda
Dhandothi
MULKOD
MUDBOL
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Source: ICAR-NBSS&LUP, Bengaluru


MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli :D
SANGAI
INVI
Malakuda
Mulkod
MULKOD
Dhandothi
MUDBOL
SATELLITE IMAGE
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
km
0 0.25 0.5 1
N
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
Land Parcels
Village boundary
Micro-watershed boundary
Source: Cartosat1 Imagery, 2011


MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
TENGLI
MATTIMAD
Thonasanahalli :D
INVI
Dhandothi
MULKOD
MUDBOL
SATELLITE IMAGE
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
km
0 0.25 0.5 1
N
References
Stream/Drainage
Road/Cart track
Land Parcels
Village boundary
Micro-watershed boundary
Source: Cartosat1 Imagery, 2011


MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
CURRENT LANDUSE (2014)
Tonsanhalli 1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli
(Rg)
NA
INVI
SANGAI
(Gg)
(Hg+Rg)
(Rg+Gg)
(Rg+CF)
Malakuda
(Sl)
Dhandothi
(CF)
MULKOD
MUDBOL
Current Landuse
Redgram (Rg)
Greengram (Gg)
Current Fallow (CF)
Settlement+Redgram (Rg)
Redgram+Scrub land (Rg+Sl)
Horsegram+Redgram (Hg+Rg)
Redgram+Greengram (Rg+Gg)
Redgram+Current Fallow (Rg+CF)
Scrub Land (Sl)
Not Available
Quarry
Road
Habitation
Waterbody
References
Stream/Drainage
Road/Cart track
199 Land Parcel with No's
Village Boundary
Micro-watershed boundary
Source: ICAR-NBSS&LUP, Bengaluru


MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
CURRENT LANDUSE (2014)
Tonsanhalli 2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
MATTIMAD
TENGLI
Gundagurthi(Rg+Jw)
(Hg+Rg)
(CF)
CF+Rg)
Thonasanahalli_D
(Gg)
(Gg+Rg)
(Rg)
Road
INVI
(CF+Rg+Gg)
NA
(Rg+Gg+Jw)
Malakuda
Dhandothi
MULKOD
MUDBOL
Current Landuse
Redgram (Rg)
Greengram (Gg)
Cultivated Fallow (CF)
Redgram+Jowar (Rg+Jw)
Greengram+Redgram (Gg+Rg)
Horsegram+Redgram (Hg+Rg)
Cultivated Fallow+Redgram (CF+Rg)
Redgram+Greengram+Jowar (Rg+Gg+Jw)
Current Fallow+Redgram+Greengram (CF+Rg+Gg)
NA
Road
References
Stream/Drainage
Road/Cart track
105 Land Parcel with No's
Village Boundary
Micro-watershed boundary
Source: ICAR-NBSS&LUP, Bengaluru

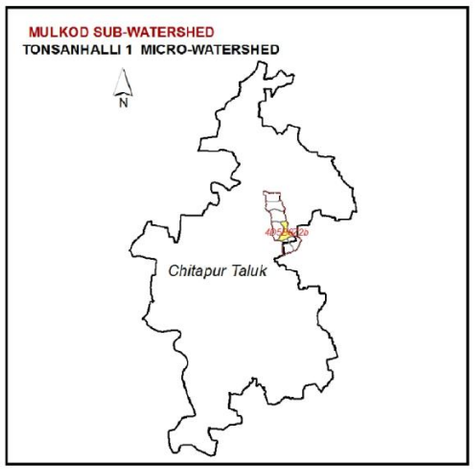
SOILS

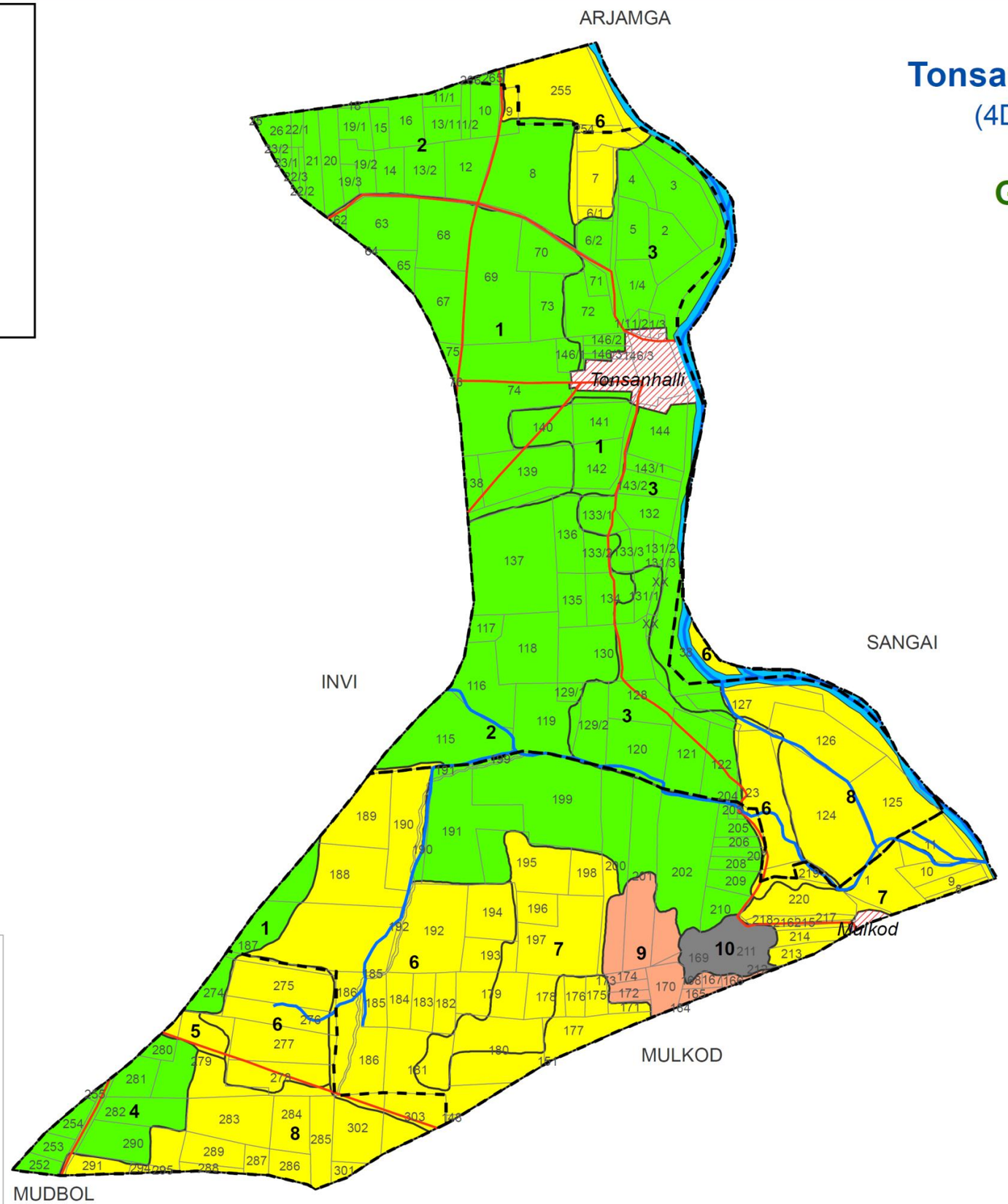
Tonsanhalli-1 Micro-watershed

(4D5B8Z2b : Area - 575.55 ha)

Chitapur Taluk

GULBARGA DISTRICT





0 0.25 0.5 1 km

N

Texture Gravelliness

DRG m A 1 g1

Soil Series | Slope | Erosion

KEY

TEXTURE
m – Clay

SLOPE
A – Nearly level (0-1%)
B – Very gently sloping (1-3%)

EROSION
1 – Slight
2 – Moderate

GRAVELLINESS
g1 – Gravelly (15-35 %)

DEPTH
TNH-Moderately shallow (50-75cm)
DRG-Deep (100-150cm)
DDT-Very deep (>150 cm)

References

- Stream/Drainage
- Road/Cart track
- Habitation
- Waterbody
- 199 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Soil Phases	Area in ha (%)
1, DDTmA1	72 (12.57)
2, DDTmB1	141 (24.42)
3, DDTmB2	79 (13.81)
4, DDTmB2K**	16 (2.79)
5, DRGmA1g1	2 (0.39)
6, DRGmB1	122 (21.15)
7, DRGmB1K**	44 (7.59)
8, DRGmB2	61 (10.52)
9, TNHmB1K**	13 (2.26)
10, Quarry	6 (1.06)
11, Others*	20 (3.44)

* - Habitation & Waterbody

** - Calcium nodules (15-25%)

Source: ICAR-NBSS&LUP, Bengaluru

Table 1. Mapping unit description of Tonsanhalli-1 (4D5B8Z2b) Micro-watershed in Chitapur Taluk, Gulbarga District

Sl.No*	Map unit	Description	Area in ha (%)
1	DDTmA1	Very deep, black clayey soils developed from weathered basalt on very gently sloping uplands; clay surface on 0-1% slope, slightly eroded	72.32 (12.57)
2	DDTmB1	Very deep, black clayey soils developed from weathered basalt on very gently sloping uplands; clay surface on 1-3% slope, slightly eroded	140.57 (24.42)
3	DDTmB2	Very deep, black clayey soils developed from weathered basalt on very gently sloping uplands; clay surface on 1-3 % slope, moderately eroded	79.47 (13.81)
4	DDTmB2k	Very deep, black clayey soils developed from weathered basalt on very gently sloping uplands; clay surface on 1-3 % slope, moderately eroded, slightly gravelly, 15-35 per cent gravel (calcium nodules).	16.06 (2.79)
5	DRGmA1g1	Deep, black clayey soils developed from weathered basalt on nearly level uplands; clay surface on 0-1 % slope, slightly eroded, slightly gravelly, 15-35 per cent gravel.	2.26 (0.39)
6	DRGmB1	Deep, black clayey soils developed from weathered basalt on very gently sloping uplands; clay surface on 1-3% slope, slightly eroded	121.74 (21.15)
7	DRGmB1K	Deep, black clayey soils developed from weathered basalt on very gently sloping uplands; clay surface on 1-3% slope, slightly eroded, slightly gravelly, 15-35 per cent gravel (calcium nodules).	43.67 (7.59)
8	DRGmB2	Deep, black clayey soils developed from weathered basalt on very gently sloping uplands; clay surface on 1-3% slope, moderately eroded	60.54 (10.52)
9	TNHmB1k	Moderately shallow, black clayey soils developed from weathered basalt on very gently sloping uplands; clay surface on 1-3% slope, slightly eroded, slightly gravelly, 15-35 per cent gravel (calcium nodules).	12.99 (2.26)

*Soil map unit numbers are continuous for the taluk, not the micro-watershed

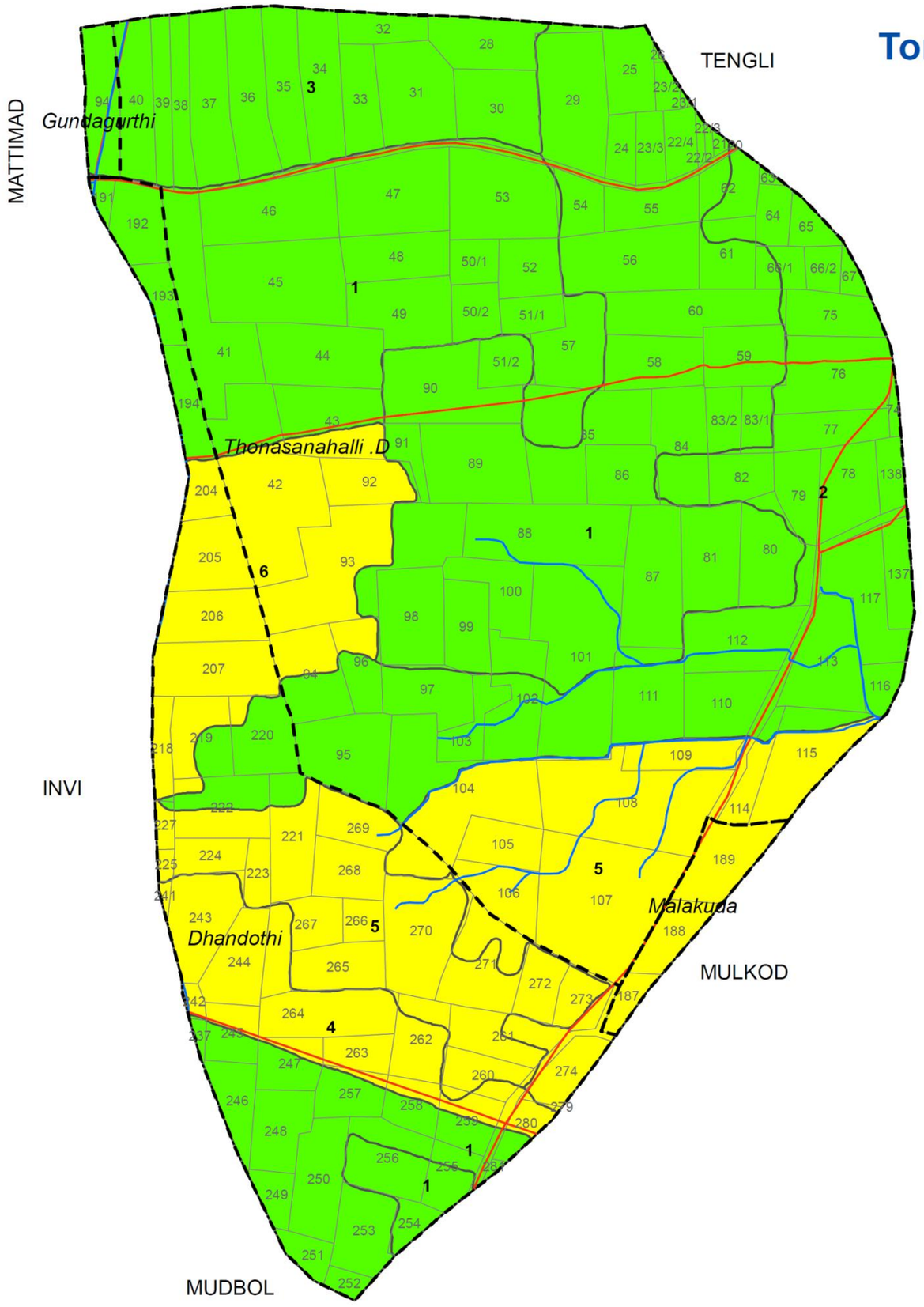
SOILS

Tonsanhalli-2 Micro-watershed

(4D5B8Z2a : Area - 676.39 ha)

Chitapur Taluk

GULBARGA DISTRICT



0 0.25 0.5 1 km

N

Texture **Gravelliness**

DDT m A 1 g1

Soil Series **Slope** **Erosion**

KEY

TEXTURE
m – Clay

SLOPE
A – Nearly level (0-1%)
B – Very gently sloping (1-3%)

EROSION
1 – Slight
2 – Moderate

GRAVELLINESS
g1 – Gravelly (15-35 %)

DEPTH
DRG-Deep (100-150cm)
DDT-Very deep (>150 cm)

References

- Stream/Drainage
- Road/Cart track
- 105 Land parcel with No's
- Village boundary
- Micro-watershed boundary

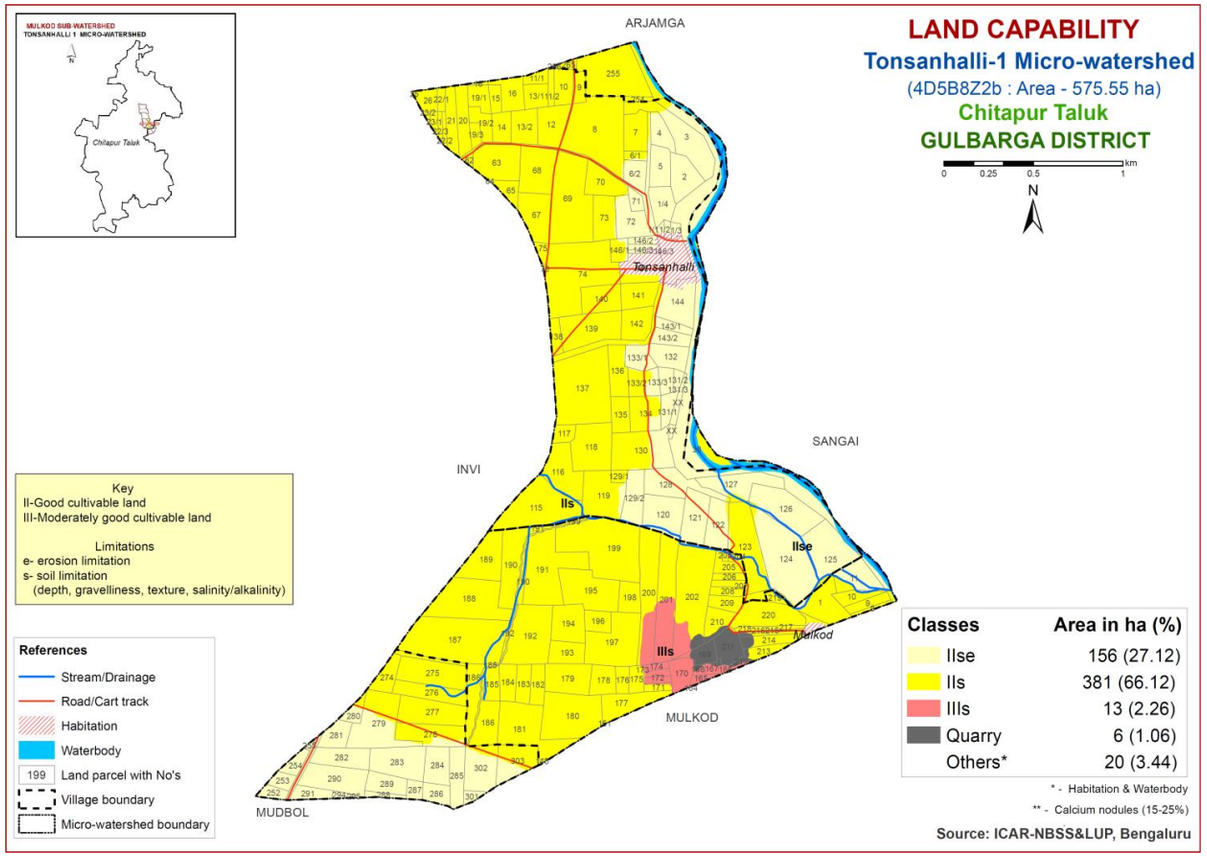
Soil Phases	Area in ha (%)
1, DDTmA1g1	291 (43.0)
2, DDTmB1g1	120 (17.73)
3, DDTmB2g1	62 (9.13)
4, DRGmA1g1	30 (4.46)
5, DRGmB1g1	122 (17.97)
6, DRGmB2g1	52 (7.71)

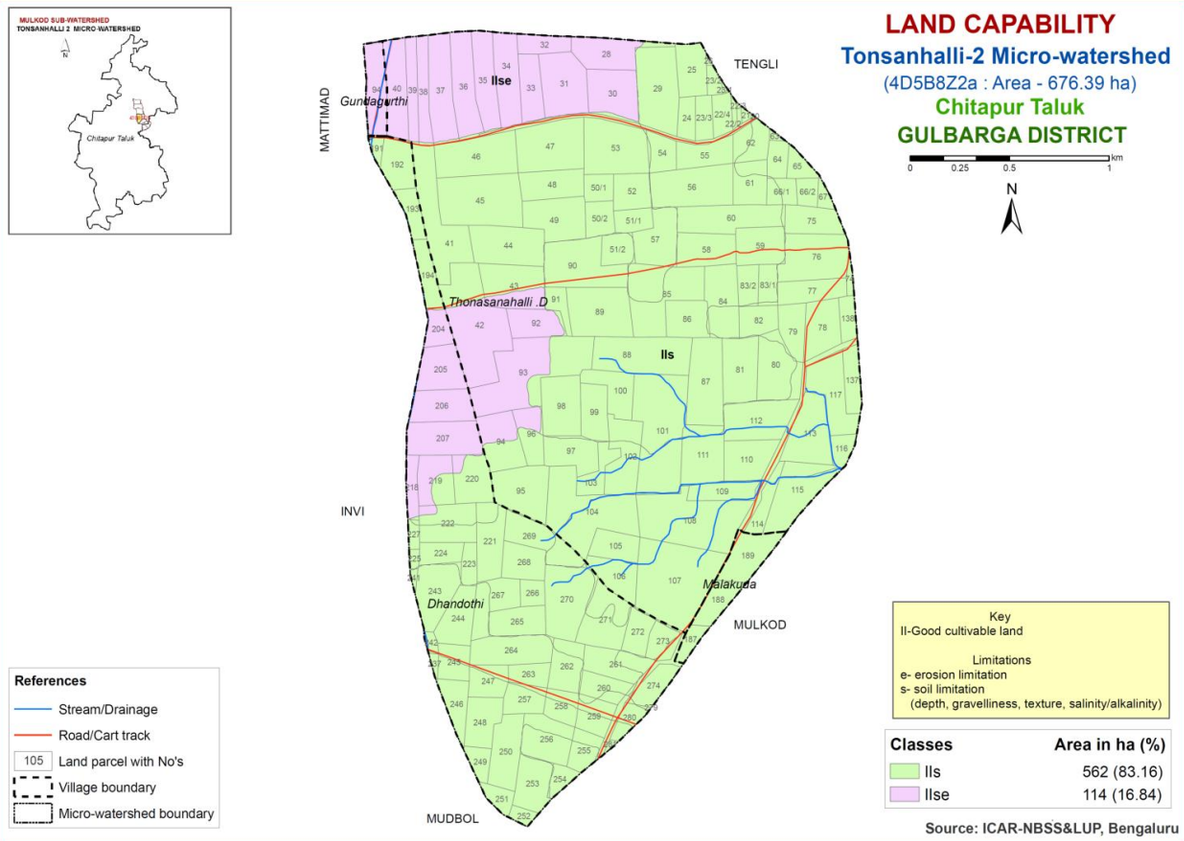
Source: ICAR-NBSS&LUP, Bengaluru

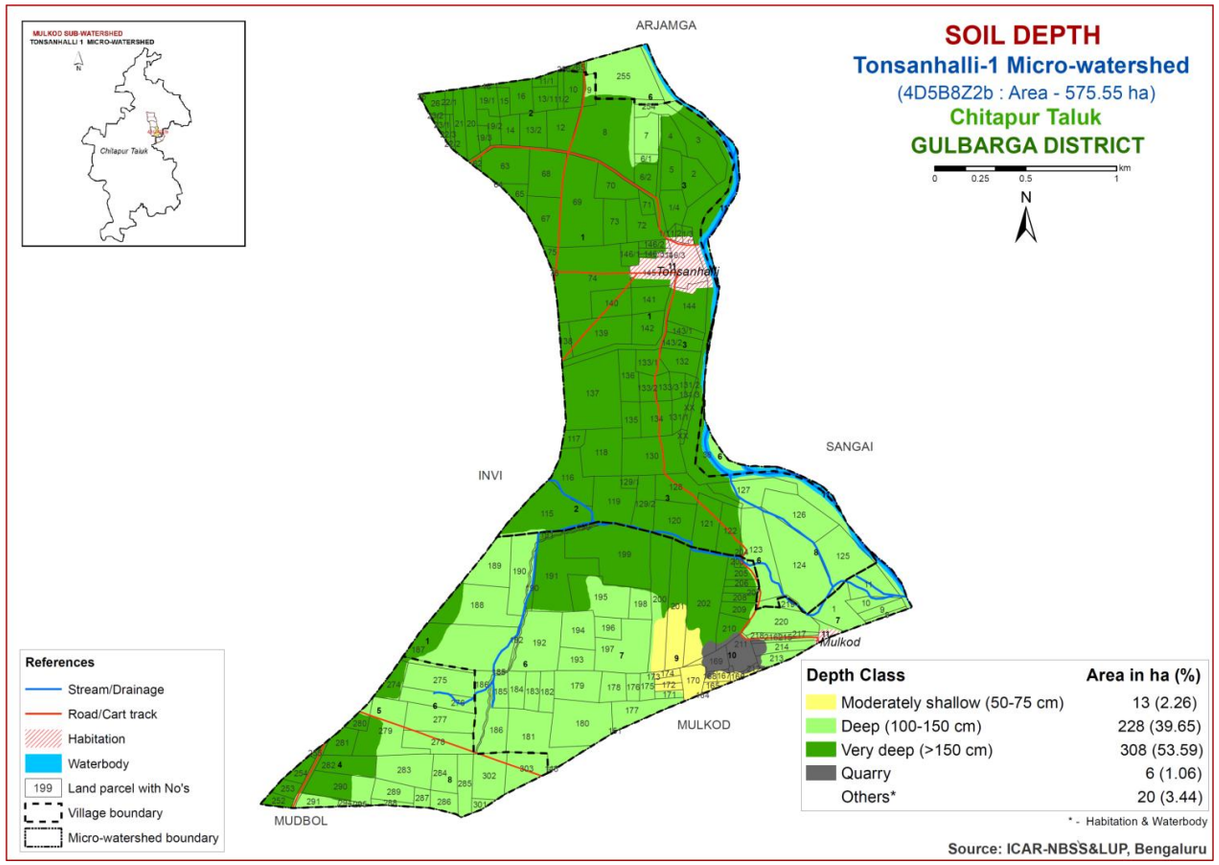
Table 2. Mapping unit description of Tonsanhalli-2 (4D5B8Z2a) Micro-watershed in Chitapur Taluk, Gulbarga District

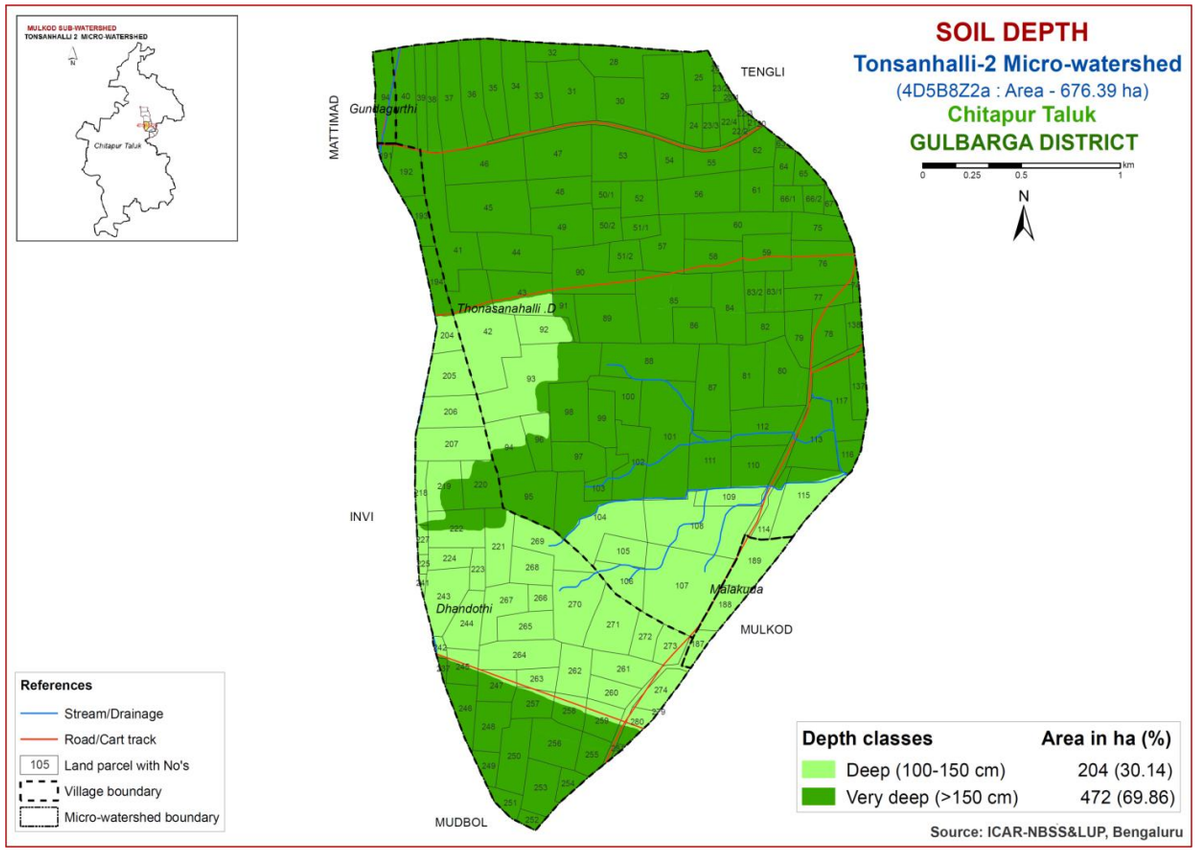
Sl.No*	Map unit	Description	Area in ha (%)
1	DDmA1g1	Very deep, black clayey soils developed from weathered basalt on nearly level uplands; clay surface on 0-1% slope, slightly eroded, slightly gravelly, 15-35 per cent gravel.	290.86 (43.00)
2	DDmB1g1	Very deep, black clayey soils developed from weathered basalt on very gently sloping uplands; clay surface on 1-3% slope, slightly eroded, slightly gravelly, 15-35 per cent gravel.	119.90 (17.73)
3	DDmB2g1	Very deep, black clayey soils developed from weathered basalt on very gently sloping uplands; clay surface on 1-3 % slope, moderately eroded, slightly gravelly, 15-35 per cent gravel.	61.74 (9.13)
4	DRmA1g1	Deep, black clayey soils developed from weathered basalt on nearly level uplands; clay surface on 0-1% slope, slightly eroded, slightly gravelly, 15-35 per cent gravel.	30.15 (4.46)
5	DRmB1g1	Deep, black clayey soils developed from weathered basalt on very gently sloping uplands; clay surface on 1-3% slope, slightly eroded, slightly gravelly, 15-35 per cent gravel.	121.57 (17.97)
6	DRmB2g1	Deep, black clayey soils developed from weathered basalt on very gently sloping uplands; clay surface on 1-3% slope, moderately eroded, slightly gravelly, 15-35 per cent gravel.	52.17 (7.71)

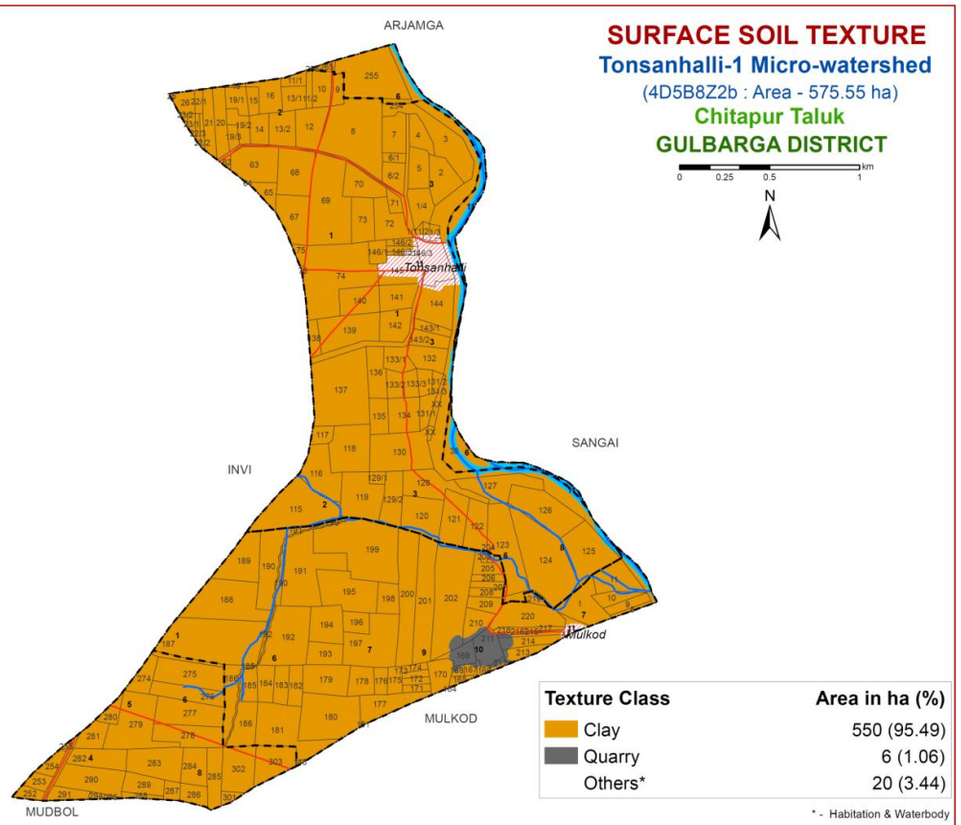
*Soil map unit numbers are continuous for the taluk, not the micro-watershed


MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
ARJAMGA
INVI
SANGAI
MULKOD
MUDBOL
Tonsanhalli
Mulkod
IIs
IIse
IIIs
LAND CAPABILITY
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
Key
II-Good cultivable land
III-Moderately good cultivable land
Limitations
e- erosion limitation
s- soil limitation
(depth, gravelliness, texture, salinity/alkalinity)
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Classes | Area in ha (%)
IIse | 156 (27.12)
IIs | 381 (66.12)
IIIs | 13 (2.26)
Quarry | 6 (1.06)
Others* | 20 (3.44)
* - Habitation & Waterbody
** - Calcium nodules (15-25%)
Source: ICAR-NBSS&LUP, Bengaluru


MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
MATTIMAD
TENGLI
INVI
MULKOD
MUDBOL
Gundagurthi
Thonasanahalli .D
Dhandothi
Malakuda
IIs
IIse
LAND CAPABILITY
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
Key
II-Good cultivable land
Limitations
e- erosion limitation
s- soil limitation
(depth, gravelliness, texture, salinity/alkalinity)
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Classes | Area in ha (%)
IIs | 562 (83.16)
IIse | 114 (16.84)
Source: ICAR-NBSS&LUP, Bengaluru


MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
ARJAMGA
INVI
SANGAI
MULKOD
MUDBOL
Tonsanhalli
Mulkod
SOIL DEPTH
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Depth Class | Area in ha (%)
Moderately shallow (50-75 cm) | 13 (2.26)
Deep (100-150 cm) | 228 (39.65)
Very deep (>150 cm) | 308 (53.59)
Quarry | 6 (1.06)
Others* | 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru


MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
MATTIMAD
TENGLI
INVI
MULKOD
MUDBOL
Gundagurthi
Thonasanahalli .D
Dhandothi
Malakuda
SOIL DEPTH
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Depth classes | Area in ha (%)
Deep (100-150 cm) | 204 (30.14)
Very deep (>150 cm) | 472 (69.86)
Source: ICAR-NBSS&LUP, Bengaluru



SURFACE SOIL TEXTURE

Tonsanhalli-1 Micro-watershed

(4D5B8Z2b : Area - 575.55 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km

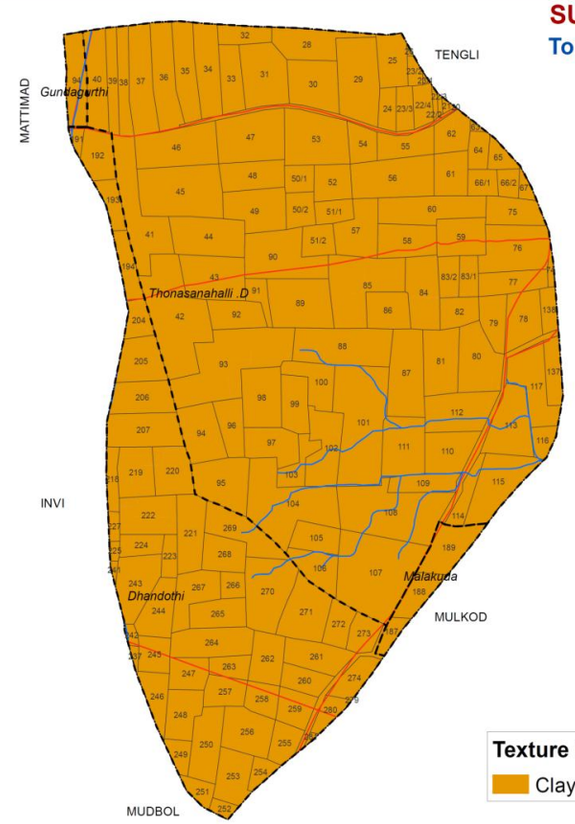
N

Texture Class	Area in ha (%)
Clay	550 (95.49)
Quarry	6 (1.06)
Others*	20 (3.44)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

References
- Stream/Drainage
- Road/Cart track
- Habitation
- Waterbody
- 199 Land parcel with No's
- Village boundary
- Micro-watershed boundary



SURFACE SOIL TEXTURE

Tonsanhalli-2 Micro-watershed

(4D5B8Z2a : Area - 676.39 ha)

Chitapur Taluk

GULBARGA DISTRICT

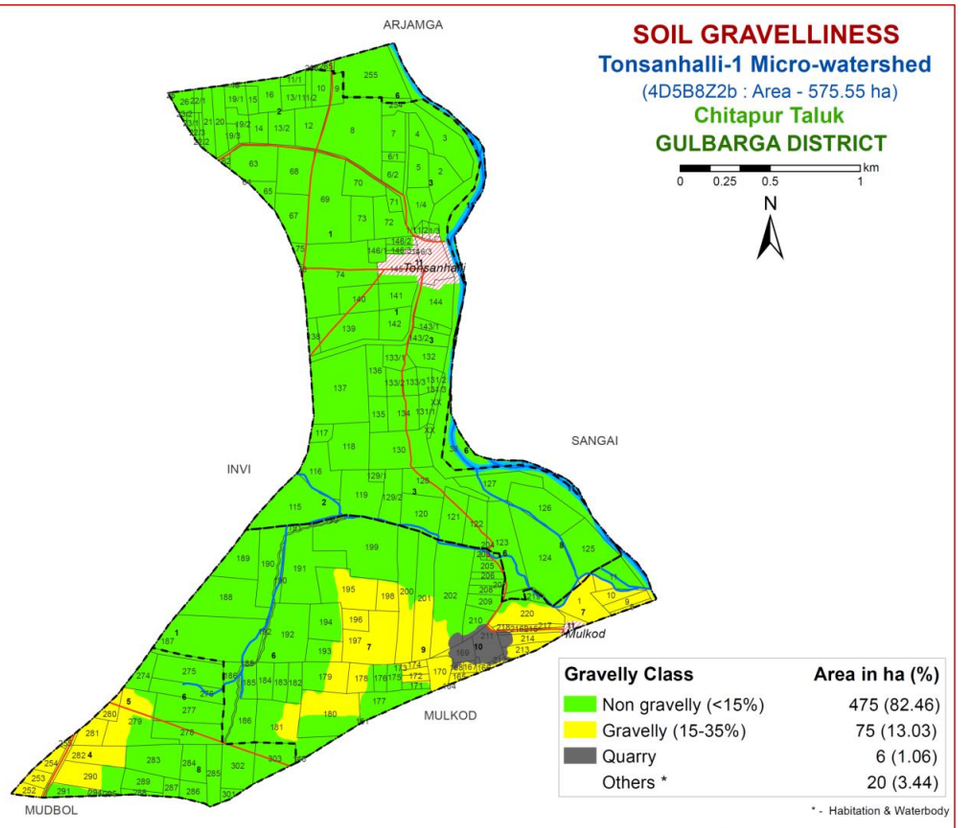
0 0.25 0.5 1 km

N

Texture Class	Area in ha (%)
Clay	676 (100.0)

Source: ICAR-NBSS&LUP, Bengaluru

References
- Stream/Drainage
- Road/Cart track
- 105 Land parcel with No's
- Village boundary
- Micro-watershed boundary



SOIL GRAVELLINESS

Tonsanhalli-1 Micro-watershed

(4D5B8Z2b : Area - 575.55 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km

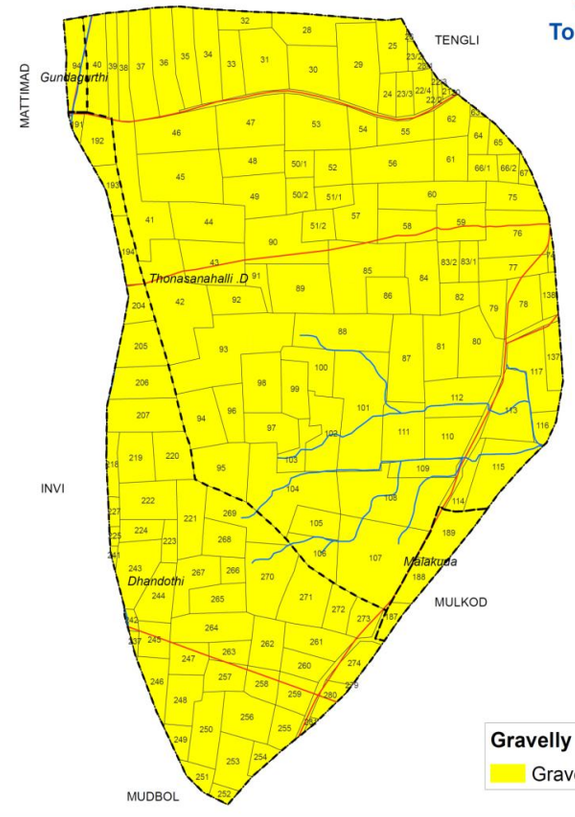
N

Gravelly Class	Area in ha (%)
Non gravelly (<15%)	475 (82.46)
Gravelly (15-35%)	75 (13.03)
Quarry	6 (1.06)
Others *	20 (3.44)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

References
- Stream/Drainage
- Road/Cart track
- Habitation
- Waterbody
- 199 Land parcel with No's
- Village boundary
- Micro-watershed boundary



SOIL GRAVELLINESS

Tonsanhalli-2 Micro-watershed

(4D5B8Z2a : Area - 676.39 ha)

Chitapur Taluk

GULBARGA DISTRICT

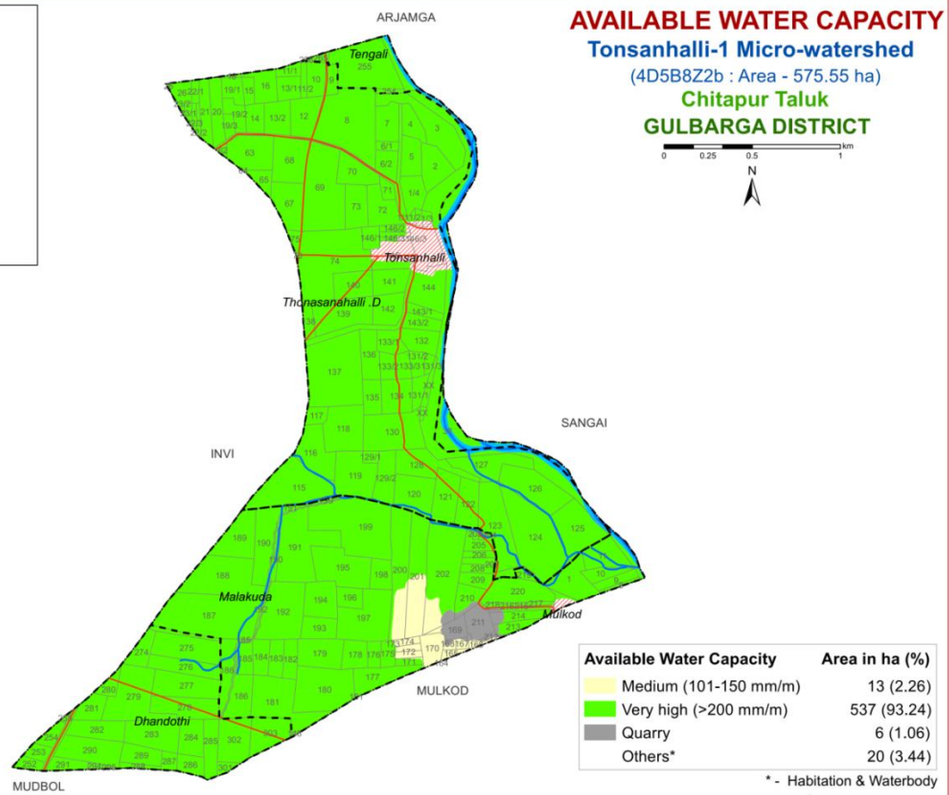
0 0.25 0.5 1 km

N

Gravelly Class	Area in ha (%)
Gravelly (15-35%)	676 (100.0)

Source: ICAR-NBSS&LUP, Bengaluru

References
- Stream/Drainage
- Road/Cart track
- 105 Land parcel with No's
- Village boundary
- Micro-watershed boundary



AVAILABLE WATER CAPACITY
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT

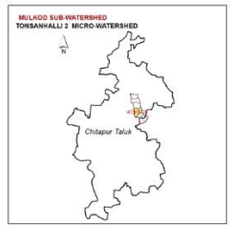
0 0.25 0.5 1 km
N

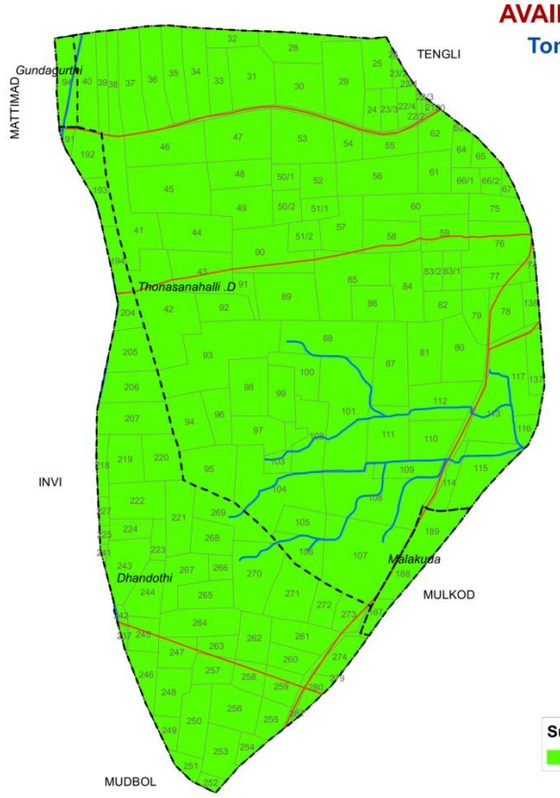
References
- Stream/Drainage
- Road/Cart track
- Habitation
- Waterbody
- 199 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Available Water Capacity	Area in ha (%)
Medium (101-150 mm/m)	13 (2.26)
Very high (>200 mm/m)	537 (93.24)
Quarry	6 (1.06)
Others*	20 (3.44)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru





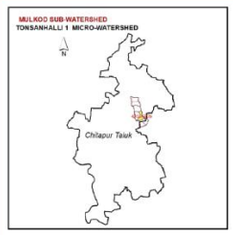
AVAILABLE WATER CAPACITY
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT

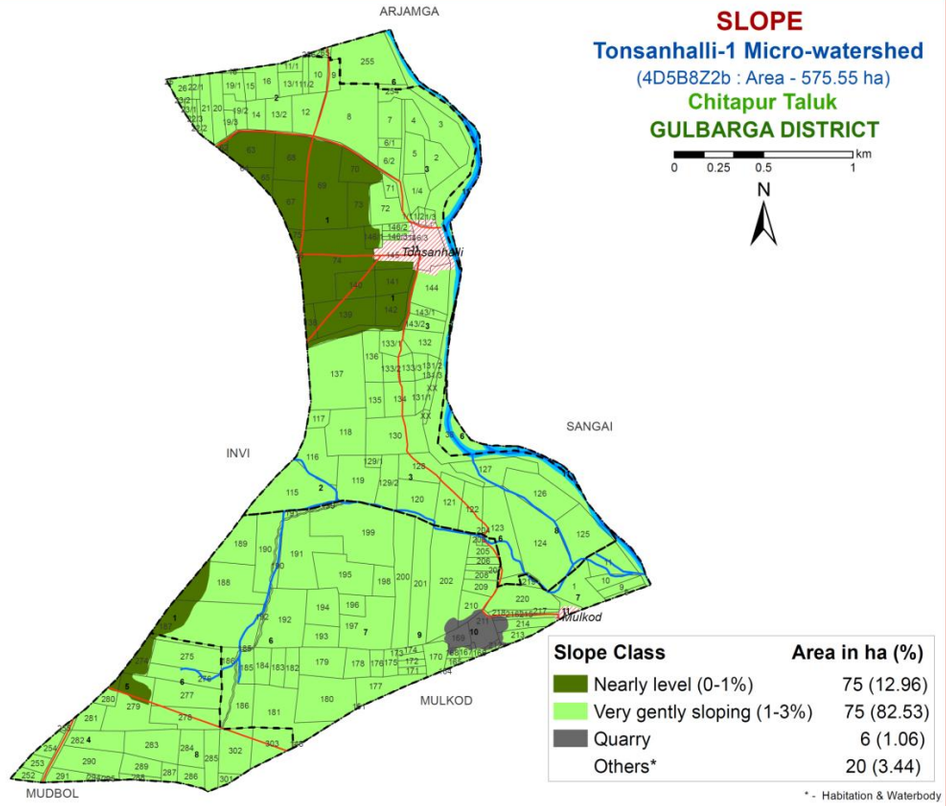
0 0.25 0.5 1 km
N

References
- Stream/Drainage
- Road/Cart track
- 105 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
Very high (>200 mm/m)	676 (100)

Source: ICAR-NBSS&LUP, Bengaluru





SLOPE
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT

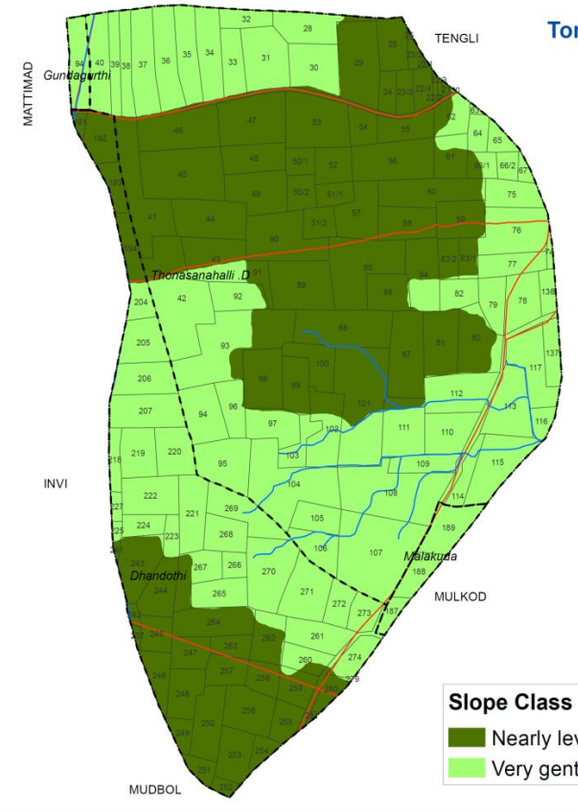
0 0.25 0.5 1 km
N

References
- Stream/Drainage
- Road/Cart track
- Habitation
- Waterbody
- 199 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Slope Class	Area in ha (%)
Nearly level (0-1%)	75 (12.96)
Very gently sloping (1-3%)	75 (82.53)
Quarry	6 (1.06)
Others*	20 (3.44)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru



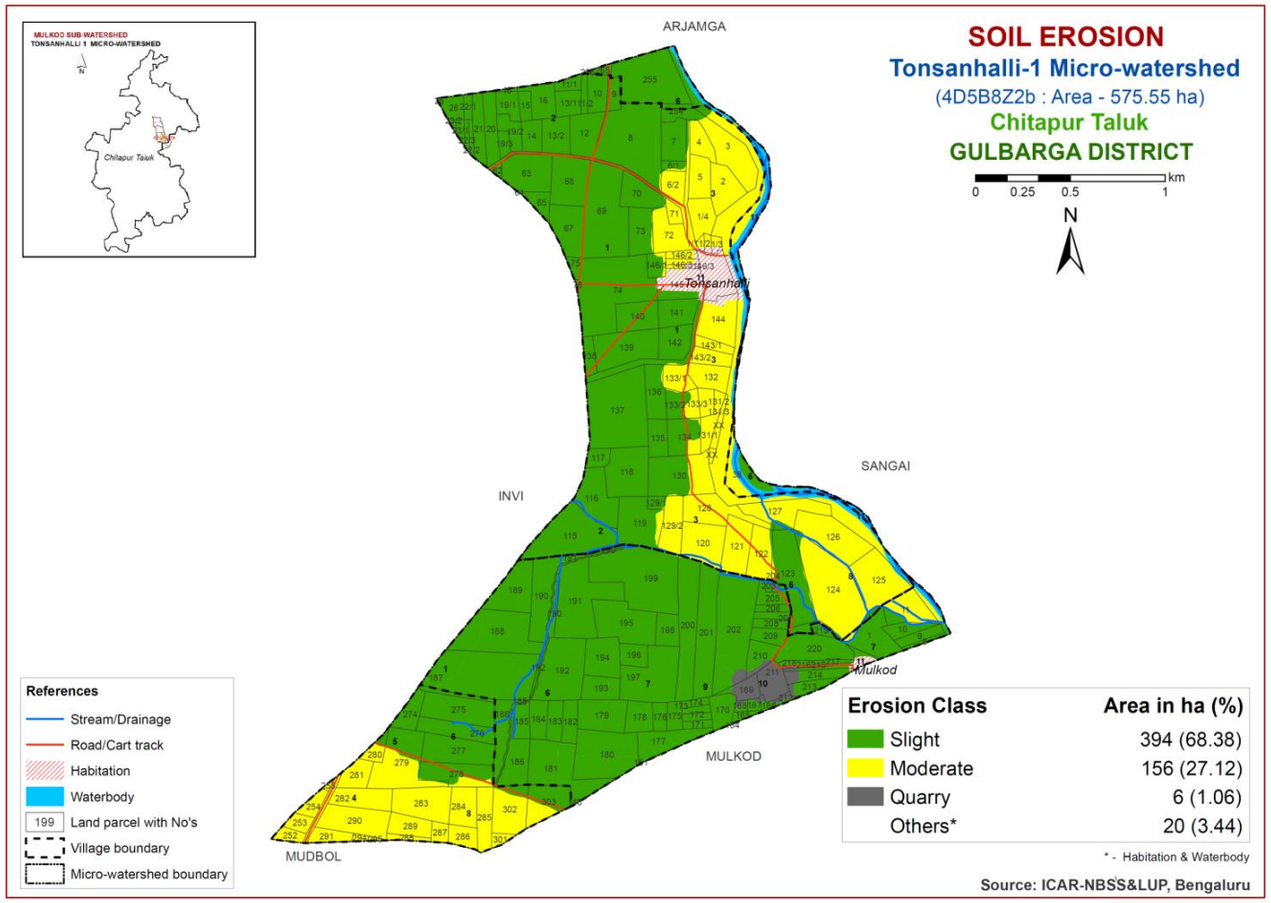
SLOPE
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT

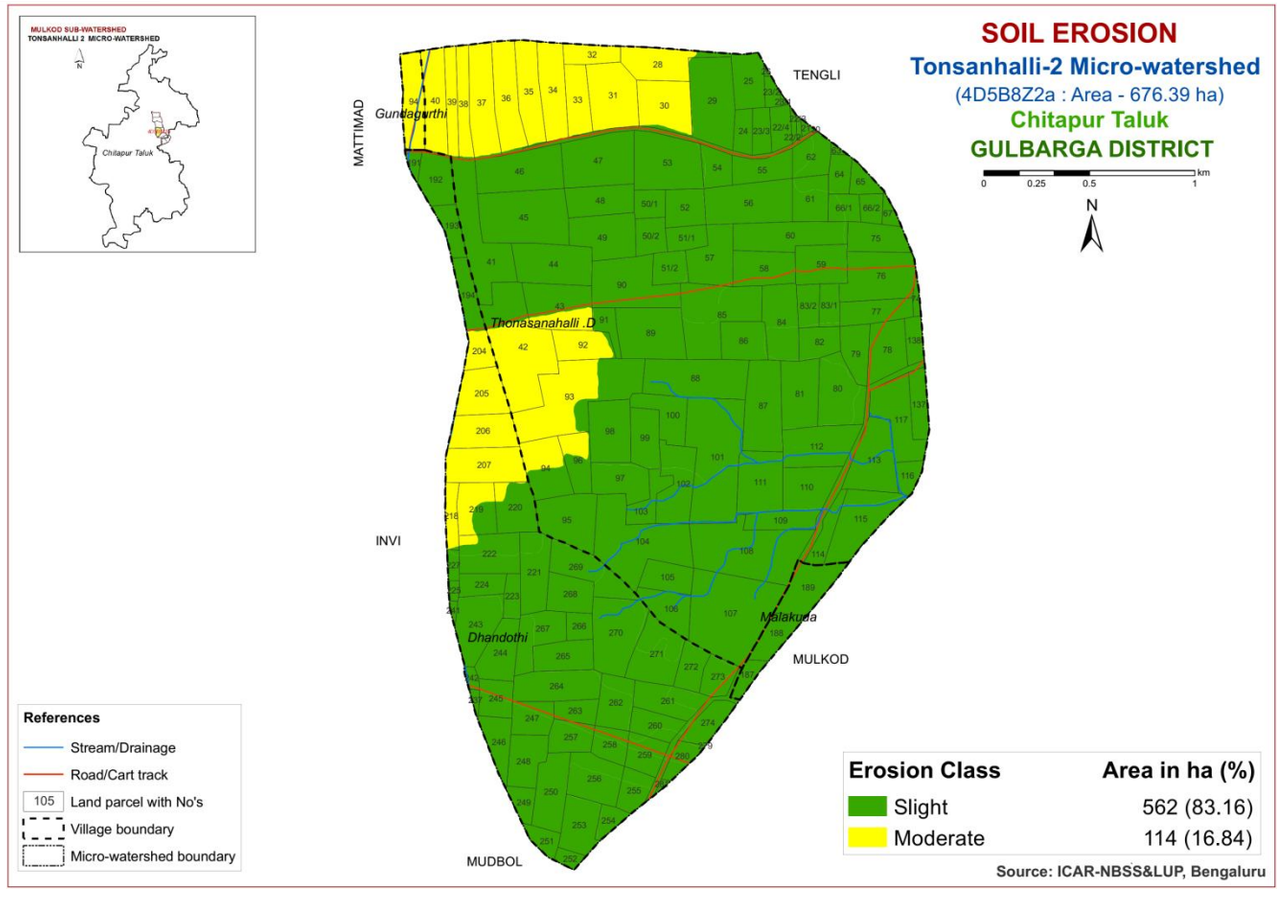
0 0.25 0.5 1 km
N

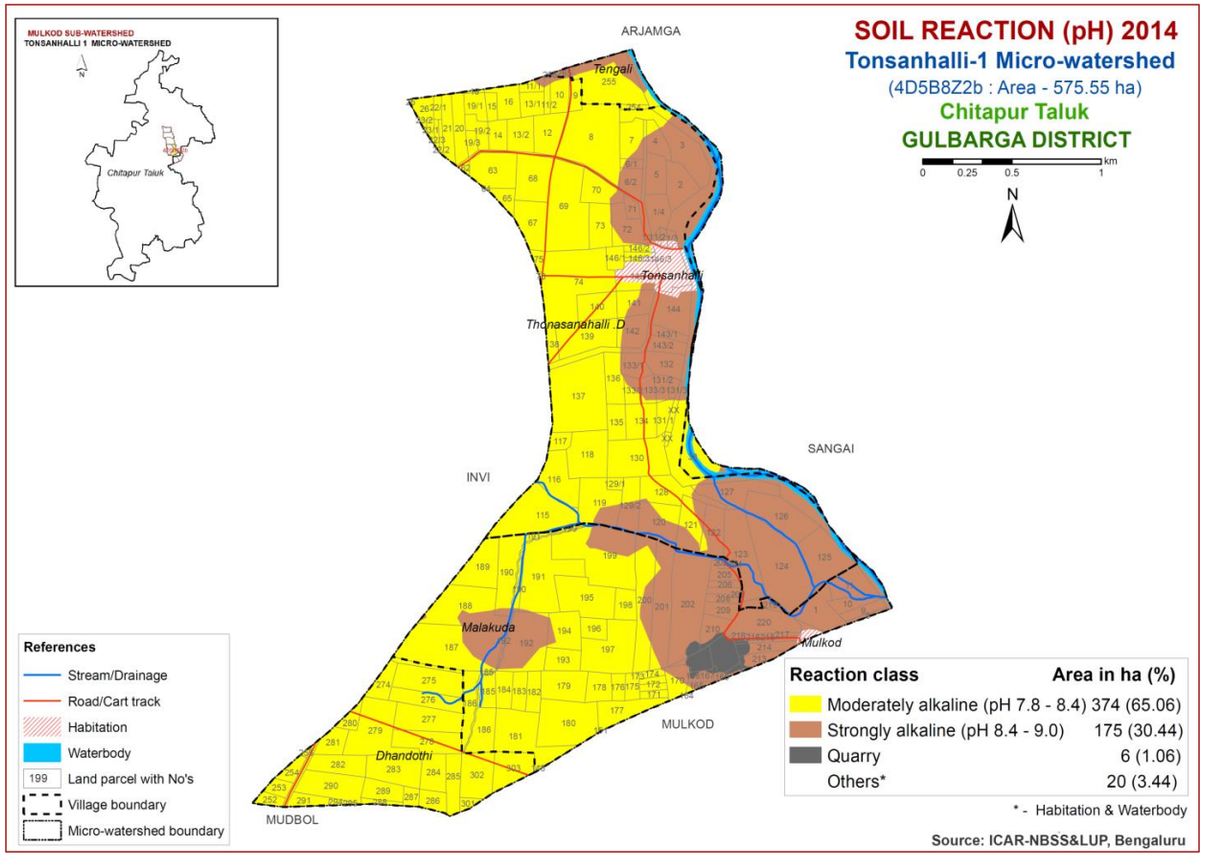
References
- Stream/Drainage
- Road/Cart track
- 105 Land parcel with No's
- Village boundary
- Micro-watershed boundary

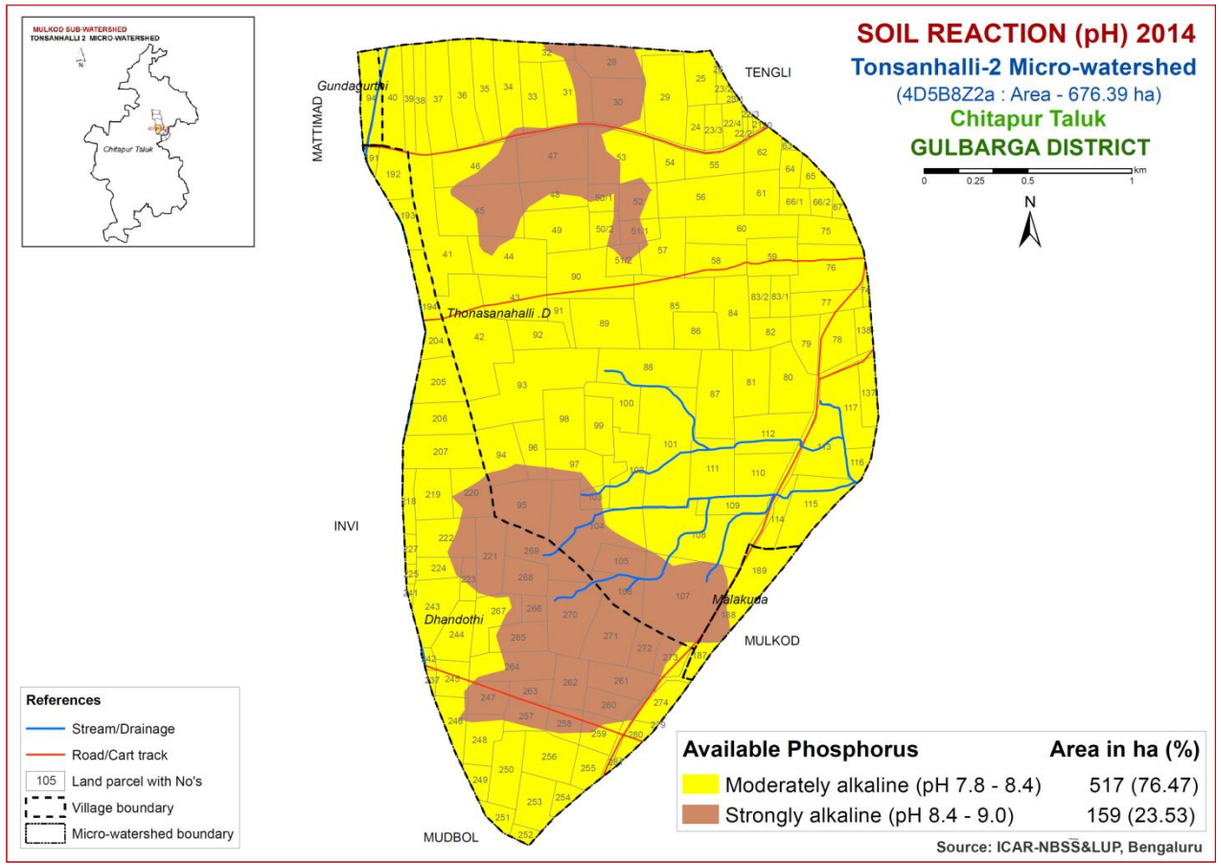
Slope Class	Area in ha (%)
Nearly level (0-1%)	321 (47.46)
Very gently sloping (1-3%)	355 (52.54)

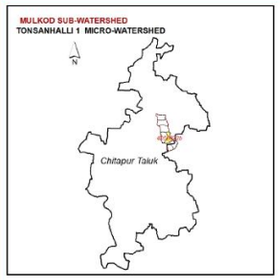
Source: ICAR-NBSS&LUP, Bengaluru

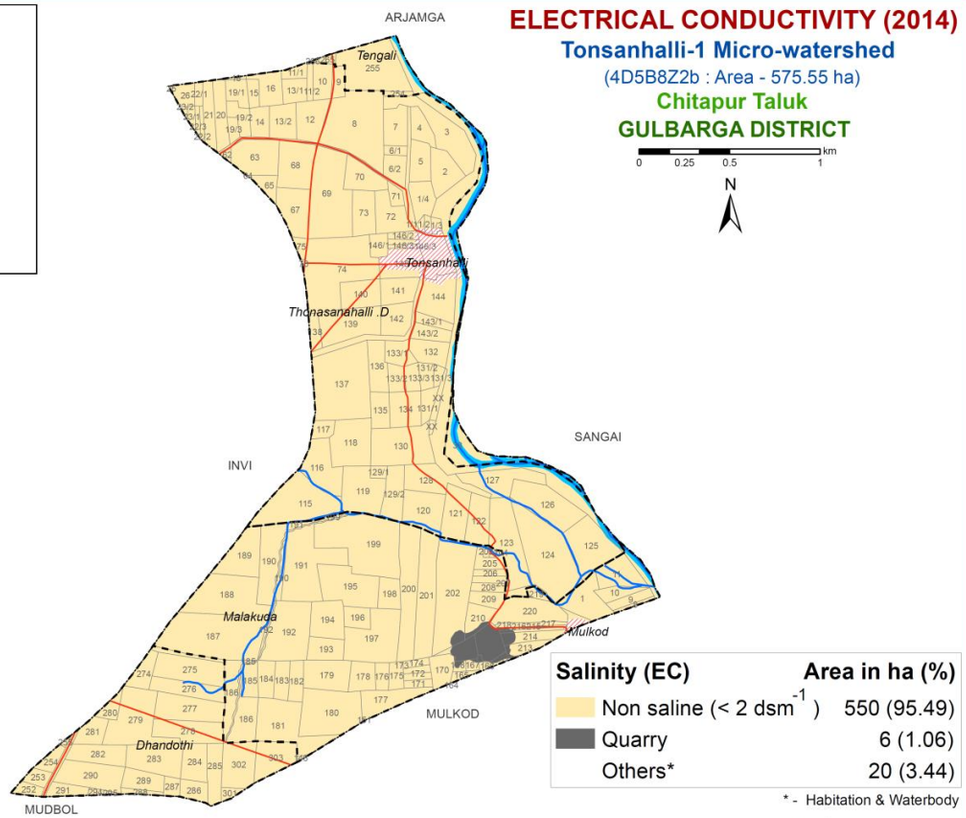

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
ARJAMGA
SOIL EROSION
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
Tonsanhalli
INVI
SANGAI
Mulkod
MULKOD
MUDBOL
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Erosion Class
Area in ha (%)
Slight 394 (68.38)
Moderate 156 (27.12)
Quarry 6 (1.06)
Others* 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru


MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
SOIL EROSION
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
TENGLI
MATTIMAD
Gundagurthi
Thonasanahalli .D
INVI
Malakuda
Dhandothi
MULKOD
MUDBOL
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Erosion Class
Area in ha (%)
Slight 562 (83.16)
Moderate 114 (16.84)
Source: ICAR-NBSS&LUP, Bengaluru


MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
SOIL REACTION (pH) 2014
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
Malakuda
Mulkod
MULKOD
Dhandothi
MUDBOL
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Reaction class
Area in ha (%)
Moderately alkaline (pH 7.8 - 8.4) 374 (65.06)
Strongly alkaline (pH 8.4 - 9.0) 175 (30.44)
Quarry 6 (1.06)
Others* 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru


MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
SOIL REACTION (pH) 2014
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
TENGLI
MATTIMAD
Gundagurthi
Thonasanahalli .D
INVI
Malakuda
Dhandothi
MULKOD
MUDBOL
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Available Phosphorus
Area in ha (%)
Moderately alkaline (pH 7.8 - 8.4) 517 (76.47)
Strongly alkaline (pH 8.4 - 9.0) 159 (23.53)
Source: ICAR-NBSS&LUP, Bengaluru





ELECTRICAL CONDUCTIVITY (2014)

Tonsanhalli-1 Micro-watershed

(4D5B8Z2b : Area - 575.55 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km

N

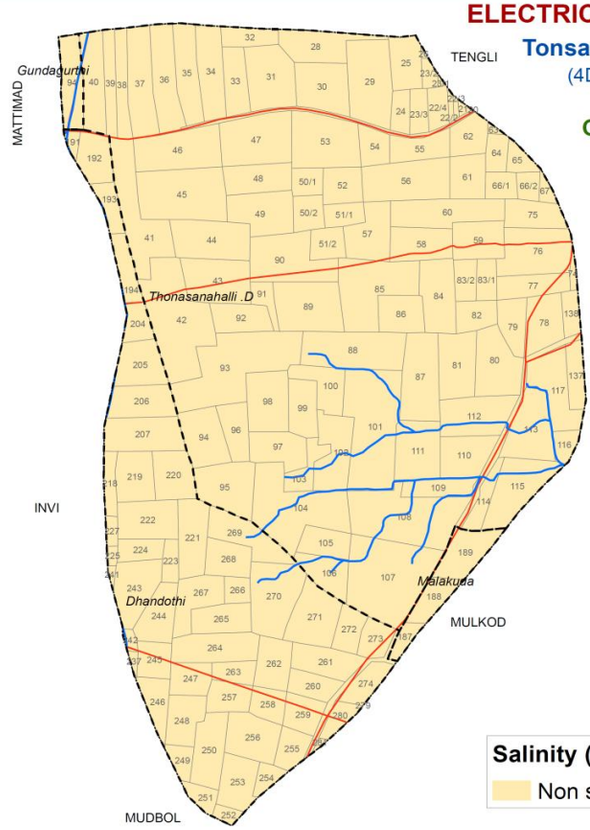
References

- Stream/Drainage
- Road/Cart track
- Habitation
- Waterbody
- 199 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Salinity (EC)	Area in ha (%)
Non saline (< 2 dsm^{-1})	550 (95.49)
Quarry	6 (1.06)
Others*	20 (3.44)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru



ELECTRICAL CONDUCTIVITY (2014)

Tonsanhalli-2 Micro-watershed

(4D5B8Z2a : Area - 676.39 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km

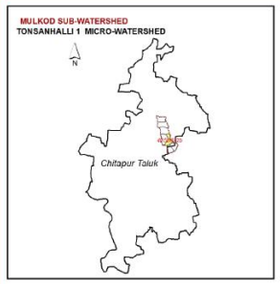
N

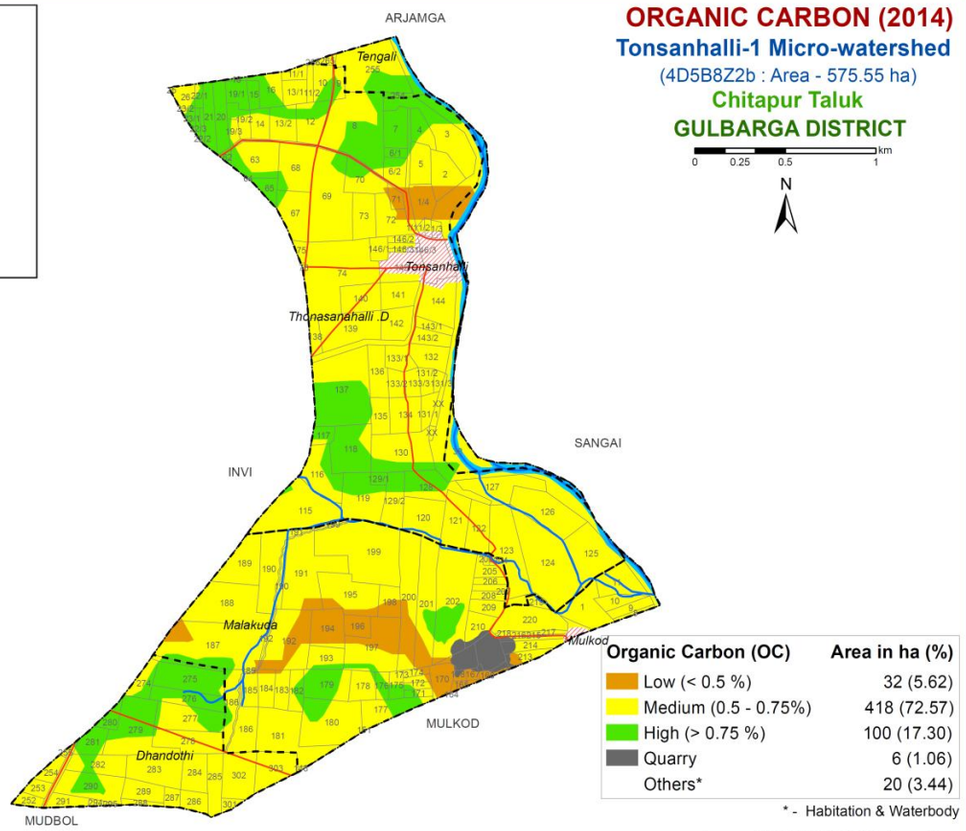
References

- Stream/Drainage
- Road/Cart track
- 105 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Salinity (EC)	Area in ha (%)
Non saline (< 2 dsm^{-1})	676 (100.00)

Source: ICAR-NBSS&LUP, Bengaluru





ORGANIC CARBON (2014)

Tonsanhalli-1 Micro-watershed

(4D5B8Z2b : Area - 575.55 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km

N

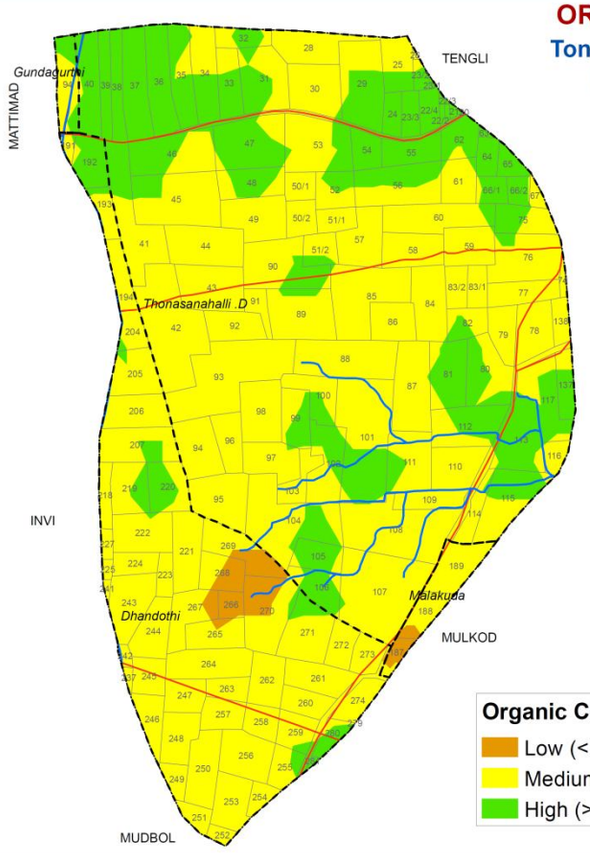
References

- Stream/Drainage
- Road/Cart track
- Habitation
- Waterbody
- 199 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Organic Carbon (OC)	Area in ha (%)
Low (< 0.5 %)	32 (5.62)
Medium (0.5 - 0.75%)	418 (72.57)
High (> 0.75 %)	100 (17.30)
Quarry	6 (1.06)
Others*	20 (3.44)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru



ORGANIC CARBON (2014)

Tonsanhalli-2 Micro-watershed

(4D5B8Z2a : Area - 676.39 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km

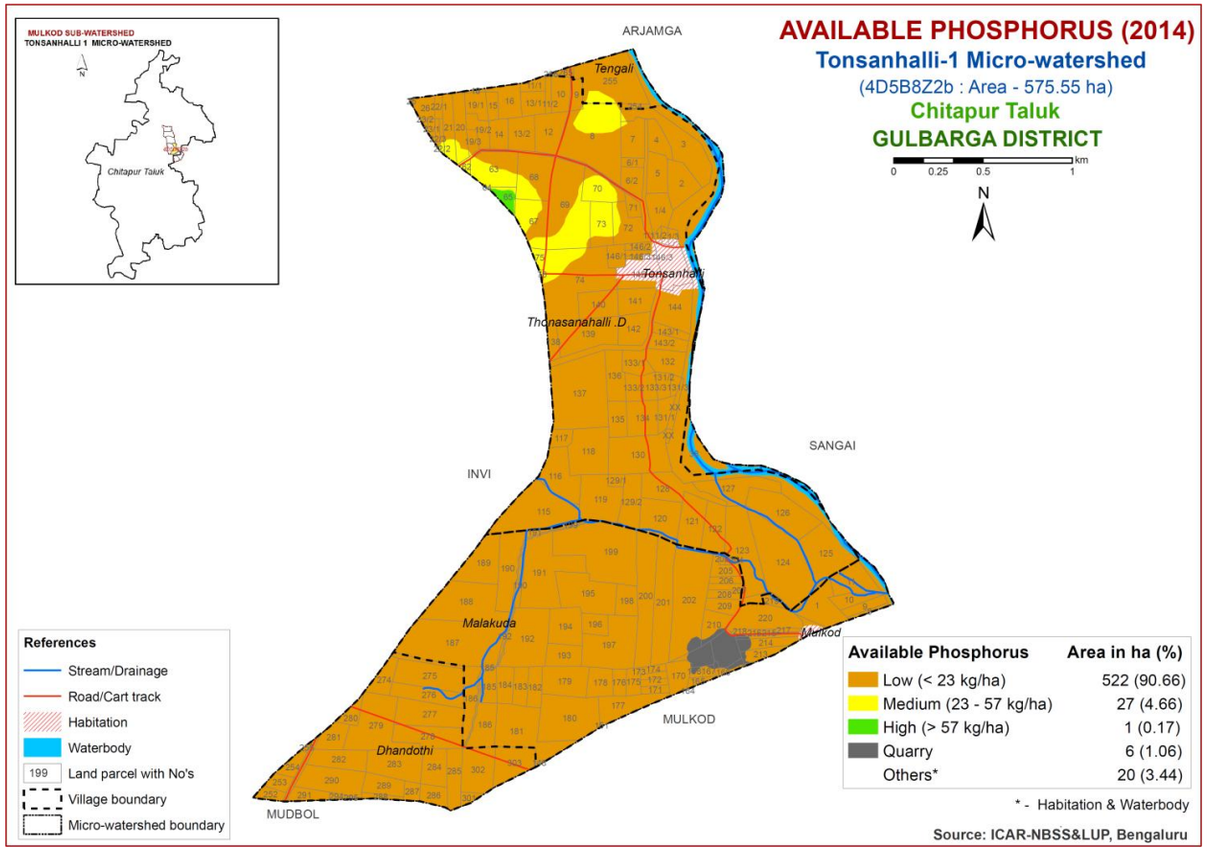
N

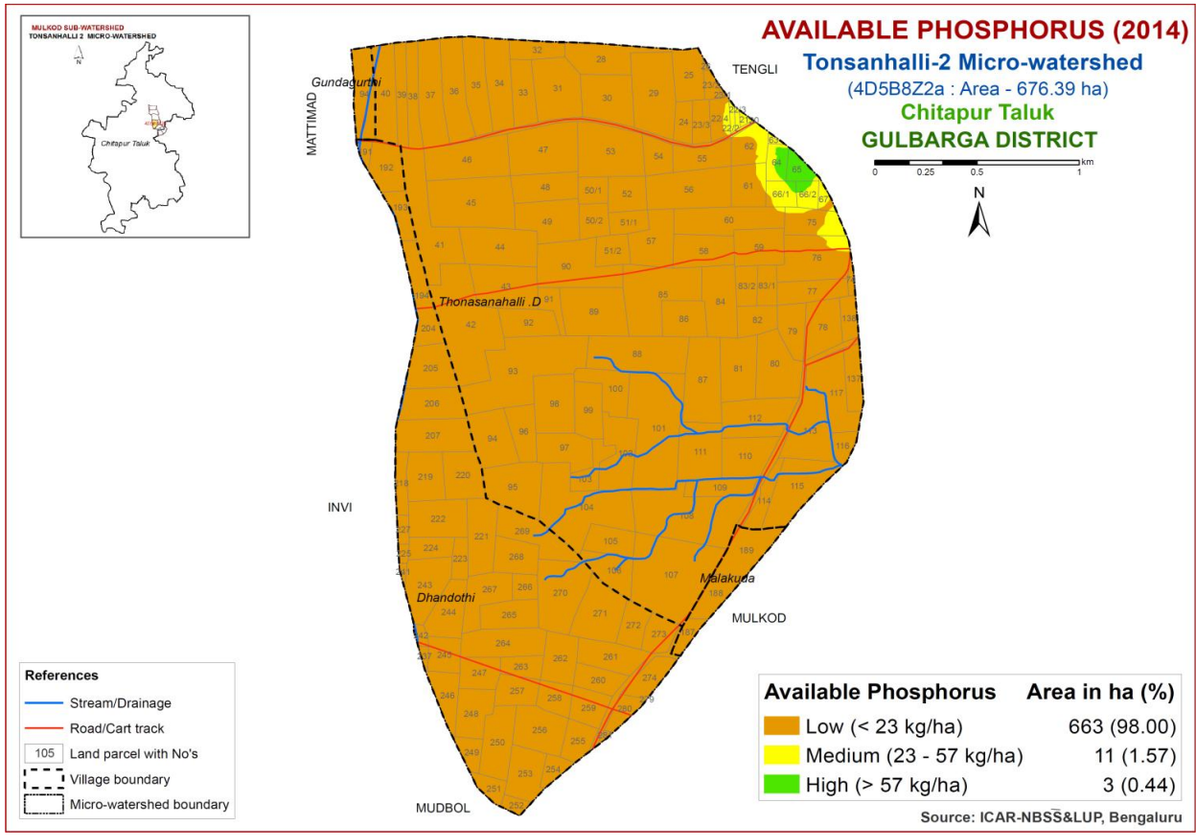
References

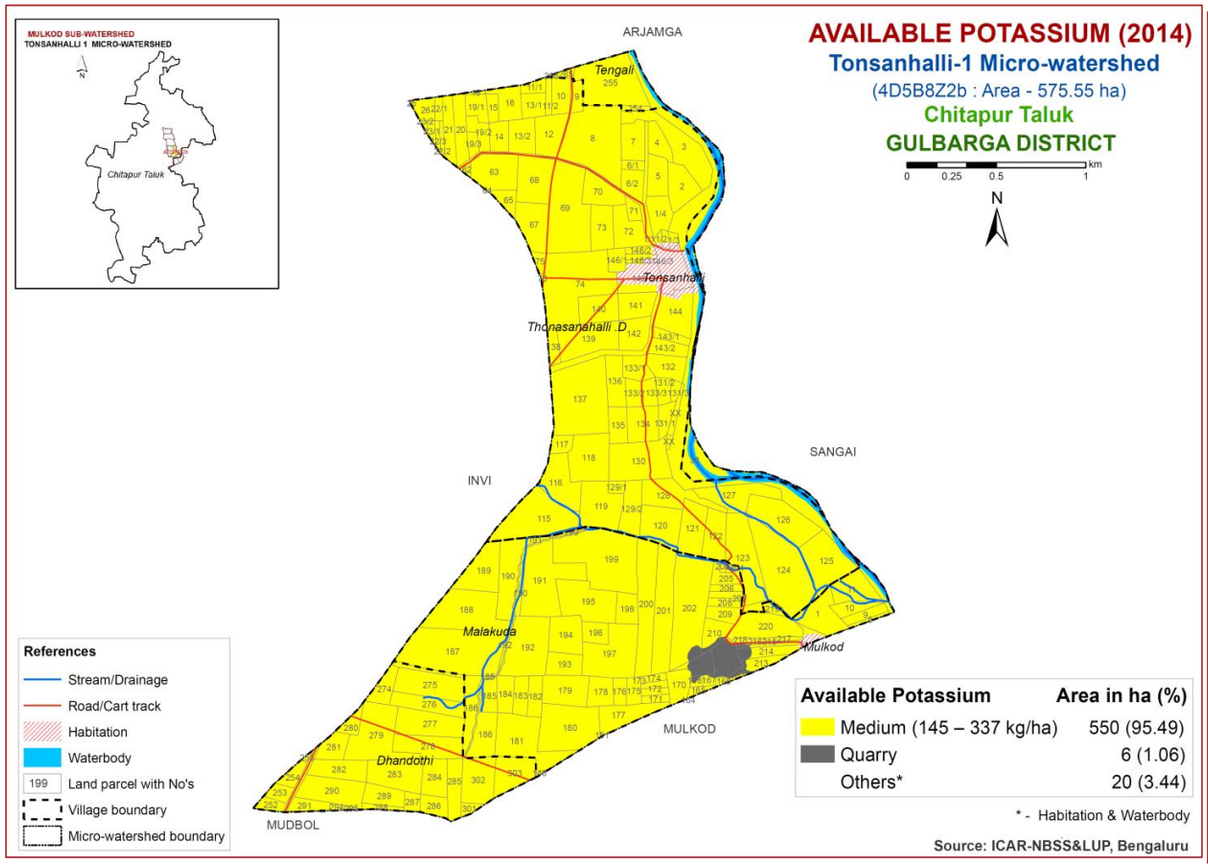
- Stream/Drainage
- Road/Cart track
- 105 Land parcel with No's
- Village boundary
- Micro-watershed boundary

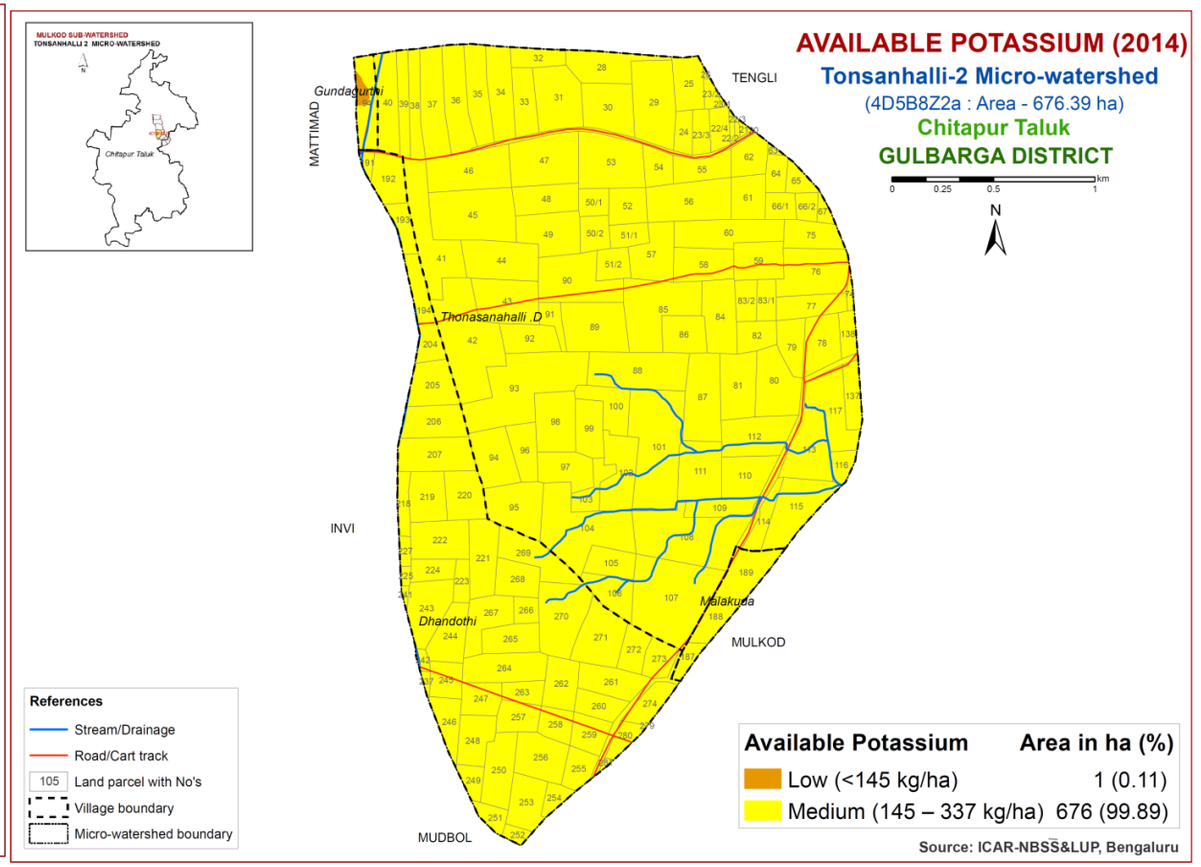
Organic Carbon (OC)	Area in ha (%)
Low (< 0.5 %)	12 (1.73)
Medium (0.5 - 0.75%)	499 (73.84)
High (> 0.75 %)	165 (24.43)

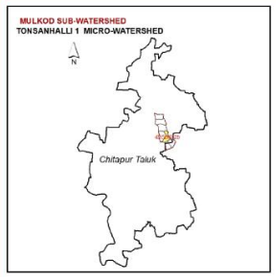
Source: ICAR-NBSS&LUP, Bengaluru

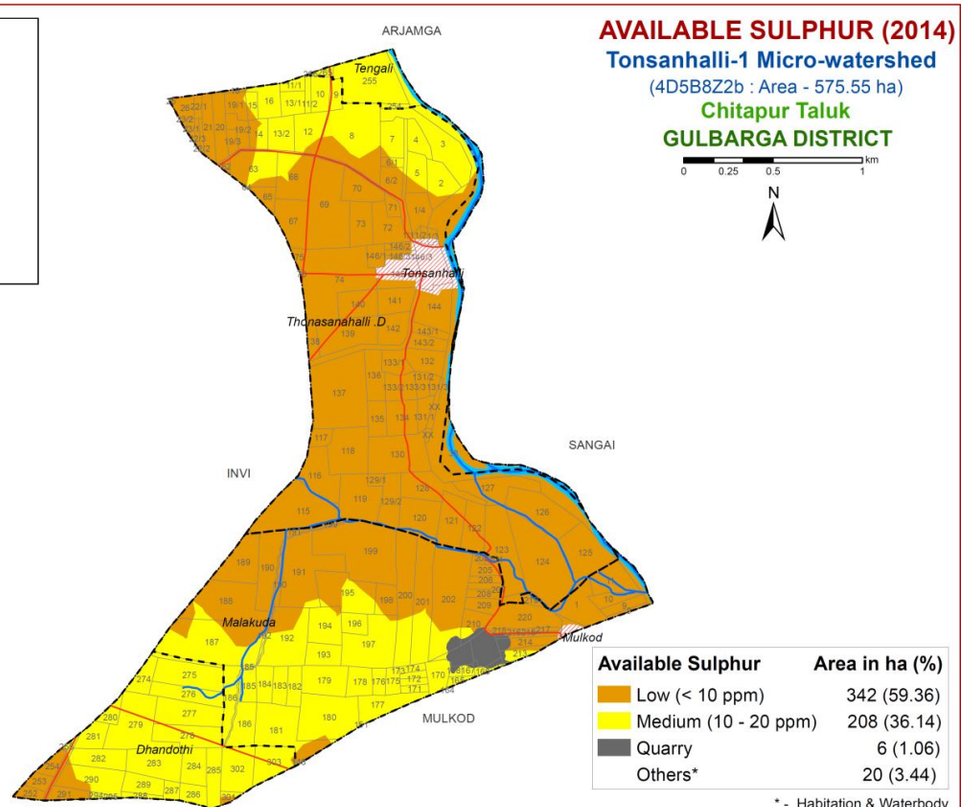

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
AVAILABLE PHOSPHORUS (2014)
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
Malakuda
Mulkod
MULKOD
Dhandothi
MUDBOL
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Available Phosphorus | Area in ha (%)
Low (< 23 kg/ha) | 522 (90.66)
Medium (23 - 57 kg/ha) | 27 (4.66)
High (> 57 kg/ha) | 1 (0.17)
Quarry | 6 (1.06)
Others* | 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru


MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
AVAILABLE PHOSPHORUS (2014)
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
MATTIMAD
Gundagurthi
TENGLI
Thonasanahalli .D
INVI
Malakuda
Dhandothi
MULKOD
MUDBOL
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Available Phosphorus | Area in ha (%)
Low (< 23 kg/ha) | 663 (98.00)
Medium (23 - 57 kg/ha) | 11 (1.57)
High (> 57 kg/ha) | 3 (0.44)
Source: ICAR-NBSS&LUP, Bengaluru


MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
AVAILABLE POTASSIUM (2014)
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
Malakuda
Mulkod
MULKOD
Dhandothi
MUDBOL
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Available Potassium | Area in ha (%)
Medium (145 – 337 kg/ha) | 550 (95.49)
Quarry | 6 (1.06)
Others* | 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru


MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
AVAILABLE POTASSIUM (2014)
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
MATTIMAD
Gundagurthi
TENGLI
Thonasanahalli .D
INVI
Malakuda
Dhandothi
MULKOD
MUDBOL
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Available Potassium | Area in ha (%)
Low (<145 kg/ha) | 1 (0.11)
Medium (145 – 337 kg/ha) | 676 (99.89)
Source: ICAR-NBSS&LUP, Bengaluru





AVAILABLE SULPHUR (2014)

Tonsanhalli-1 Micro-watershed

(4D5B8Z2b : Area - 575.55 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km

N

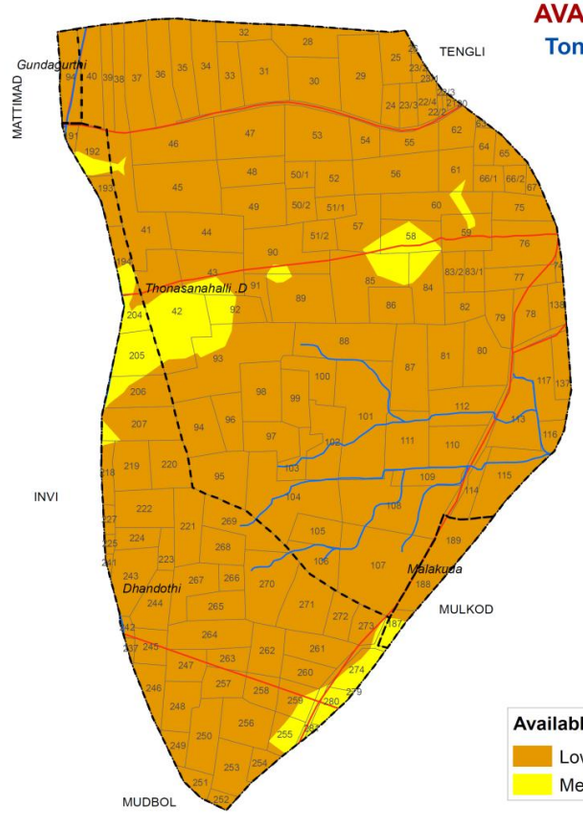
Available Sulphur	Area in ha (%)
Low (< 10 ppm)	342 (59.36)
Medium (10 - 20 ppm)	208 (36.14)
Quarry	6 (1.06)
Others*	20 (3.44)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

References

- Stream/Drainage
- Road/Cart track
- Habitation
- Waterbody
- 199 Land parcel with No's
- Village boundary
- Micro-watershed boundary



AVAILABLE SULPHUR (2014)

Tonsanhalli-2 Micro-watershed

(4D5B8Z2a : Area - 676.39 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km

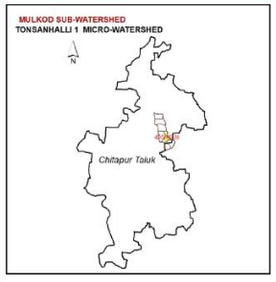
N

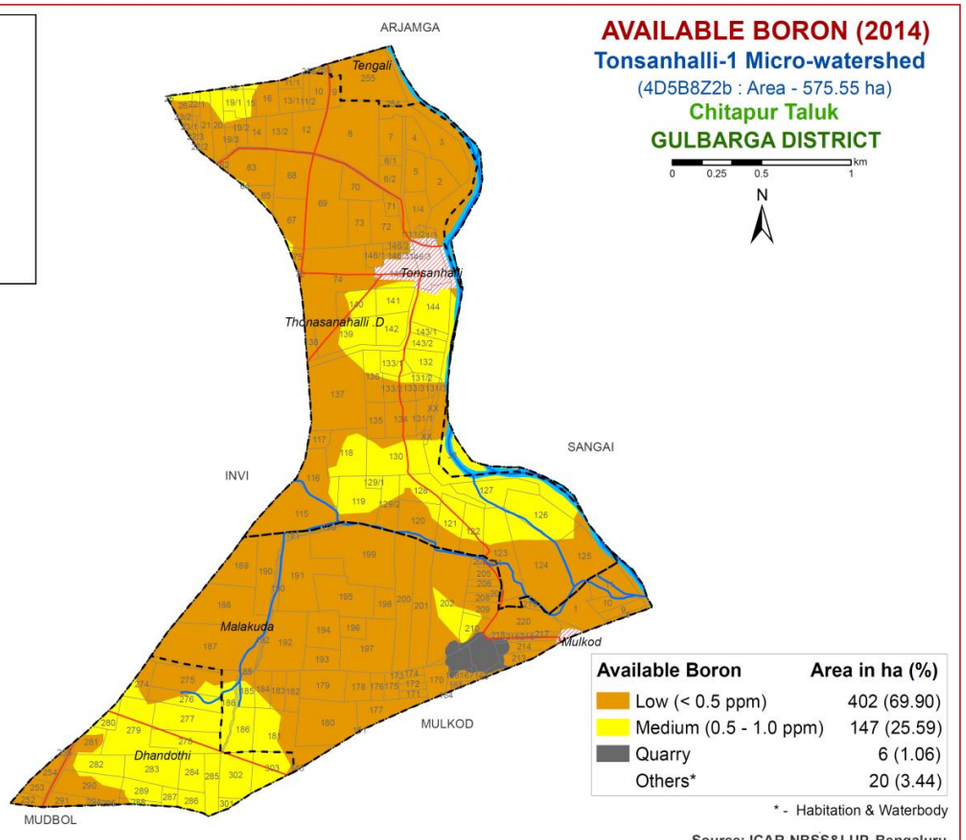
Available Sulphur	Area in ha (%)
Low (< 10 ppm)	634 (93.67)
Medium (10 - 20 ppm)	43 (6.33)

Source: ICAR-NBSS&LUP, Bengaluru

References

- Stream/Drainage
- Road/Cart track
- 105 Land parcel with No's
- Village boundary
- Micro-watershed boundary





AVAILABLE BORON (2014)

Tonsanhalli-1 Micro-watershed

(4D5B8Z2b : Area - 575.55 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km

N

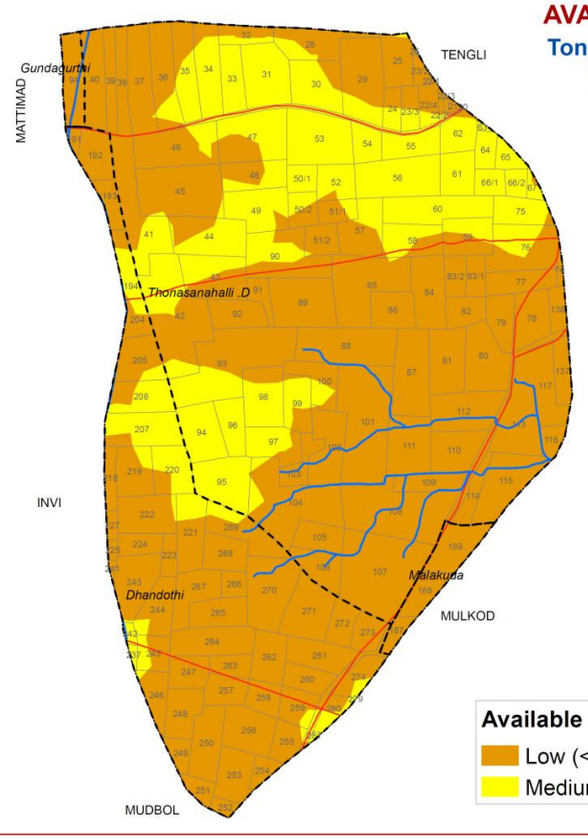
Available Boron	Area in ha (%)
Low (< 0.5 ppm)	402 (69.90)
Medium (0.5 - 1.0 ppm)	147 (25.59)
Quarry	6 (1.06)
Others*	20 (3.44)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

References

- Stream/Drainage
- Road/Cart track
- Habitation
- Waterbody
- 199 Land parcel with No's
- Village boundary
- Micro-watershed boundary



AVAILABLE BORON (2014)

Tonsanhalli-2 Micro-watershed

(4D5B8Z2a : Area - 676.39 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km

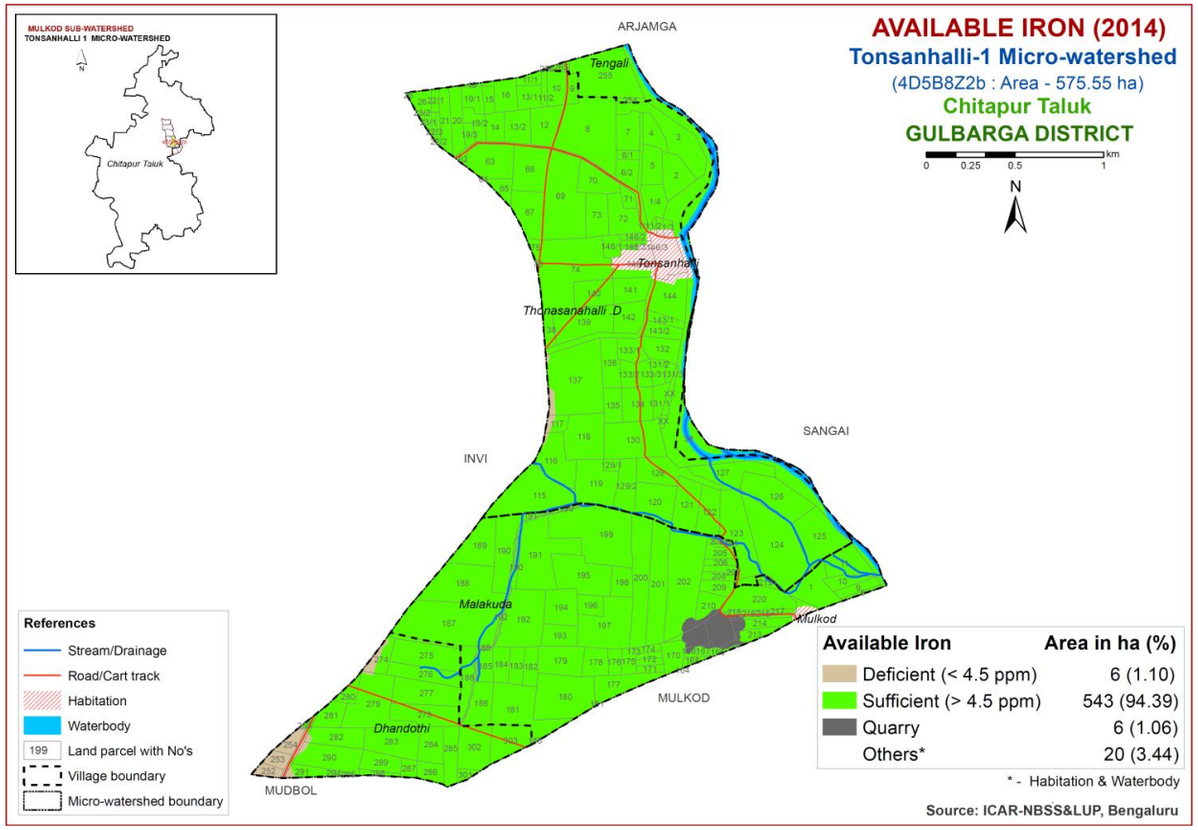
N

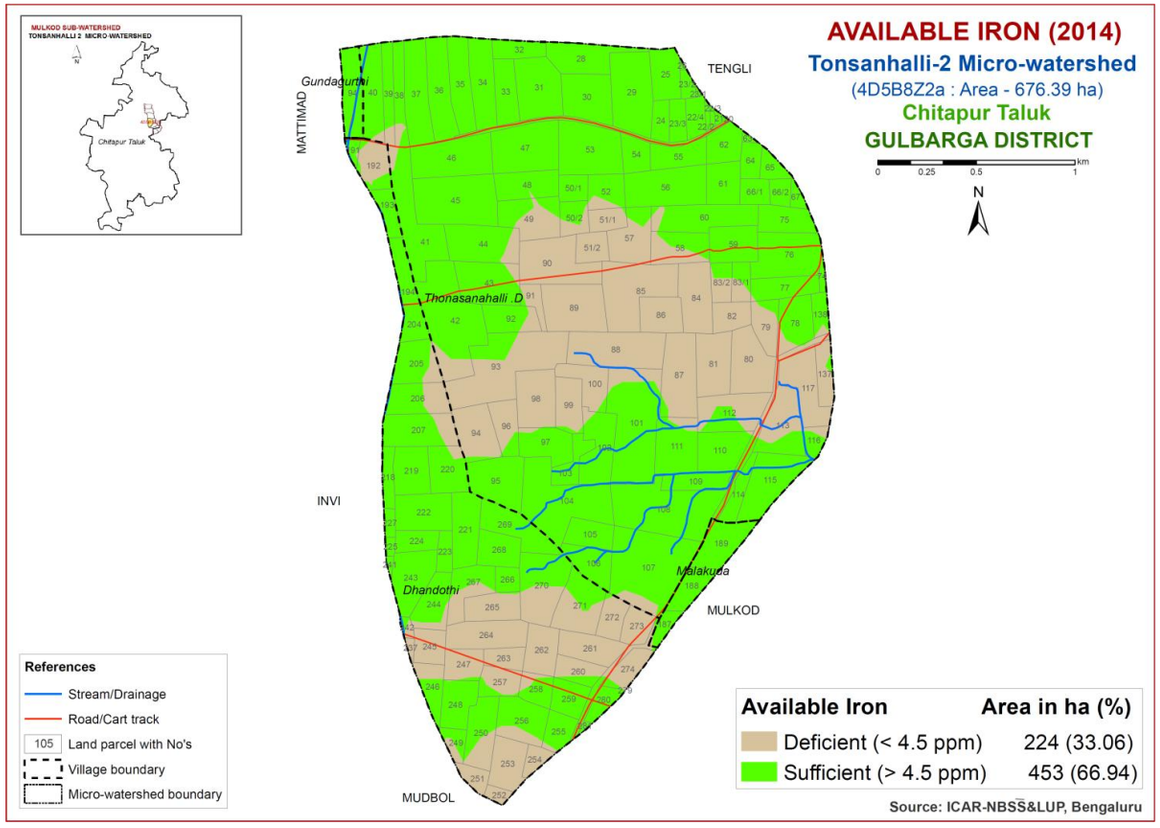
Available Boron	Area in ha (%)
Low (< 0.5 ppm)	486 (71.79)
Medium (0.5 - 1.0 ppm)	191 (28.21)

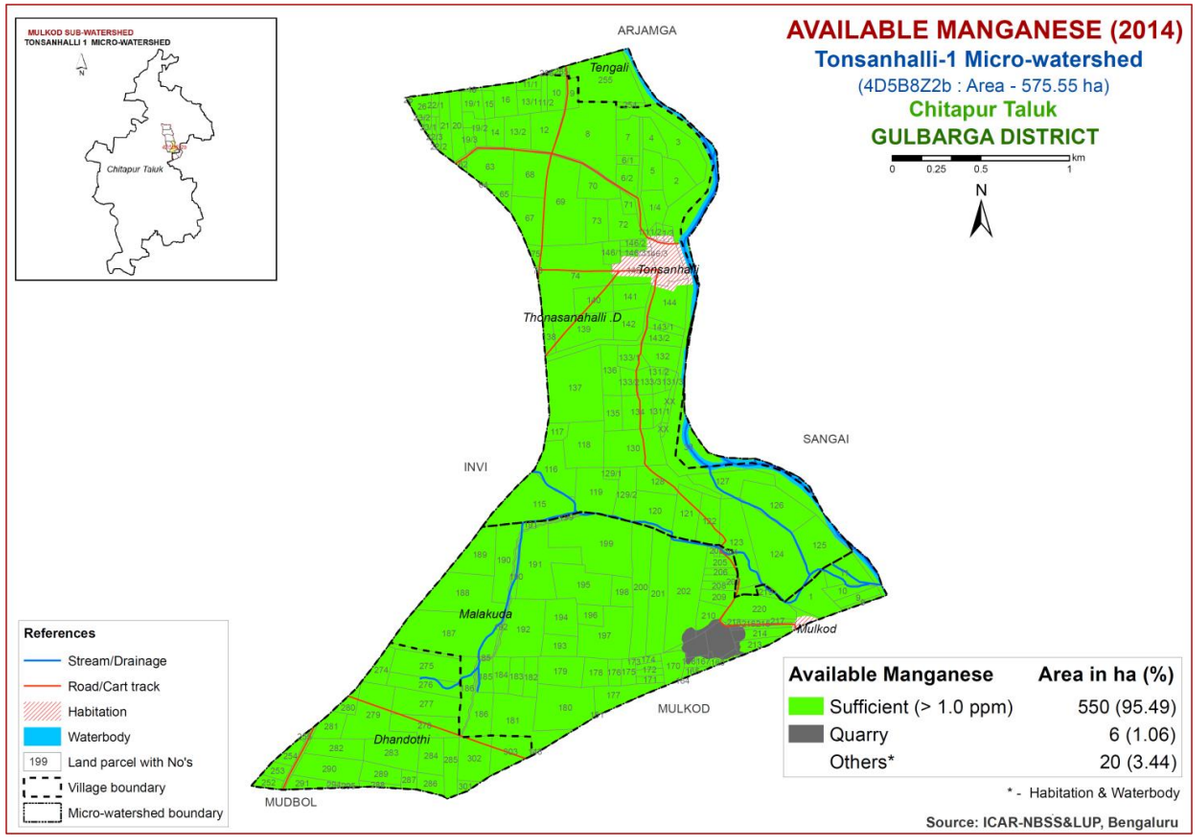
Source: ICAR-NBSS&LUP, Bengaluru

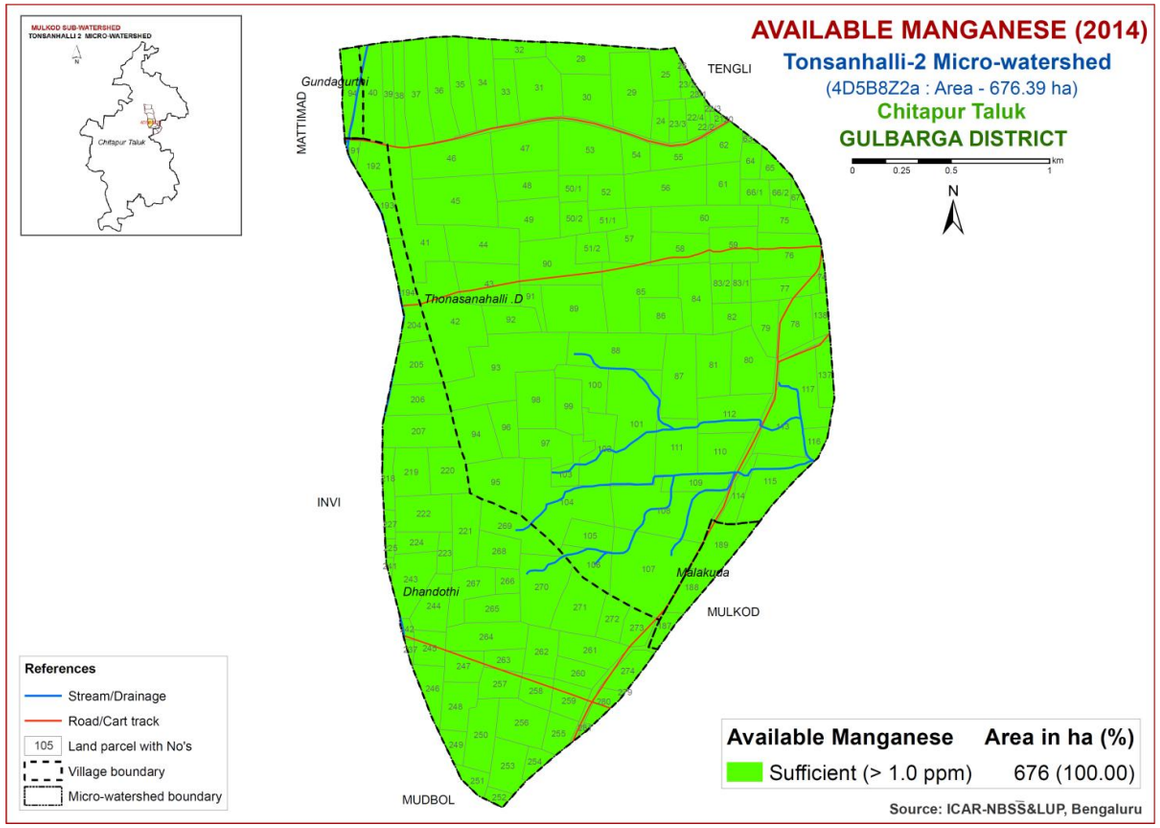
References

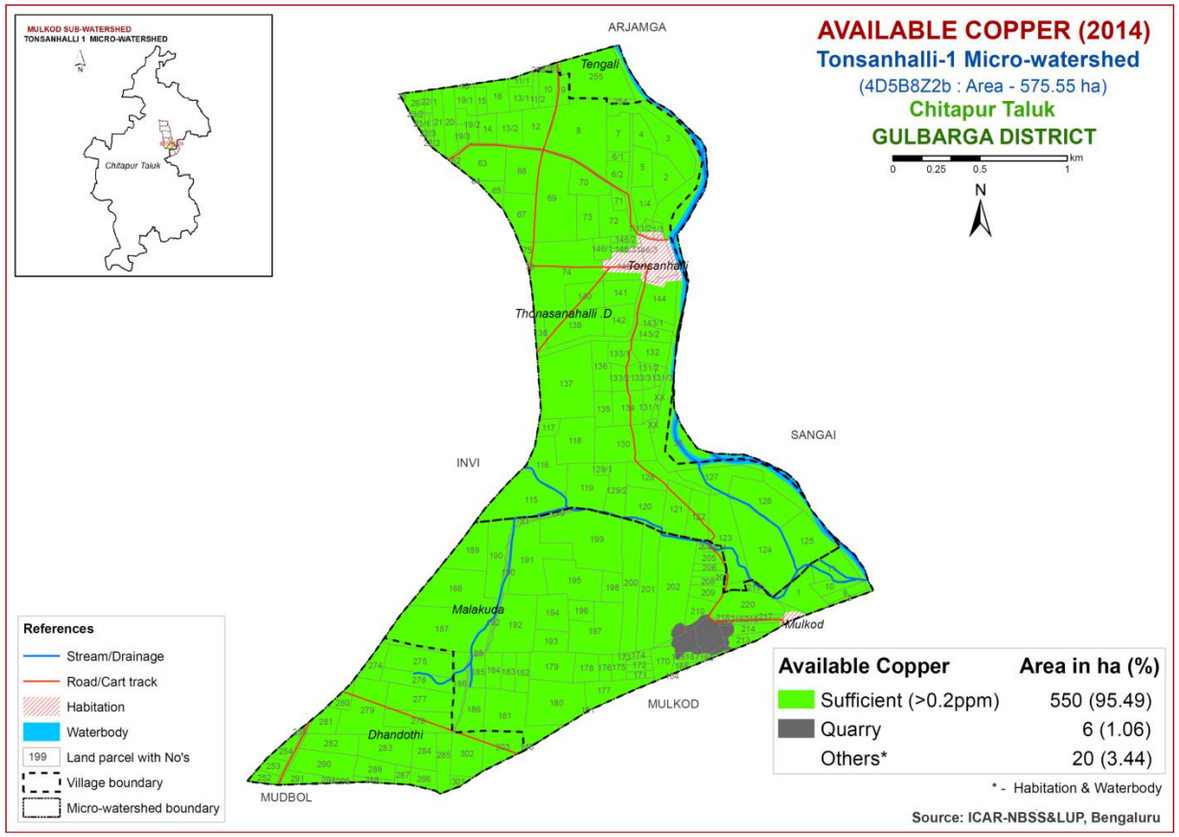
- Stream/Drainage
- Road/Cart track
- 105 Land parcel with No's
- Village boundary
- Micro-watershed boundary

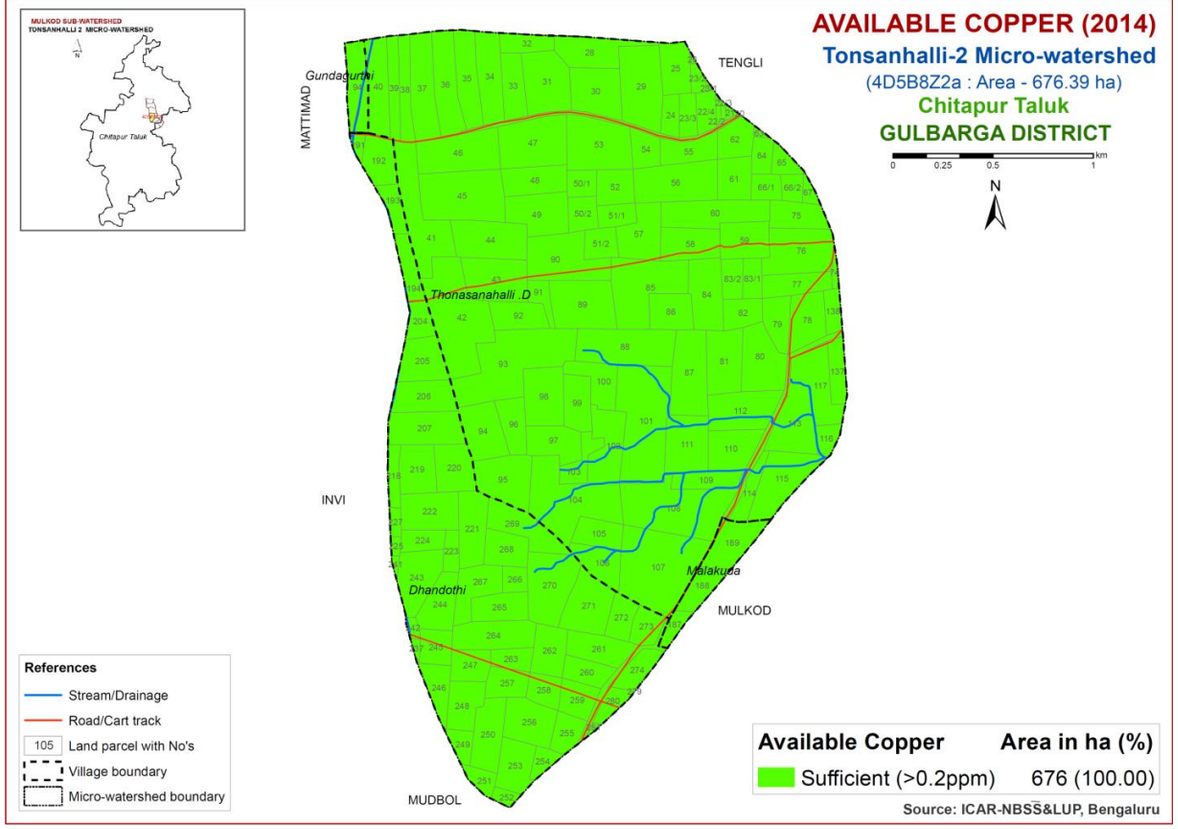

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
Malakuda
Mulkod
MULKOD
Dhandothi
MUDBOL
AVAILABLE IRON (2014)
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Available Iron | Area in ha (%)
Deficient (< 4.5 ppm) | 6 (1.10)
Sufficient (> 4.5 ppm) | 543 (94.39)
Quarry | 6 (1.06)
Others* | 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru

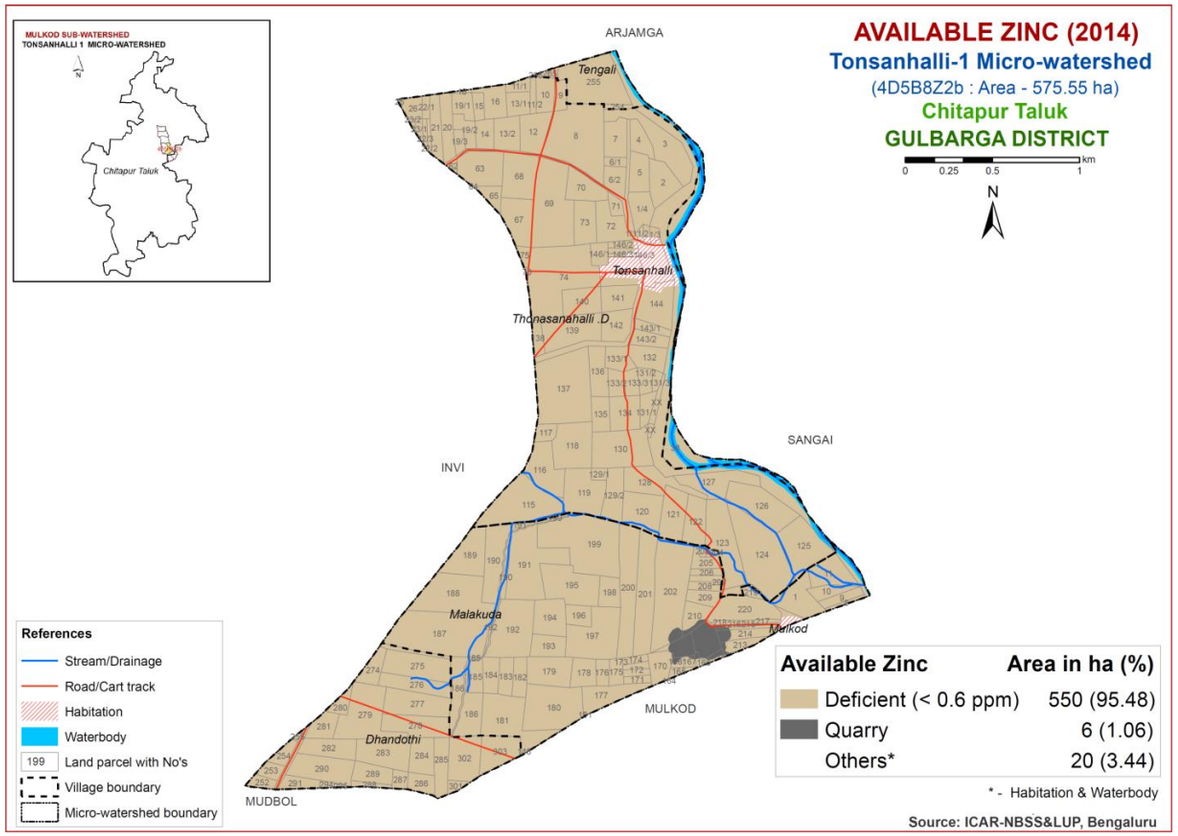

MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
TENGLI
MATTIMAD
Gundagurthi
Thonasanahalli .D
INVI
Malakuda
Dhandothi
MULKOD
MUDBOL
AVAILABLE IRON (2014)
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Available Iron | Area in ha (%)
Deficient (< 4.5 ppm) | 224 (33.06)
Sufficient (> 4.5 ppm) | 453 (66.94)
Source: ICAR-NBSS&LUP, Bengaluru

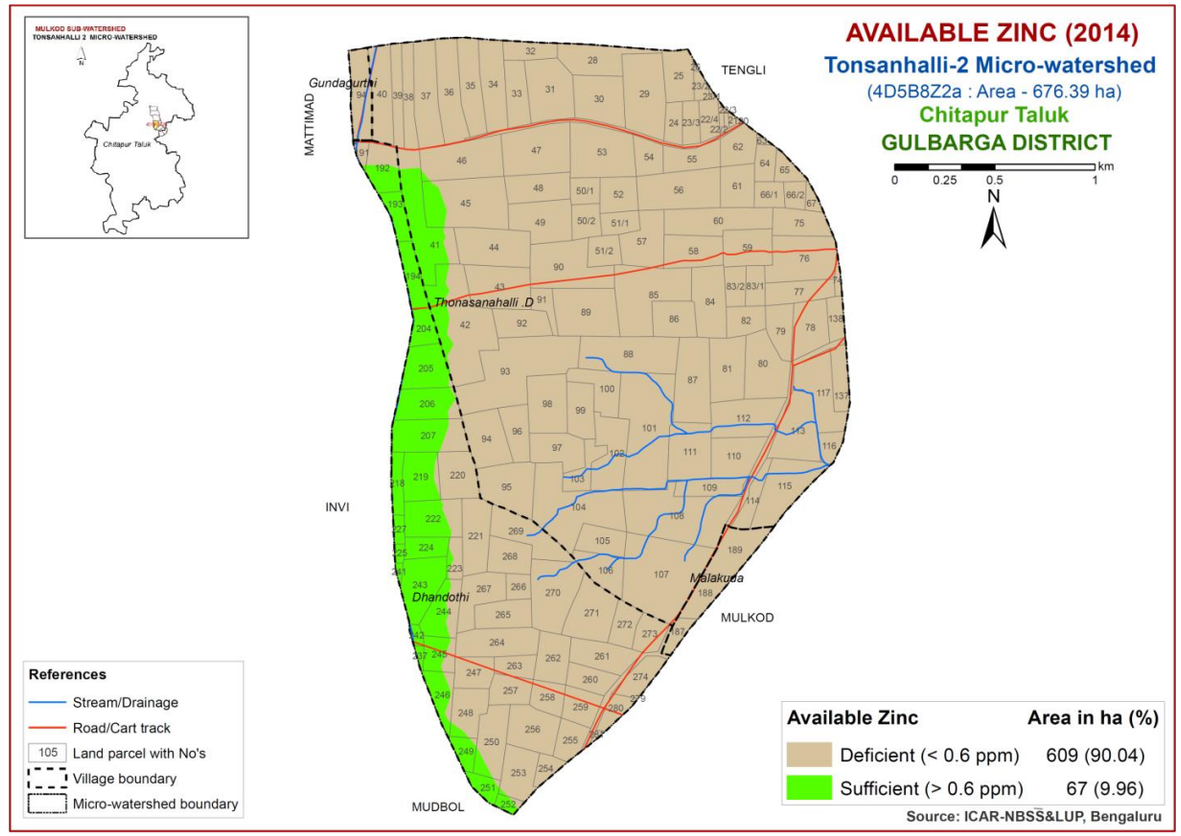

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
Malakuda
Mulkod
MULKOD
Dhandothi
MUDBOL
AVAILABLE MANGANESE (2014)
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Available Manganese | Area in ha (%)
Sufficient (> 1.0 ppm) | 550 (95.49)
Quarry | 6 (1.06)
Others* | 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru

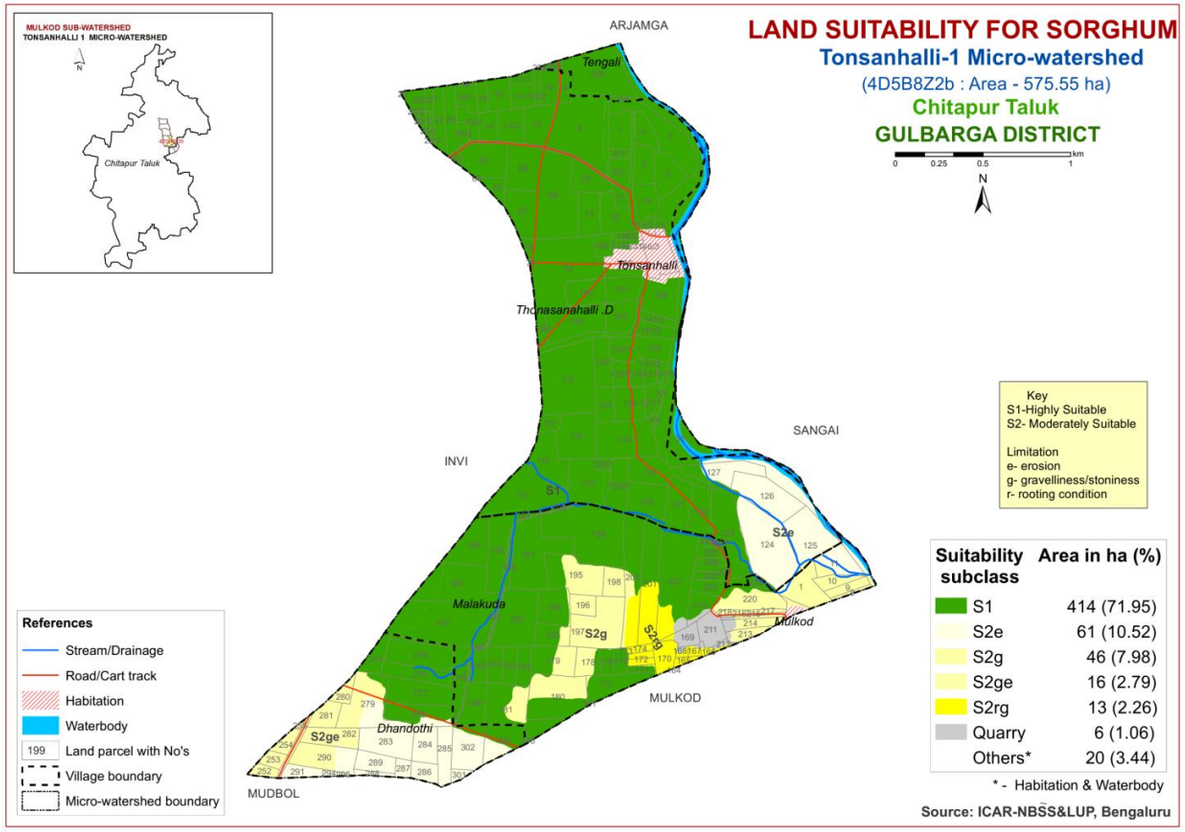

MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
TENGLI
MATTIMAD
Gundagurthi
Thonasanahalli .D
INVI
Malakuda
Dhandothi
MULKOD
MUDBOL
AVAILABLE MANGANESE (2014)
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Available Manganese | Area in ha (%)
Sufficient (> 1.0 ppm) | 676 (100.00)
Source: ICAR-NBSS&LUP, Bengaluru

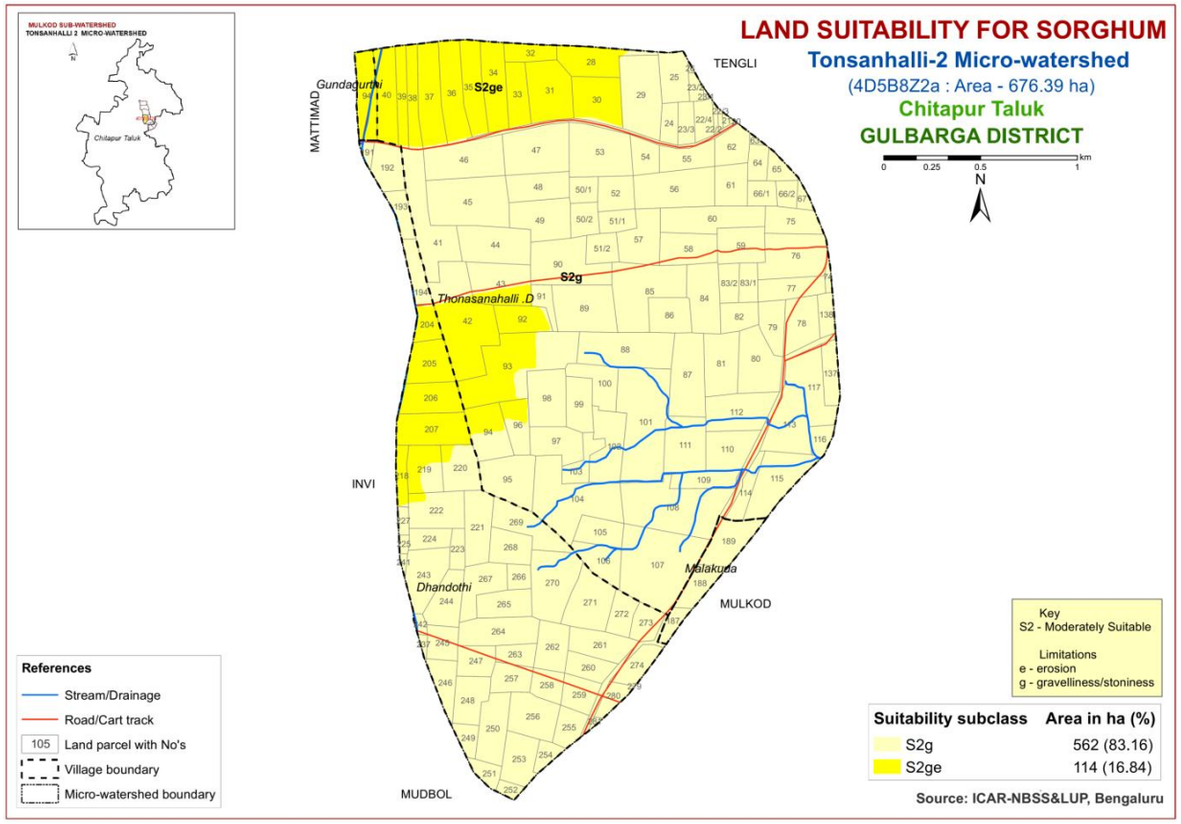

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
AVAILABLE COPPER (2014)
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
Malakuda
Mulkod
MULKOD
Dhandothi
MUDBOL
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Available Copper Area in ha (%)
Sufficient (>0.2ppm) 550 (95.49)
Quarry 6 (1.06)
Others* 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru

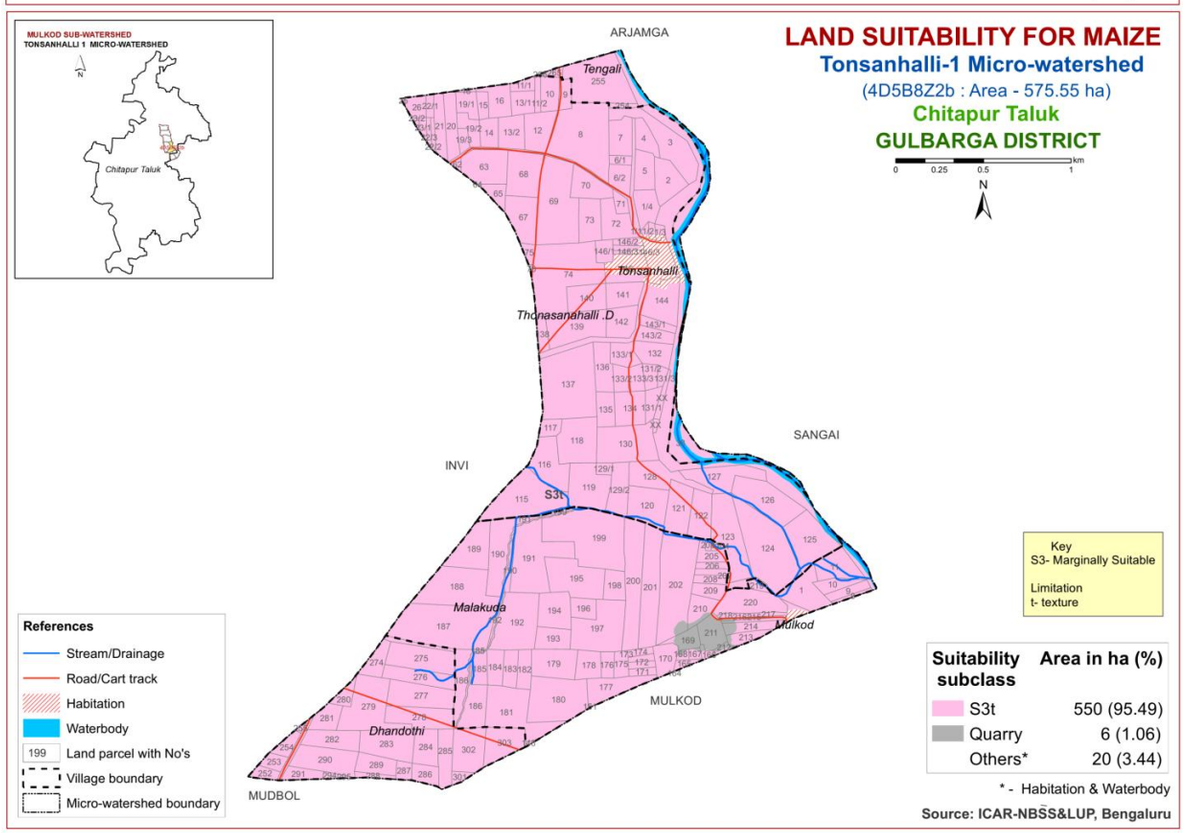

MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
AVAILABLE COPPER (2014)
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
TENGLI
Gundagurthi
MATTIMAD
Thonasanahalli .D
INVI
Malakuda
Dhandothi
MULKOD
MUDBOL
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Available Copper Area in ha (%)
Sufficient (>0.2ppm) 676 (100.00)
Source: ICAR-NBSS&LUP, Bengaluru

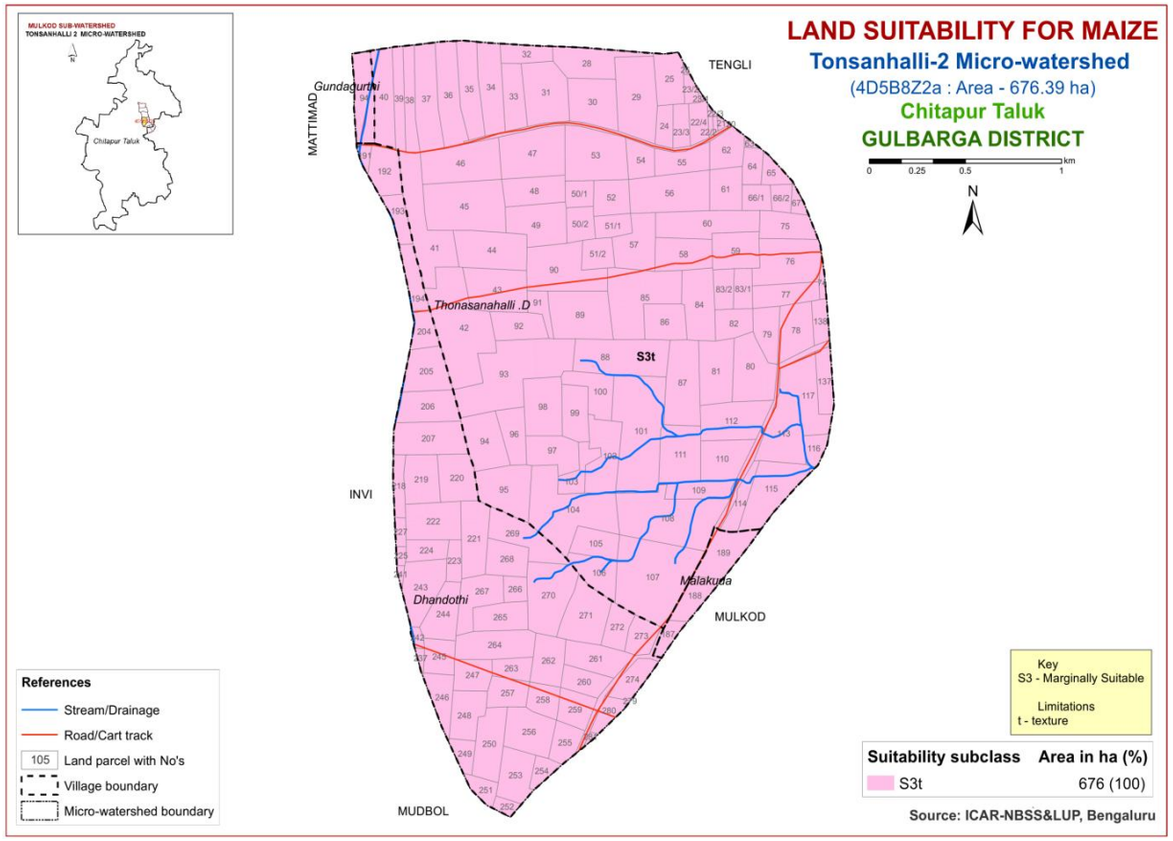

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
AVAILABLE ZINC (2014)
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
Malakuda
Mulkod
MULKOD
Dhandothi
MUDBOL
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Available Zinc Area in ha (%)
Deficient (< 0.6 ppm) 550 (95.48)
Quarry 6 (1.06)
Others* 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru

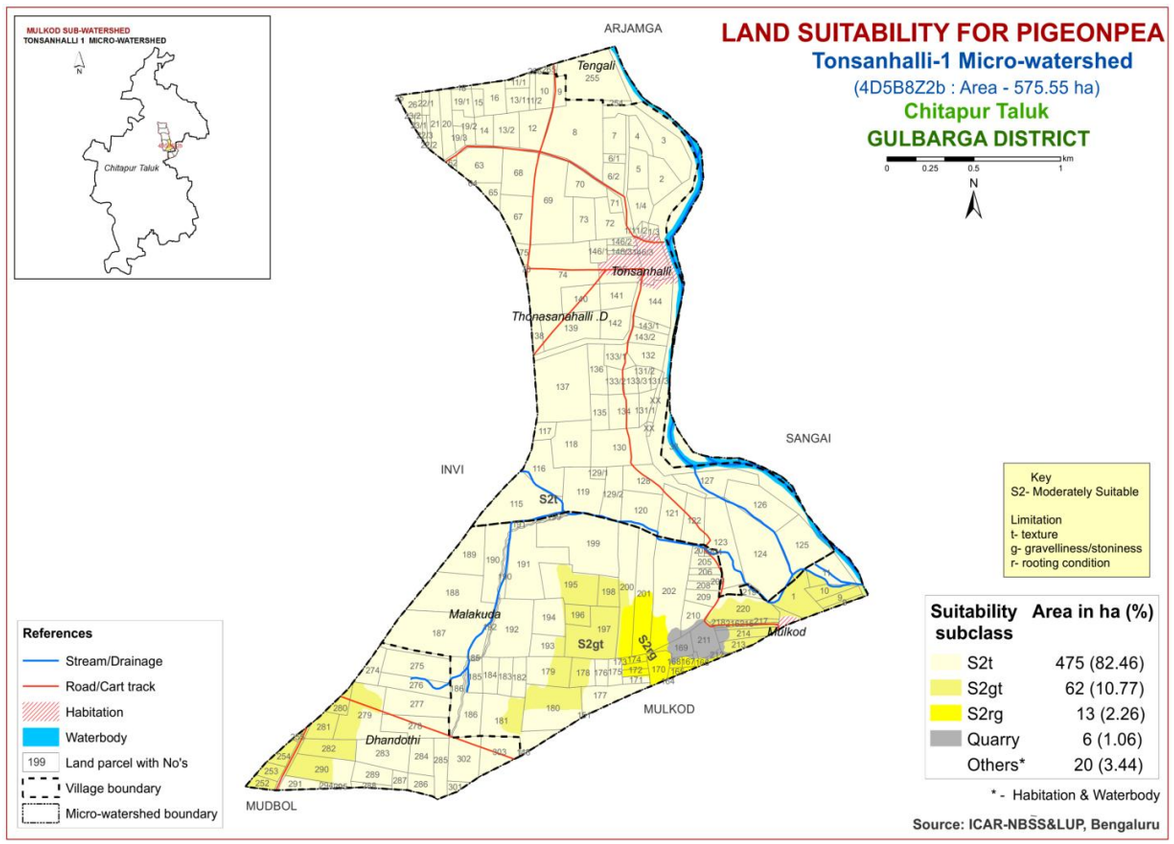

MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
AVAILABLE ZINC (2014)
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
TENGLI
Gundagurthi
MATTIMAD
Thonasanahalli .D
INVI
Malakuda
Dhandothi
MULKOD
MUDBOL
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Available Zinc Area in ha (%)
Deficient (< 0.6 ppm) 609 (90.04)
Sufficient (> 0.6 ppm) 67 (9.96)
Source: ICAR-NBSS&LUP, Bengaluru

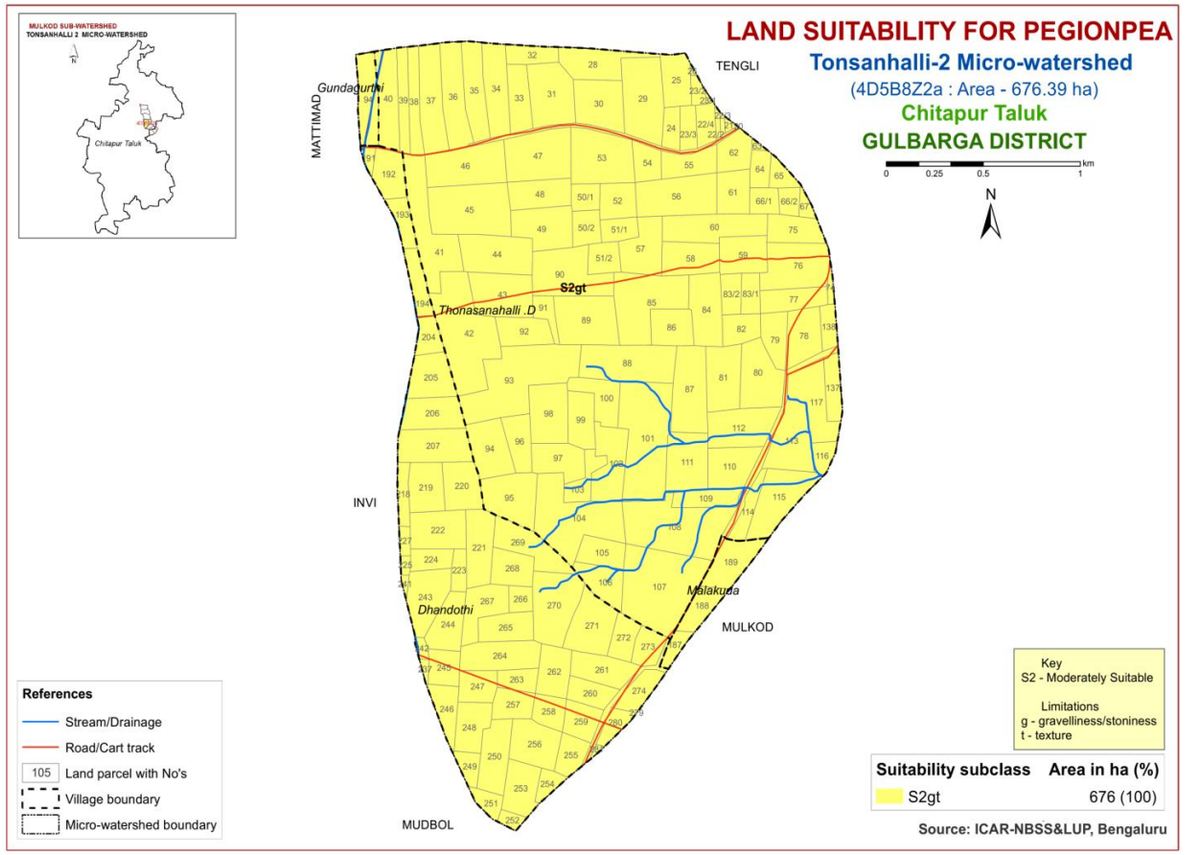

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR SORGHUM
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
MULKOD
MUDBOL
Malakuda
Dhandothi
Mulkod
S1
S2e
S2g
S2ge
Key
S1-Highly Suitable
S2- Moderately Suitable
Limitation
e- erosion
g- gravelliness/stoniness
r- rooting condition
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Suitability subclass
Area in ha (%)
S1 414 (71.95)
S2e 61 (10.52)
S2g 46 (7.98)
S2ge 16 (2.79)
S2rg 13 (2.26)
Quarry 6 (1.06)
Others* 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru

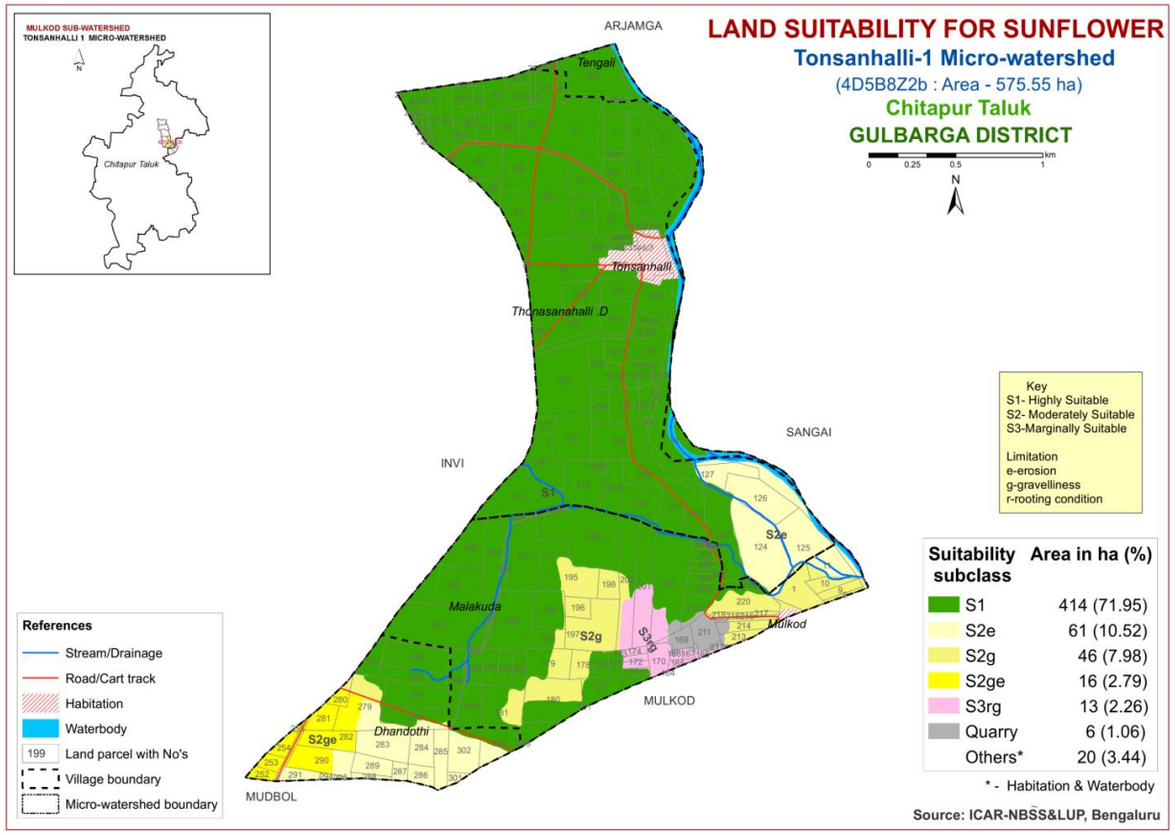

MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR SORGHUM
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
MATTIMAD
TENGLI
Gundagurthi
Thonasanahalli .D
INVI
MULKOD
MUDBOL
Malakuda
Dhandothi
S2ge
S2g
Key
S2 - Moderately Suitable
Limitations
e - erosion
g - gravelliness/stoniness
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Suitability subclass
Area in ha (%)
S2g 562 (83.16)
S2ge 114 (16.84)
Source: ICAR-NBSS&LUP, Bengaluru

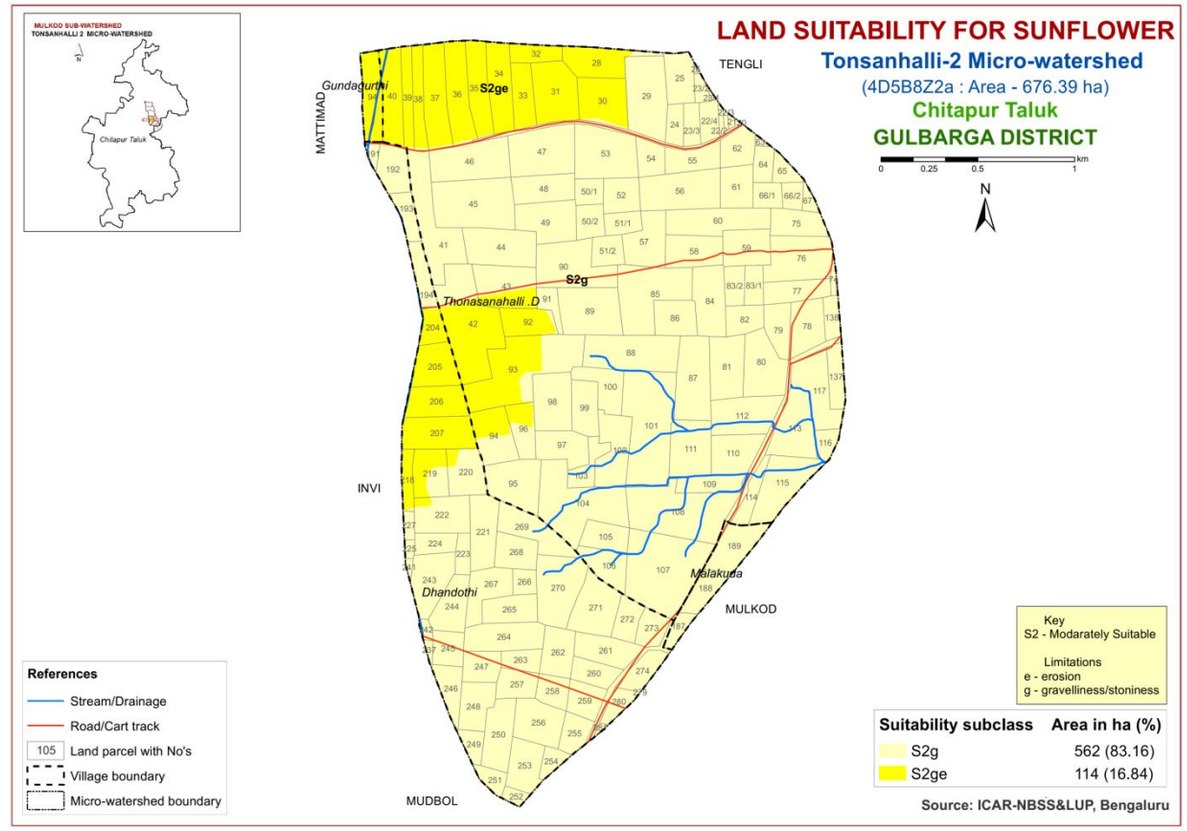

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR MAIZE
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
MULKOD
MUDBOL
Malakuda
Dhandothi
Mulkod
S3t
Key
S3- Marginally Suitable
Limitation
t- texture
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Suitability subclass
Area in ha (%)
S3t 550 (95.49)
Quarry 6 (1.06)
Others* 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru

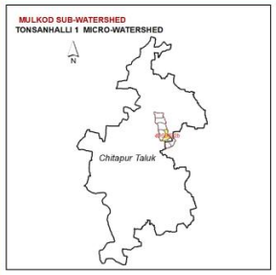

MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR MAIZE
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
MATTIMAD
TENGLI
Gundagurthi
Thonasanahalli .D
INVI
MULKOD
MUDBOL
Malakuda
Dhandothi
S3t
Key
S3 - Marginally Suitable
Limitations
t - texture
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Suitability subclass
Area in ha (%)
S3t 676 (100)
Source: ICAR-NBSS&LUP, Bengaluru

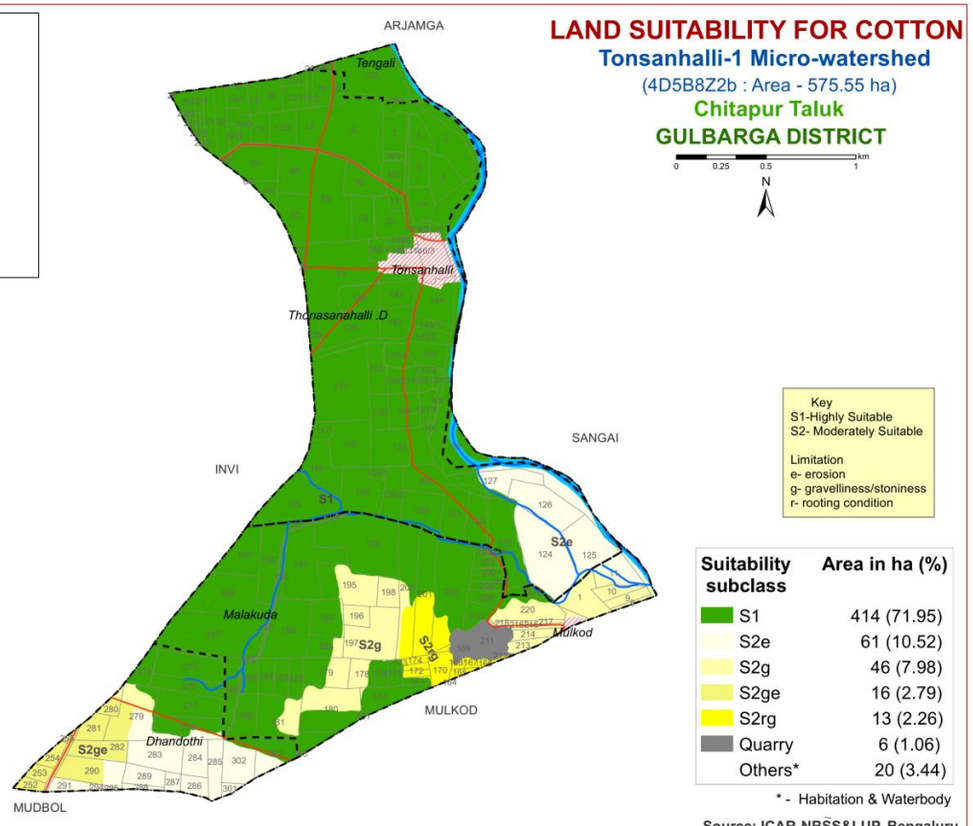

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR PIGEONPEA
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
MULKOD
MUDBOL
Malakuda
Dhandothi
Mulkod
S2t
S2gt
S2rg
Key
S2- Moderately Suitable
Limitation
t- texture
g- gravelliness/stoniness
r- rooting condition
Suitability subclass
Area in ha (%)
S2t 475 (82.46)
S2gt 62 (10.77)
S2rg 13 (2.26)
Quarry 6 (1.06)
Others* 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary


MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR PEGIONPEA
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
TENGLI
MATTIMAD
Gundagurthi
Thonasanahalli .D
INVI
MULKOD
MUDBOL
Malakuda
Dhandothi
S2gt
Key
S2 - Moderately Suitable
Limitations
g - gravelliness/stoniness
t - texture
Suitability subclass
Area in ha (%)
S2gt 676 (100)
Source: ICAR-NBSS&LUP, Bengaluru
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary


MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR SUNFLOWER
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
MULKOD
MUDBOL
Malakuda
Dhandothi
S1
S2e
S2g
S2ge
S3rg
Key
S1- Highly Suitable
S2- Moderately Suitable
S3-Marginally Suitable
Limitation
e-erosion
g-gravelliness
r-rooting condition
Suitability subclass
Area in ha (%)
S1 414 (71.95)
S2e 61 (10.52)
S2g 46 (7.98)
S2ge 16 (2.79)
S3rg 13 (2.26)
Quarry 6 (1.06)
Others* 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary


MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR SUNFLOWER
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
TENGLI
MATTIMAD
Gundagurthi
Thonasanahalli .D
INVI
MULKOD
MUDBOL
Malakuda
Dhandothi
S2ge
S2g
Key
S2 - Modarately Suitable
Limitations
e - erosion
g - gravelliness/stoniness
Suitability subclass
Area in ha (%)
S2g 562 (83.16)
S2ge 114 (16.84)
Source: ICAR-NBSS&LUP, Bengaluru
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary





LAND SUITABILITY FOR COTTON

Tonsanhalli-1 Micro-watershed

(4D5B8Z2b : Area - 575.55 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km

N

Key
S1-Highly Suitable
S2- Moderately Suitable

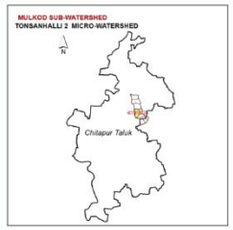
Limitation
e- erosion
g- gravelliness/stoniness
r- rooting condition

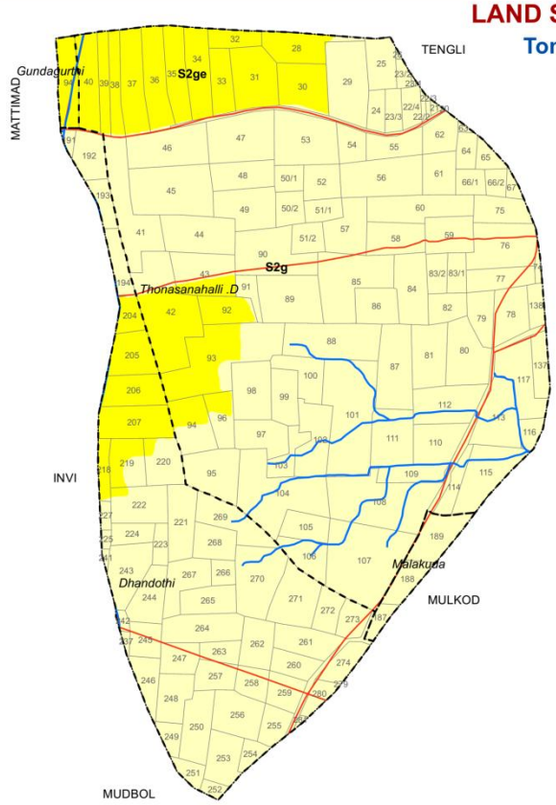
Suitability subclass	Area in ha (%)
S1	414 (71.95)
S2e	61 (10.52)
S2g	46 (7.98)
S2ge	16 (2.79)
S2rg	13 (2.26)
Quarry	6 (1.06)
Others*	20 (3.44)

* - Habitation & Waterbody

References
- Stream/Drainage
- Road/Cart track
- Habitation
- Waterbody
- 199 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru





LAND SUITABILITY FOR COTTON

Tonsanhalli-2 Micro-watershed

(4D5B8Z2a : Area - 676.39 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km

N

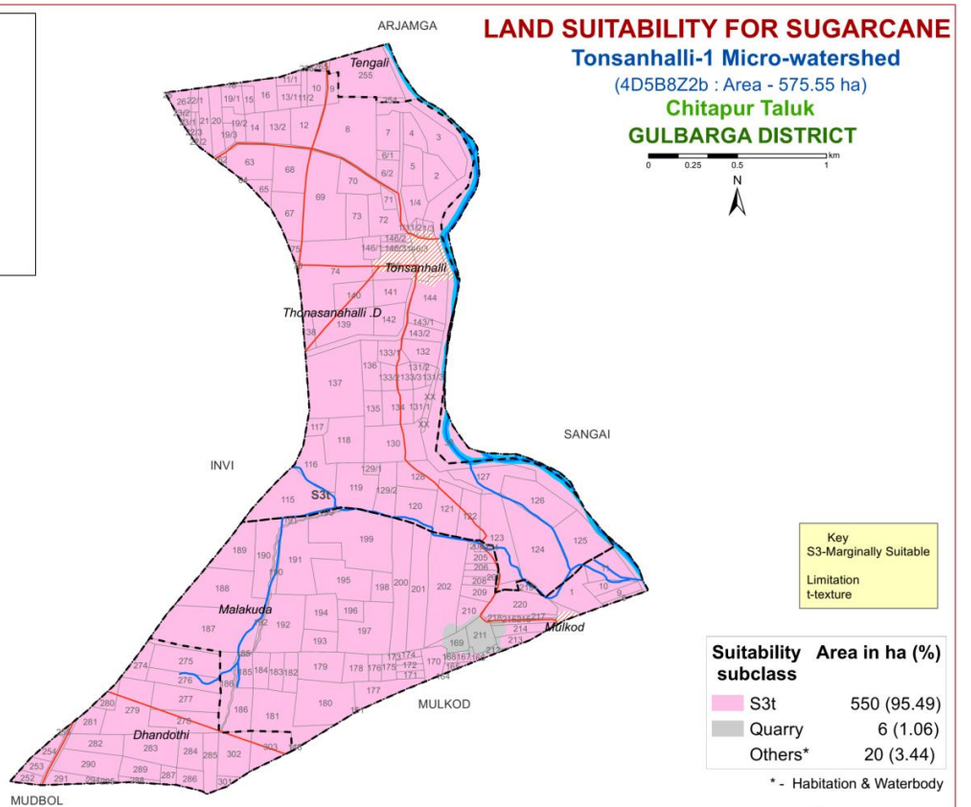
Key
S2 - Moderately Suitable

Limitations
e - erosion
g - gravelliness/stoniness

Suitability subclass	Area in ha (%)
S2g	562 (83.16)
S2ge	114 (16.84)

References
- Stream/Drainage
- Road/Cart track
- 105 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru



LAND SUITABILITY FOR SUGARCANE

Tonsanhalli-1 Micro-watershed

(4D5B8Z2b : Area - 575.55 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km

N

Key
S3-Marginally Suitable

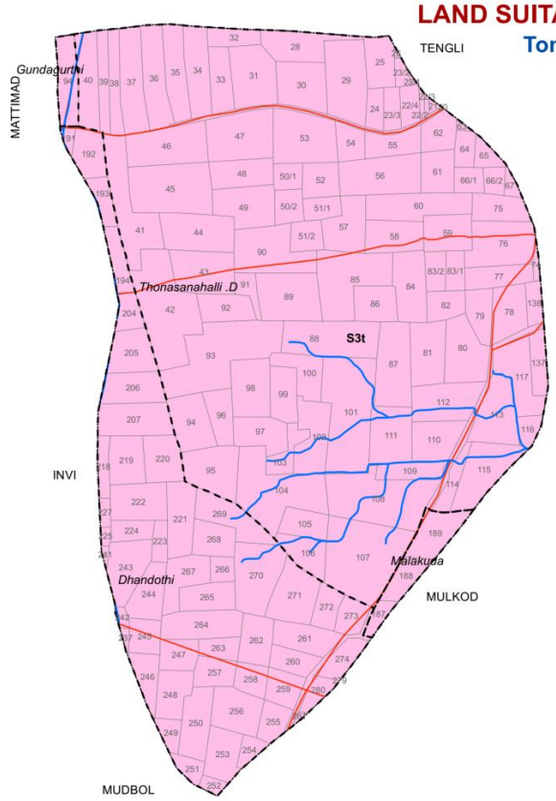
Limitation
t-texture

Suitability subclass	Area in ha (%)
S3t	550 (95.49)
Quarry	6 (1.06)
Others*	20 (3.44)

* - Habitation & Waterbody

References
- Stream/Drainage
- Road/Cart track
- Habitation
- Waterbody
- 199 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru



LAND SUITABILITY FOR SUGARCANE

Tonsanhalli-2 Micro-watershed

(4D5B8Z2a : Area - 676.39 ha)

Chitapur Taluk

GULBARGA DISTRICT

0 0.25 0.5 1 km

N

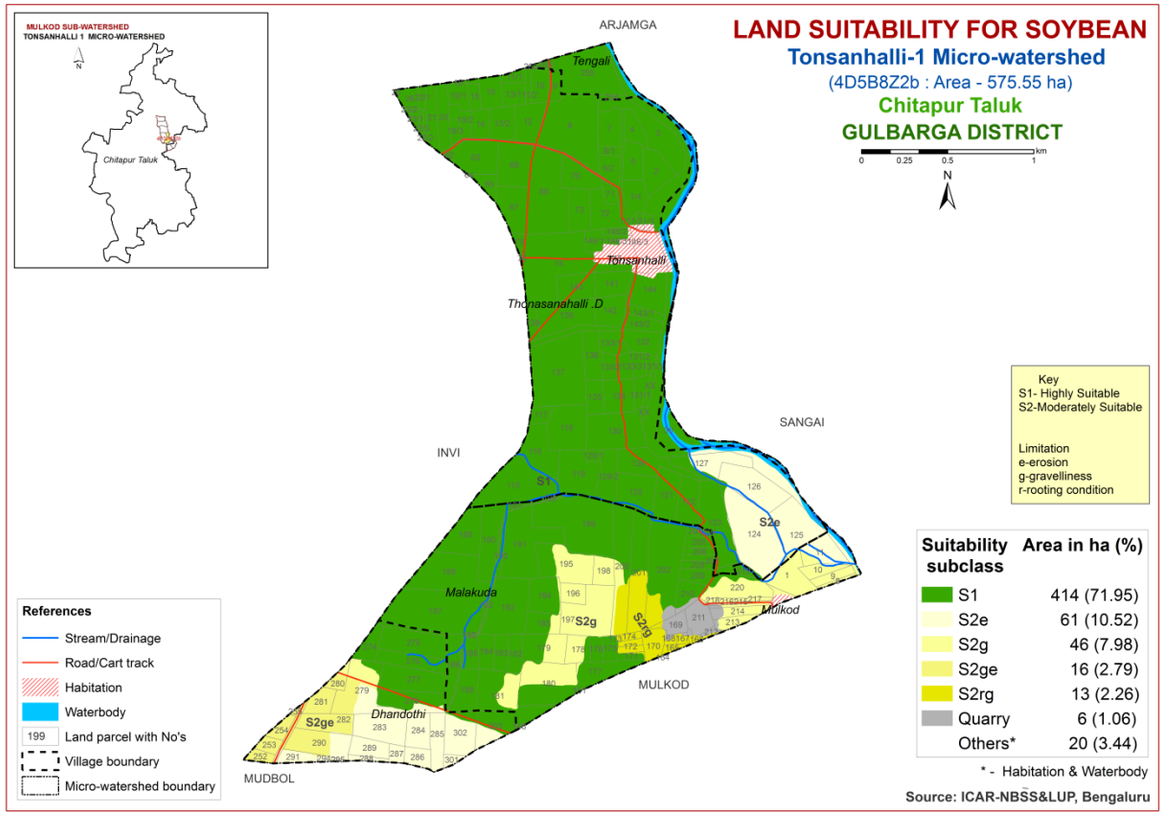
Key
S3 - Marginally Suitable

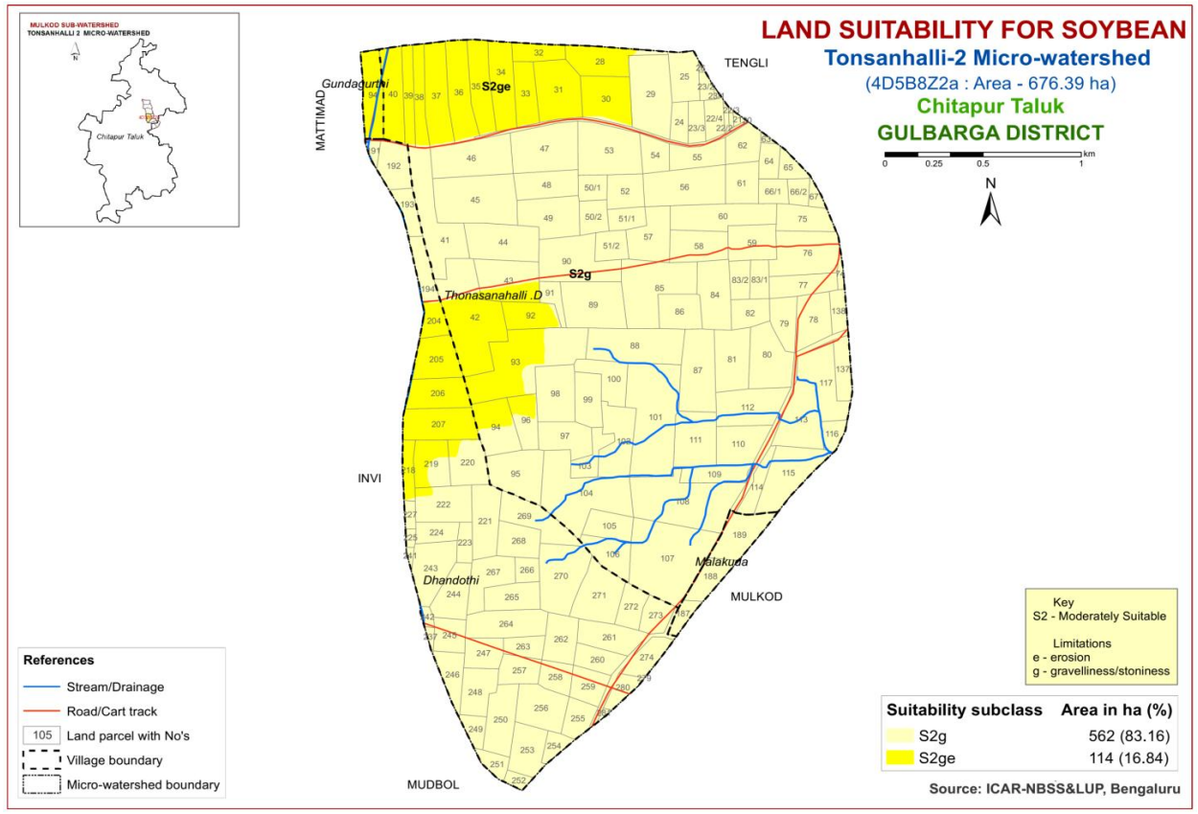
Limitations
t - texture

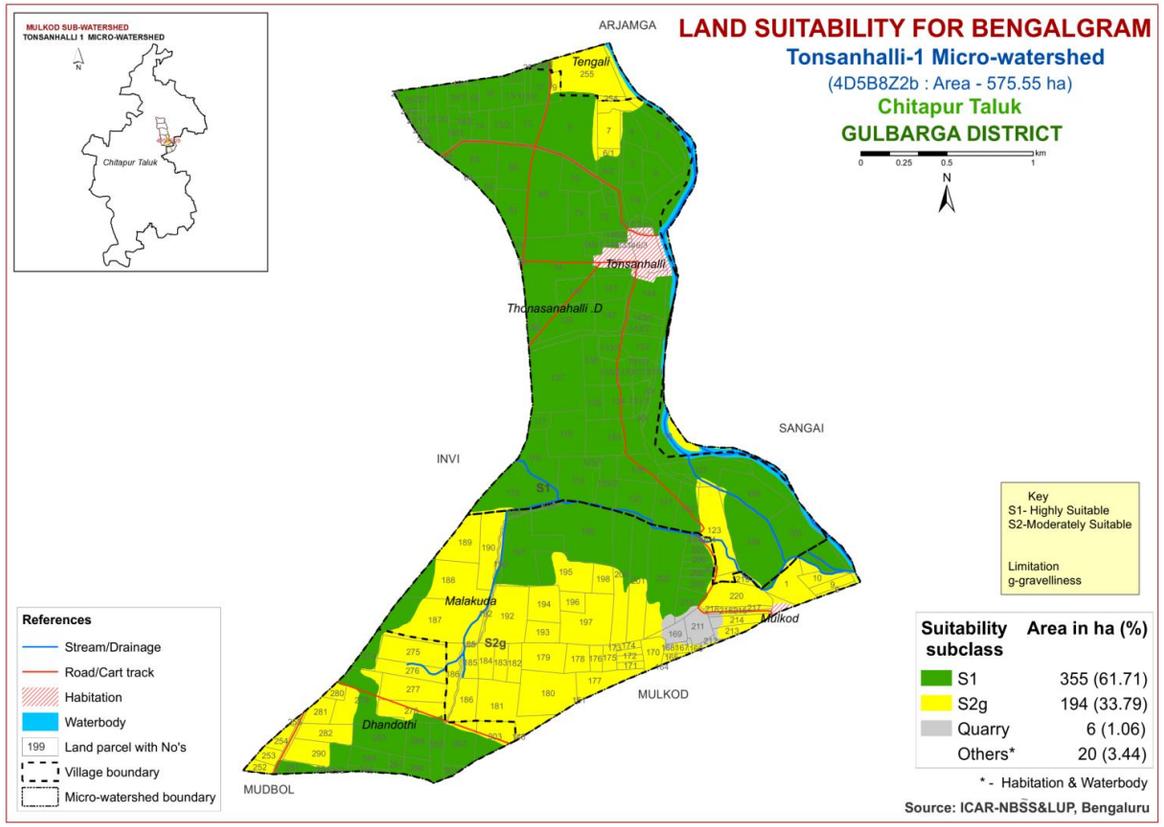
Suitability subclass	Area in ha (%)
S3t	676 (100)

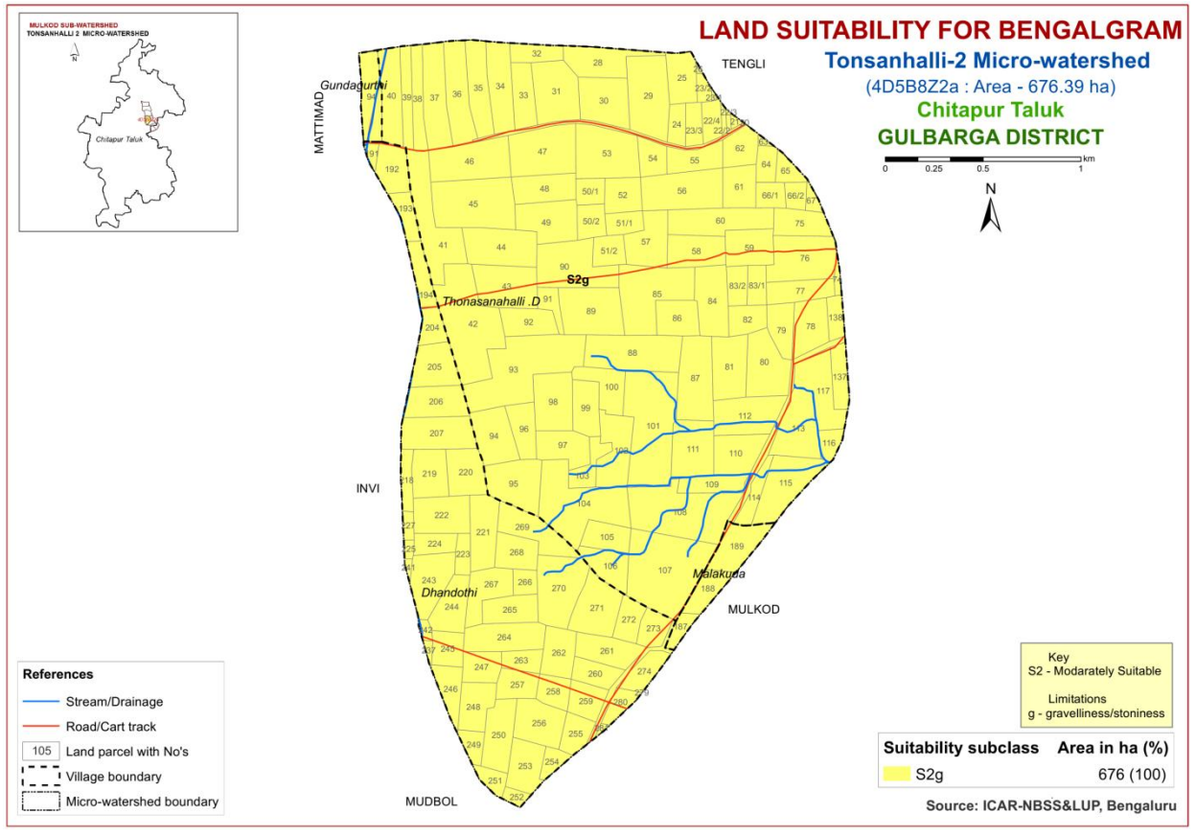
References
- Stream/Drainage
- Road/Cart track
- 105 Land parcel with No's
- Village boundary
- Micro-watershed boundary

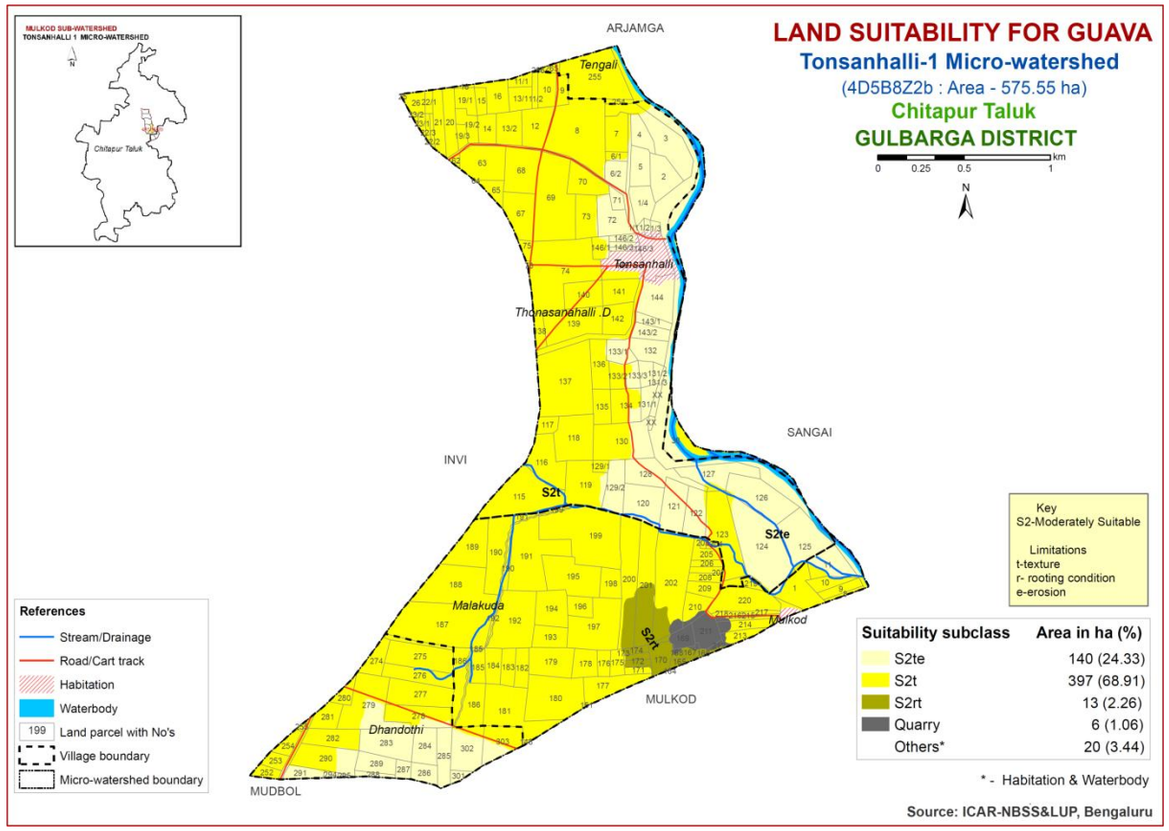
Source: ICAR-NBSS&LUP, Bengaluru

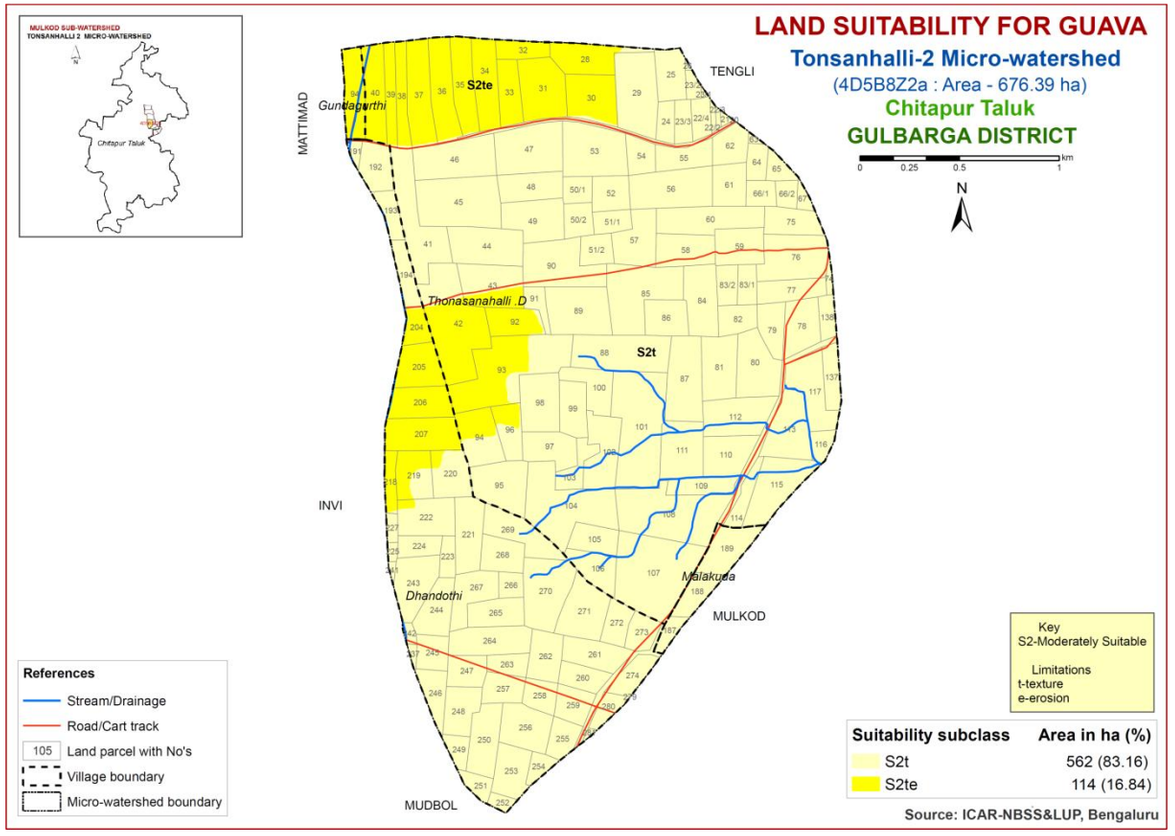

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR SOYBEAN
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
MULKOD
MUDBOL
Malakuda
Dhandothi
S1
S2e
S2g
S2ge
Key
S1- Highly Suitable
S2-Moderately Suitable
Limitation
e-erosion
g-gravelliness
r-rooting condition
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Suitability subclass
Area in ha (%)
S1 414 (71.95)
S2e 61 (10.52)
S2g 46 (7.98)
S2ge 16 (2.79)
S2rg 13 (2.26)
Quarry 6 (1.06)
Others* 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru

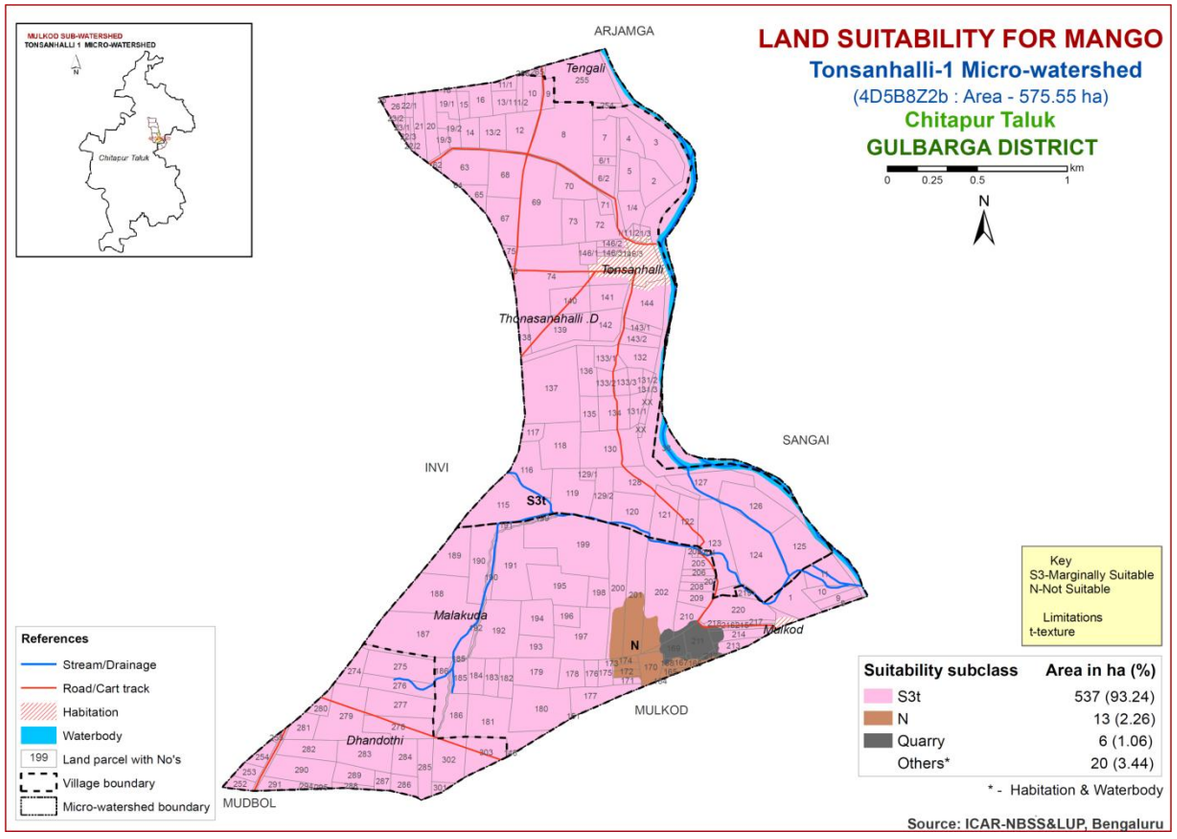

MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR SOYBEAN
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
TENGLI
MATTIMAD
Gundagurthi
Thonasanahalli .D
INVI
MULKOD
MUDBOL
Malakuda
Dhandothi
S2g
S2ge
Key
S2 - Moderately Suitable
Limitations
e - erosion
g - gravelliness/stoniness
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Suitability subclass
Area in ha (%)
S2g 562 (83.16)
S2ge 114 (16.84)
Source: ICAR-NBSS&LUP, Bengaluru

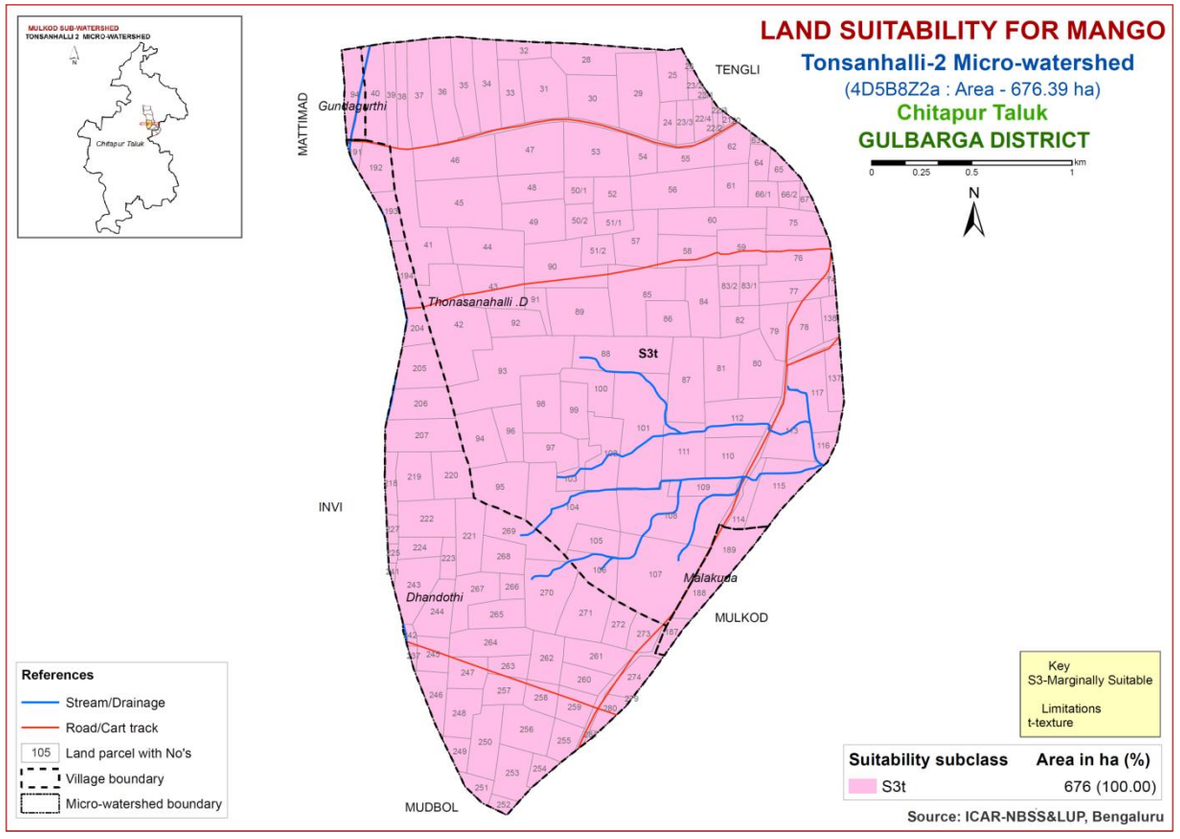

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR BENGALGRAM
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
MULKOD
MUDBOL
Malakuda
Dhandothi
S1
S2g
Key
S1- Highly Suitable
S2-Moderately Suitable
Limitation
g-gravelliness
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Suitability subclass
Area in ha (%)
S1 355 (61.71)
S2g 194 (33.79)
Quarry 6 (1.06)
Others* 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru

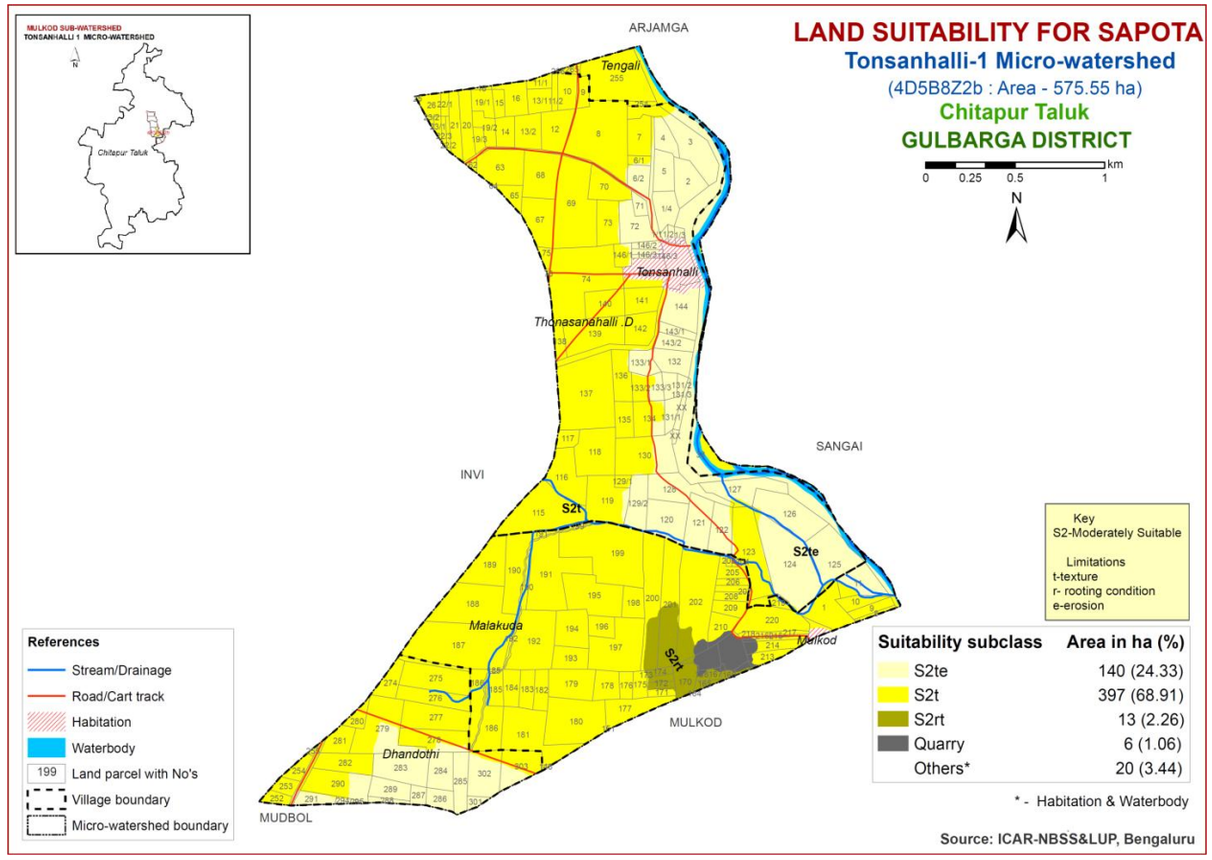

MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR BENGALGRAM
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
TENGLI
MATTIMAD
Gundagurthi
Thonasanahalli .D
INVI
MULKOD
MUDBOL
Malakuda
Dhandothi
S2g
Key
S2 - Modarately Suitable
Limitations
g - gravelliness/stoniness
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Suitability subclass
Area in ha (%)
S2g 676 (100)
Source: ICAR-NBSS&LUP, Bengaluru

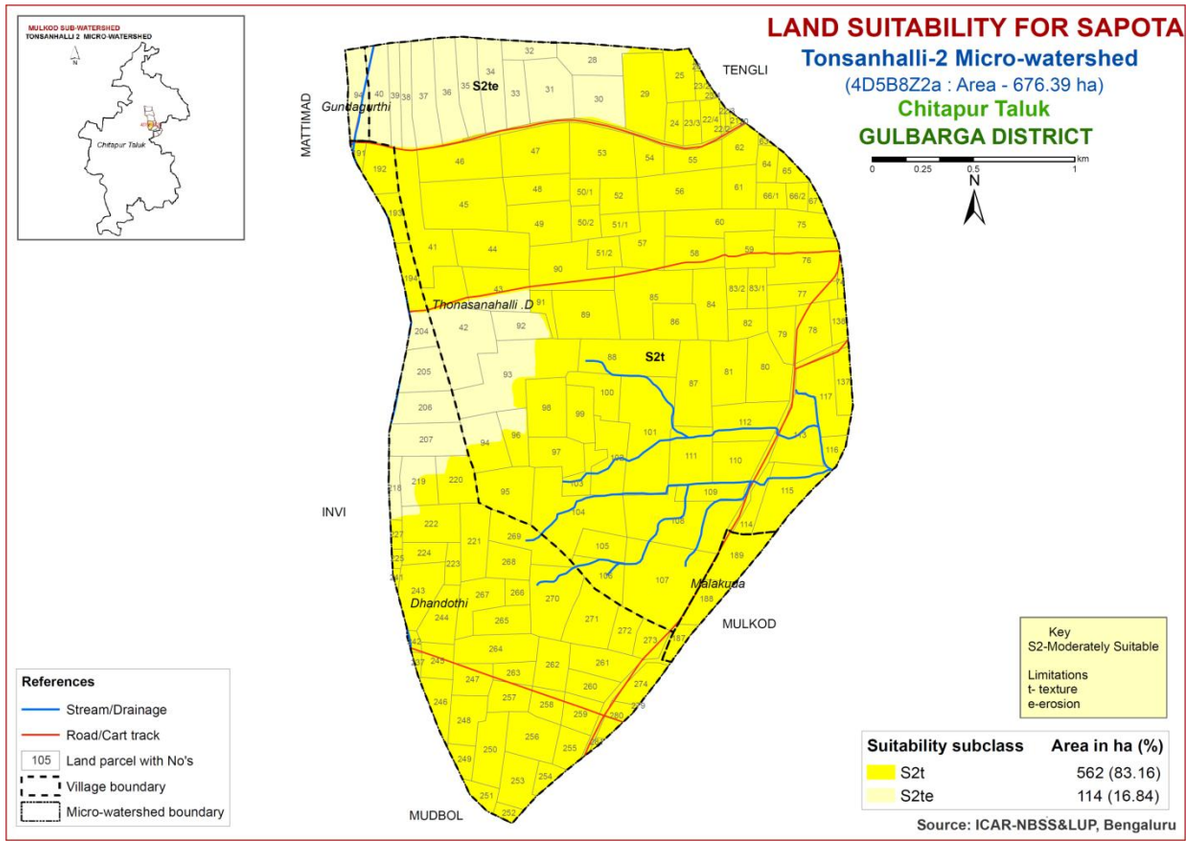

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR GUAVA
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
MULKOD
MUDBOL
Malakuda
Dhandothi
S2t
S2te
Key
S2-Moderately Suitable
Limitations
t-texture
r- rooting condition
e-erosion
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Suitability subclass | Area in ha (%)
S2te | 140 (24.33)
S2t | 397 (68.91)
S2rt | 13 (2.26)
Quarry | 6 (1.06)
Others* | 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru

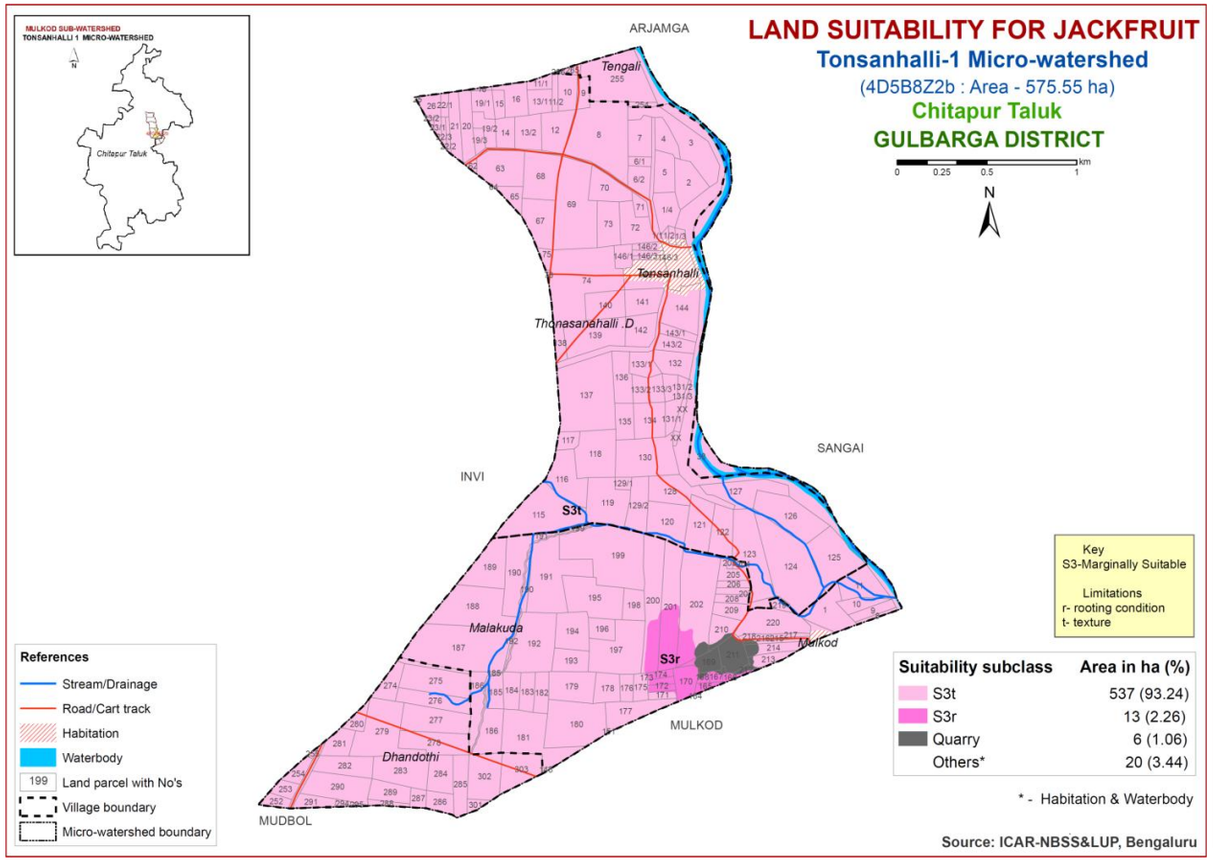

MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR GUAVA
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
TENGLI
MATTIMAD
Gundagurthi
Thonasanahalli .D
INVI
MULKOD
MUDBOL
Malakuda
Dhandothi
S2t
S2te
Key
S2-Moderately Suitable
Limitations
t-texture
e-erosion
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Suitability subclass | Area in ha (%)
S2t | 562 (83.16)
S2te | 114 (16.84)
Source: ICAR-NBSS&LUP, Bengaluru

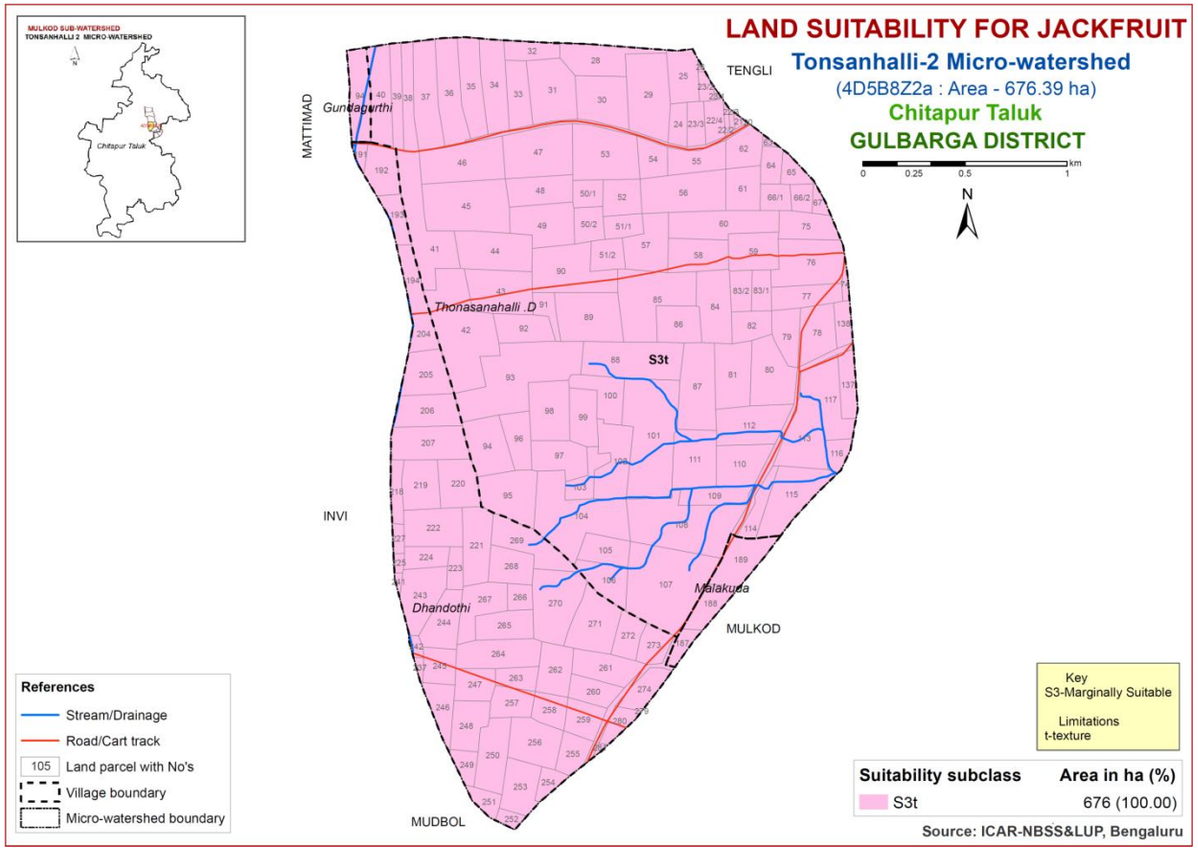

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR MANGO
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
MULKOD
MUDBOL
Malakuda
Dhandothi
S3t
N
Key
S3-Marginally Suitable
N-Not Suitable
Limitations
t-texture
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Suitability subclass | Area in ha (%)
S3t | 537 (93.24)
N | 13 (2.26)
Quarry | 6 (1.06)
Others* | 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru

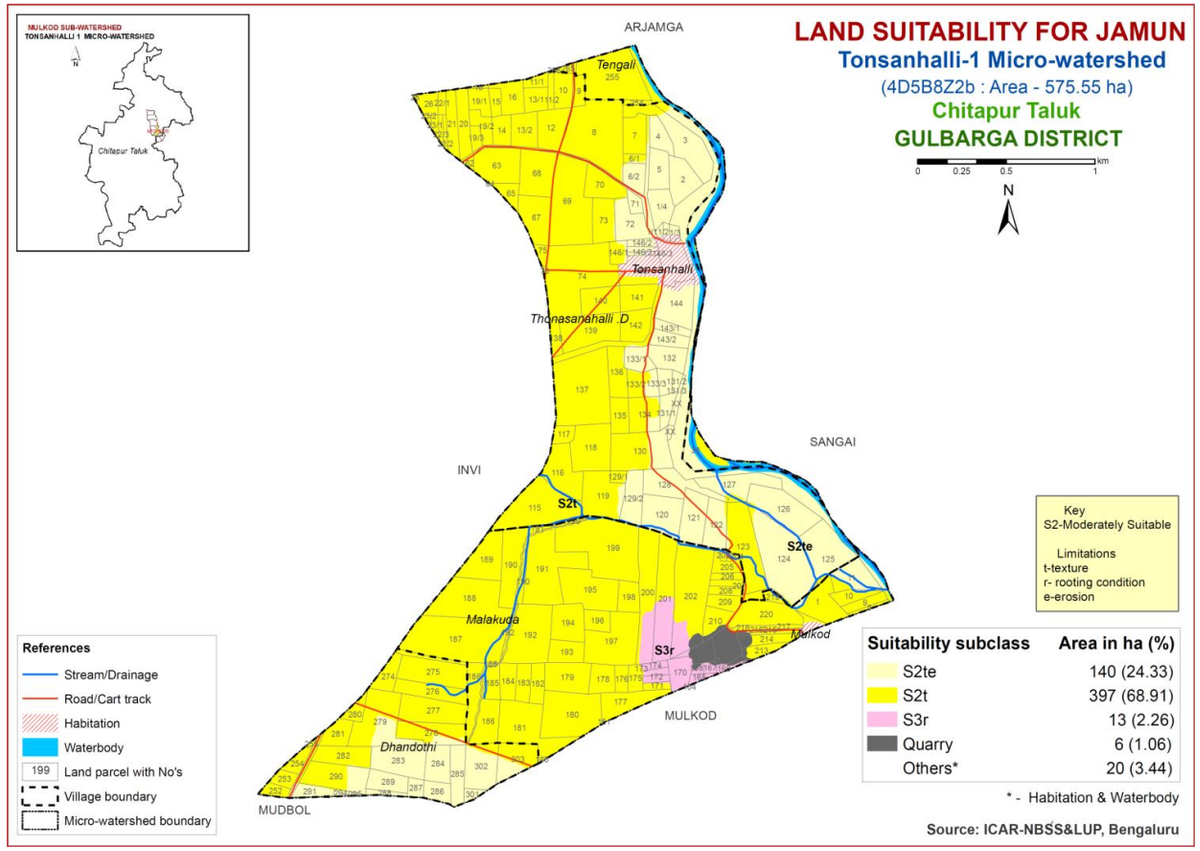

MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR MANGO
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
TENGLI
MATTIMAD
Gundagurthi
Thonasanahalli .D
INVI
MULKOD
MUDBOL
Malakuda
Dhandothi
S3t
Key
S3-Marginally Suitable
Limitations
t-texture
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Suitability subclass | Area in ha (%)
S3t | 676 (100.00)
Source: ICAR-NBSS&LUP, Bengaluru

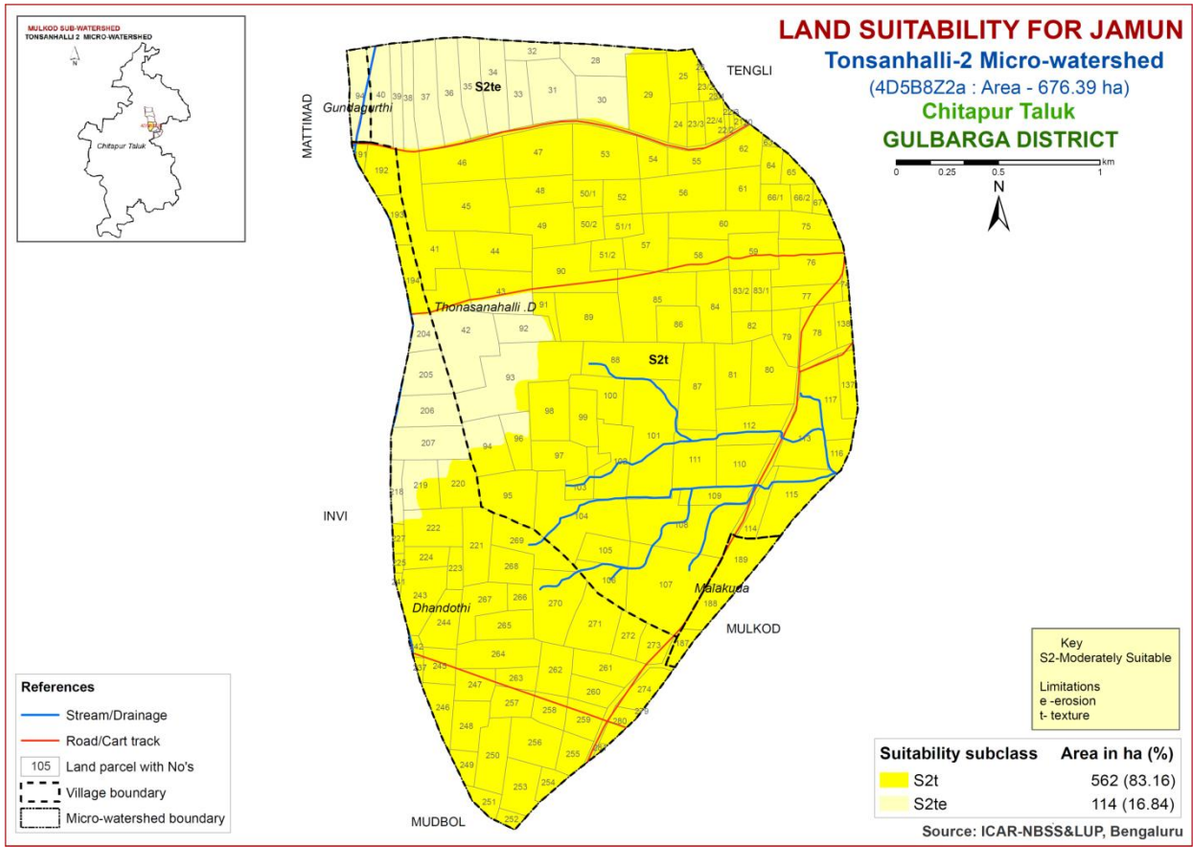

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
S2t
S2te
S2rt
Malakuda
Dhandothi
Mulkod
MULKOD
MUDBOL
LAND SUITABILITY FOR SAPOTA
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
Key
S2-Moderately Suitable
Limitations
t-texture
r- rooting condition
e-erosion
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Suitability subclass | Area in ha (%)
S2te | 140 (24.33)
S2t | 397 (68.91)
S2rt | 13 (2.26)
Quarry | 6 (1.06)
Others* | 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru

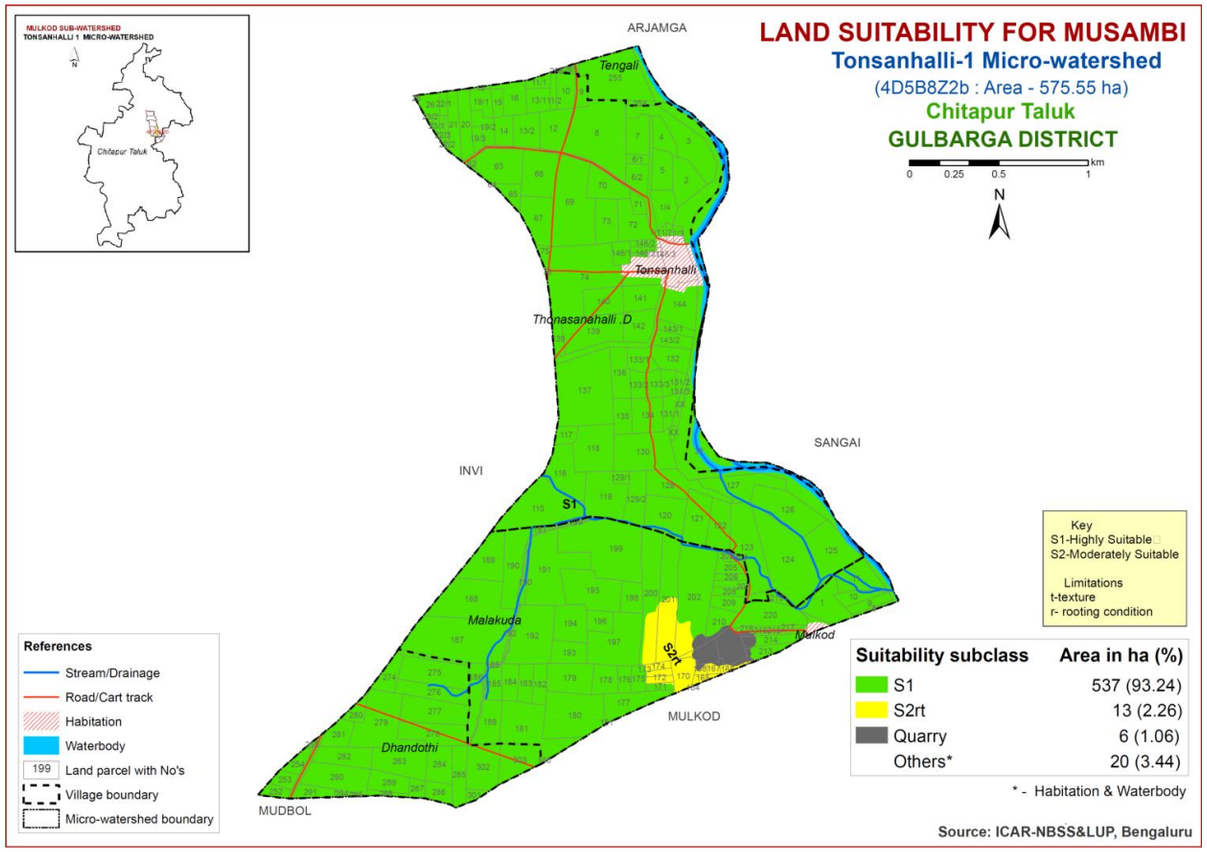

MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
TENGLI
MATTIMAD
Gundagurthi
Thonasanahalli .D
INVI
S2t
S2te
Malakuda
Dhandothi
MULKOD
MUDBOL
LAND SUITABILITY FOR SAPOTA
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
Key
S2-Moderately Suitable
Limitations
t- texture
e-erosion
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Suitability subclass | Area in ha (%)
S2t | 562 (83.16)
S2te | 114 (16.84)
Source: ICAR-NBSS&LUP, Bengaluru

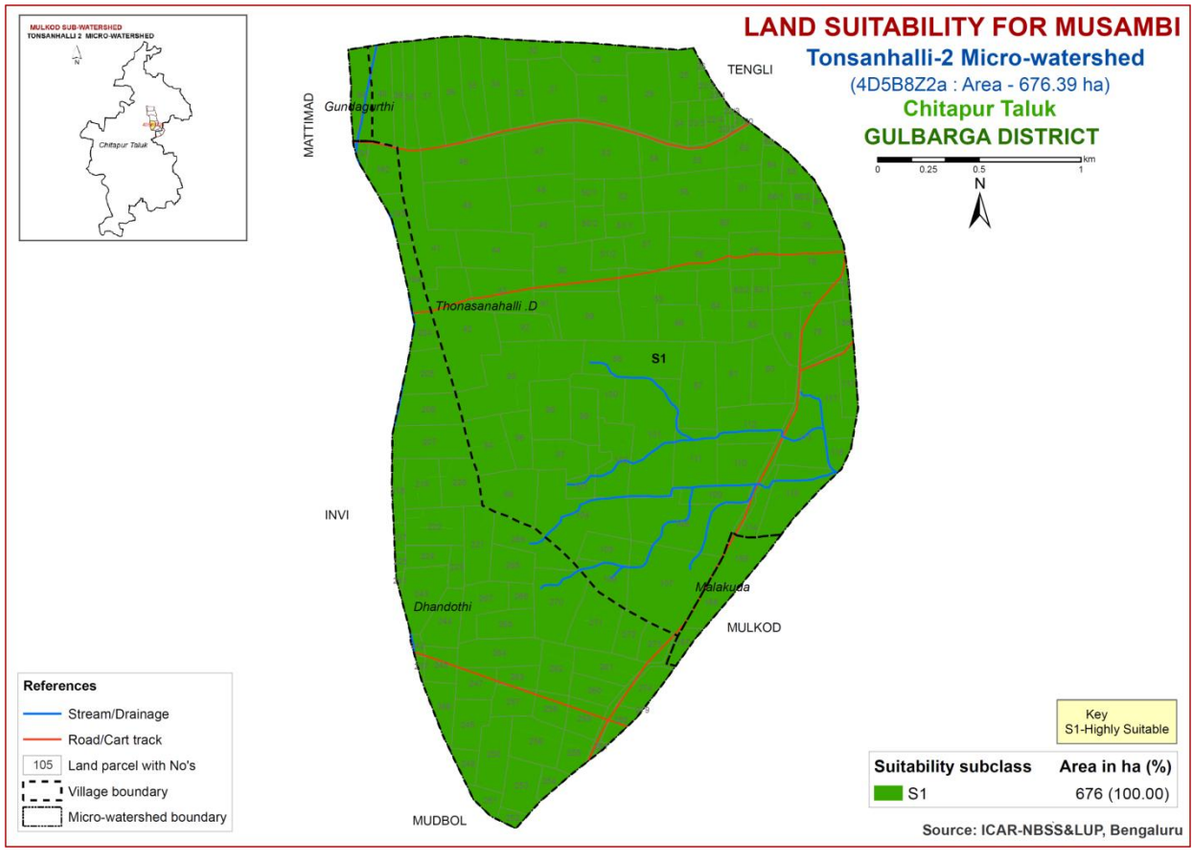

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
S3t
S3r
Malakuda
Dhandothi
Mulkod
MULKOD
MUDBOL
LAND SUITABILITY FOR JACKFRUIT
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
Key
S3-Marginally Suitable
Limitations
r- rooting condition
t- texture
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Suitability subclass | Area in ha (%)
S3t | 537 (93.24)
S3r | 13 (2.26)
Quarry | 6 (1.06)
Others* | 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru

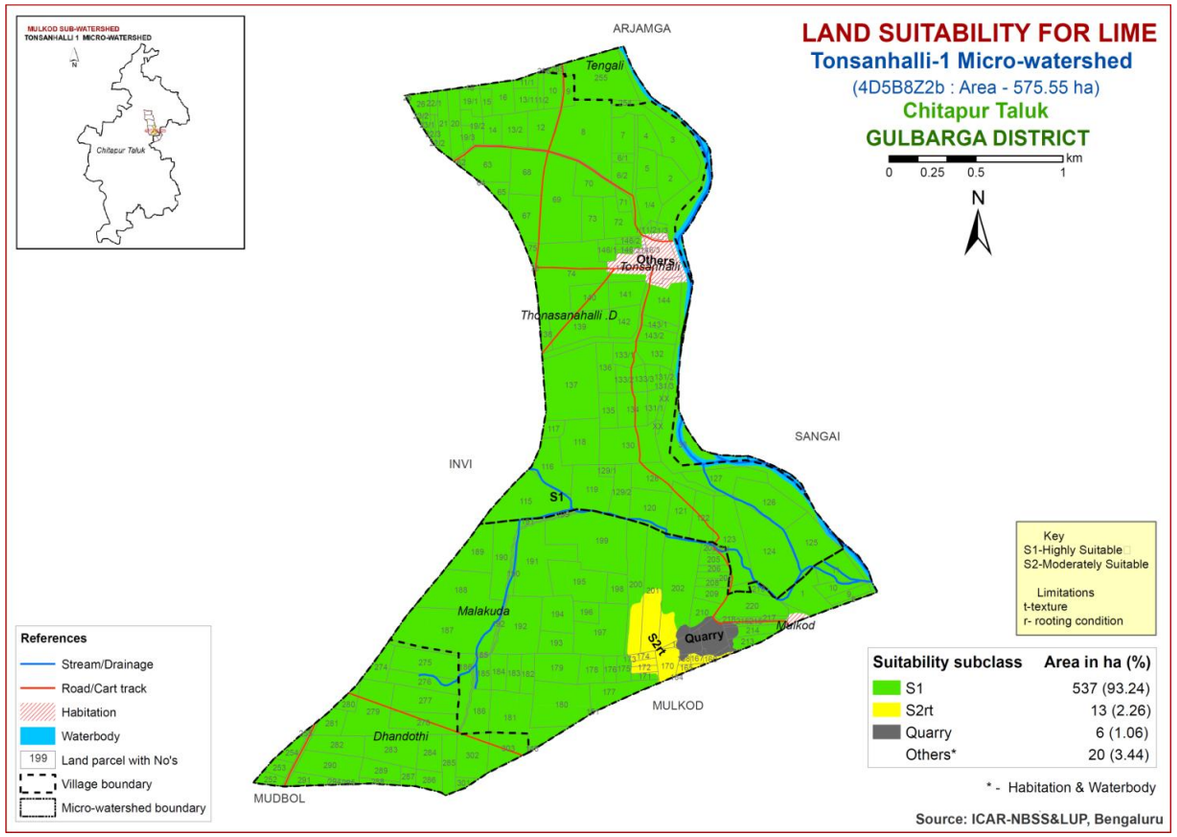

MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
TENGLI
MATTIMAD
Gundagurthi
Thonasanahalli .D
INVI
S3t
Malakuda
Dhandothi
MULKOD
MUDBOL
LAND SUITABILITY FOR JACKFRUIT
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
Key
S3-Marginally Suitable
Limitations
t-texture
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Suitability subclass | Area in ha (%)
S3t | 676 (100.00)
Source: ICAR-NBSS&LUP, Bengaluru

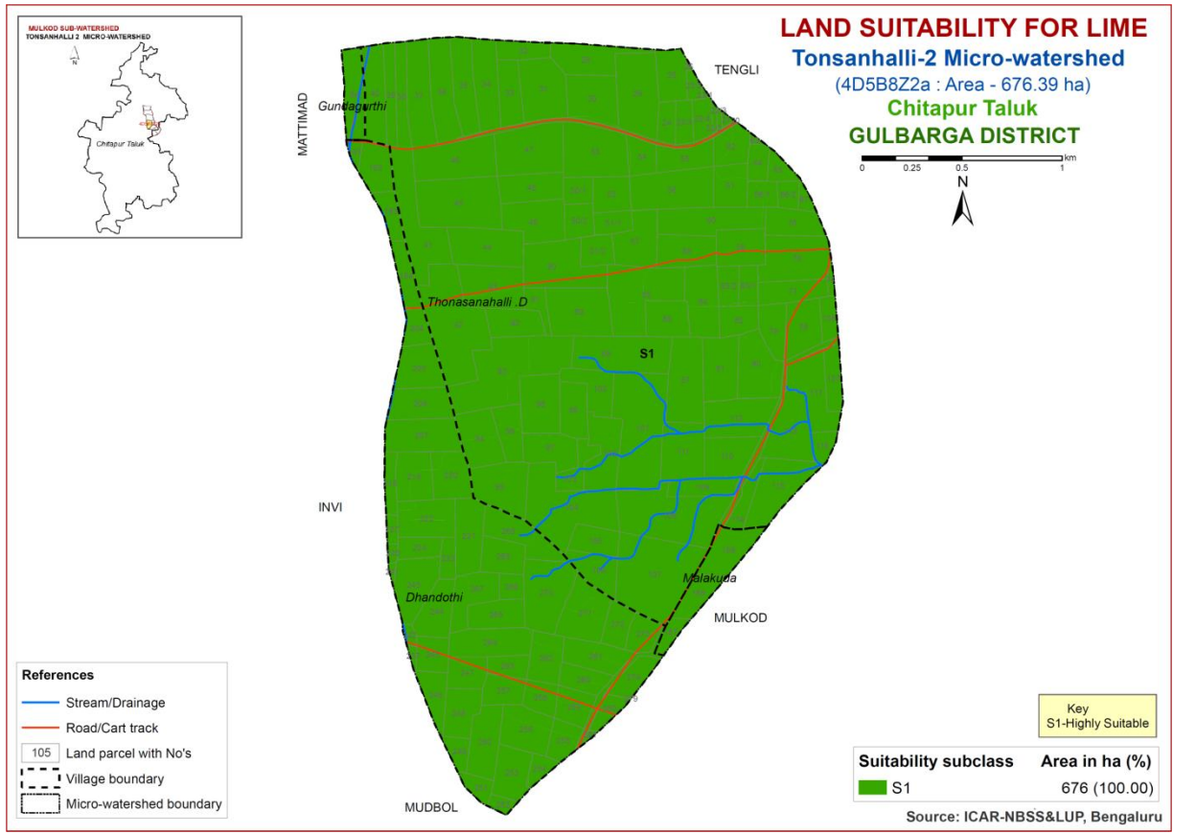

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR JAMUN
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
S2t
S2te
Malakuda
S3r
Mulkod
MULKOD
Dhandothi
MUDBOL
Key
S2-Moderately Suitable
Limitations
t-texture
r- rooting condition
Suitability subclass | Area in ha (%)
S2te | 140 (24.33)
S2t | 397 (68.91)
S3r | 13 (2.26)
Quarry | 6 (1.06)
Others* | 20 (3.44)
* - Habitation & Waterbody
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Source: ICAR-NBSS&LUP, Bengaluru

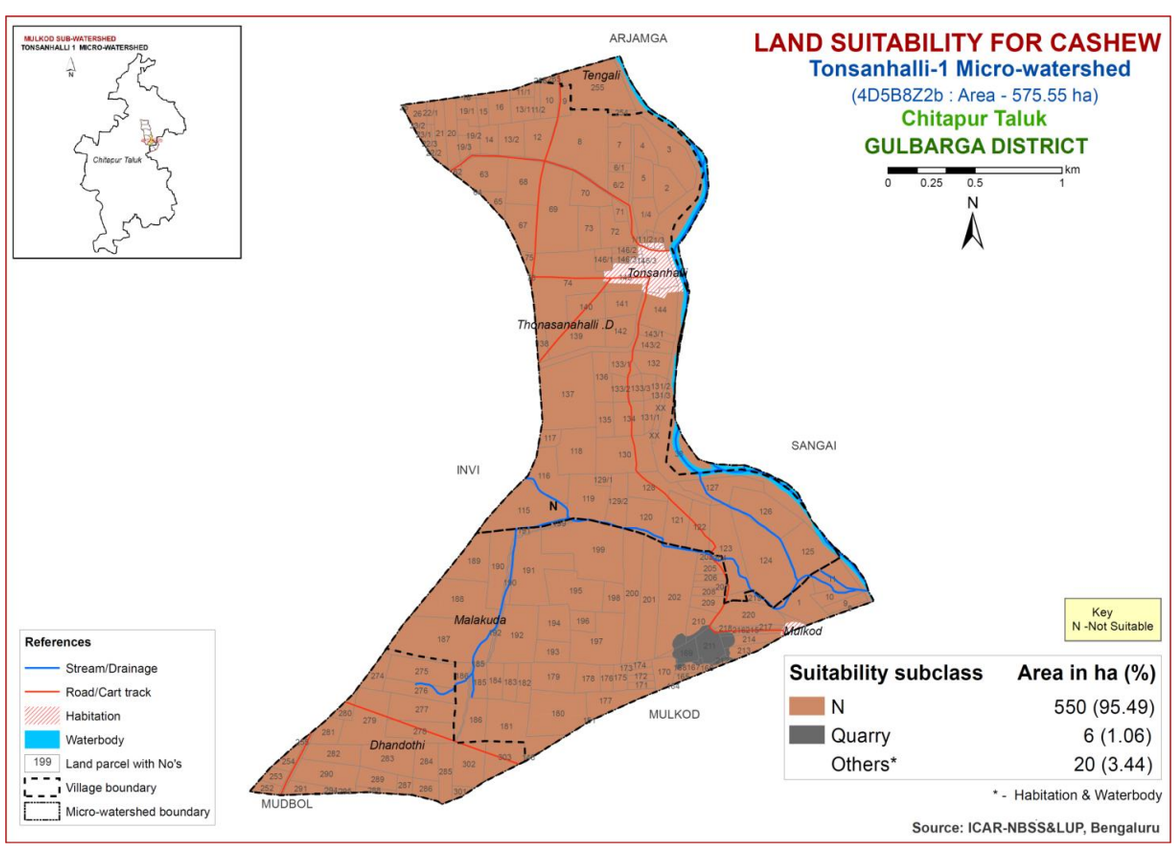

MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR JAMUN
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
TENGLI
MATTIMAD
Gundagurthi
S2te
Thonasanahalli .D
S2t
INVI
Malakuda
Dhandothi
MULKOD
MUDBOL
Key
S2-Moderately Suitable
Limitations
e -erosion
t- texture
Suitability subclass | Area in ha (%)
S2t | 562 (83.16)
S2te | 114 (16.84)
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Source: ICAR-NBSS&LUP, Bengaluru

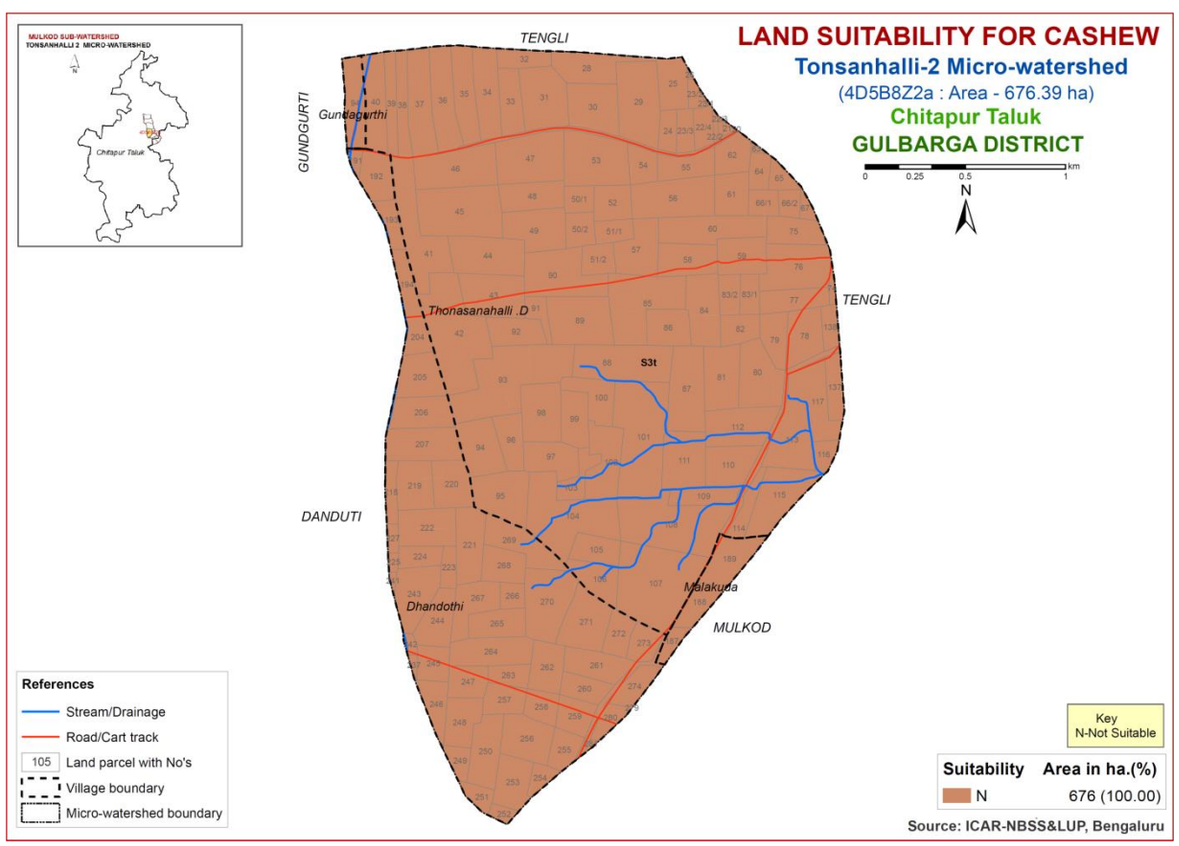

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR MUSAMBI
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
S1
S2rt
Malakuda
Mulkod
MULKOD
Dhandothi
MUDBOL
Key
S1-Highly Suitable
S2-Moderately Suitable
Limitations
t-texture
r- rooting condition
Suitability subclass | Area in ha (%)
S1 | 537 (93.24)
S2rt | 13 (2.26)
Quarry | 6 (1.06)
Others* | 20 (3.44)
* - Habitation & Waterbody
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Source: ICAR-NBSS&LUP, Bengaluru

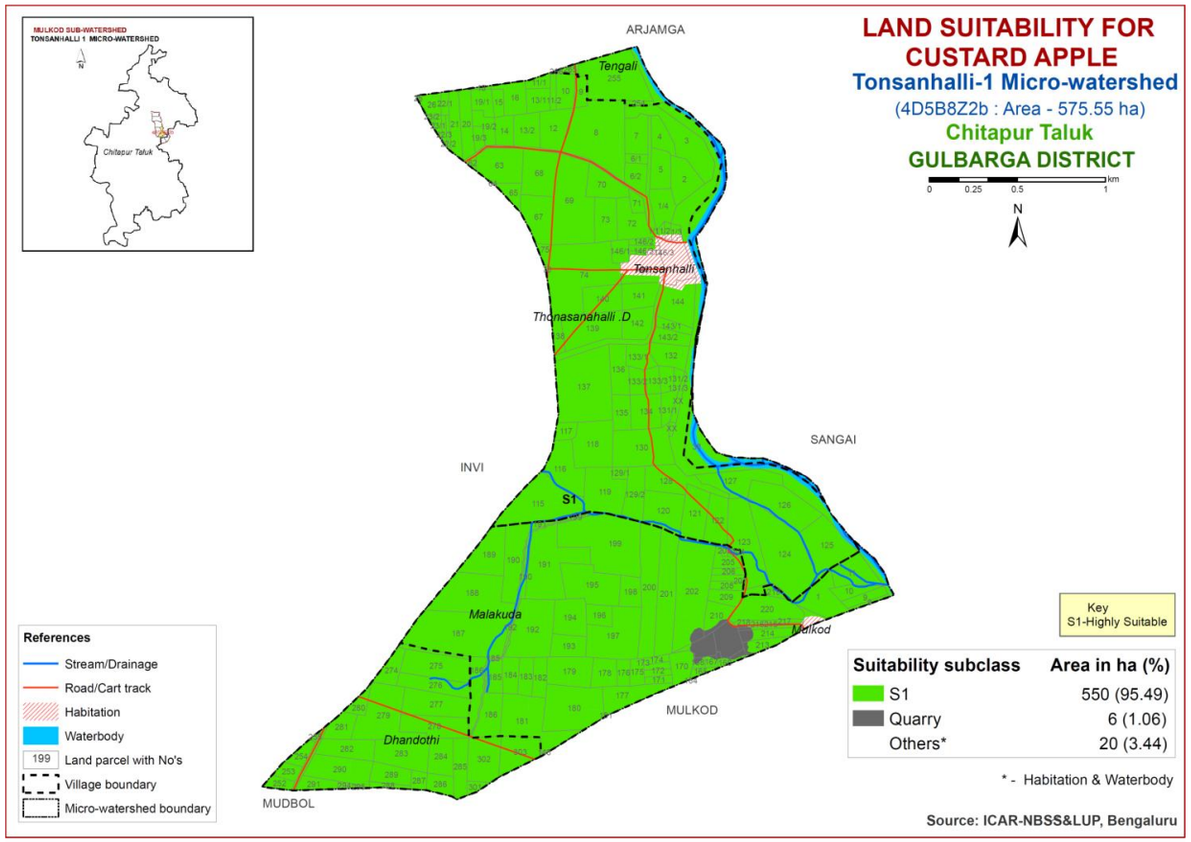

MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR MUSAMBI
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
TENGLI
MATTIMAD
Gundagurthi
Thonasanahalli .D
S1
INVI
Malakuda
Dhandothi
MULKOD
MUDBOL
Key
S1-Highly Suitable
Suitability subclass | Area in ha (%)
S1 | 676 (100.00)
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Source: ICAR-NBSS&LUP, Bengaluru

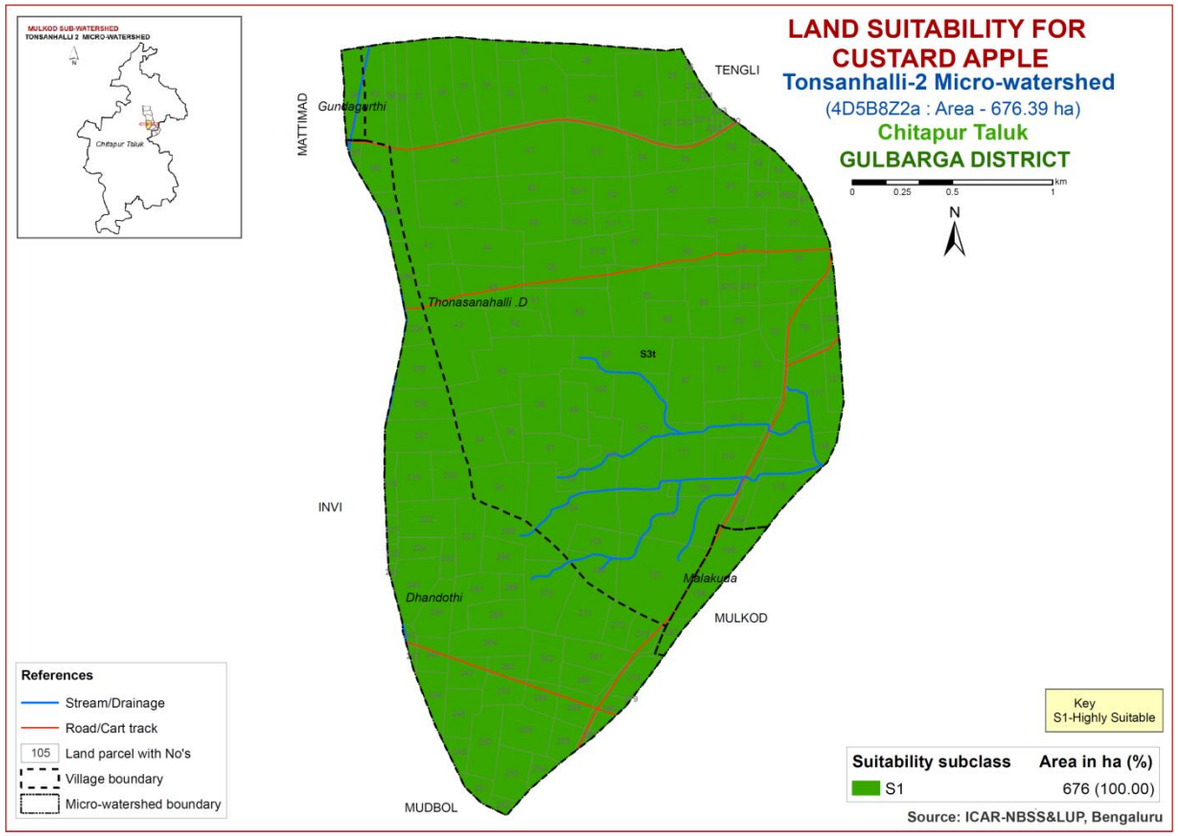

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
ARJAMGA
Tengali
Others
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
S1
Malakuda
S2rt
Quarry
Mulkod
Dhandothi
MULKOD
MUDBOL
LAND SUITABILITY FOR LIME
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
km
0 0.25 0.5 1
N
Key
S1-Highly Suitable
S2-Moderately Suitable
Limitations
t-texture
r- rooting condition
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Suitability subclass | Area in ha (%)
S1 | 537 (93.24)
S2rt | 13 (2.26)
Quarry | 6 (1.06)
Others* | 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru

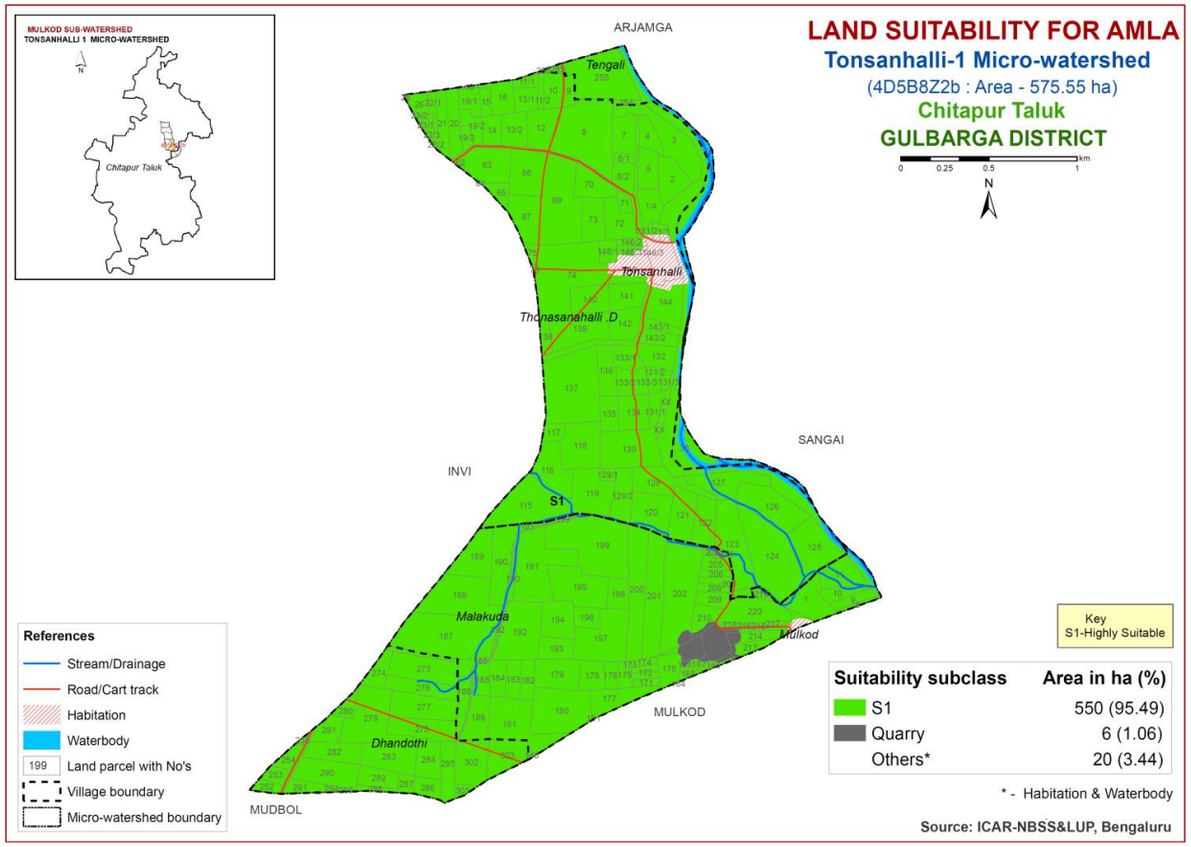

MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
TENGLI
MATTIMAD
Gunnagurthi
Thonasanahalli .D
S1
INVI
Malakuda
Dhandothi
MULKOD
MUDBOL
LAND SUITABILITY FOR LIME
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
km
0 0.25 0.5 1
N
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Key
S1-Highly Suitable
Suitability subclass | Area in ha (%)
S1 | 676 (100.00)
Source: ICAR-NBSS&LUP, Bengaluru

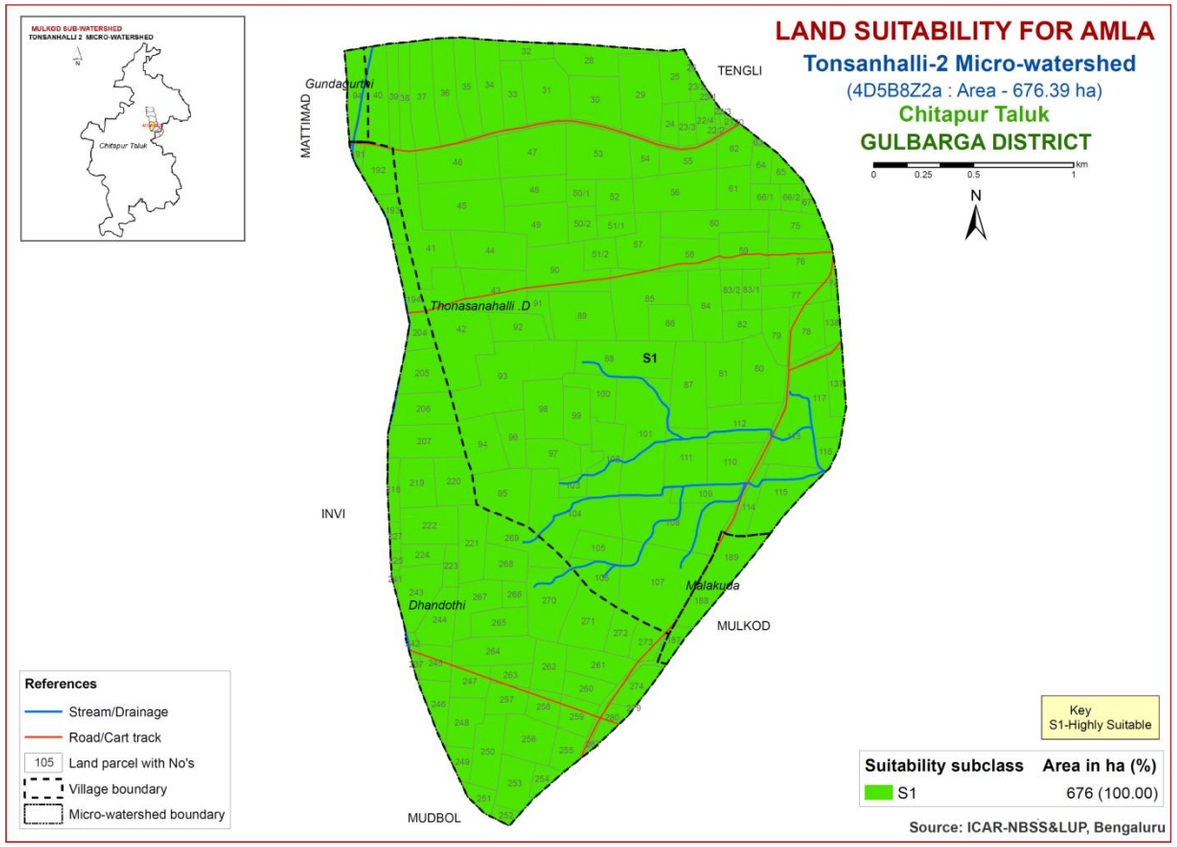

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
N
Malakuda
Mulkod
Dhandothi
MULKOD
MUDBOL
LAND SUITABILITY FOR CASHEW
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
km
0 0.25 0.5 1
N
Key
N -Not Suitable
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Suitability subclass | Area in ha (%)
N | 550 (95.49)
Quarry | 6 (1.06)
Others* | 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru

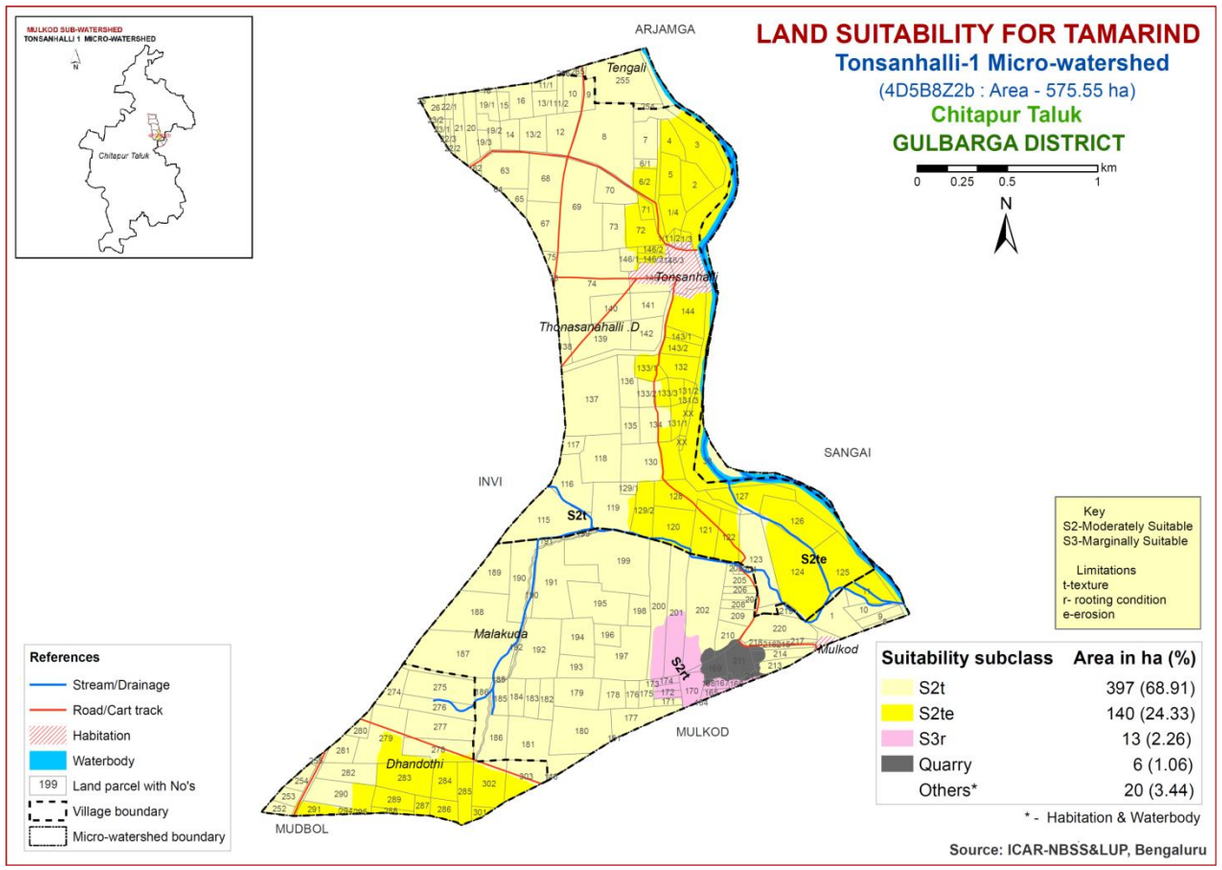

MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
TENGLI
GUNDGURTI
Gunnagurthi
Thonasanahalli .D
S3t
TENGLI
DANDUTI
Malakuda
Dhandothi
MULKOD
LAND SUITABILITY FOR CASHEW
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
km
0 0.25 0.5 1
N
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Key
N-Not Suitable
Suitability | Area in ha.(%)
N | 676 (100.00)
Source: ICAR-NBSS&LUP, Bengaluru

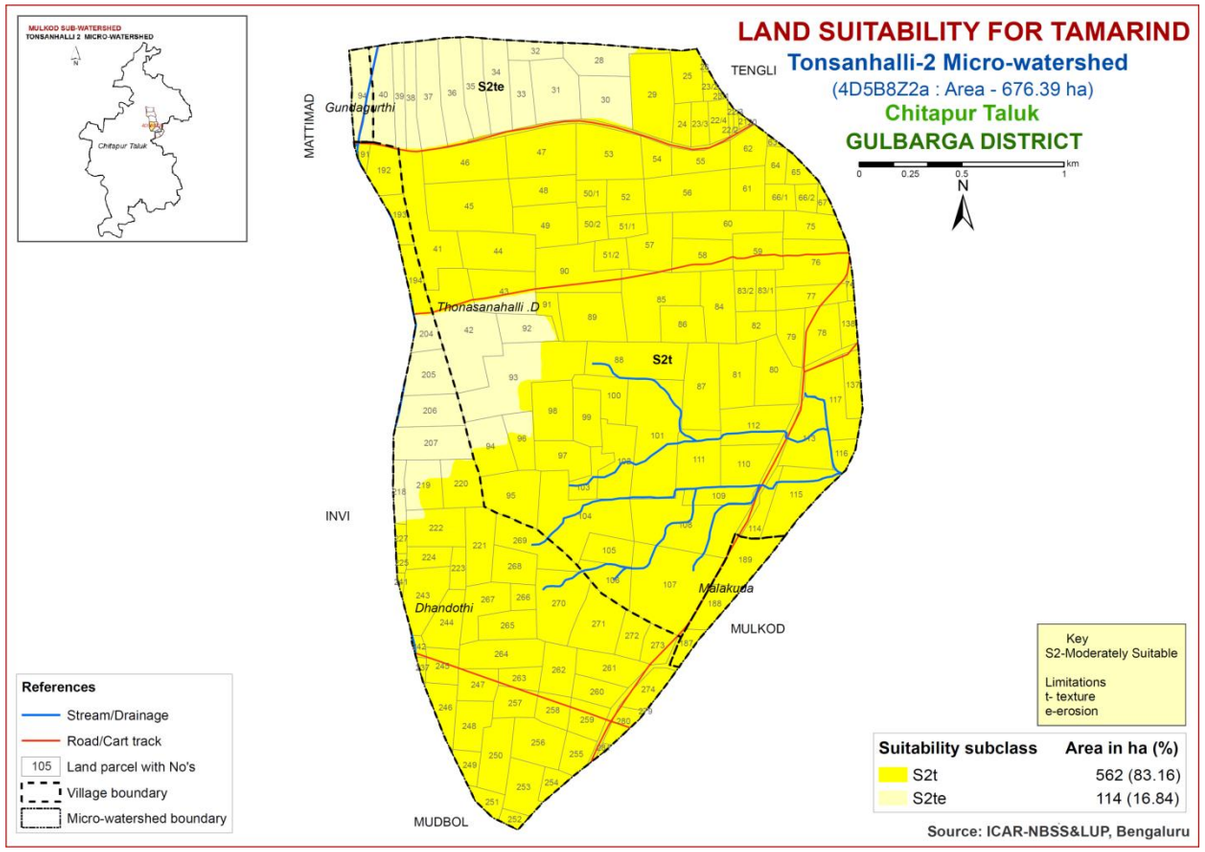

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
S1
Malakuda
Mulkod
Dhandothi
MULKOD
MUDBOL
LAND SUITABILITY FOR
CUSTARD APPLE
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
Key
S1-Highly Suitable
Suitability subclass | Area in ha (%)
S1 | 550 (95.49)
Quarry | 6 (1.06)
Others* | 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary

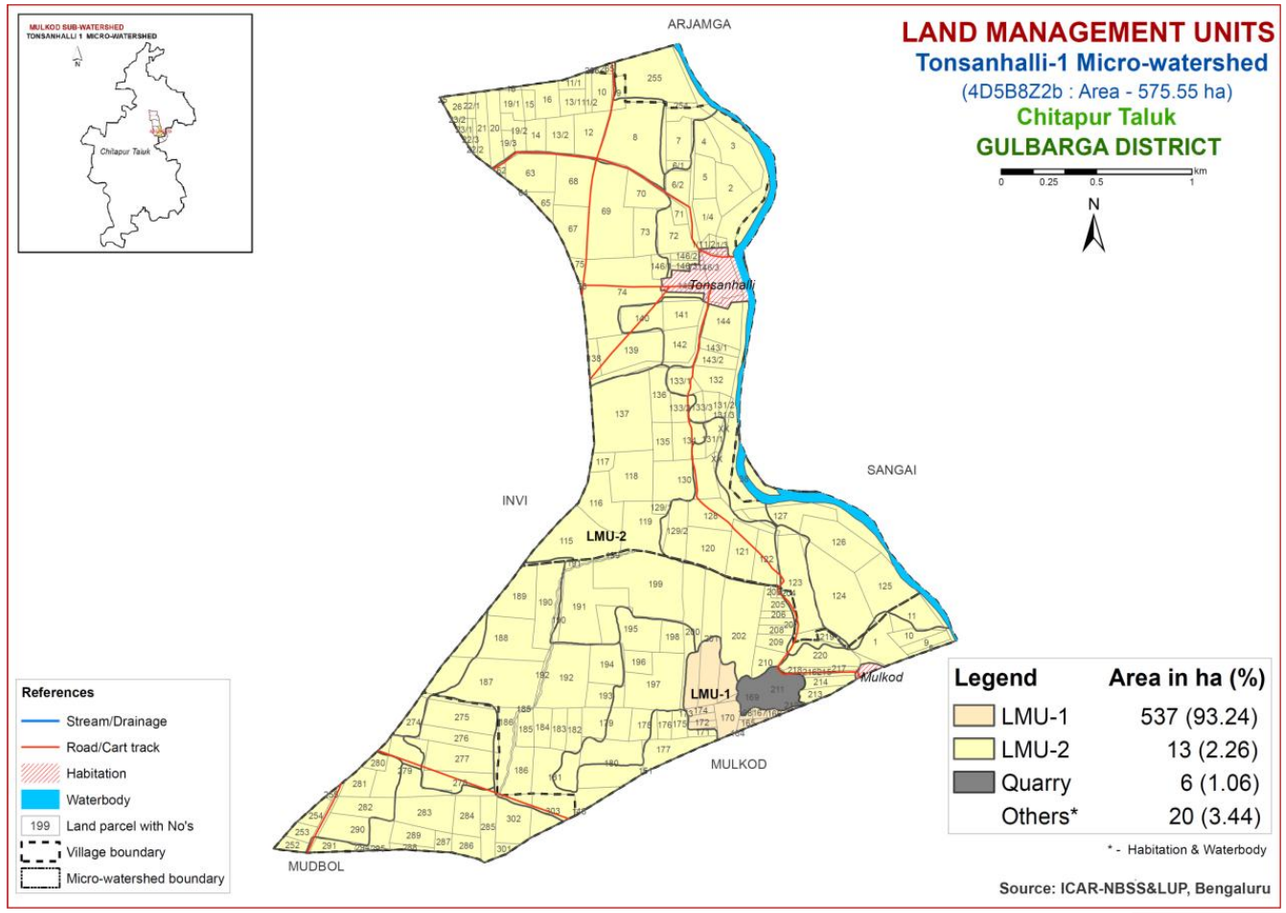

MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
TENGLI
MATTIMAD
Gundagurthi
Thonasanahalli .D
S3t
INVI
Malakuda
Dhandothi
MULKOD
MUDBOL
LAND SUITABILITY FOR
CUSTARD APPLE
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
Key
S1-Highly Suitable
Suitability subclass | Area in ha (%)
S1 | 676 (100.00)
Source: ICAR-NBSS&LUP, Bengaluru
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary

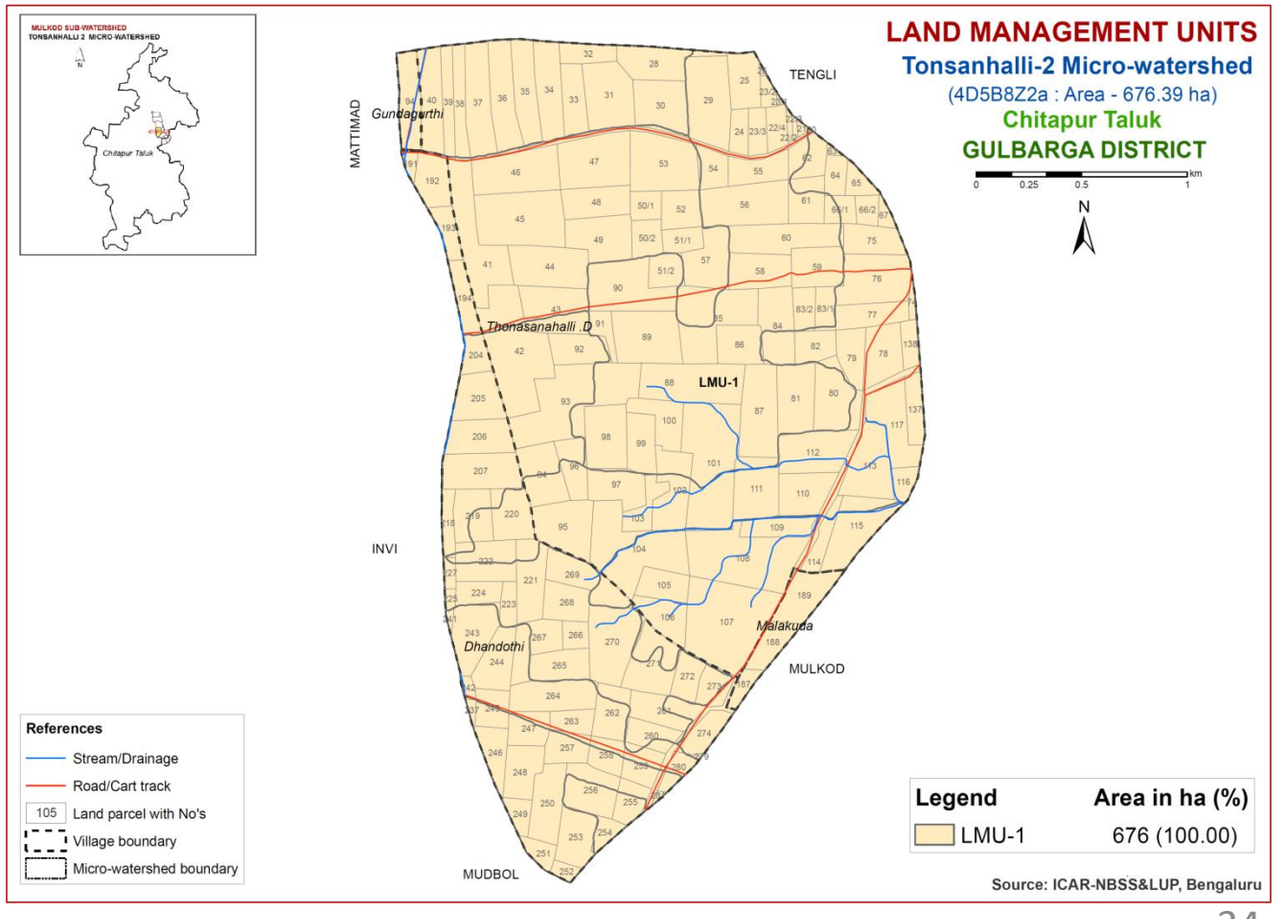

MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
S1
Malakuda
Mulkod
Dhandothi
MULKOD
MUDBOL
LAND SUITABILITY FOR AMLA
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
Key
S1-Highly Suitable
Suitability subclass | Area in ha (%)
S1 | 550 (95.49)
Quarry | 6 (1.06)
Others* | 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary


MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
TENGLI
MATTIMAD
Gundagurthi
Thonasanahalli .D
S1
INVI
Malakuda
Dhandothi
MULKOD
MUDBOL
LAND SUITABILITY FOR AMLA
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
Key
S1-Highly Suitable
Suitability subclass | Area in ha (%)
S1 | 676 (100.00)
Source: ICAR-NBSS&LUP, Bengaluru
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary


MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR TAMARIND
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
km
0 0.25 0.5 1
N
ARJAMGA
Tengali
Tonsanhalli
Thonasanahalli .D
INVI
SANGAI
MULKOD
MUDBOL
Malakuda
Dhandothi
S2t
S2te
S3r
Key
S2-Moderately Suitable
S3-Marginally Suitable
Limitations
t-texture
r- rooting condition
e-erosion
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Suitability subclass Area in ha (%)
S2t 397 (68.91)
S2te 140 (24.33)
S3r 13 (2.26)
Quarry 6 (1.06)
Others* 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru


MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
LAND SUITABILITY FOR TAMARIND
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
km
0 0.25 0.5 1
N
TENGLI
MATTIMAD
INVI
MULKOD
MUDBOL
Gundagurthi
Thonasanahalli .D
Malakuda
Dhandothi
S2te
S2t
Key
S2-Moderately Suitable
Limitations
t- texture
e-erosion
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Suitability subclass Area in ha (%)
S2t 562 (83.16)
S2te 114 (16.84)
Source: ICAR-NBSS&LUP, Bengaluru





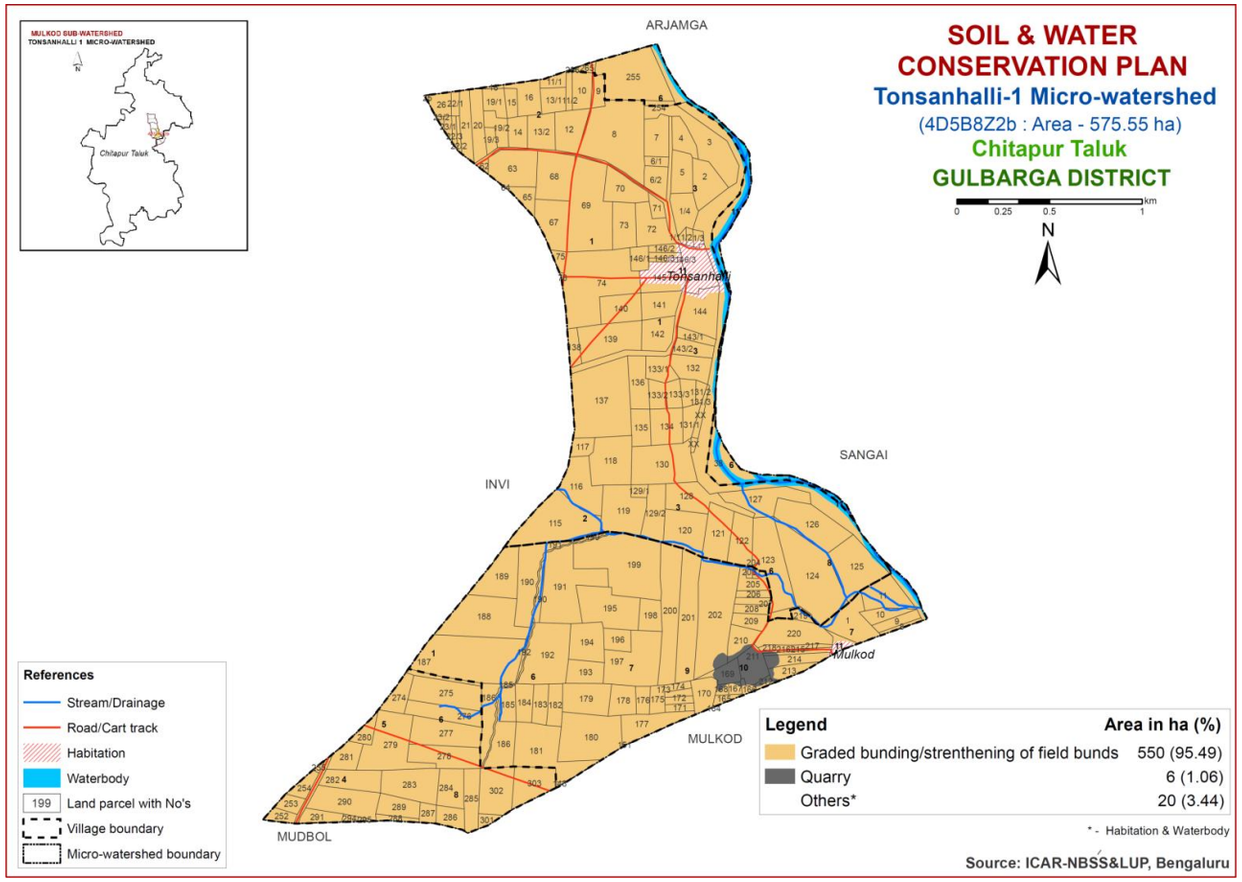
NOTE: *Proposed Crop Plan for LMU's are given in Table*

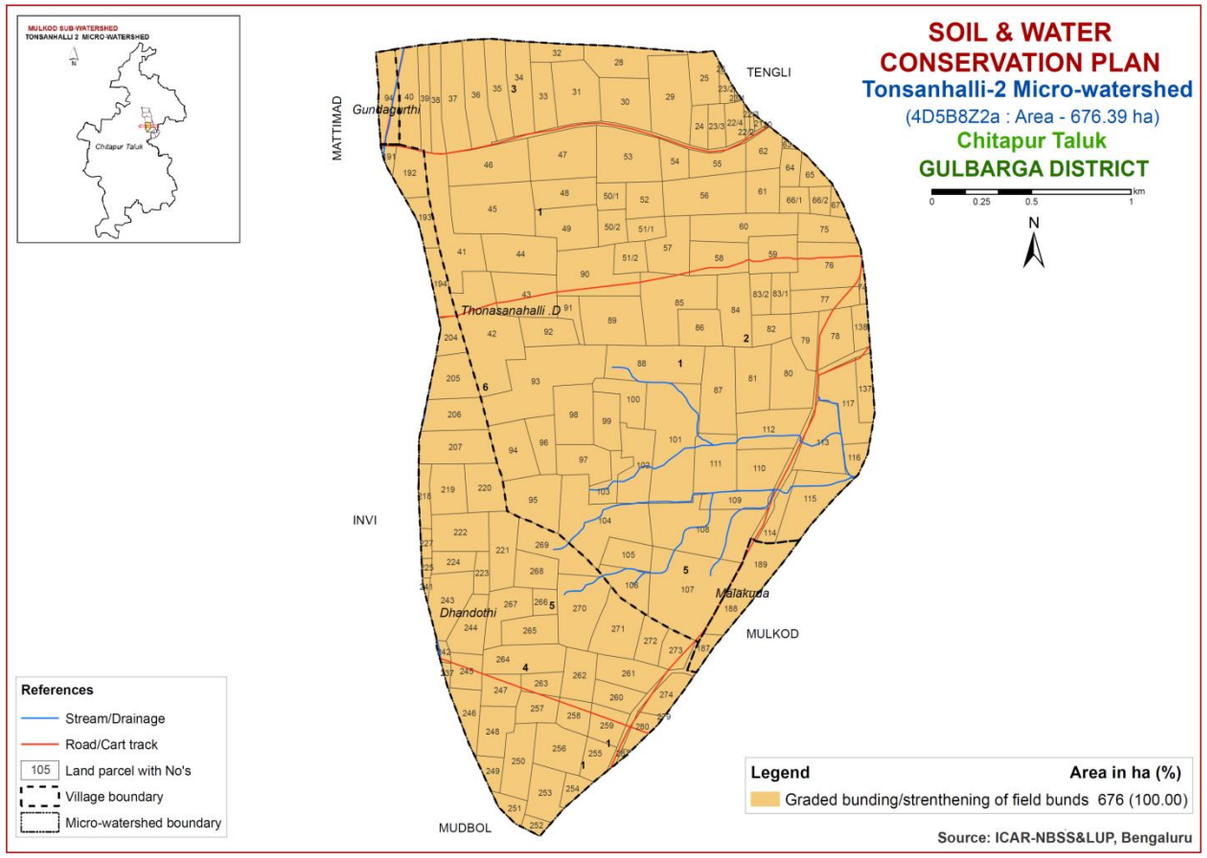
Table3. Proposed Crop Plan for Tonsanhalli-1 Micro-watershed, Mulkod Sub-watershed Chitapur Taluk, Gulbarga District based on soil-site–crop suitability Assessment

LMU	Mapping unit	Survey No	Characters	Crops proposed				Suitable Intervention
				Field crops	Forestry Crop/Grasses	Horticulture crops (Rainfed Condition)	Horticulture crops With suitable intervention	
LMU-1	TNHmB1k	**Malakuda**: 164,165,166,167,168,170,172, 173, 174,201	Moderately shallow black soil (50-75 cm) 3-5 % slope, severely eroded.	Sorghum, Black gram, Green gram, Soybean, Sesame, Safflower Rabi: Sorghum, Chickpea	Subabhul, Neem, Teak	Custard apple, Charoli, Ber, Amla Vegetable: Ladies finger, Brinjal, Cowpea, Flower: Marigold, Chrysanthemum	Custard apple, Charoli, Ber, Amla, Papaya, Lime, Citrus Vegetable: Onion, Tomato, Brinjal, Chillies, Bhendi Flower: Marigold, Chrysanthemum	Graded bunds, Strengthening of field bunds
LMU-2	1 DDTmA1 2 DDTmB1 3 DDTmB2 4 DDTmB2k 5 DRGmA1g1 6 DRGmB1 7 DRGmB1k 8 DRGmB2	**Dhandothi**: 252,253,254,255,274,275,276, 277,278,279,280,281,282,283, 284,285,286,287,288,289,290, 291,294,295, 301,302,303 **Malakuda**: 1,8,9,10,11,38,148,151,171,175 , 176,177,178,179,180,181,182, 183,184,185,186,187,188,189, 190,191,192,193,194,195,196, 197,198,199,200,202,203,204, 205,206,207,208,209,210,213, 214,215,216,217,218,219,220 **Tengali**: 254,255,265,266 **Thonsanhalli**: 1/1,1/2,1/3,1/4,2,3,4,5,6/1,6/2, 7,8,9,10,11/1,11/2,12,13/1,13/ 2,14,15,16,18,19/1,19/2,19/3,2 0,21, 22/1,22/2,22/3,22/4,23/1,23/2, 25,26,62,63,64,65,67,68,69,70, 71,72,73,74,75,76,115,116,117, 118, 119,120,121,122,123,124,125, 126,127,128,129/1,129/2,130, 131/1,131/2,131/3,132,133/1, 133/2,133/3,134,135,136,137, 138,139,140,141,142,143/1, 143/2,144, 146/1,146/2,146/3	Deep to very deep Black soil (100-150 & >150 cm), 0-3 % slope, slight to moderate erosion	Sorghum, Cotton, Red Gram,Black gram, Green gram, Soybean,Sunflower, Safflower, Sesame, Rabi: Sorghum, wheat, Chickpea Mixed cropping: Red gram-cotton Pulses+sorghum	-	Vegetable: Ladies finger, Brinjal, Cowpea, coriander Field crops: Sorghum, Cotton, Red Gram, Sunflower, Safflower, Perennial component: Guava, Tamarind, Sapota, Lime, Mosambi Flower: Marigold, Chrysanthemum	Banana, Papaya, Lime. Mosambi, Guava, Tamrind Vegetable: Onion, Tomato, Brinjal, Chillies, Bhendi Flower: Marigold, Chrysanthemum	Graded bunds, Strengthening of field bunds

Table4. Proposed Crop Plan for Tonsanhalli-2 Micro-watershed, Mulkod Sub-watershed Chitapur Taluk, Gulbarga District based on soil-site–crop suitability Assessment

LMU	Mapping unit	Survey No	Characters	Crops proposed				Suitable Intervention
				Field crops	Forestry Crop/Grasses	Horticulture crops (Rainfed Condition)	Horticulture crops with suitable intervention	
LMU-1	1 DDTmA1g1 2 DDTmB1g1 3 DDTmB2g1 4DRGmA1g1 5 DRGmB1g1 6 DRGmB2g1	**Dhadothi**: 191,192,193,194,204,205,206, 207,218,219,220,221,222,223, 224,225,227,237,241,242,243, 244,245,246,247,248,249,250, 251,252,253,254,255,256,257, 258,259,260,261,262,263,264, 265,266,267,268,269,270,271, 272,273,274,279,280,281 **Gundagurthi**: 94 **Malakuda**: 187,188,189 **Thonsanahalli**: 20,21,22/2,22/3,22/4,23/1,23/ 2,23/3,24,25,26,28,29,30,31, 32,33,34,35,36,37,38,39,40,41, 42,43,44,45,46,47,48,49,50/1, 50/2,51/1,51/2,52,53,54,55,56, 57,58,59,60,61,62,63,64,65, 66/1,66/2,67,74,75,76,77,78,7 9,80,81,82,83/1,83/2,84,85,86, 87,88,89,90,91,92,93,94,95,96, 97,98,99,100,101,102,103,104, 105,106,107,108,109,110,111, 112,113,114,115,116,117,137, 138	Deep to very deep Black soil (100-150 & >150 cm), 0-3 % slope, slight to moderate erosion	Sorghum, Cotton, Red Gram,Black gram,Green gram,Soybean,Su nflower, Safflower, Sesame, Rabi: Sorghum, wheat, Chickpea Mixed cropping: Red gram-cotton Pulses+sorghum	-	Vegetable: Ladies finger, Brinjal, Cowpea, coriander Field crops: Sorghum, Cotton, Red Gram, Sunflower, Safflower, Perennial component: Guava, Tamarind, Sapota, Lime, Mosambi Flower: Marigold, Chrysanthemum	Banana, Papaya, Lime. Mosambi, Guava, Tamrind Vegetable: Onion, Tomato, Brinjal, Chillies, Bhendi Flower: Marigold, Chrysanthemum	Graded bunds, Strengthening of field bunds


MULKOD SUB-WATERSHED
TONSANHALLI 1 MICRO-WATERSHED
Chitapur Taluk
ARJAMGA
SOIL & WATER CONSERVATION PLAN
Tonsanhalli-1 Micro-watershed
(4D5B8Z2b : Area - 575.55 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
Tonsanhalli
INVI
SANGAI
Mulkod
MULKOD
MUDBOL
References
Stream/Drainage
Road/Cart track
Habitation
Waterbody
199 Land parcel with No's
Village boundary
Micro-watershed boundary
Legend
Area in ha (%)
Graded bunding/strenthening of field bunds 550 (95.49)
Quarry 6 (1.06)
Others* 20 (3.44)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru


MULKOD SUB-WATERSHED
TONSANHALLI 2 MICRO-WATERSHED
Chitapur Taluk
SOIL & WATER CONSERVATION PLAN
Tonsanhalli-2 Micro-watershed
(4D5B8Z2a : Area - 676.39 ha)
Chitapur Taluk
GULBARGA DISTRICT
0 0.25 0.5 1 km
N
TENGLI
MATTIMAD
Gundagurthi
Thonasanahalli .D
INVI
Malakuda
Dhandothi
MULKOD
MUDBOL
References
Stream/Drainage
Road/Cart track
105 Land parcel with No's
Village boundary
Micro-watershed boundary
Legend
Area in ha (%)
Graded bunding/strenthening of field bunds 676 (100.00)
Source: ICAR-NBSS&LUP, Bengaluru

1.WATER BUDGETING TORSANAHALLI 1 MICRO-WATERSHED, CHITAPUR TALUK

Torsanahalli 1 Micro-watershed, Chitapur Taluk	(5D5B8Z2b : Area - 575.55 ha)

EXAMPLE:

Catchment Details: Area: 575.6 ha.
slope: 1 to 3 %

Average annual Rainfall 723 mm
NO. of Runoff Producing Rains 8
Total Depth of Rain on runoff producing rainy days 99 mm
(Run off producing Rainy day : A day with > 2o mm depth Rain)

A. QUANTITY OF RUNOFF WATER:

= Catchment area (ha.) x Depth of rain water of runoff producing rains(mm) x 10000

3/4 x 1000

= 575.55 x 99 x 10000

= 7 1/4 x 1000

= 299365 m³

B. QUANTITY OF WATER STORED BEHINDFIELD BUNDS

40278.2

C. QUANTITY OF WATER STORED DUE TO LAND SHAPPING

39733.9

D. QUANTITY OF WATER STORED BEHIND GRADED BUNDS (0.3M Crest height in Waste weirs):.

= Bund Length x Cross sectional area of storage (m²)

= 80600 x 2.3 S / F

= 185380.00 m³

Where:
s = landslope: 2 %
F = Fall between bunds 0.6 m

TOTAL QUANTITY OF WATER STORED IN THE PROPOSED STRUCTURES:.

Field Bund	Land Shaping	Graded bund	TOTAL
40278.20	39733.90	185380.00	265392.10

To be continued….

E. BALANCE OF RUNOFF WATER:

= QUANTITY OF RUNOFF WATER - - TOTAL QUANTITY OF WATER STORED IN THE PROPOSED STRUCTURES:.

= 299365.00 - 265392.10

= 33972.90 m^3

NOTE: QUANTITY OF RUNOFF TO BE SET APART FOR THE COMMITMENTS LIKE EXISTING WATER BODIES HAS TO BE TAKEN CARE OF BEFORE FINALISING THE NUMBER AND CAPACITY OF STORAGE/ RECHARGE STRUCTURES

F. ADDITIONAL STORAGE STRUCTURES:

= BALANCE OF RUNOFF WATER/ STORAGE CAPACITY OF PROPOSED STRUCTURE

			STORAGE CAPACITY (m3)			
		DIMENSION OF POND(m)	EXCAVATION BY SEGMENTAL METHOD		EXCAVATION BY MECHANICAL MEANS	
		L x W x D	QUANTITY (m^3)	NOS.	QUANTITY (m^3)	NOS.
33972.90	/ 319.7	12 X 12 X 3	319.7	106	258	132
		OR				
33972.90	/ 530.3	15 X 15 X 3	530.3	64	447	76
		OR				
33972.90	/ 794.9	18 X 18 X 3	794.9	43	690	49
		OR				
33972.90	/ 1113.5	21 X 21 X3	1113.5	31	987	34

OR CHECK DAMS/NALA BUNDS ON DECIDING THE IDEAL SPOTS FOR RECHARGE

2.WATER BUDGETING TORSANAHALLI 2 MICRO-WATERSHED, CHITAPUR TALUK

Torsanahalli 2 Micro-watershed, Chitapur Taluk	(4D5B8Z2a : Area - 676.39 ha)

EXAMPLE:

Catchment Details: Area: 676.4 ha. | Average annual Rainfall 723 mm

slope: 1 to 3 % | NO. of Runoff Producing Rains 8

Total Depth of Rain on runoff producing rainy days 99 mm

(Run off producing Rainy day : A day with > 2o mm depth Rain)

A. QUANTITY OF RUNOFF WATER:

		Catchment area (ha.)	x	Depth of rain water of runoff producing rains(mm)		x	10000
				3/4	x 1000		
=		676.39	x	99	x 10000		
=				7 1/4	x 1000		
=		368491.1 m³					

B. QUANTITY OF WATER STORED BEHIND FIELD BUNDS

174720.3

C. QUANTITY OF WATER STORED BEHIND GRADED BUNDS (0.3M Crest height in Waste weirs):.

=		Bund Length	x	Cross sectional area of storage (m²)			
=		71200	x	2.3		S / F	Where:
=		163760.00 m³					s = landslope: 2%
							F =
							Fall betw een
							bund s 0.6 m

TOTAL QUANTITY OF WATER STORED IN THE PROPOSED STRUCTURES:.

Field Bund	Graded bund	TOTAL
174720.30	163760.00	338480.30

D. BALANCE OF RUNOFF WATER:

=	QUANTITY OF RUNOFF WATER -	-	TOTAL QUANTITY OF WATER STORED IN THE PROPOSED STRUCTURES:.	
=	368491.10	-	338480.30	
=	30010.80 m³			

NOTE: QUANTITY OF RUNOFF TO BE SET APART FOR THE COMMITMENTS LIKE EXISTING WATER BODIES HAS TO BE TAKEN CARE OF BEFORE FINALISING THE NUMBER AND CAPACITY OF STORAGE/ RECHARGE STRUCTURES

To be continued….

D. ADDITIONAL STORAGE STRUCTURES:

= BALANCE OF RUNOFF WATER/ STORAGE CAPACITY OF PROPOSED STRUCTURE

				STORAGE CAPACITY (m3)			
			DIMENSION OF POND(m)	EXCAVATION BY SEGMENTAL METHOD		EXCAVATION BY MECHANICAL MEANS	
			L x W x D	QUANTITY (m^3)	NOS.	QUANTITY (m^3)	NOS.
30010.80	/	319.7	12 X 12 X 3	319.7	94	258	116
			OR				
30010.80	/	530.3	15 X 15 X 3	530.3	57	447	67
			OR				
30010.80	/	794.9	18 X 18 X 3	794.9	38	690	43
			OR				
30010.80	/	1113.5	21 X 21 X3	1113.5	27	987	30

OR CHECK DAMS/NALA BUNDS ON DECIDING THE IDEAL SPOTS FOR RECHARGE

PART-B

Hydrological Inventory of Mulkod Sub-watershed, Chitapur Taluk, Gulbarga District, Karnataka for Watershed Planning and Development

Sujala - III
Karnataka Watershed Development Project-II
Watershed Development Department
Government of Karnataka

THE WORLD BANK

Hydrological Inventory of Mulkod Sub-watershed, Chitapur Taluk, Kalaburagi District, Karnataka for Watershed Planning and Development

Prepared by
ICAR-National Bureau of Soil Survey and Land Use Planning
Regional Centre, Hebbal, Bangalore - 560 024

ICAR - NBSS & LUP

Phone:080-23412242

E-mail: hd_rcb.nbsslup@icar.gov.in
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Dr. S. Srinivas	Principal Scientist
Dr. K .V. Niranjana	Chief Technical Officer
Sh. R.S.Reddy	Consultant
Sh. A.G.Devendra Prasad	Consultant
Smt. K.Karunya Lakshmi	Research Associate
Ms. Seema, K.V.	Senior Research Fellow
Dr. Sekhar Muddu (Reviewed and approved)	Professor & Lead Scientist, Dept. of Civil Engineering & ICWaR, IISc, Bangalore

Email: hd_rcb.nbsslup@icar.gov.in
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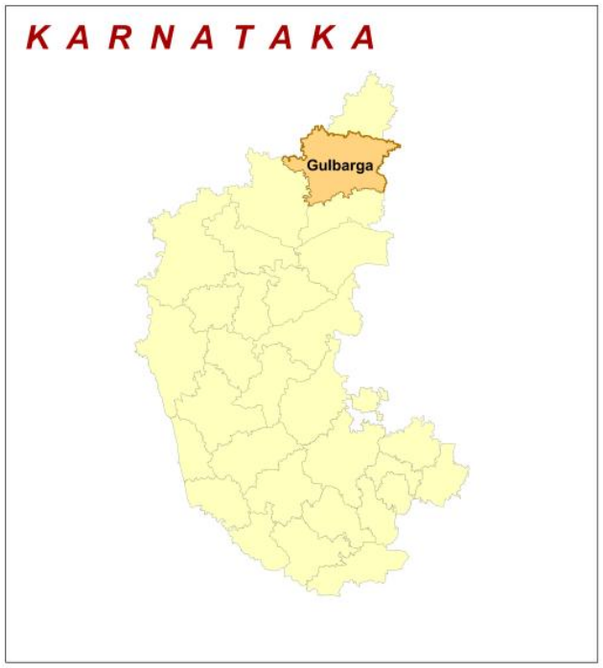
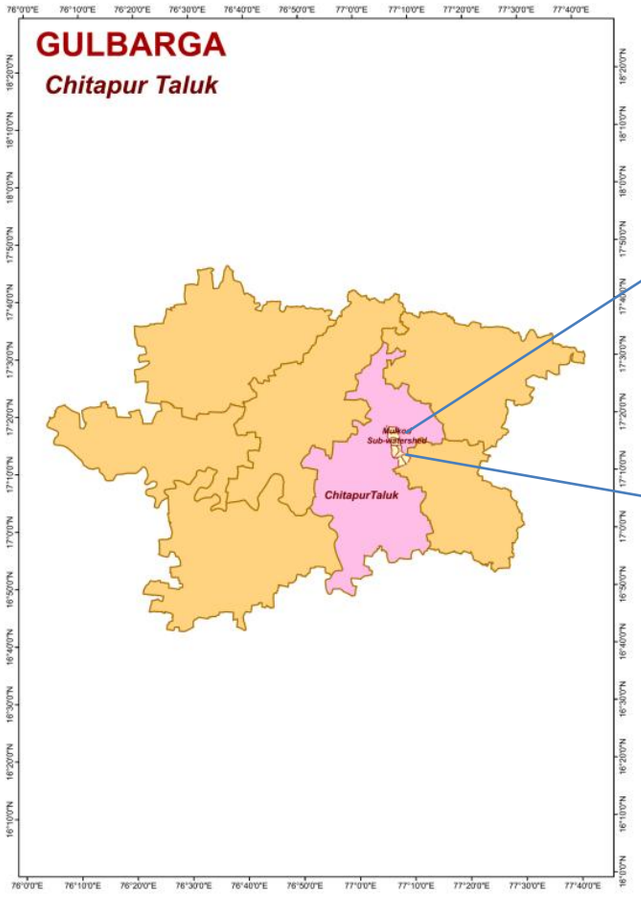
Fax: 080-23510350

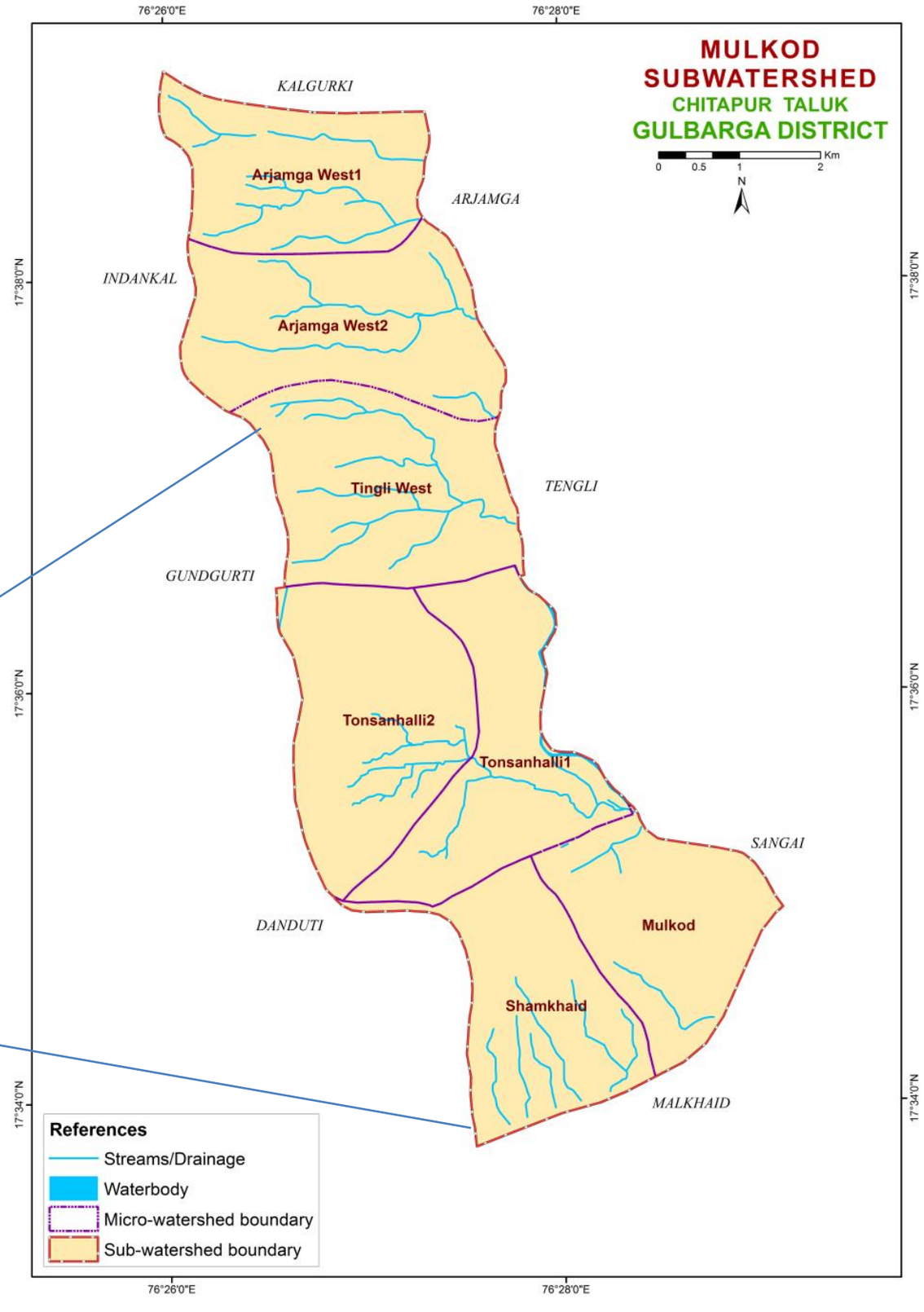
INTRODUCTION

- The inventory and documentation of spatial and temporal changes in hydrological components of Mulkod sub-watershed (4D5B8Z) in Chitapur taluk, Kalaburagi district, has been undertaken for integrated planning, development and management at the level of soil mapping units.
- Mulkod sub-watershed (Chitapur Taluk, Kalaburagi District) is located between $17^0$9’54”–17^0 17’55” North latitudes and $77^0$3’34”- $77^0$10’47” East longitudes, covering an area of about 4196.37 ha.
- This sub-watershed encompasses of 7 MWs namely, Arjamga West-1 (4D5B8Z1a), Arjamga West-2 (4D5B8Z1b), Tingli West (4D5B8Z1c), Tonsanhalli-1 (4D5B8Z2b), Tonsanhalli-2 (4D5B8Z2a), Mulkod (4D5B8Z2c) and Shamkhaid (4D5B8Z2d) micro watersheds. Land Resource Inventory (LRI) was generated for two among the seven micro-watersheds.
- Average annual rainfall (1960-2014) of the Hobli (Block) pertaining to the sub-watershed is 759 mm.
- In this sub-watershed major *kharif* crops grown are Maize, Soyabean, Redgram, Sugarcane, Sunflower, Cotton and major *rabi* crops are Sorghum and Bengalgram.
- Hydrological components namely rainfall (annual, *kharif*, *rabi* and summer*)*, PET, AET, runoff, surface soil moisture, ground water status and water balance are presented.

LOCATION MAP OF MULKOD SUB-WATERSHED

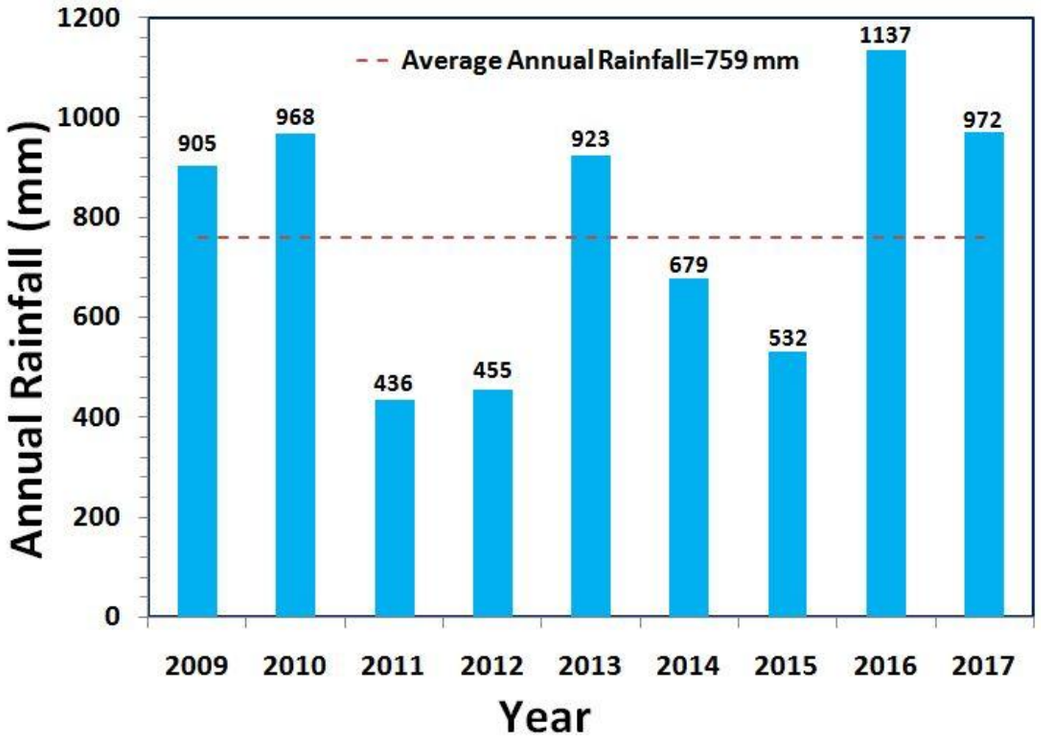






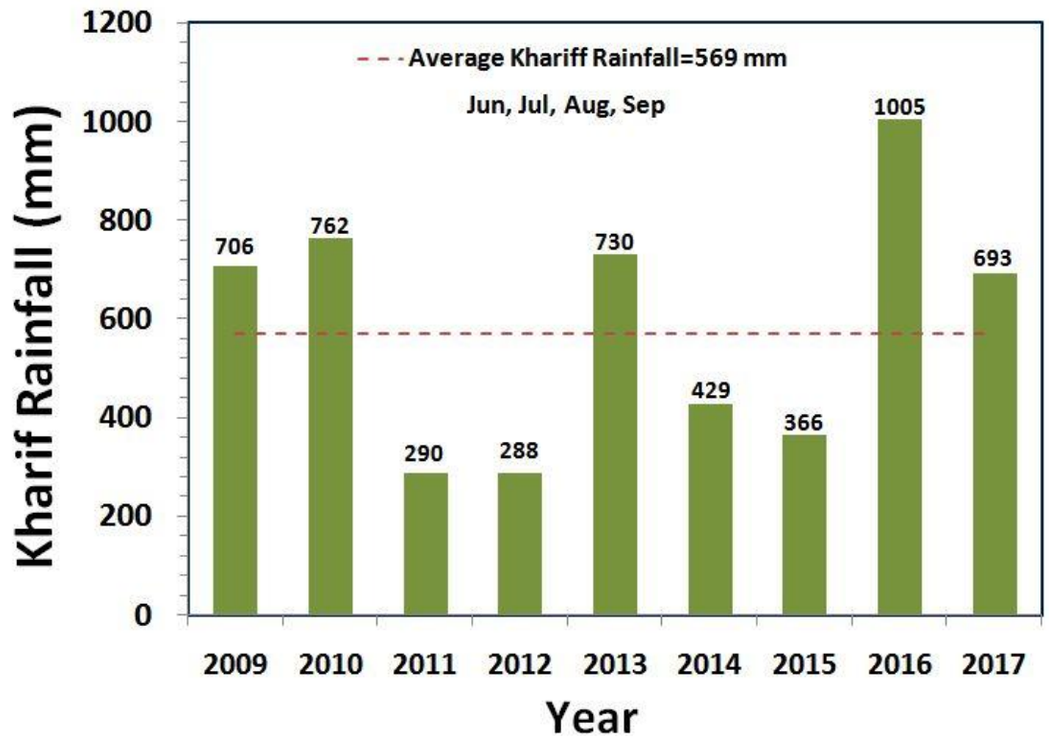
Soil & Water Conservation Structures in Mulkod Sub-watershed, Chitapur taluk, Kalaburagi district

RAINFALL INDEX

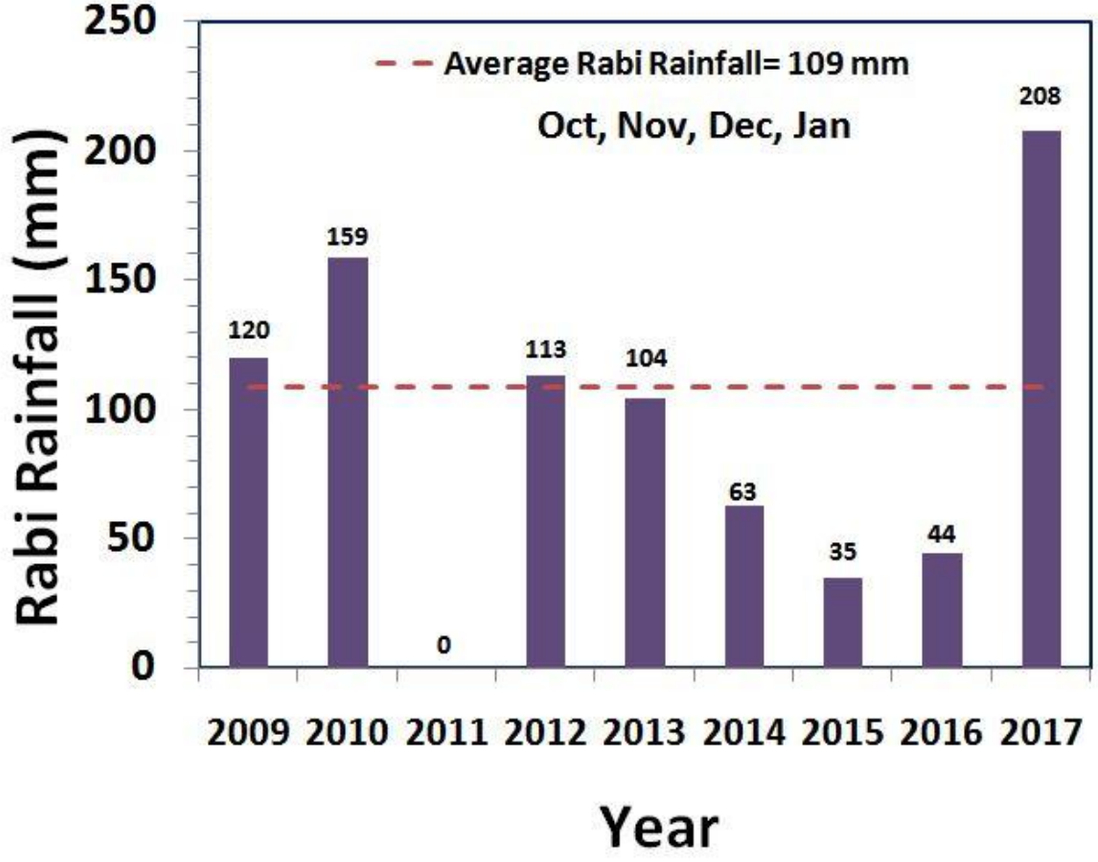


The average annual rainfall (1960-2014) recorded at the Chitapur Station in Chitapur taluk of Kalaburagi district is 759 mm. The annual rainfall at Kalgi station (Hobli H.Q.) is presented. During the years 2011, 2012, 2014 and 2015 the annual rainfall was deficient by 43%, 40%, 11% and 30% respectively.

The *kharif* rainfall (Jun–Sep) is an average about 73% of the annual rainfall and it typically follows the annual rainfall patterns. During the years 2011, 2012, 2014 and 2015 the *kharif* rainfall was deficient by 49%, 49%, 25% and 36% respectively.

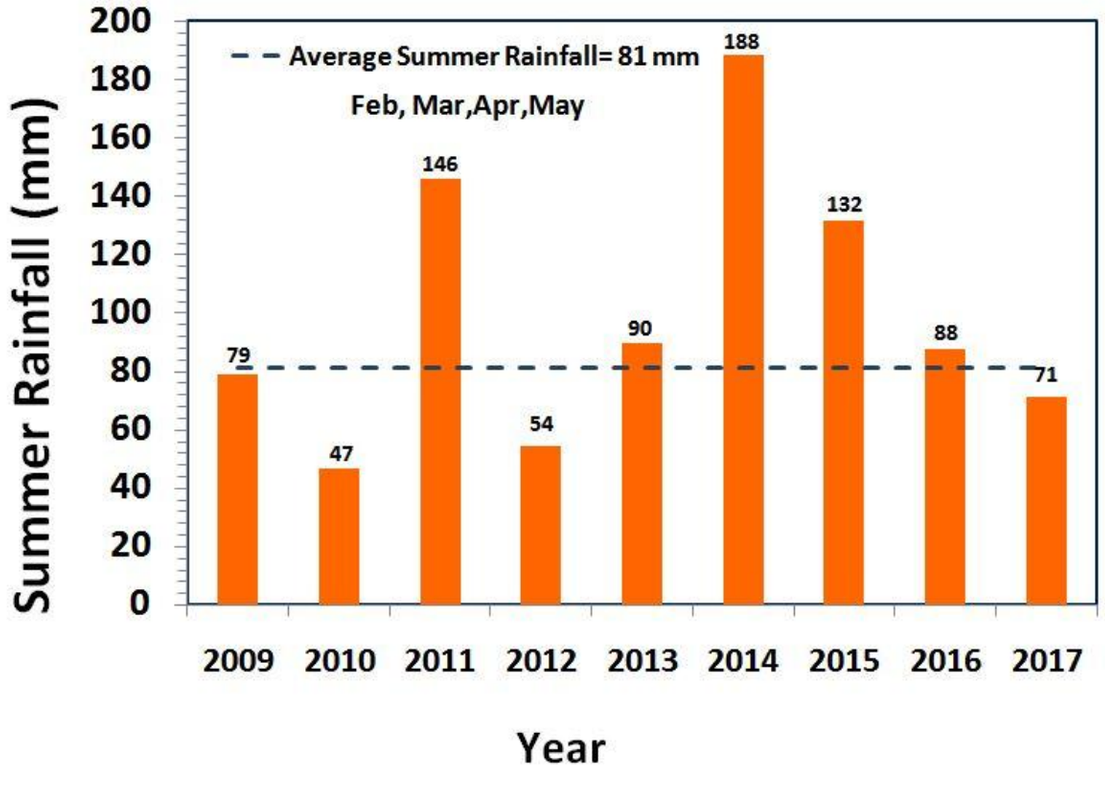


RAINFALL INDEX

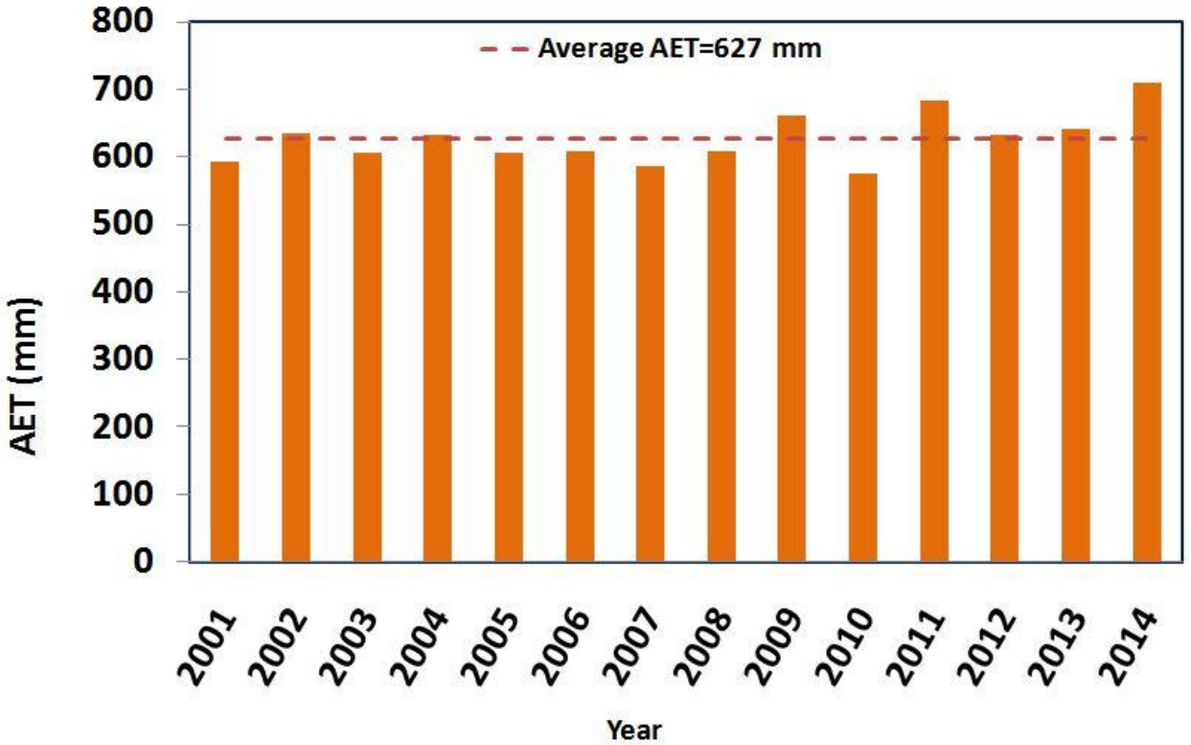


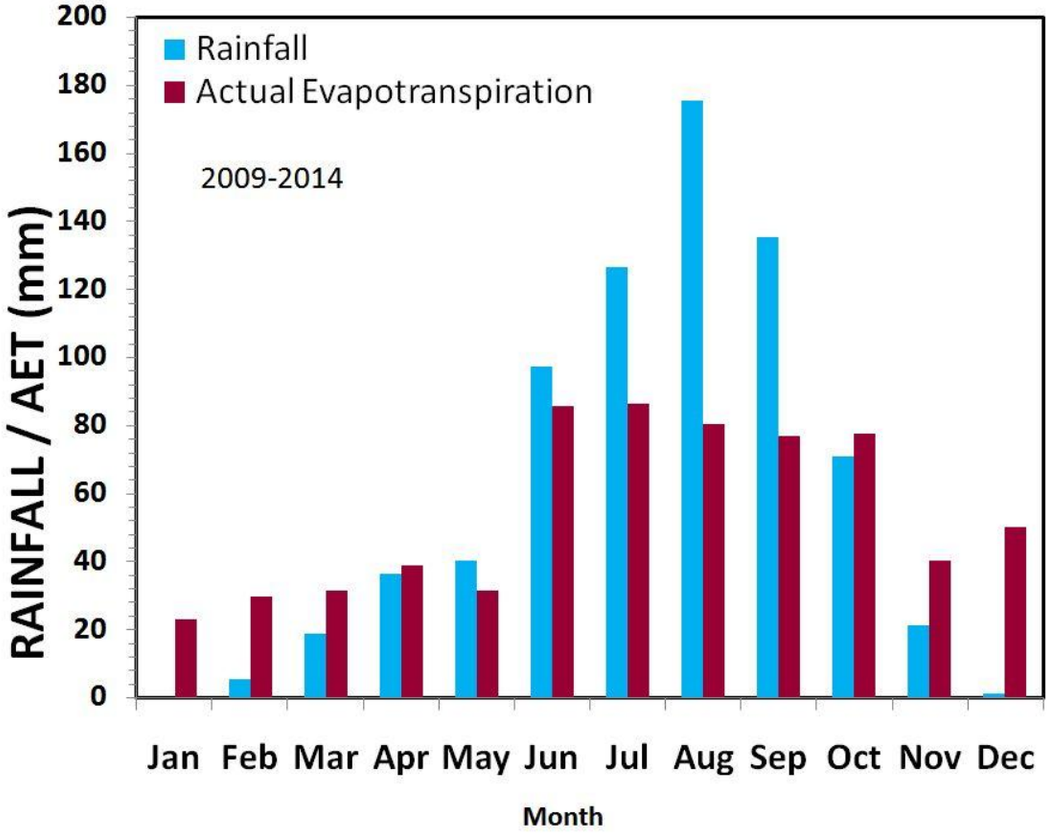
The average *rabi* rainfall (Oct-Jan) is about 12% of the average annual rainfall. During the years 2011, 2013, 2014, 2015 and 2016 the *rabi* rainfall was deficient by 100%, 5%, 42%, 68% and 60% respectively.

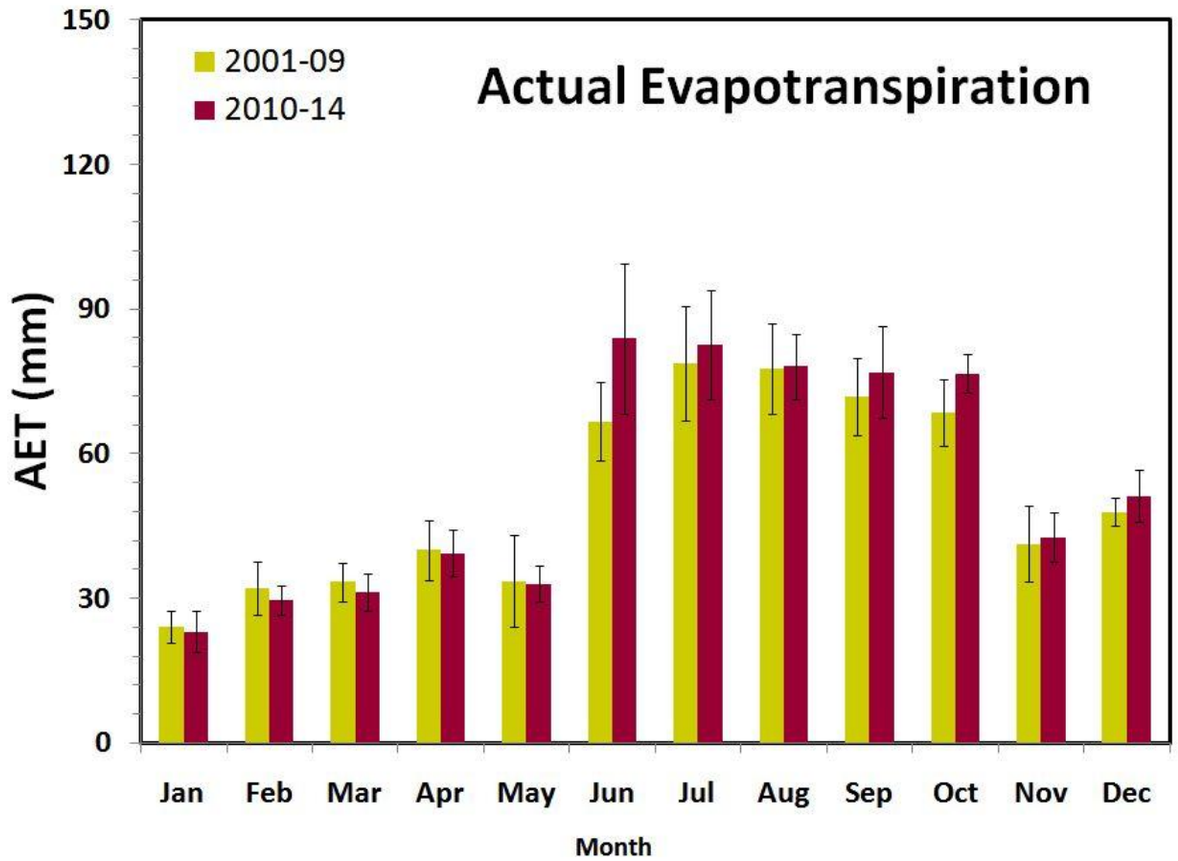
The average summer rainfall (Feb-May) is about 15% of the average annual rainfall.



EVAPOTRANSPIRATION

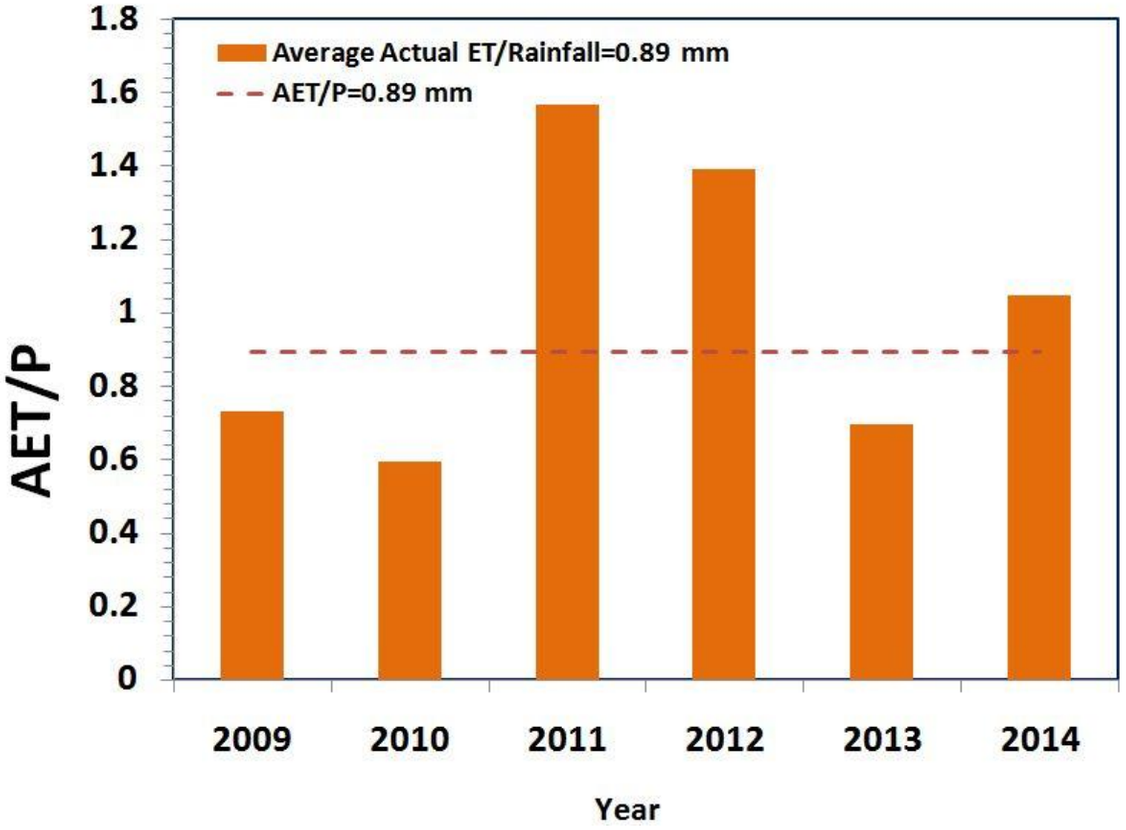


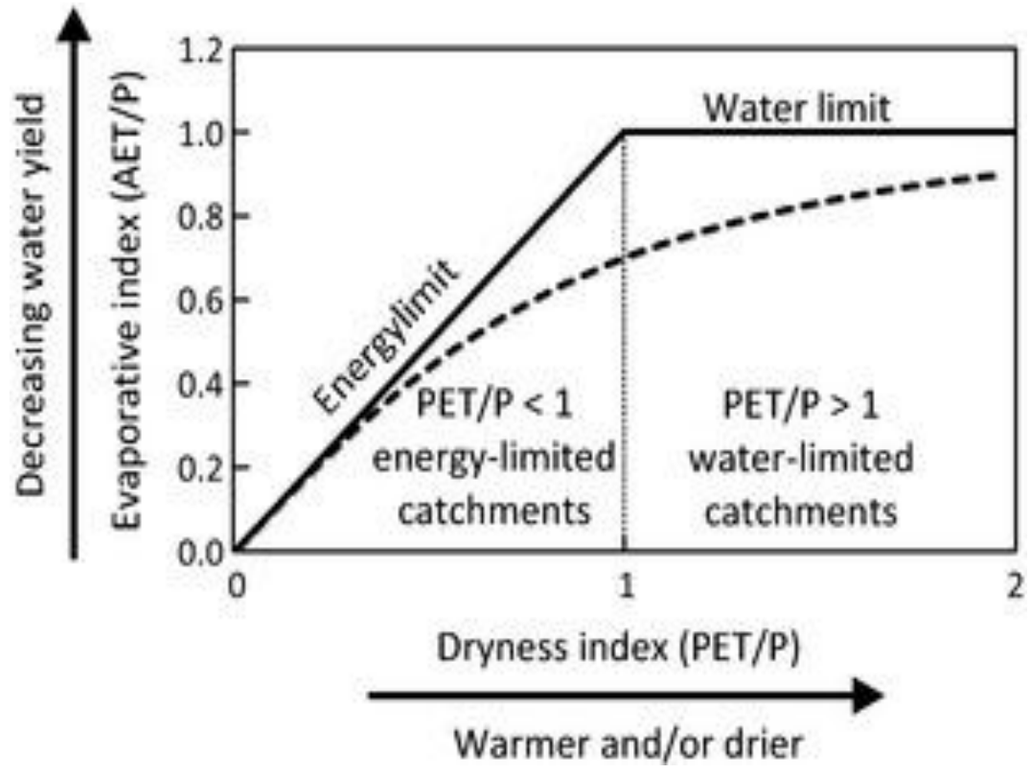




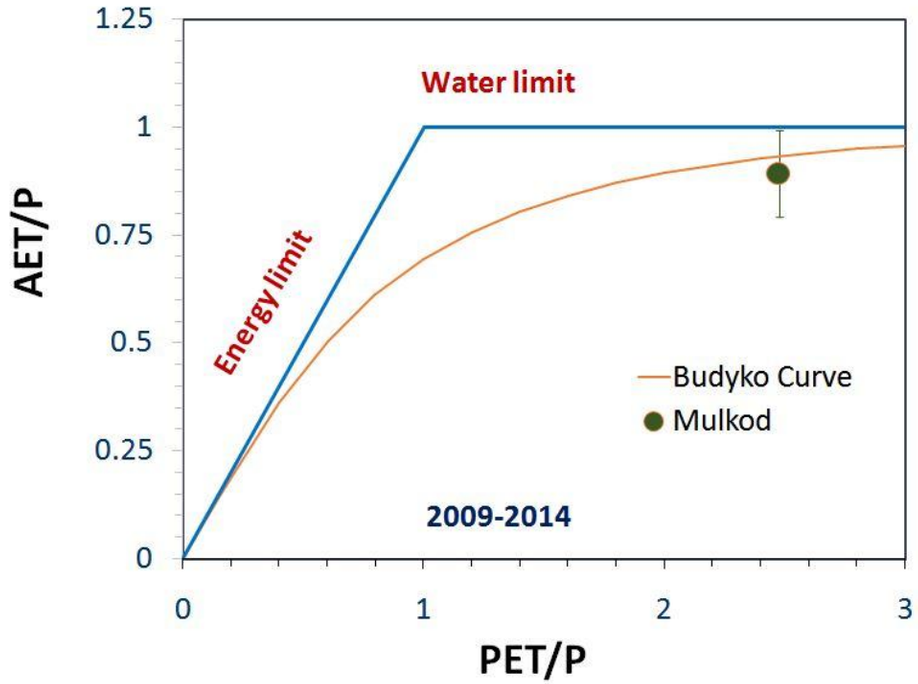
The average annual actual ET is lower than the average rainfall. During *kharif*, average rainfall and ET was found to be 585 mm and 329 mm respectively, whereas in *rabi* it was about 94 mm and 191 mm. In comparison to the 2001-2009, the annual ET increased by 5% during 2010-2014.

EVAPOTRANSPIRATION INDEX

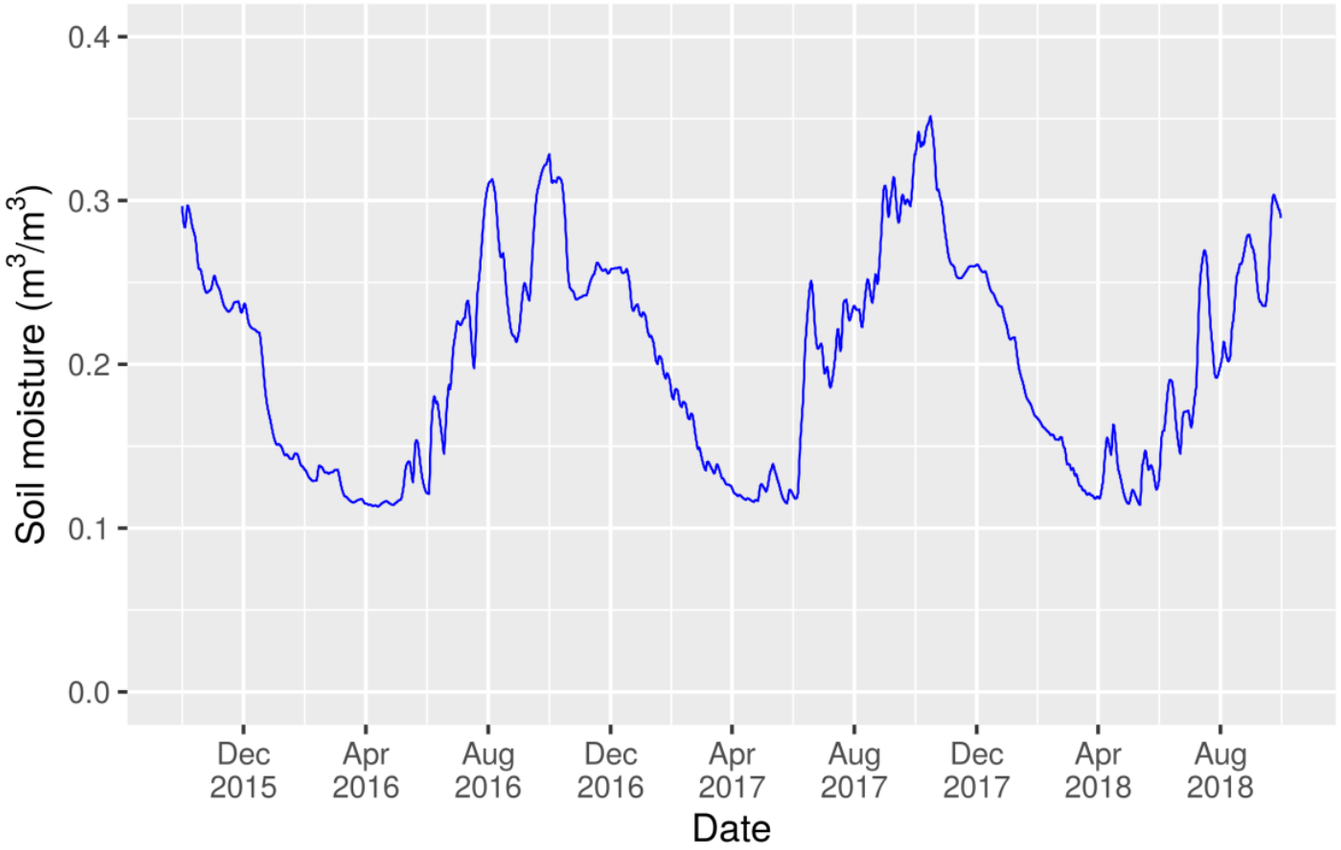


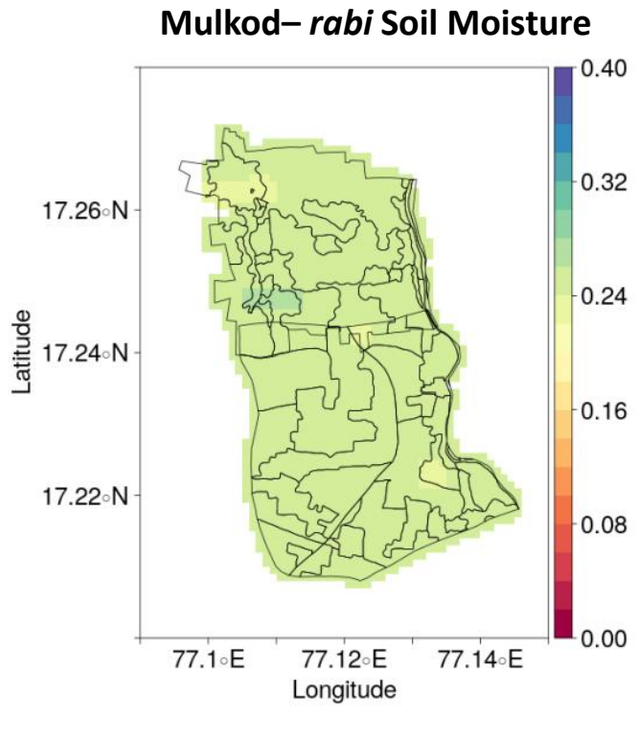


The average AET/P ratio was about 89%, which is slightly higher than the sustainable limit of about 80%.This suggests the sub-watershed is in sustainable limit due to good rainfall during *kharif* season.

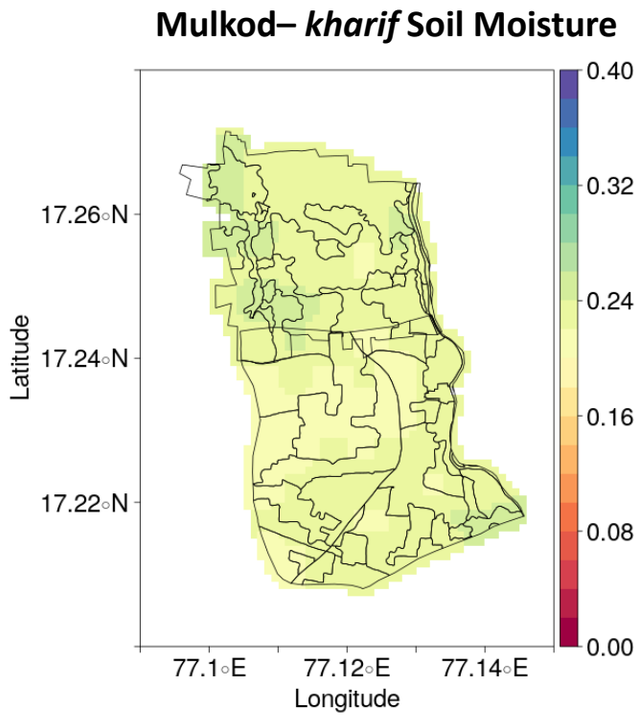


SATELLITE RETRIEVED SOIL MOISTURE





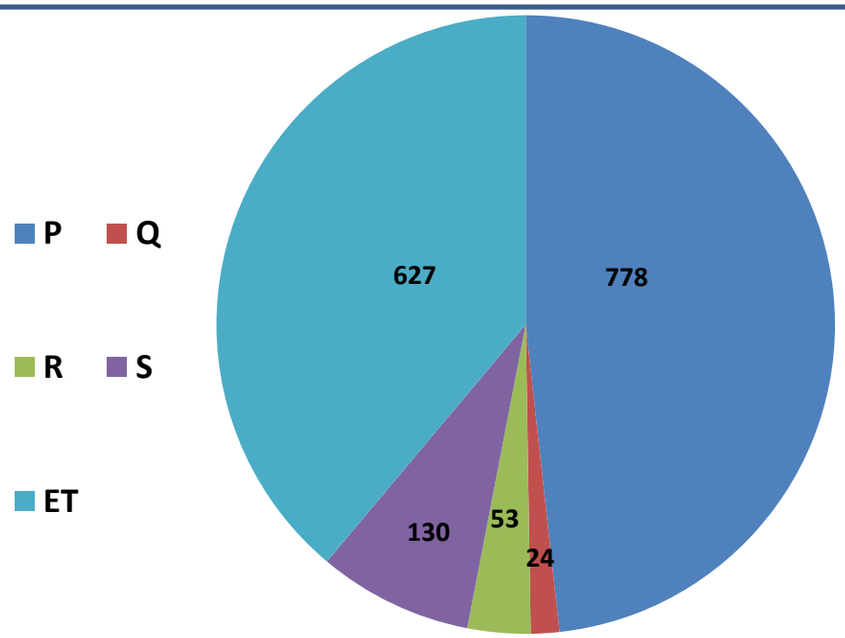
The method developed for retrieving soil moisture from multi-satellite observations allowed to map surface soil moisture behavior in the micro-watershed. The available surface moisture was varied in the range of 13-22 % in *kharif* and 24-33% in *rabi* seasons of 2016 and 13-32 % in *kharif* and 22-34% in *rabi* seasons of 2017.



WATER BALANCE

$$Q = P - E - R - S$$

- Q = Runoff
- P = Precipitation
- E = Evapotranspiration
- R = Groundwater recharge
- S = Soil moisture storage change

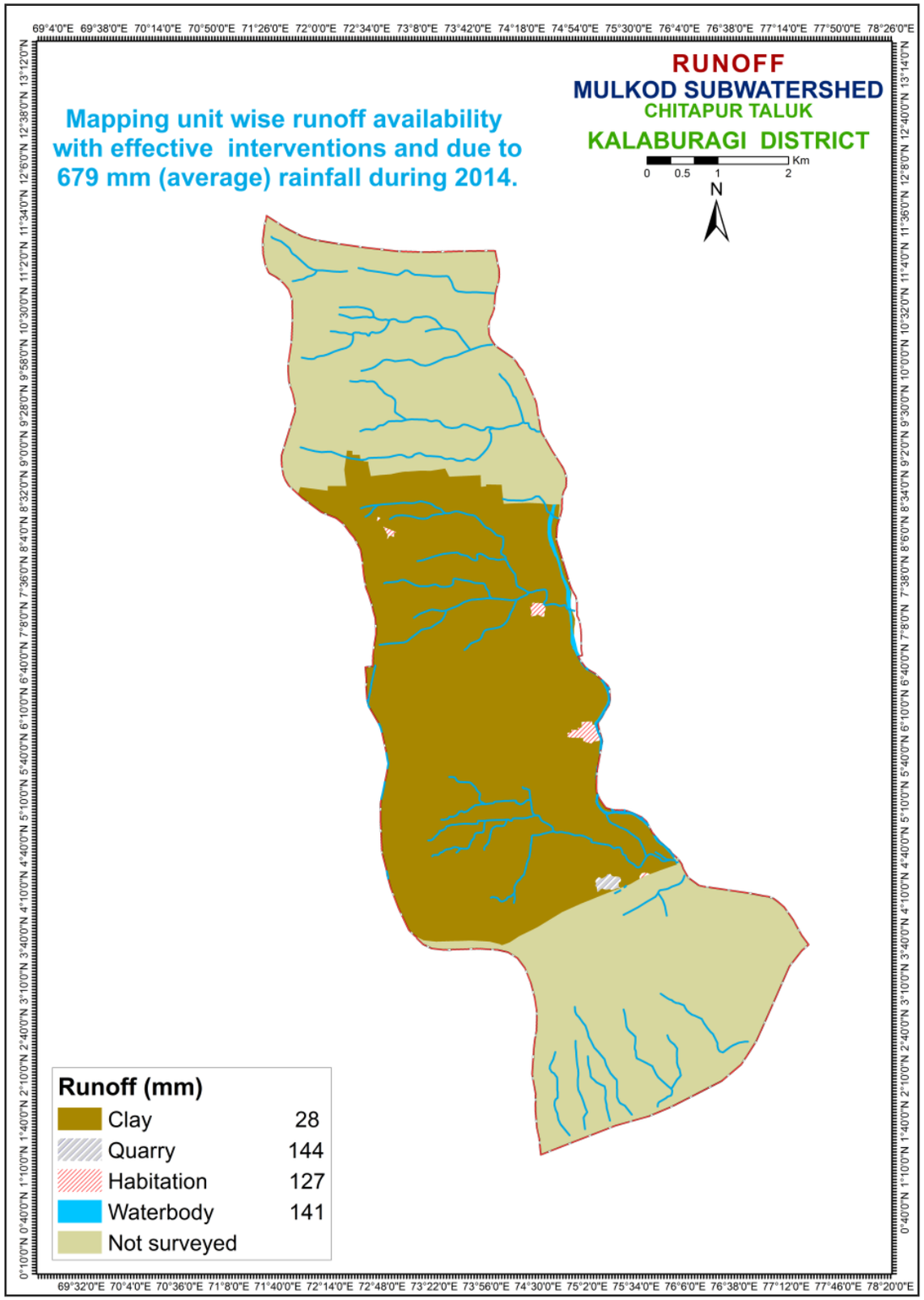


During June-September months, Precipitation is slightly higher than Evapotranspiration, hence Slight Runoff can occur in the watershed.

P = 778 mm (average of 2009-2017) ET = 627 mm R = 53 mm S = 130 mm Q = 24 mm

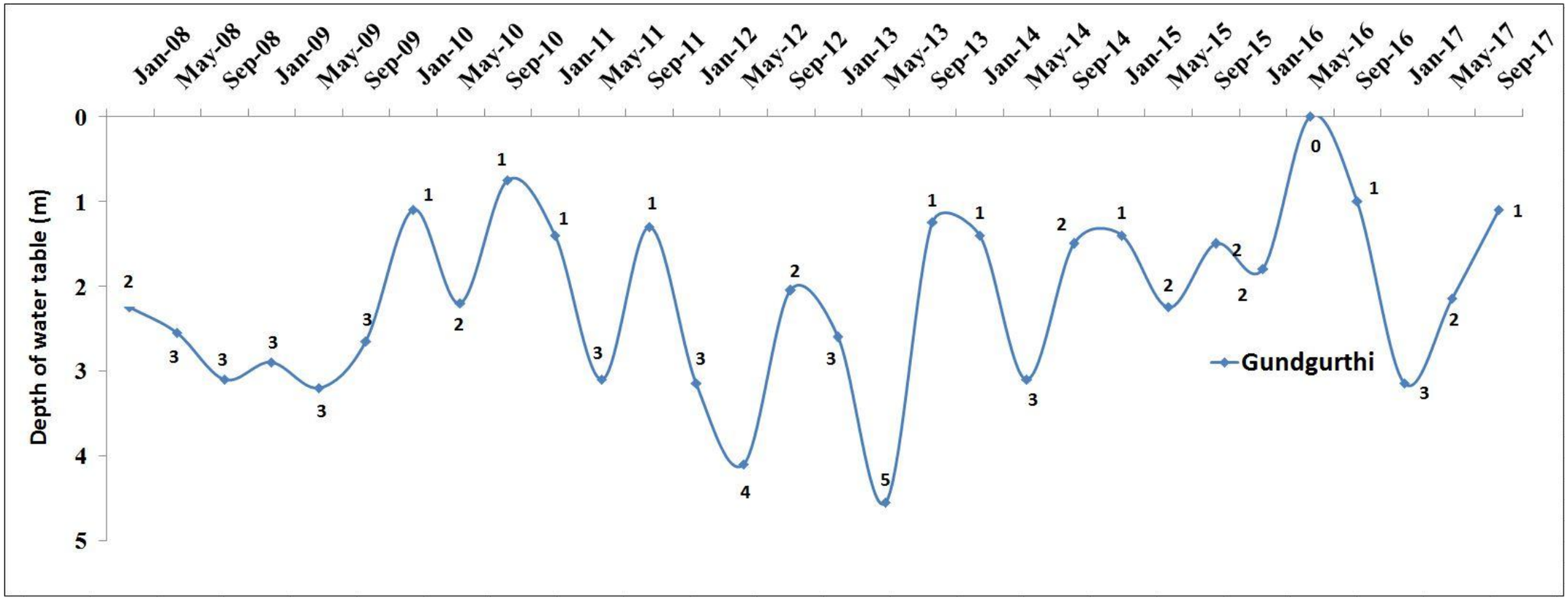
Sl. No.	Parameters	Average_ 2014 (mm)
1.	Rainfall	679
2.	Runoff availability with existing conditions	110
3.	Runoff availability with effective interventions	30
4.	Runoff allowed as environmental flow at the outlet	6
5.	Runoff excess for harvesting by construction of structures	24

RUNOFF


RUNOFF
MULKOD SUBWATERSHED
CHITAPUR TALUK
KALABURAGI DISTRICT
Mapping unit wise runoff availability with effective interventions and due to 679 mm (average) rainfall during 2014.
0 0.5 1 2 Km
N
Runoff (mm)
Clay 28
Quarry 144
Habitation 127
Waterbody 141
Not surveyed
69°4'0"E 69°38'0"E 70°14'0"E 70°50'0"E 71°26'0"E 72°0'0"E 72°34'0"E 73°8'0"E 73°42'0"E 74°18'0"E 74°54'0"E 75°30'0"E 76°4'0"E 76°38'0"E 77°14'0"E 77°50'0"E 78°26'0"E
69°32'0"E 70°4'0"E 70°36'0"E 71°8'0"E 71°40'0"E 72°14'0"E 72°48'0"E 73°22'0"E 73°56'0"E 74°30'0"E 75°2'0"E 75°34'0"E 76°6'0"E 76°38'0"E 77°12'0"E 77°46'0"E 78°20'0"E

GROUND WATER STATUS

GUNDGURTHI STATION



The groundwater level was found from the data obtained from KSNDMC for the nearest station Gundgurthi. The above graph depicts the groundwater levels during the years 2008-2017 was slightly varying except May 2016.

x

SUMMARY

- The average annual rainfall of 759 mm in the Mulkod sub-watershed as recorded from the Kalgi station data by KSNDMC.

- 73%, 12% and 15% of the annual rainfall occurs during *kharif*, *rabi* and summer seasons respectively and exhibited a higher temporal variability.

- The evapotranspiration estimation tool developed indicates that the watershed water balance is in deficit .The cropping & irrigation choices are not appropriate and need to be altered to shift the deficit water balance.

- The estimated runoff available to use is 24 mm for an average annual rainfall of 778 mm (2009-2017). The utilizable groundwater is 37 mm (70% of 53 mm recharge estimated). This means the total available water resource combining the soil moisture store for kharif & rabi (130 mm) and utilizable runoff plus recharge is 191 (=130+37+24)

- The average actual evapotranspiration estimated in the watershed based on the current land use and irrigation practices for the kharif and rabi seasons is 519 mm. Hence the amount of water use for kharif and rabi seasons may be estimated as 649 mm (i.e 125% of AET). This demand for the two seasons is higher by 458 mm, i.e. (649-191). The AET in June-Sept months is 61% of rainfall. Hence, there is a good opportunity to harvest the excess water through watershed management practices for utilizing during rabi season.

- The groundwater level was found from the data obtained from KSNDMC for the nearest station Gundgurthi. The groundwater levels during the years 2008-2017 was slightly varying except May 2016.