Land Resource and Hydrological Inventory of Gudigere Sub-watershed for Watershed Planning and Development Koppal Taluk, Koppal District, Karnataka (AESR 3.0)

Sujala – III
Karnataka Watershed Development Project- II
Funded by World Bank

ICAR - National Bureau of Soil Survey and Land Use Planning, Bangalore
Watershed Development Department, Govt. of Karnataka, Bangalore

About ICAR - NBSS&LUP

The 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 optimizing 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.

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PART-A

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

Koppal Taluk, Koppal District, Karnataka (AESR 3.0)

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How to read and use the Atlas

The Land Resource Inventory of Gudigere Sub-watershed (Koppal Taluk, Koppal District) for Watershed Planning (AESR 3.0) 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 management 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 watersheds.

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.

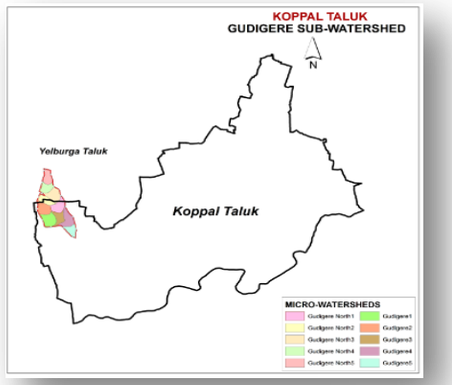
For easy map reading and understanding the information contain in different maps, the physical, cultural and scientific symbols used in the maps are illustrated in the form of colors, graphics and tables.

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.

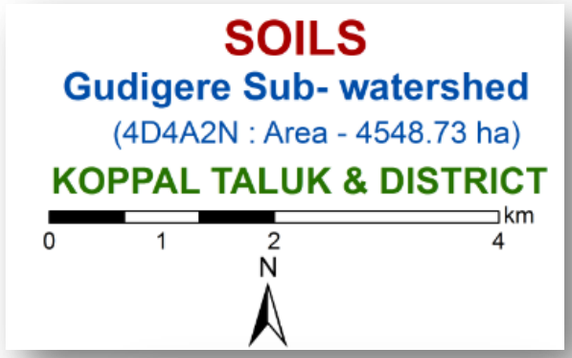
Inset map

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



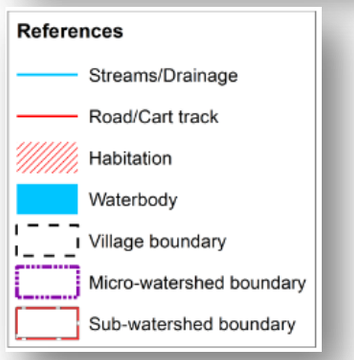
Map title

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



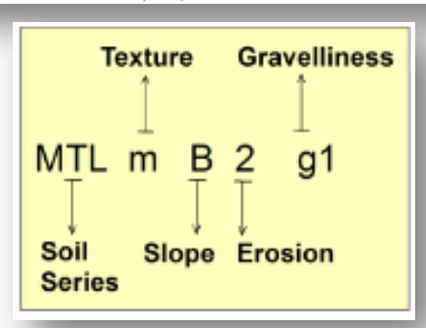
Legends and symbols

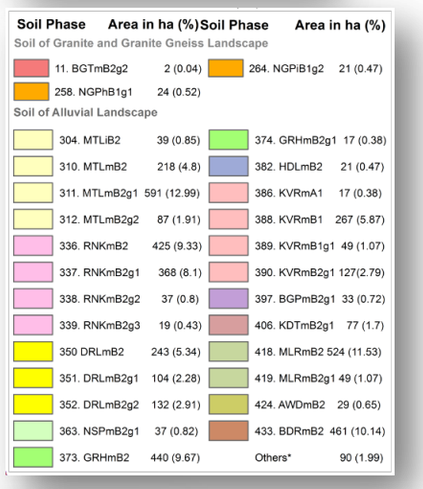
*Two legends accompany each map, a **map reference**, which depicts geographic features and a **thematic legend** which portrays spatial information. Picking up the symbol and colour of a particular enables one to go to the legends to obtain the required information.*



Soil Units

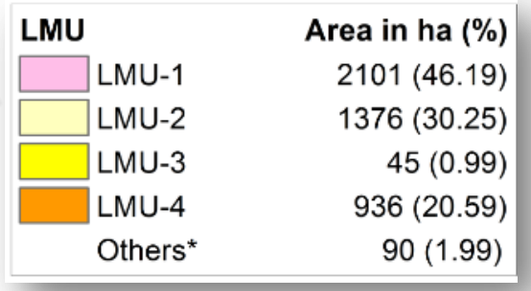
The soil map may be read at different levels. The most detailed level is that of the soil phase. Soil phases are distinguished within soil series mainly based on differences in surface of soil texture, slope, gravelliness , erosion ,etc.





Land Management Units (LMUs)

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

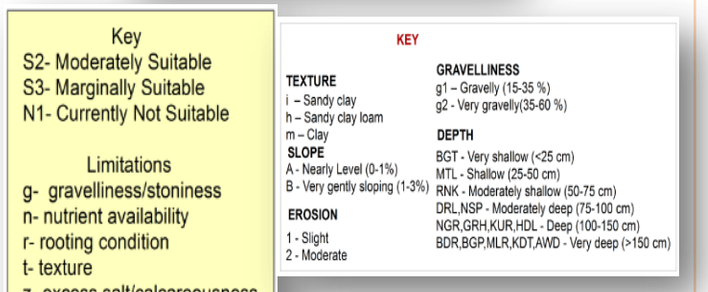


Map colours

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

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.

1. 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.

The major landforms identified in the Sub-watershed 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 in the Gudigere Sub-watershed covering an area of 3424.62 ha 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.

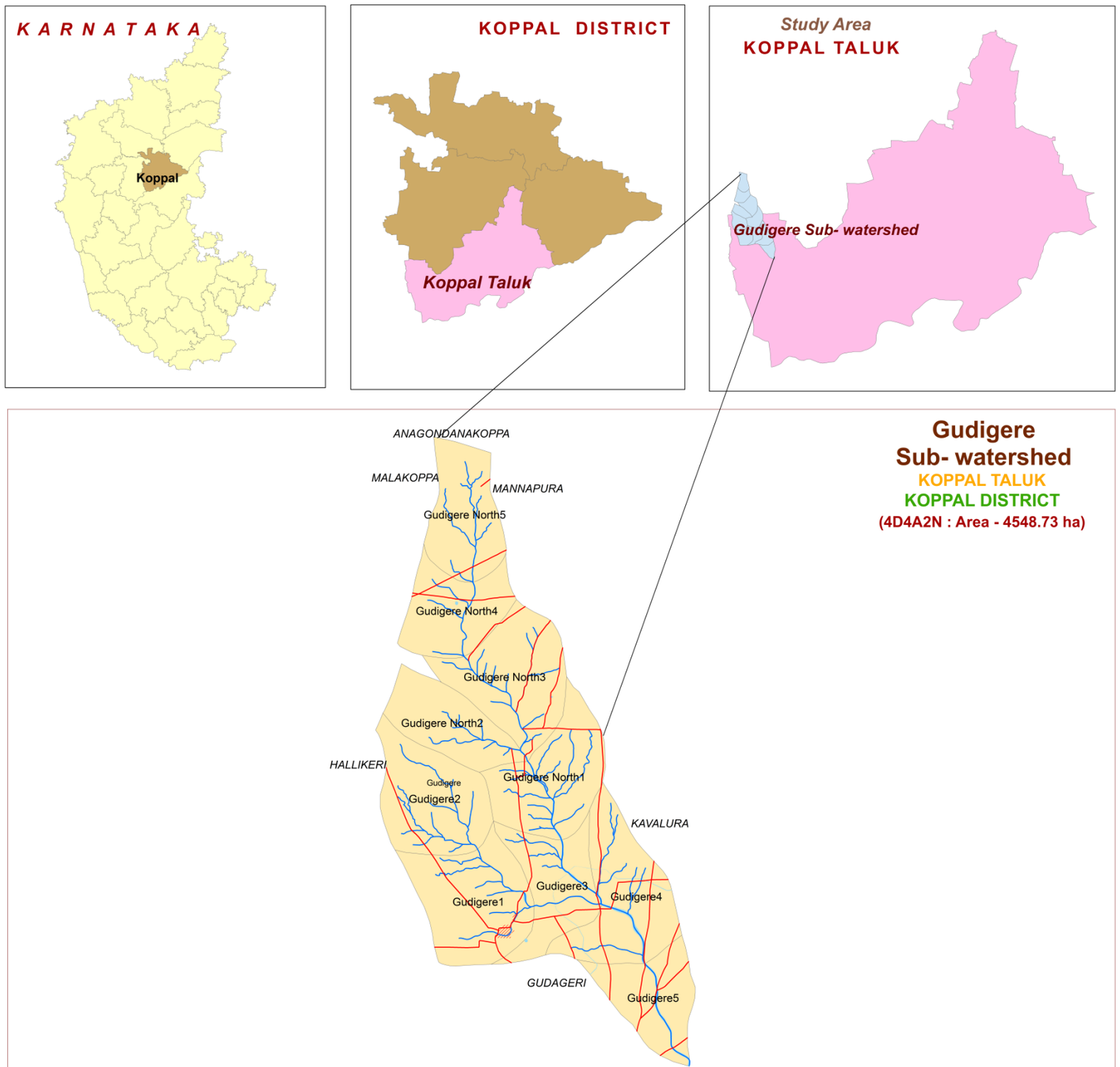
2. General Description of Sub-watershed

The Koppal district came to existence on 1st April 1998 by carving out of erst-while Raichur district of Karnataka with a geographical area of 552495 ha out of which forest area is 29451 ha, located in the northern part of the state. It lies between north latitudes 15˚ 09′ and 16˚ 01′ and east longitudes 75˚ 46′ and 76˚ 48′. The area falls in the Tungabhadra sub-basin of the Krishna basin. Tungabhadra river flows in the southern boundary of the district in north –easterly direction. The climate of the district is very hot and dry. The district has an average annual rainfall of 572 mm. Soils are well drained red sandy loam to medium deep black soils. This may be the weathering product of schistose, gneissic and granite terrain. Agriculture in Koppal district is dependent upon rainfall, irrigation tanks, wells, streams etc. The major agricultural crops grown are Jawar, Bajra, Wheat, Maize, Paddy, Horsegram, Greengram, Cowpea, Groundnut, Cotton, Niger seeds, Castor, Sunflower, Sugarcane etc. The major fruit crops include Pomegranates, Mango, Sapota, Citrus, Guava, Papaya. The major vegetable crops are leafy vegetables, Tomato, Onion, Brinjal *etc*.

As a pilot study, **ICAR-NBSS&LUP, Bangalore** carried out the generation of LRI for the Gudigere Sub-watershed in Koppal taluk, Koppal district. It was selected for data base generation under Sujala III project. Gudigere Sub-watershed (code - 4D4A2N) is covering an area of 4548.73 ha and spread across Gudageri, Hallikeri, Anagondanakoppa, Malakoppa, Mannapura and Kavalura villages.

LOCATION AND EXTENT

LOCATION MAP OF GUDIGERE SUB-WATERSHED



The Gudigere Sub-watershed (Koppal taluk, Koppal district) is located in between 15^0 17' – 15^0 24' North latitudes and 75^0 57' – 75^0 53' East longitudes, covering an area of about 4548.73 ha. bounded by across Gudageri, Hallikeri, Anagondanakoppa, Malakoppa, Mannapura and Kavalura villages.

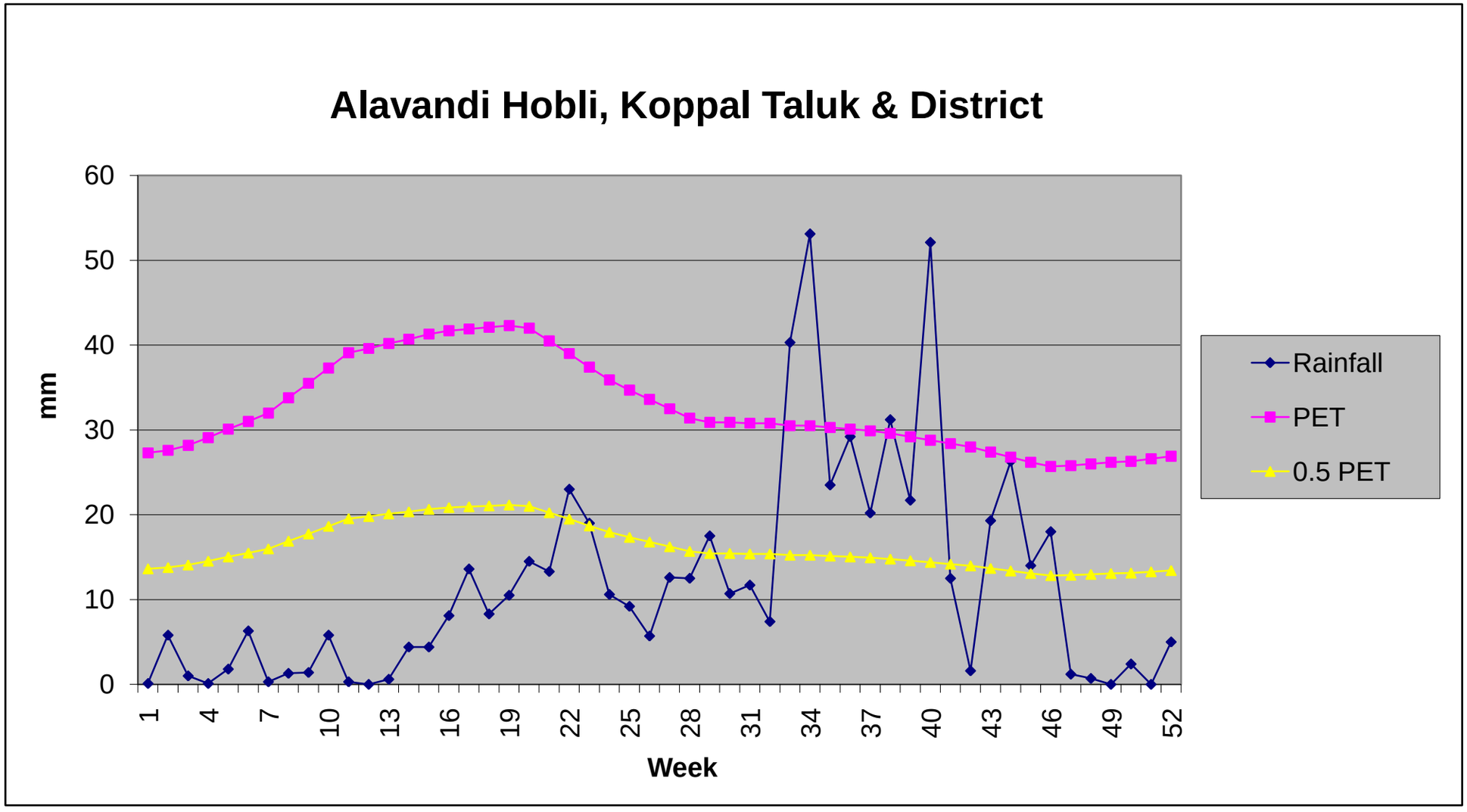
Agro Ecological Region (AER) – 3: (Deccan plateau, hot arid ecosubregion)

Karnataka Plateau (Rayalseema as inclusion), hot arid ESR with deep loamy and clayey mixed Red and Black soils, low to medium AWC and LGP 60-90 days

Agro-climatic Zone 3: Northern Dry Zone:

This zone is the largest in the state with a geographical area of 5.04 M ha, of which about 3.55 M ha is under cultivation. Irrigation is available to about 0.49 M ha. The zone encompasses the entire districts of Bijapur and Bellary, 6 taluks of Koppal, 5 taluks of Dharwad and 5 taluks of Belgaum. Of the 35 taluks in the zone, 9 taluks have a mean elevation of 800-900 m MSL while the rest have an elevation of 450-800 m. The rainfall is similar to that of the northeastern dry zone, ranging between 465 and 785 mm. Black soils are predominant in the zone with depth ranging from shallow to deep. General cropping season is *kharif* in shallow black soils and *rabi* in medium and deep black soils. Important crops of the zone are jowar, maize, bajra, groundnut, pulses, sunflower, cotton and sugarcane.

Climate

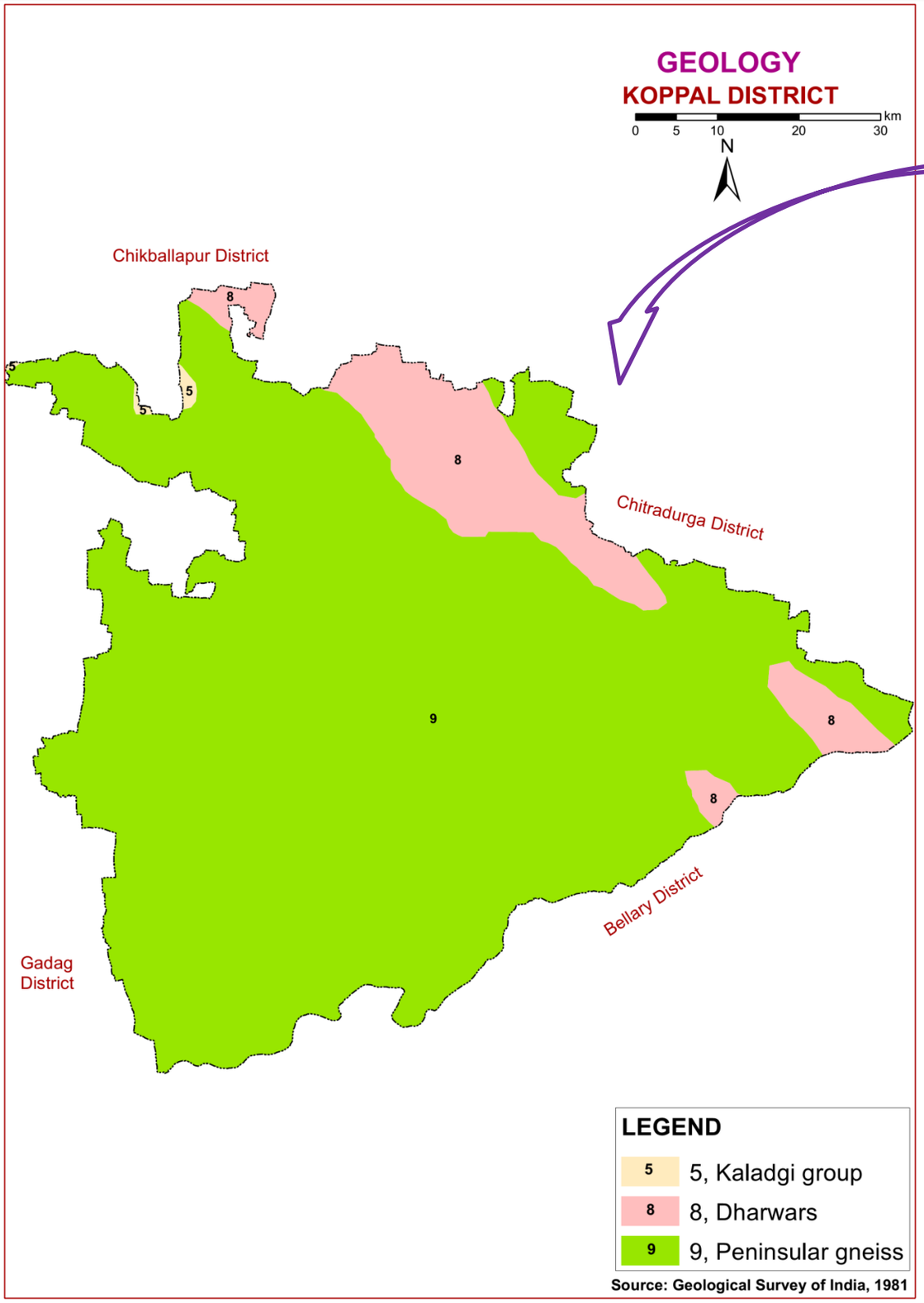


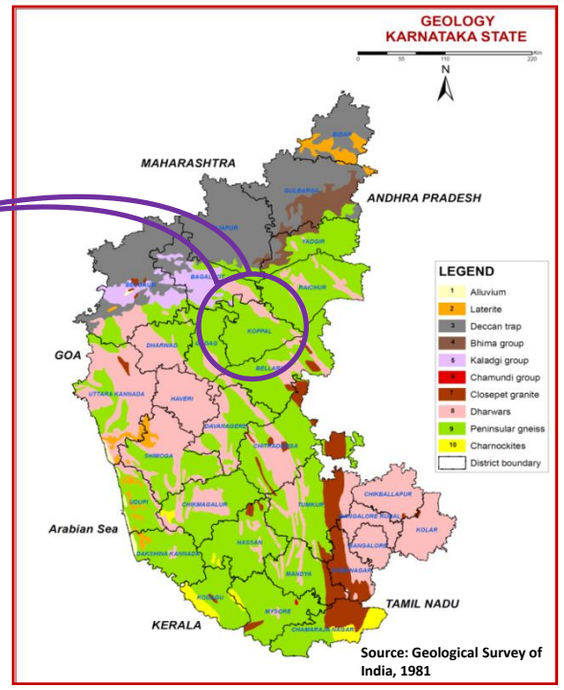
Length of Growing Period (LGP) is varying from August 2nd week to 2nd week of November (< 90 days)

Annual Rainfall : 614 mm. in the Alavandi Hobli, Koppal Taluk & District

Source: KSNMDC (1980-2011)

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 - KOPPAL DISTRICT

Kaladgi group

It consists of nearly horizontal sedimentary rocks 3000 to 5000m thick overlying the Archaeans. The component rocks are sandstones, shales, limestone, dolomite and schists.

Dharwar schists

The Dharwar schists consist of a complex series of crystalline schists associated with ultrabasic rocks such as amphibolite, peridotites and dunites. These schists are found in long, narrow bands of various dimensions running NW-SE through the Peninsular Gneiss. The Dharwars are divided into Upper and Lower.

Upper Dharwars are equivalent to the Archaean to Lower Proterozoic, and are divided into Bababudan (comprises banded ferruginous quartzites, pyroxenite, gabbro, serpentinite, acid volcanic, phyllites, metabasalt, and quartz-chlorite schist) and Chitradurga groups (includes quartzite, limestone, dolomite, chlorite-schist, and manganese and iron ores with phyllite, metabasalt and conglomerates).

Lower Dharwars occur in Mysore district and include amphibolite schist, quartzite, ironstone and marble.

Peninsular Gneiss

Exposed over a large area of Karnataka in all the districts except Bidar is the Peninsular Gneiss which is a heterogeneous mixture of several types of granitic rocks such as banded gneisses, granitic gneisses, granites and gneissic granites, granodiorites and diorites. The banded gneisses consist of white bands of quartz-feldspar alternating with dark bands of biotite, hornblende, and minor accessories. The granite group includes granites of all shades with varying composition. Peninsular gneiss seems to have formed by the granitization of the older rocks.

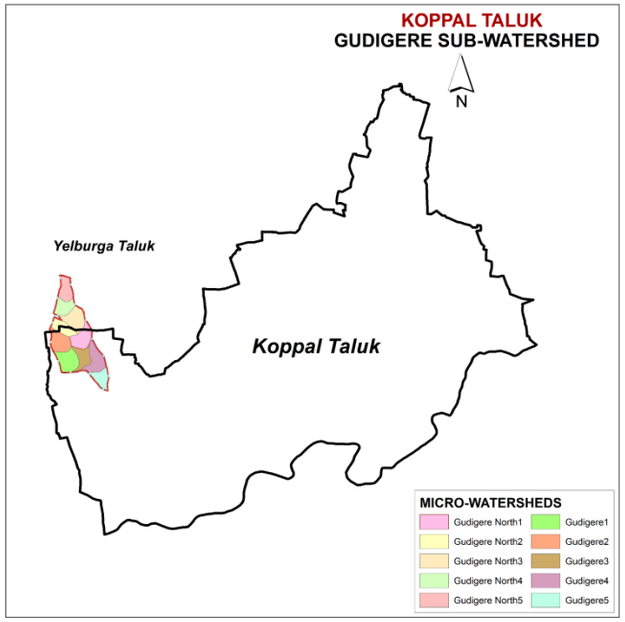
3. SURVEY METHODOLOGY

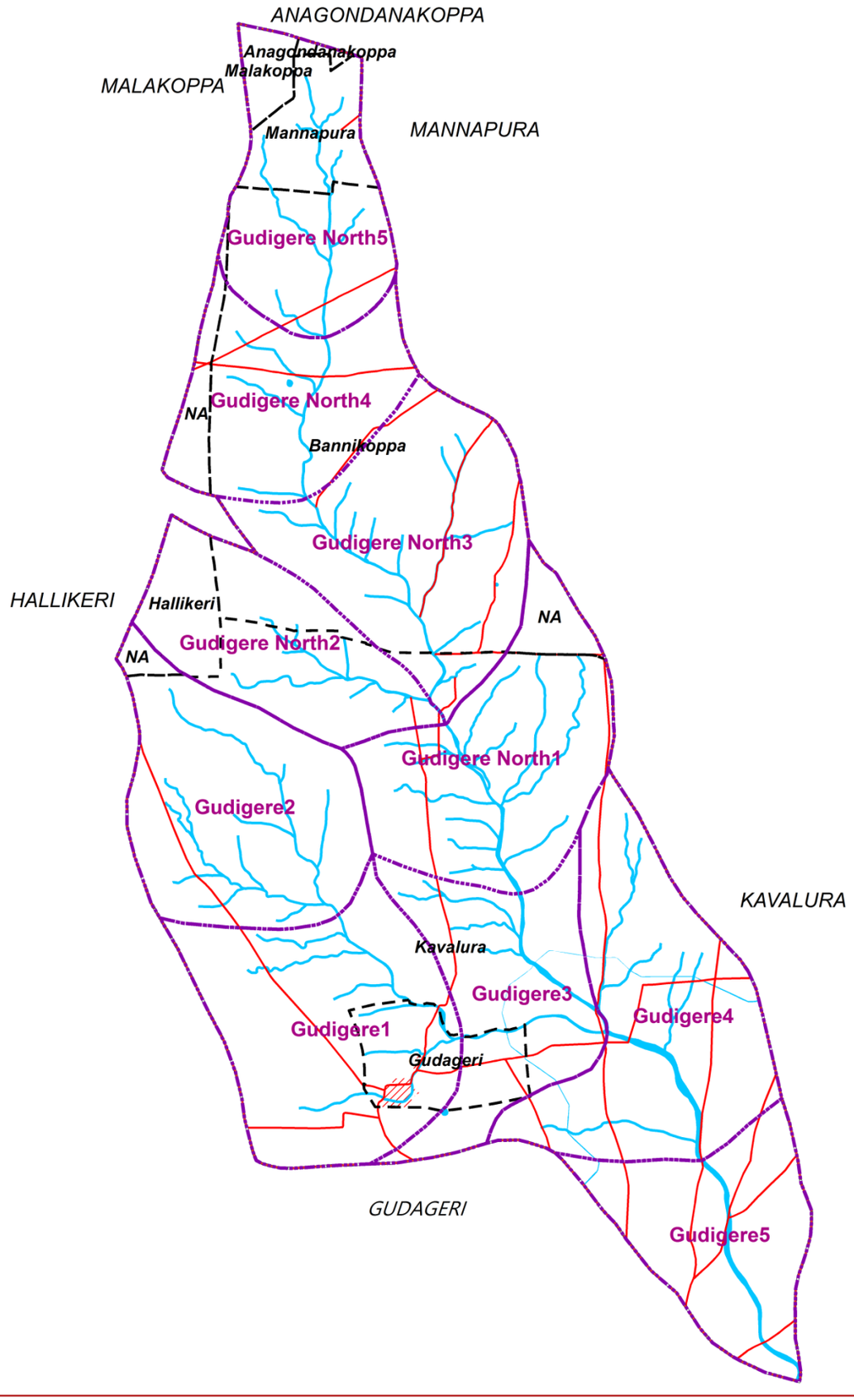
Sequence of activities in generation of LRI

- 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 (320m 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.

3.1. Database Used - Cadastral map





Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

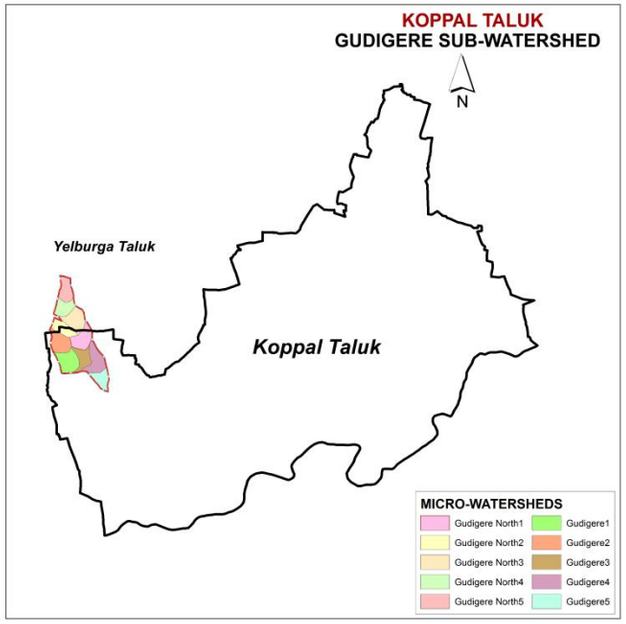
N

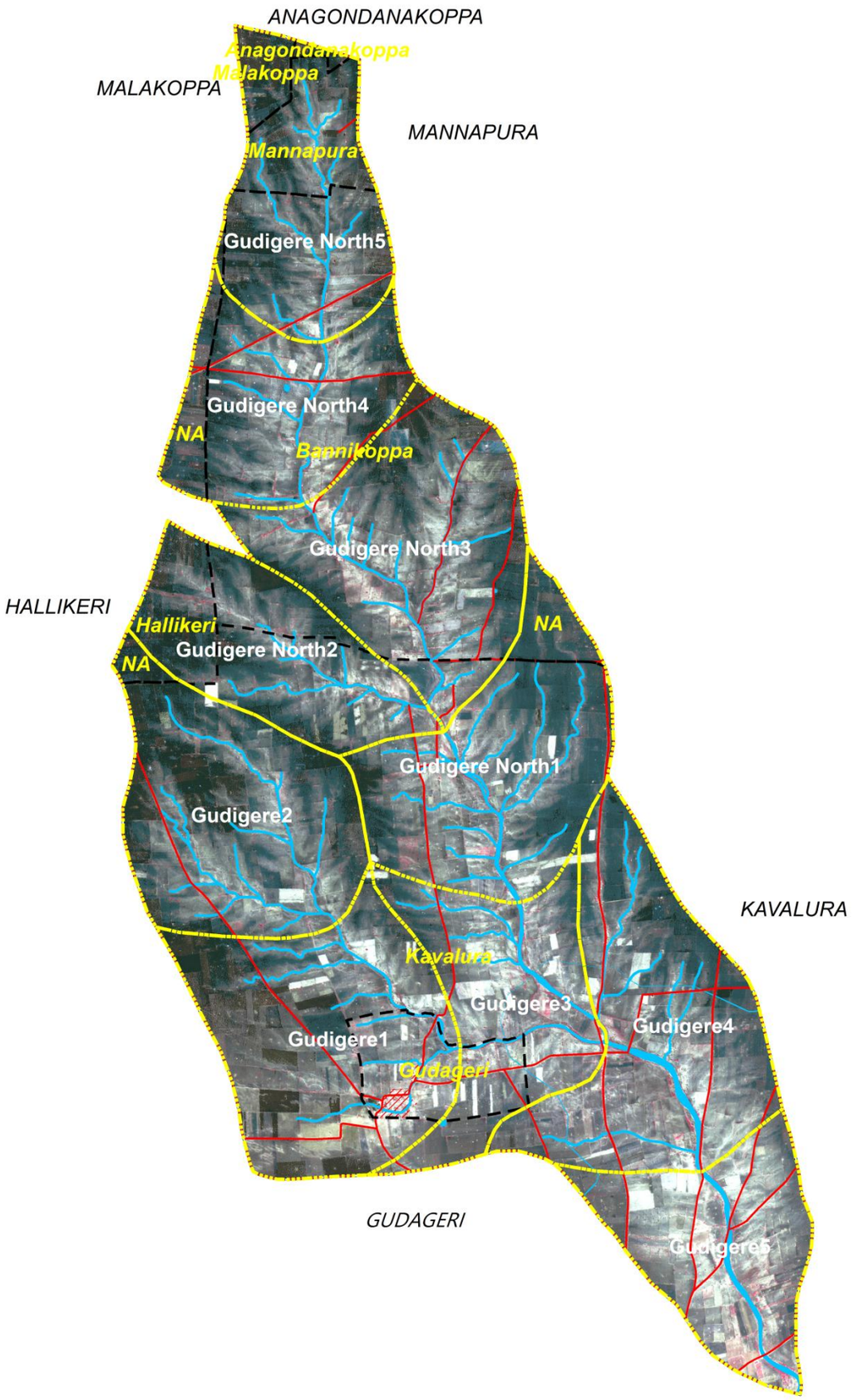
References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

3.2. Database Used - Satellite Image





SATELLITE IMAGE

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

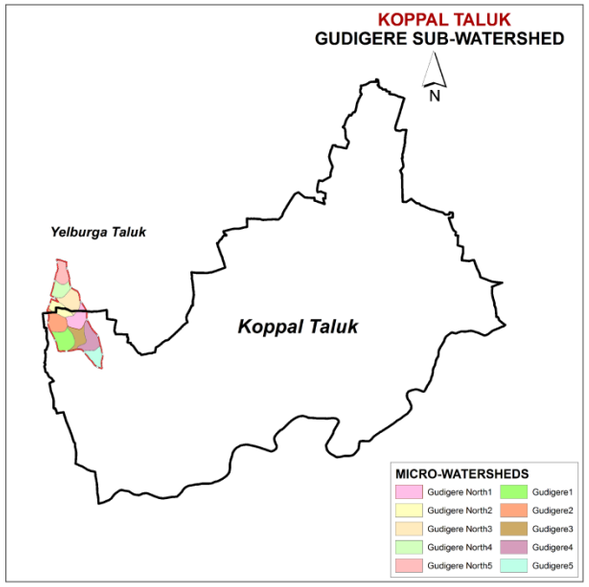
N

References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Sub-watershed boundary

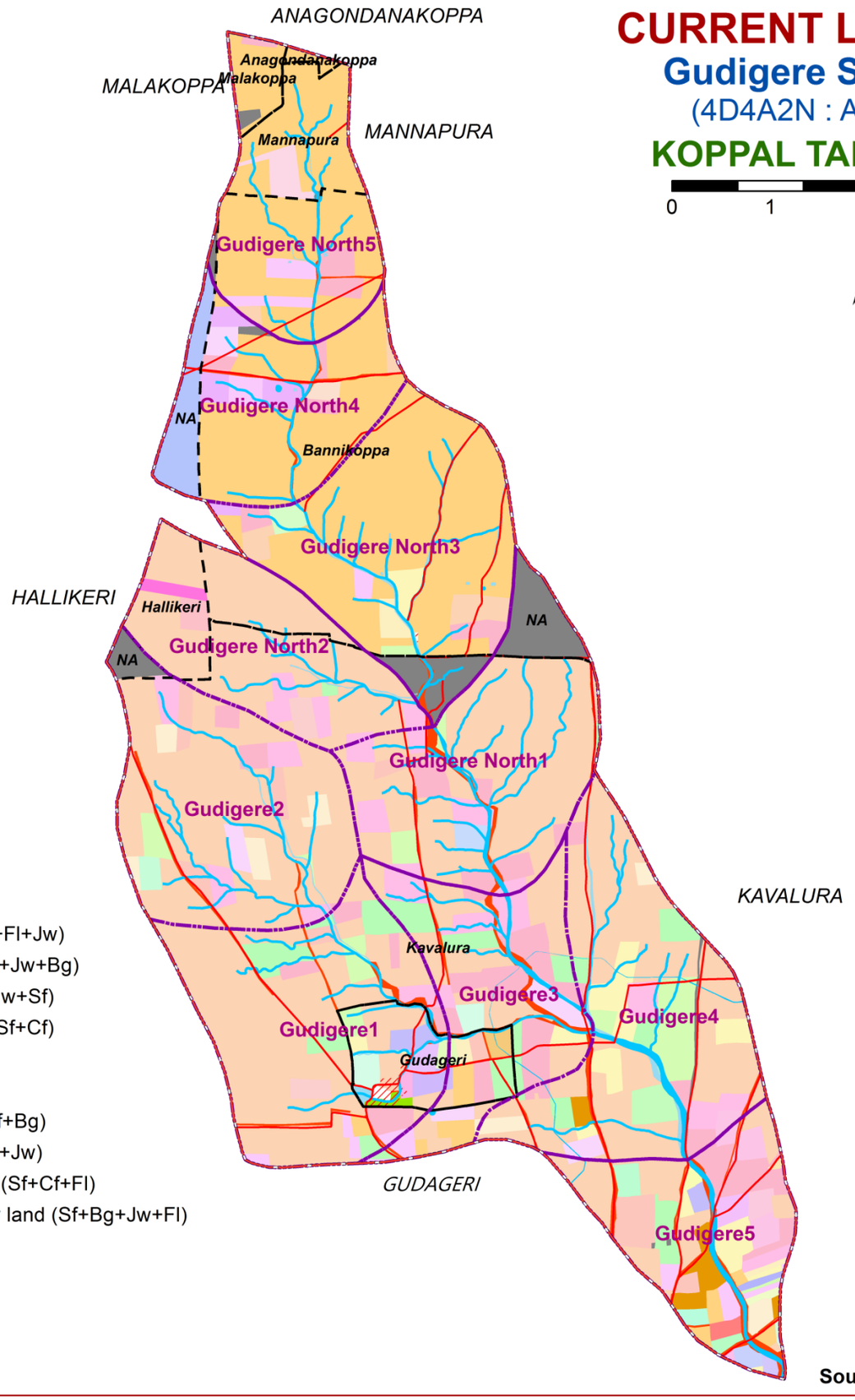
Source: ICAR-NBSS&LUP, Bengaluru

3.3. Current LandUse



Current Land Use

- Bengalgram (Bg)
- Coriander (Cd)
- Current fallow (Cf)
- Fallow land (Fl)
- Groundnut (Gn)
- Jowar (Jw)
- Railway
- Redgram (Rg)
- Sunflower (Sf)
- Wheat (Wh)
- Bengalgram+Coriander (Bg+Cd)
- Bengalgram+Current fallow (Bg+Cf)
- Bengalgram+Jowar (Bg+Jw)
- Chilly+Jowar (Ch+Jw)
- Current fallow+Bengalgram (Cf+Bg)
- Current fallow+Fallow land (Cf+Fl)
- Current fallow+Jowar (Cf+Jw)
- Current fallow+Onion (Cf+On)
- Current fallow+Sunflower (Cf+Sf)
- Fallow land+Sunflower (Fl+Sf)
- Groundnut+Onion (Gn+On)
- Jowar+Bengalgram (Jw+Bg)
- Jowar+Coriander (Jw+Cd)
- Jowar+Current fallow (Jw+Cf)
- Jowar+Fallow land (Jw+Fl)
- Jowar+Maize (Jw+Mz)
- Jowar+Sunflower (Jw+Sf)
- Jowar+Wheat (Jw+Wt)
- Maize+Fallow land (Mz+Fl)
- Maize+Jowar (Mz+Jw)
- Maize+Sunflower (Mz+Sf)
- Onion+Current fallow (On+Cf)
- Redgram+Jowar (Rg+Jw)
- Sunflower+Bengalgram (Sf+Bg)
- Sunflower+Current fallow (Sf+Cf)
- Sunflower+Jowar (Sf+Jw)
- Sunflower+Maize (Sf+Mz)
- Current fallow+Fallow land+Jowar (Cf+Fl+Jw)
- Current fallow+Jowar+Bengalgram (Cf+Jw+Bg)
- Current fallow+Jowar+Sunflower (Cf+Jw+Sf)
- Jowar+Sunflower+Current fallow (Jw+Sf+Cf)
- Maize+Jowar+Chilly (Mz+Jw+Ch)
- Maize+Jowar+Paddy (Mz+Jw+Pd)
- Paddy+Sunflower+Bengalgram (Pd+Sf+Bg)
- Sunflower+Bengalgram+Jowar (Sf+Bg+Jw)
- Sunflower+Current fallow+Fallow land (Sf+Cf+Fl)
- Sunflower+Bengalgram+Jowar+Fallow land (Sf+Bg+Jw+Fl)
- Road
- Habitation
- Waterbody
- Not Available (NA)



CURRENT LANDUSE (2018)

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

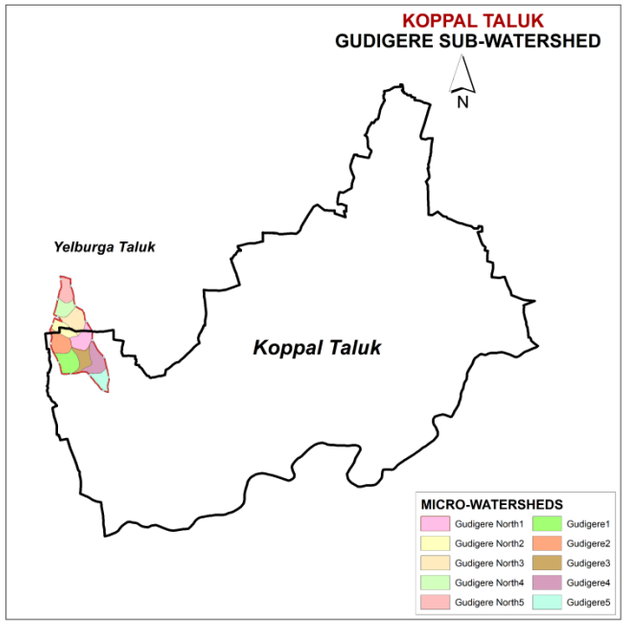
N

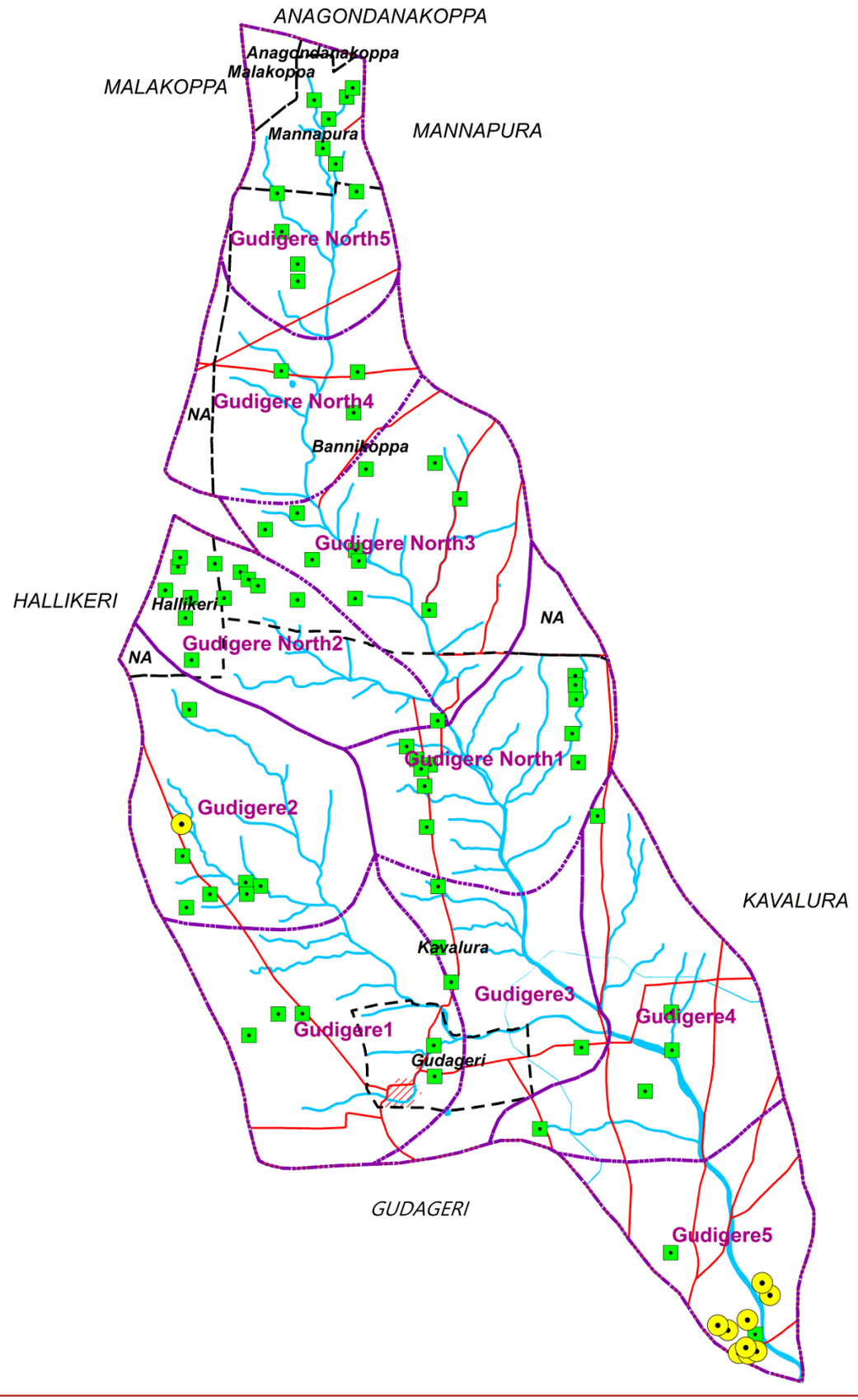
References

- Streams/Drainage
- Road/Cart track
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

3.4. Location of Wells





LOCATION OF WELLS

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

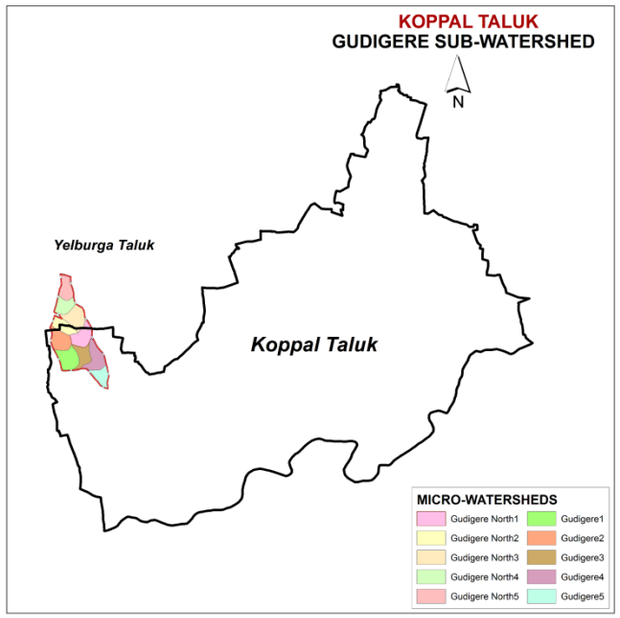
References

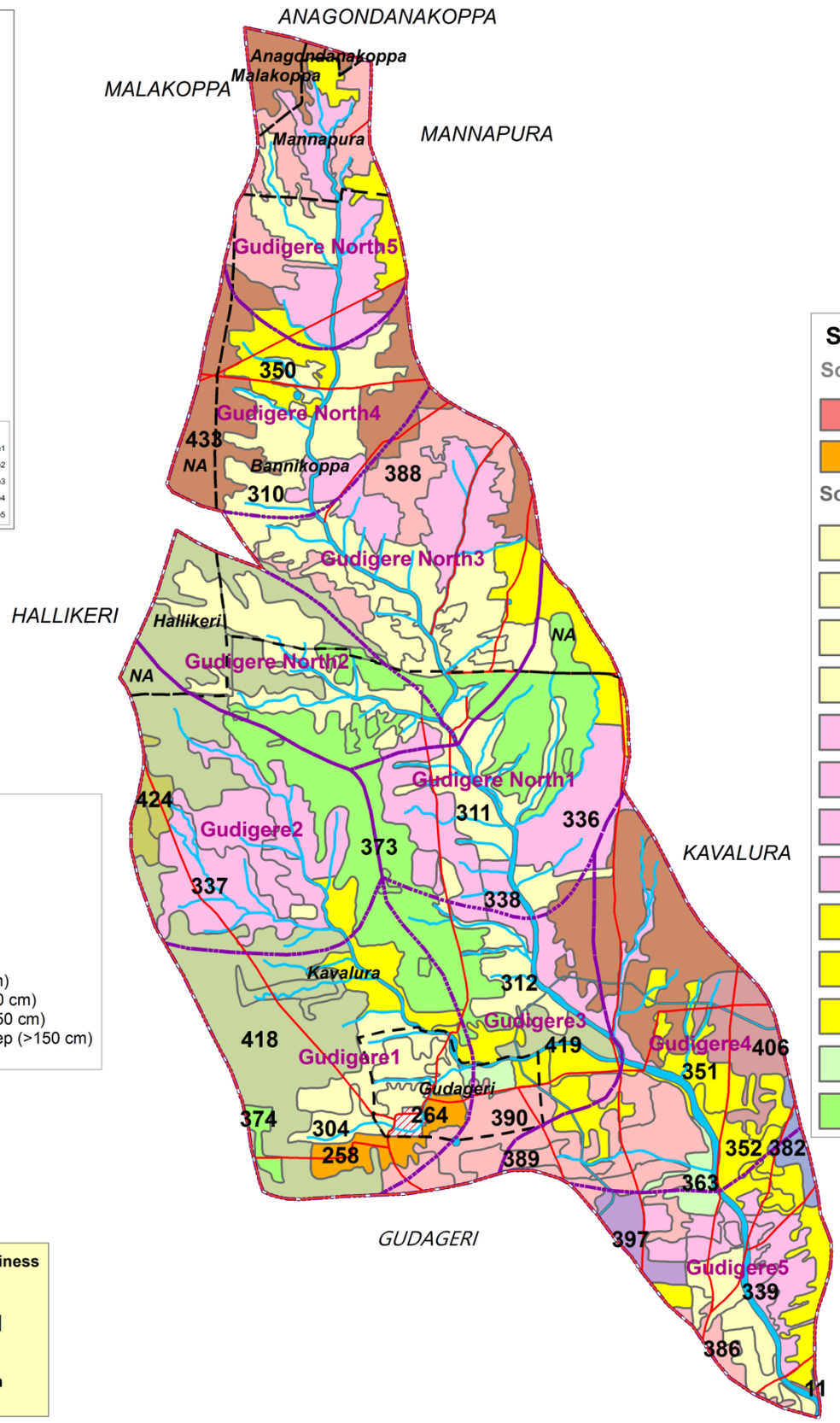
- Road/Cart track
- Streams/Drainage
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Legend	No's
Borewell	10
Farm pond	71

Source: ICAR-NBSS&LUP, Bengaluru

4. The Soils





SOILS

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

km 0 1 2 4

N

Soil Phase	Area in ha (%)	Soil Phase	Area in ha (%)
Soil of Granite and Granite Gneiss Landscape			
11. BGTmB2g2	2 (0.04)	264. NGPiB1g2	21 (0.47)
258. NGPhB1g1	24 (0.52)		
Soil of Alluvial Landscape			
304. MTLiB2	39 (0.85)	374. GRHmB2g1	17 (0.38)
310. MTLmB2	218 (4.8)	382. HDLmB2	21 (0.47)
311. MTLmB2g1	591 (12.99)	386. KVRmA1	17 (0.38)
312. MTLmB2g2	87 (1.91)	388. KVRmB1	267 (5.87)
336. RNKmB2	425 (9.33)	389. KVRmB1g1	49 (1.07)
337. RNKmB2g1	368 (8.1)	390. KVRmB2g1	127(2.79)
338. RNKmB2g2	37 (0.8)	397. BGPmB2g1	33 (0.72)
339. RNKmB2g3	19 (0.43)	406. KDTmB2g1	77 (1.7)
350 DRLmB2	243 (5.34)	418. MLRmB2	524 (11.53)
351. DRLmB2g1	104 (2.28)	419. MLRmB2g1	49 (1.07)
352. DRLmB2g2	132 (2.91)	424. AWDmB2	29 (0.65)
363. NSPmB2g1	37 (0.82)	433. BDRmB2	461 (10.14)
373. GRHmB2	440 (9.67)	Others*	90 (1.99)

KEY

TEXTURE
i – Sandy clay
h – Sandy clay loam
m – Clay

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

EROSION
1 - Slight
2 - Moderate

GRAVELLINESS
g1 – Gravelly (15-35 %)
g2 - Very gravelly(35-60 %)

DEPTH
BGT - Very shallow (<25 cm)
MTL - Shallow (25-50 cm)
RNK - Moderately shallow (50-75 cm)
DRL,NSP - Moderately deep (75-100 cm)
NGR,GRH,KUR,HDL - Deep (100-150 cm)
BDR,BGP,MLR,KDT,AWD - Very deep (>150 cm)

References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Texture		Gravelliness
MTL	m B 2	g1
Soil Series	Slope	Erosion

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

4.1 Mapping unit description of Gudigere (4D4A1U) Sub-watershed in Koppal taluk, Koppal district

Soil map unit No*	Soil Series	Soil phase	Mapping Unit Description	Area in ha (%)
Soils of Granite and Granite Gneiss Landscape				
	BGT	Belagatti soils are very shallow (< 25 cm), well drained, have dark gray to dark grayish brown gravelly calcareous clay soils occurring on very gently sloping uplands		**2 (0.04)**
11		BGTmB2g2	Clay surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	2 (0.04)
	NGP	Nagalapur soils are deep (100-150 cm), well drained, have dark reddish brown to dark red gravelly sandy clay soils occurring on nearly level to gently sloping uplands under cultivation		**45(0.99)**
258		NGPhB1g1	Sandy clay loam surface, slope 1-3%, slight erosion, gravelly (15-35%)	24 (0.52)
264		NGPiB1g2	Sandy clay surface, slope 1-3%, slight erosion, very gravelly (35-60%)	21 (0.47)
Soils of Alluvial Landscape				
	MTL	Muttal soils are shallow (25-50 cm), well drained, have very dark grayish brown to dark brown, calcareous black gravelly clay soils occurring on nearly level to gently sloping plains under cultivation		**935(20.46)**
304		MTLiB2	Sandy clay surface, slope 1-3%, moderate erosion	39 (0.85)
310		MTLmB2	Clay surface, slope 1-3%, moderate erosion	218 (4.8)
311		MTLmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	591(12.9)
312		MTLmB2g2	Clay surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	87 (1.91)
	RNK	Ravanaki soils are moderately shallow (50-75 cm), moderately well drained, have dark brown to very dark grayish brown and dark gray, sodic black clay soils occurring on nearly level to very gently sloping plains under cultivation		**849(18.66)**
336		RNKmB2	Clay surface, slope 1-3%, moderate erosion	425(9.33)
337		RNKmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	368 (8.1)
338		RNKmB2g2	Clay surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	37 (0.8)
339		RNKmB2g3	Clay surface, slope 1-3%, moderate erosion, extremely gravelly(60-80%)	19 (0.43)
	DRL	Dambarahalli soils are moderately deep (75-100 cm), moderately well drained, have dark brown to very dark gray, calcareous black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		**479(10.53)**
350		DRLmB2	Clay surface, slope 1-3%, moderate erosion	243(5.34)

To be continued...

Soil map unit No*	Soil Series	Soil phase	Mapping Unit Description	Area in ha (%)
Soils of Alluvial Landscape				
351		DRLmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	104(2.28)
352		DRLmB2g2	Clay surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	132(2.91)
	NSP	Narasapura soils are moderately deep (75-100 cm), moderately well drained, have dark grayish brown to very dark grayish brown and very dark gray, sodic black calcareous clay soils occurring on nearly level to very gently sloping plains under cultivation		**37 (0.82)**
363		NSPmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	37 (0.82)
	HDL	Handrala soils are deep (100-150 cm), moderately well drained, have dark gray to very dark gray, black calcareous cracking clay soils occurring on very gently sloping plains under cultivation		**21 (0.47)**
382		HDLmB2	Clay surface, slope 1-3%, moderate erosion	21 (0.47)
	GRH	Gatareddihal soils are deep (100-150 cm), moderately well drained, have light olive brown to very dark gray, calcareous black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		**457(10.05)**
373		GRHmB2	Clay surface, slope 1-3%, moderate erosion	440(9.67)
374		GRHmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	17 (0.38)
	KVR	Kavalur soils are deep (100-150 cm), moderately well drained, have dark yellowish brown to very dark grayish brown, calcareous cracking black clay soils occurring on nearly level to very gently sloping plains under cultivation		**460(10.11)**
386		KVRmA1	Clay surface, slope 0-1%, slight erosion	17 (0.38)
388		KVRmB1	Clay surface, slope 1-3%, slight erosion	267(5.87)
389		KVRmB1g1	Clay surface, slope 1-3%, slight erosion, gravelly (15-35%)	49 (1.07)
390		KVRmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	127(2.79)
	BGP	Budagumpa soils are very deep (>150 cm), moderately well drained, have dark yellowish brown to dark brown and dark gray , calcareous sodic black clay soils occurring on nearly level to very gently sloping plains under cultivation		**33 (0.72)**
397		BGPmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	33 (0.72)

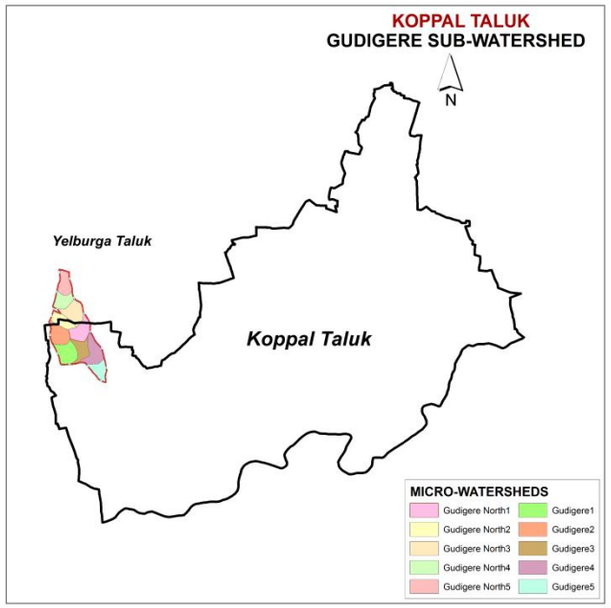
To be continued...

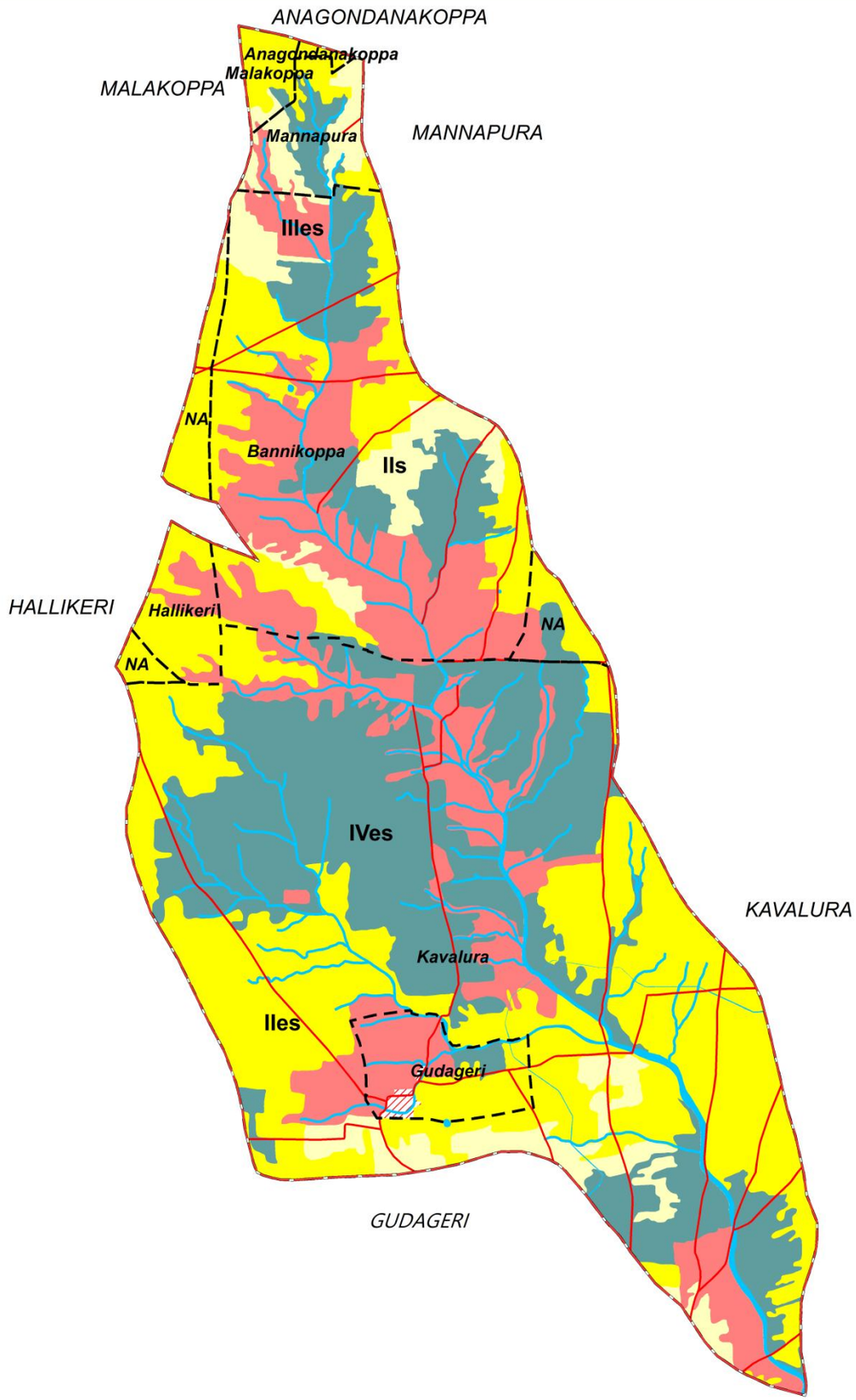
Soil map unit No*	Soil Series	Soil phase	Mapping Unit Description	Area in ha (%)
Soils of Alluvial Landscape				
	BDR	Bardur soils are very deep (>150 cm), moderately well drained, have very dark grayish brown to very dark gray, black cracking calcareous clay soils occurring on nearly level to very gently sloping plains under cultivation		**461 (10.14)**
433		BDRmB2	Clay surface, slope 1-3%, moderate erosion	461 (10.14)
	KDT	Kadagathur soils are very deep (>150 cm), moderately well drained, have dark brown to very dark grayish brown, black sandy clay to clay soils occurring on nearly level to very gently sloping plains under cultivation		**77 (1.7)**
406		KDTmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	77 (1.7)
	MLR	Murlapur soils are very deep (>150 cm), moderately well drained, have very dark grayish brown to very dark gray, calcareous black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		**573(12.6)**
418		MLRmB2	Clay surface, slope 1-3%, moderate erosion	524(11.53)
419		MLRmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	49 (1.07)
	AWD	Alawandi soils are very deep (>150 cm), moderately well drained, have very dark grayish brown to black , calcareous black cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		**29 (0.65)**
424		AWDmB2	Clay surface, slope 1-3%, moderate erosion	29 (0.65)
1000	Others	Habitation and water body		**90 (1.99)**

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

5. Soil Survey Interpretations

5.1. Land Capability Classification





LAND CAPABILITY

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

km
0 1 2 4
N

Key
II - Good cultivable land
III - Moderately good cultivable lands
IV - Fairly good cultivable lands

Limitations
e - erosion limitation
s - soil limitation
(depth, gravelliness, texture, salinity/alkalinity)

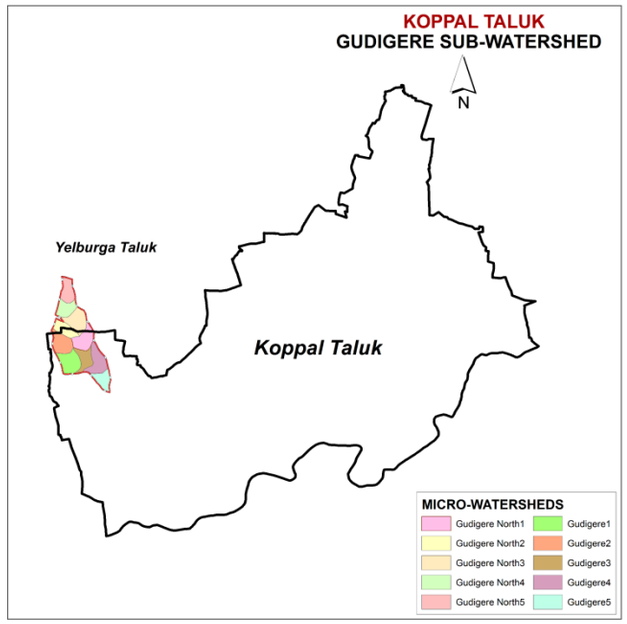
Capability subclass	Area in ha (%)
IIs	357 (7.84)
IIes	1789 (39.33)
IIIes	935 (20.55)
IVes	1377 (30.28)
Others*	90 (1.99)

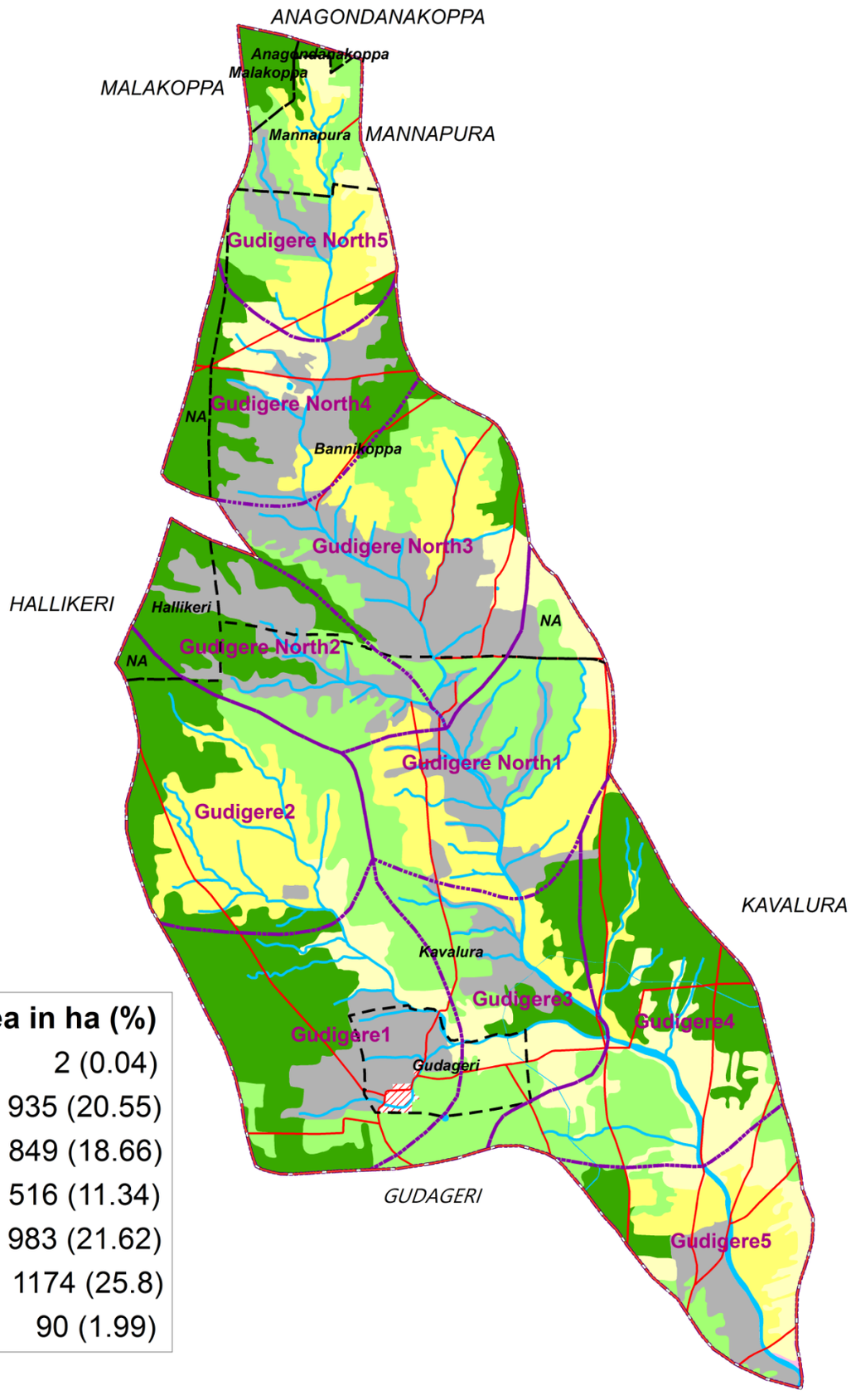
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

5.2. Soil Depth





SOIL DEPTH

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Depth Class	Area in ha (%)
Very shallow (<25 cm)	2 (0.04)
Shallow (25-50 cm)	935 (20.55)
Moderately shallow (50-75 cm)	849 (18.66)
Moderately deep (75-100 cm)	516 (11.34)
Deep (100-150 cm)	983 (21.62)
Very deep (>150 cm)	1174 (25.8)
Others*	90 (1.99)

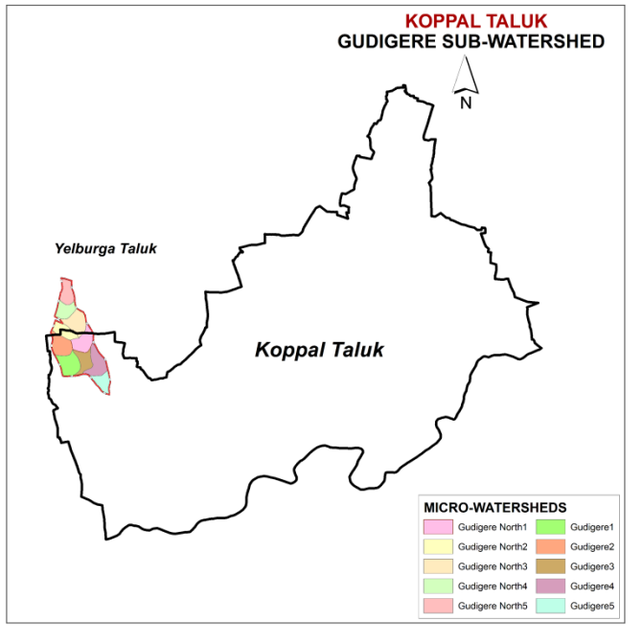
* - Habitation & Waterbody

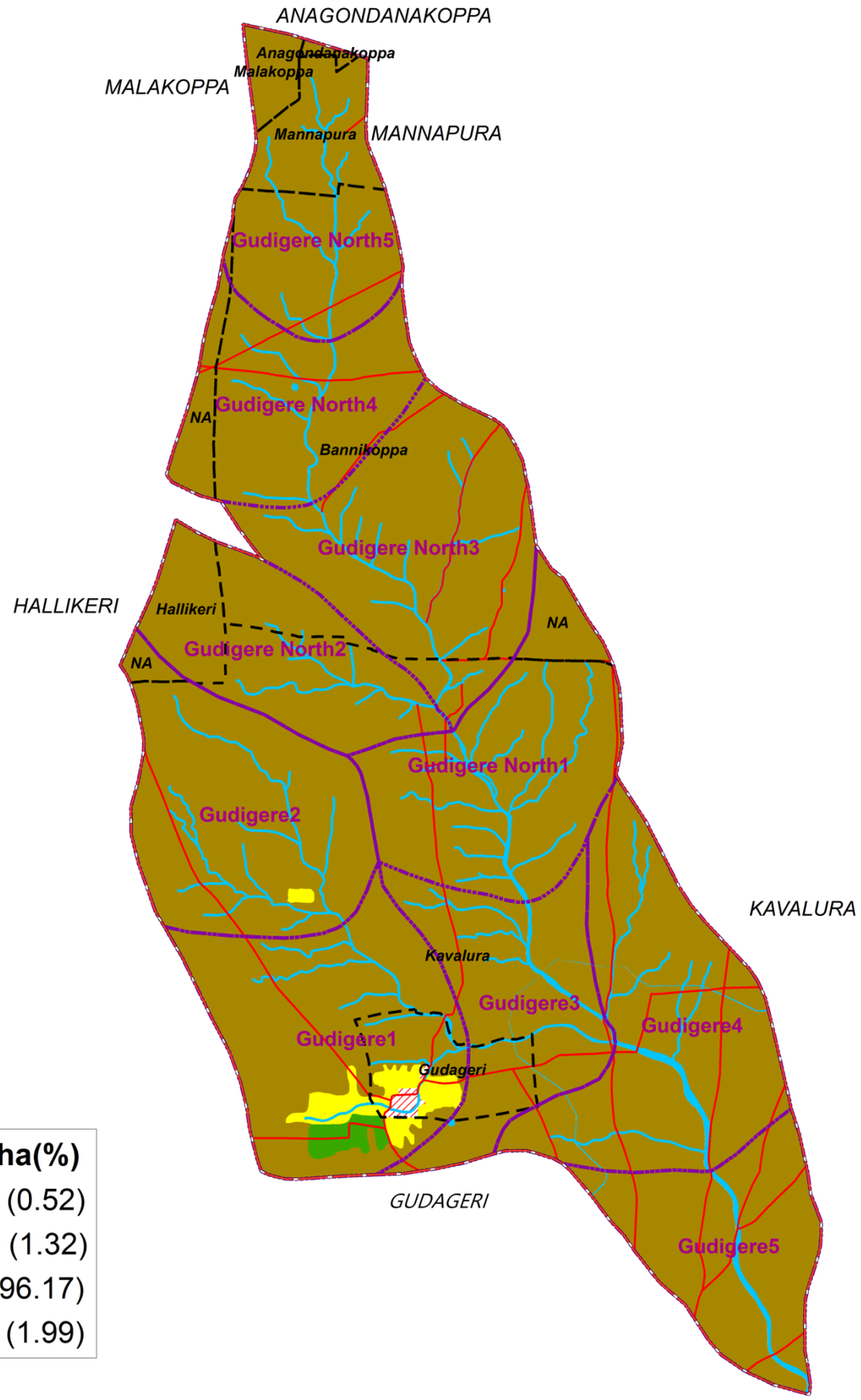
References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

5.3. Surface Soil Texture





SURFACE SOIL TEXTURE

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Texture Class	Area in ha(%)
Sandy clay loam	24 (0.52)
Sandy clay	60 (1.32)
Clay	4375 (96.17)
Others*	90 (1.99)

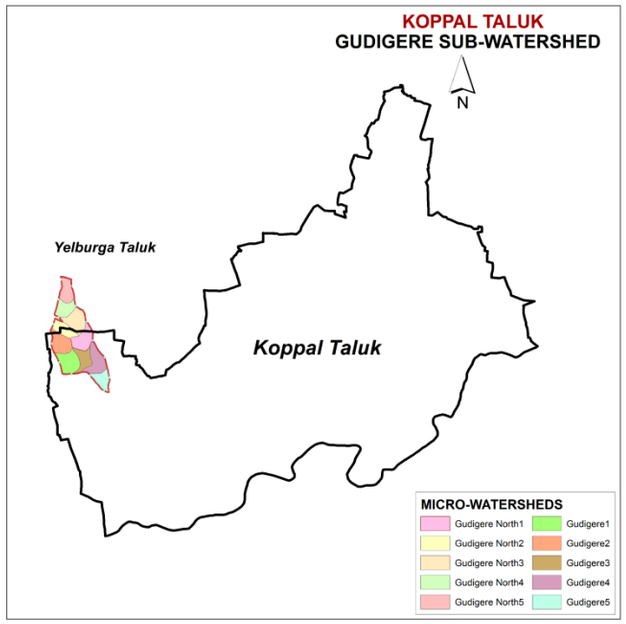
* - Habitation & Waterbody

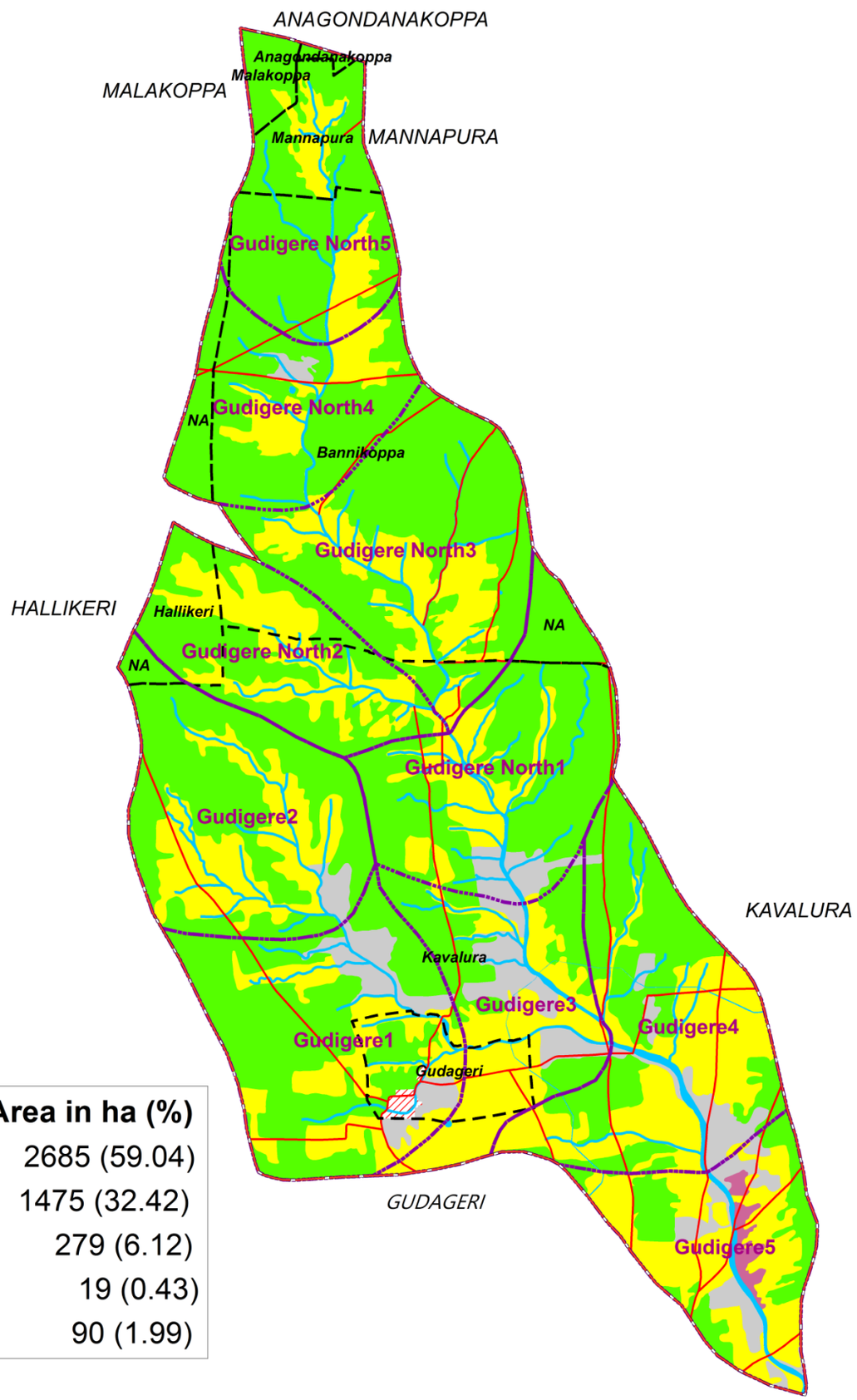
References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

5.4. Surface Soil Gravelliness





SOIL GRAVELLINESS

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Gravelly Class	Area in ha (%)
Non gravelly (<15%)	2685 (59.04)
Gravelly (15-35%)	1475 (32.42)
Very gravelly (35-60%)	279 (6.12)
Extremely gravelly (60-80%)	19 (0.43)
Others*	90 (1.99)

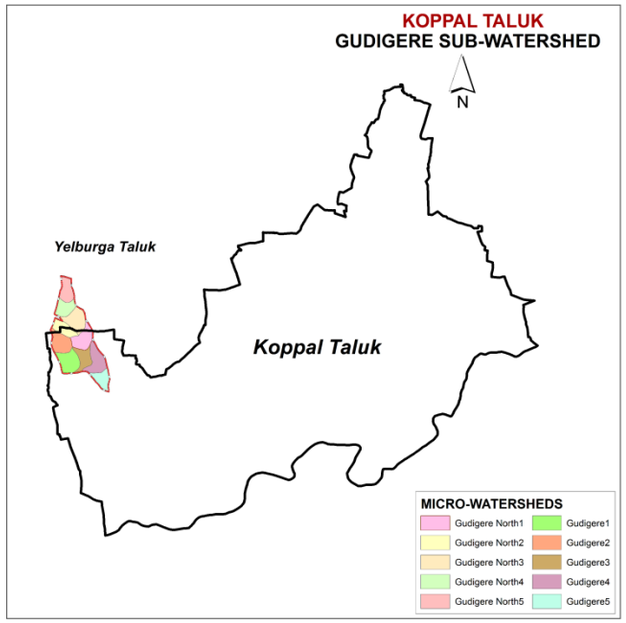
* - Habitation & Waterbody

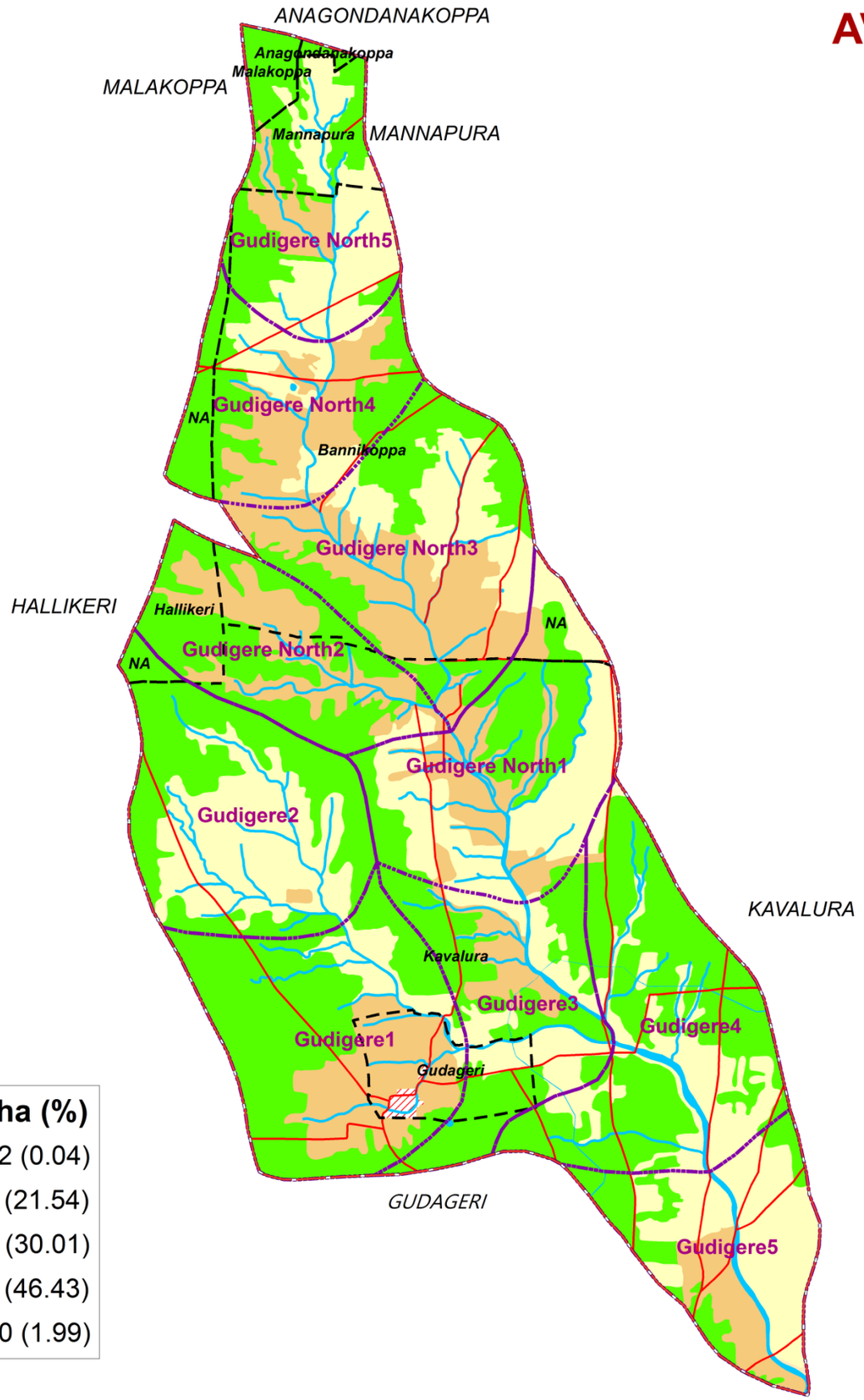
References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

5.5. Available Water Capacity





AVAILABLE WATER CAPACITY

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Available Water Capacity	Area in ha (%)
Very Low (<50 mm/m)	2 (0.04)
Low (51-100 mm/m)	980 (21.54)
Medium (101-150 mm/m)	1365 (30.01)
Very high (>200 mm/m)	2112 (46.43)
Others*	90 (1.99)

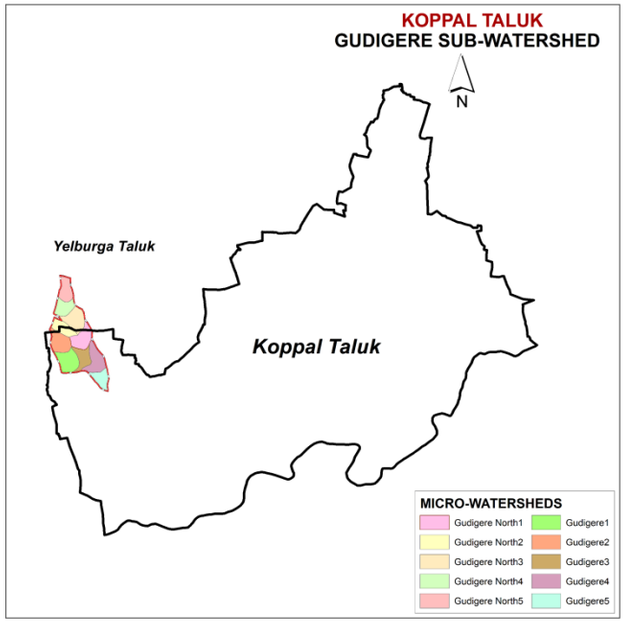
* - Habitation & Waterbody

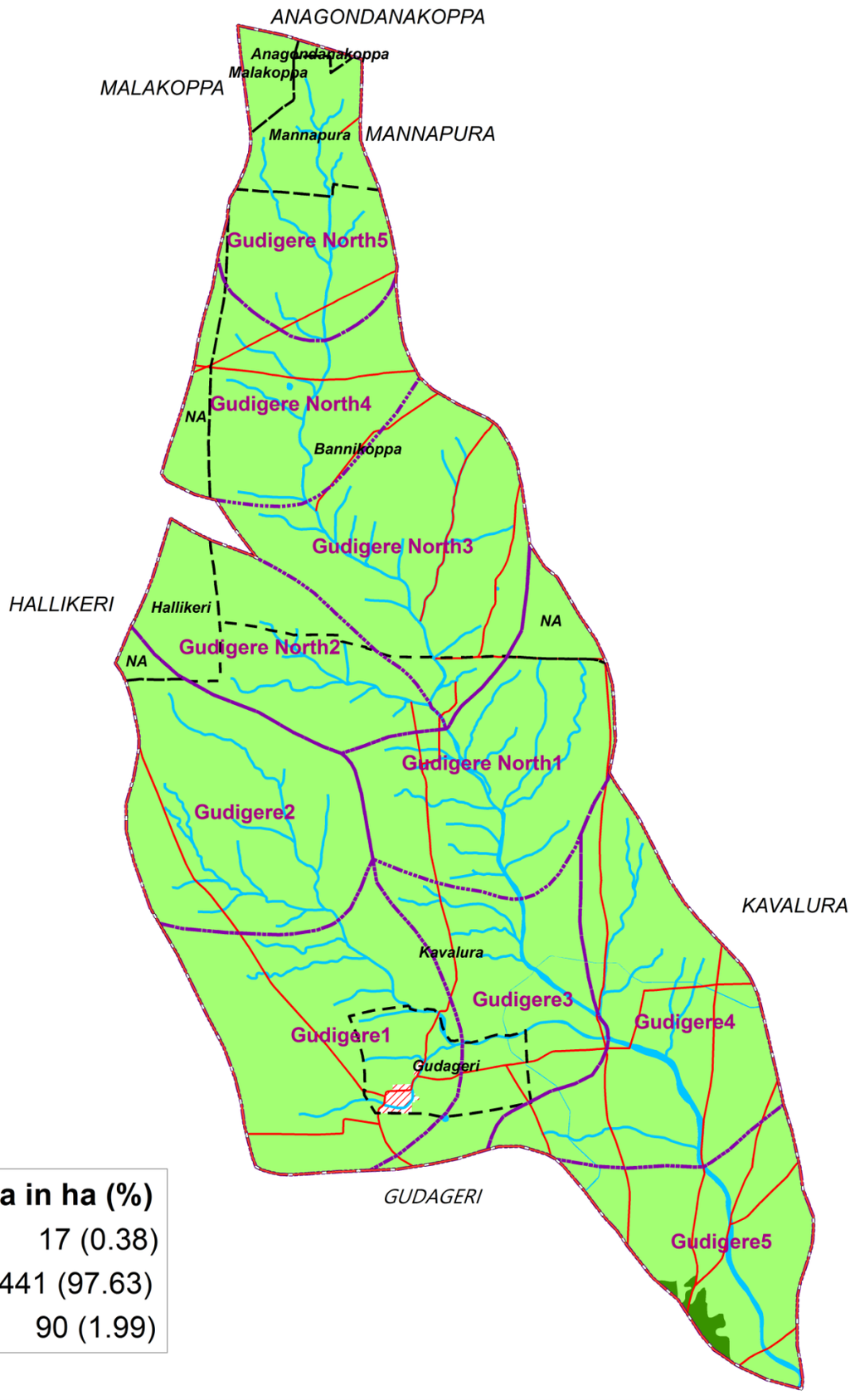
References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

5.6.Slope





SLOPE

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Slope Class	Area in ha (%)
Nearly level (0-1%)	17 (0.38)
Very gently sloping (1-3%)	4441 (97.63)
Others*	90 (1.99)

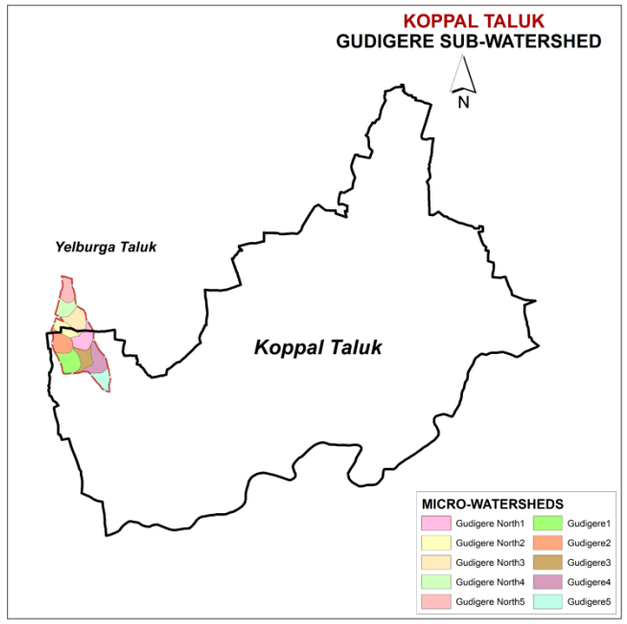
* - Habitation & Waterbody

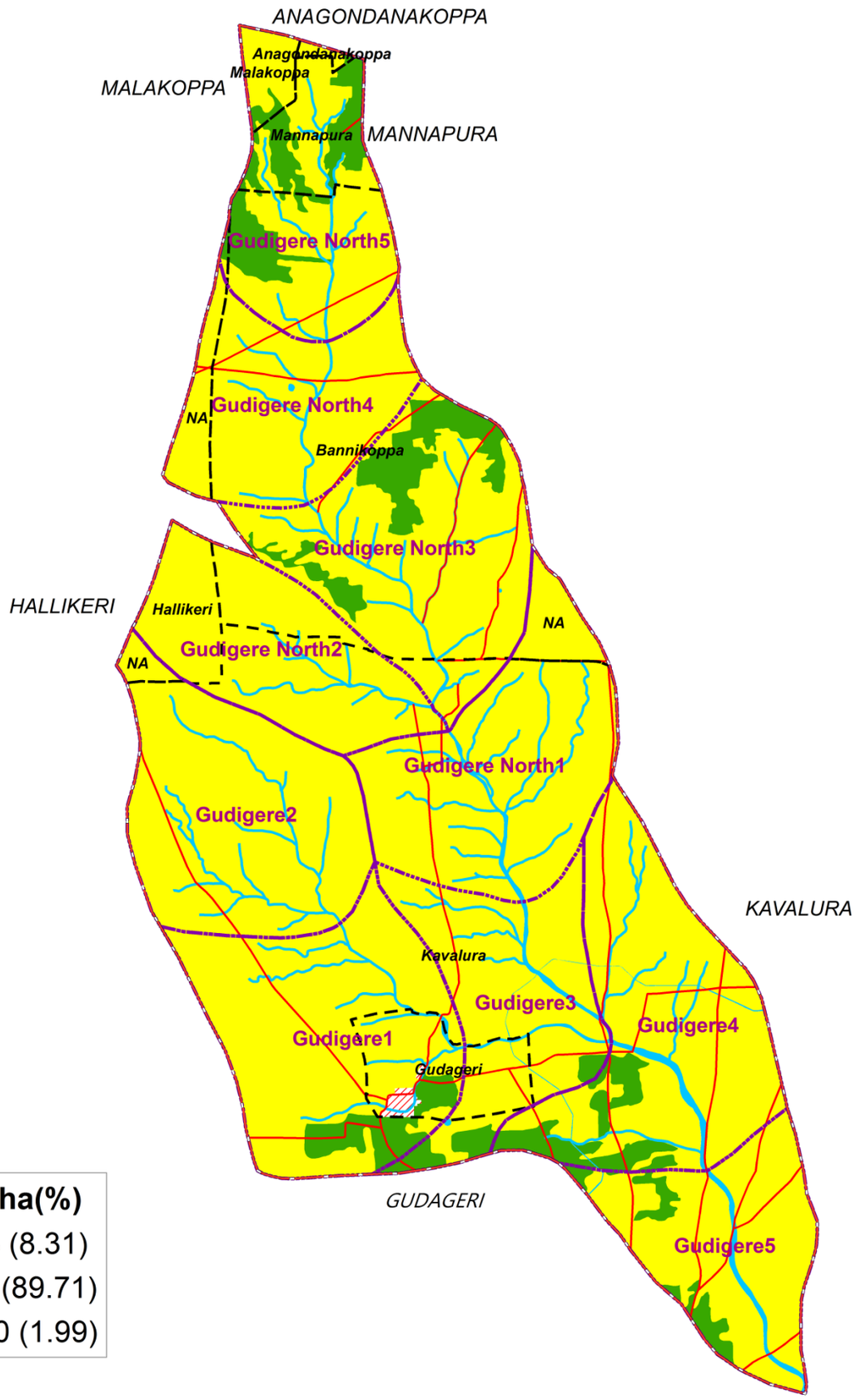
References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

5.7.Soil Erosion





SOIL EROSION

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Erosion Class	Area in ha(%)
Slight	378 (8.31)
Moderate	4080 (89.71)
Others*	90 (1.99)

* - Habitation & Waterbody

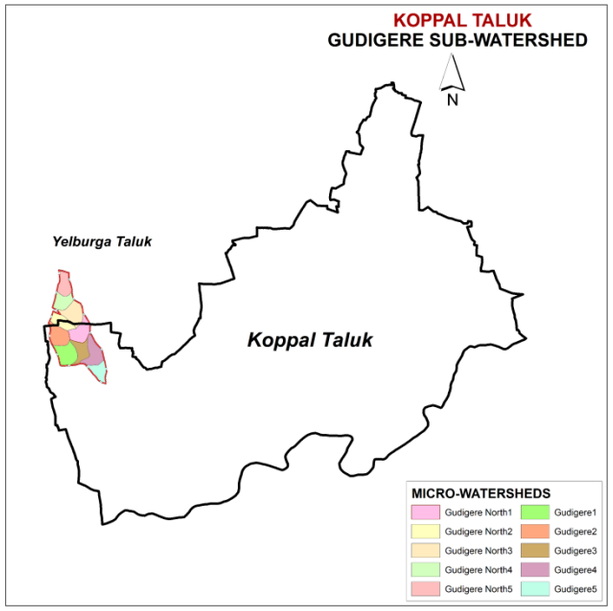
References

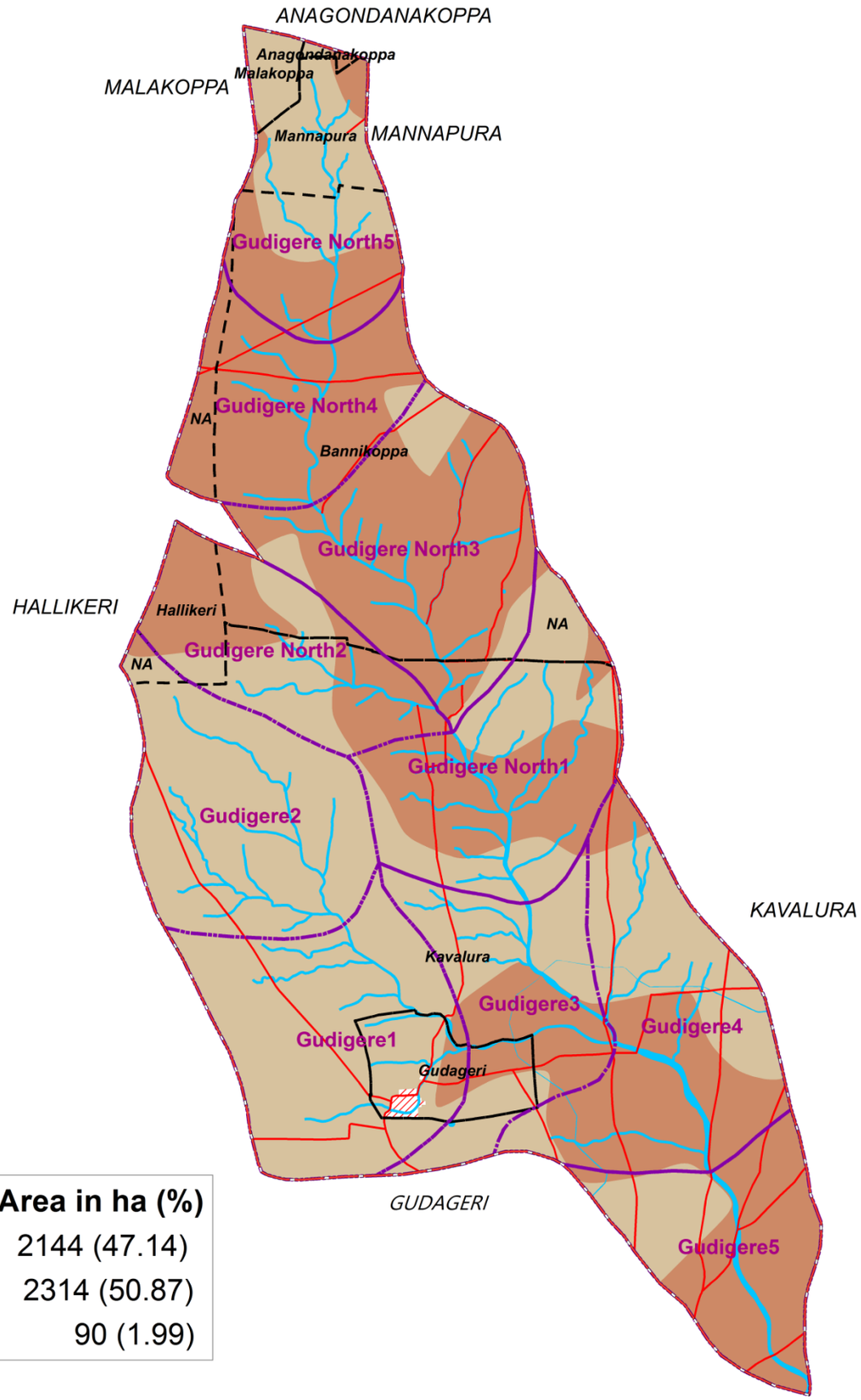
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

6. Soil Fertility Status

6.1. Soil Reaction (pH)





SOIL REACTION (pH) (2018)

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Reaction Class	Area in ha (%)
Strongly alkaline (pH 8.4 – 9.0)	2144 (47.14)
Very strongly alkaline (pH > 9.0)	2314 (50.87)
Others*	90 (1.99)

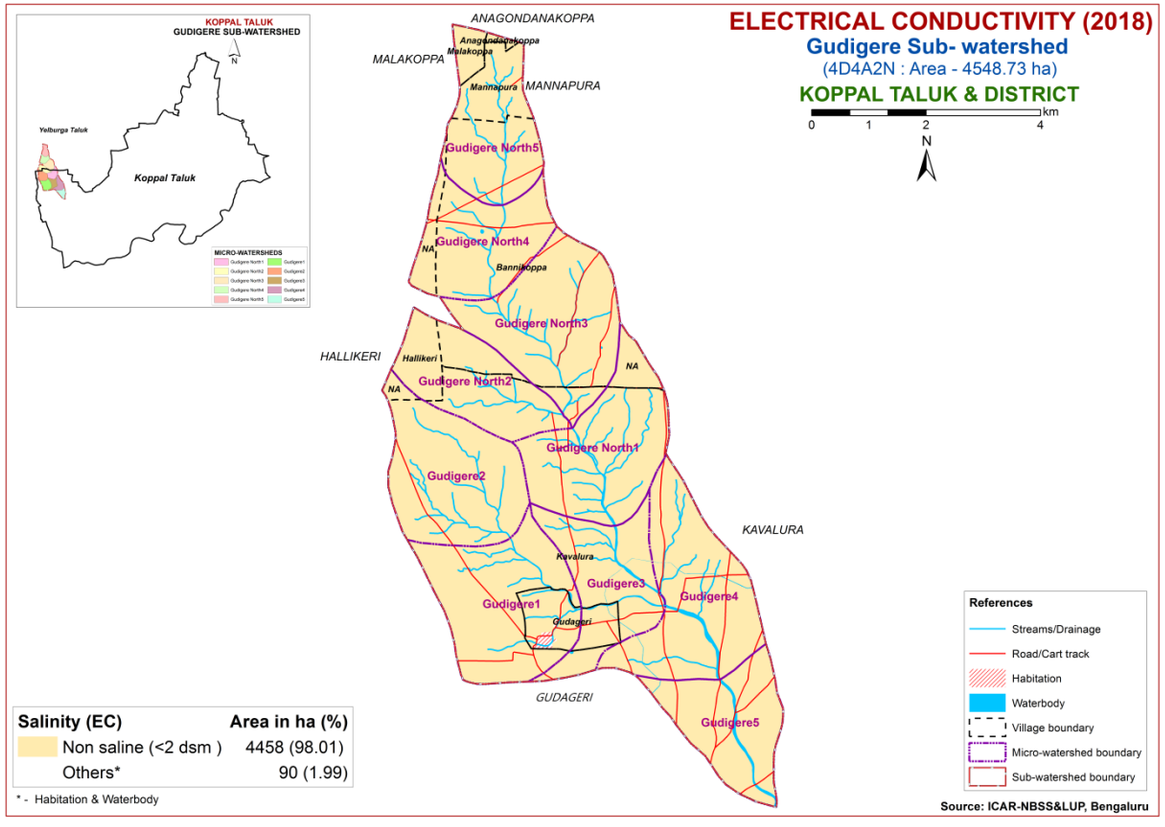
* - Habitation & Waterbody

References

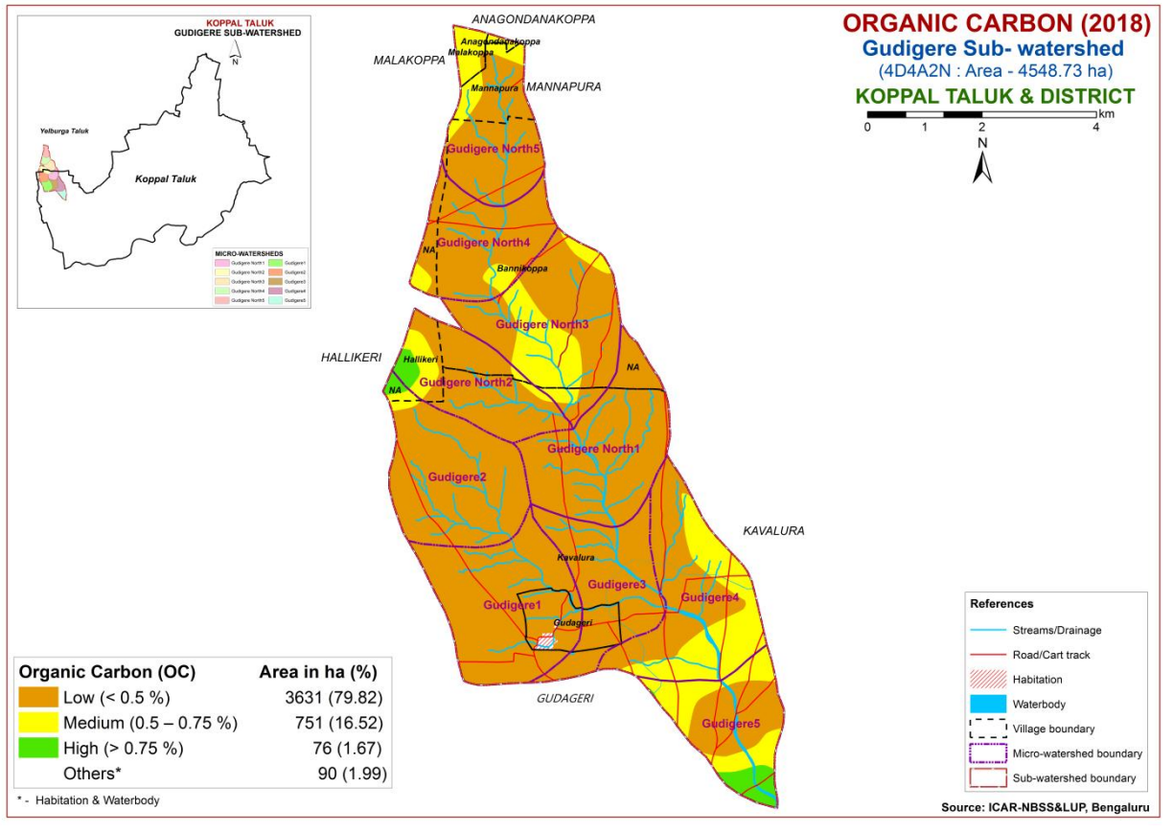
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

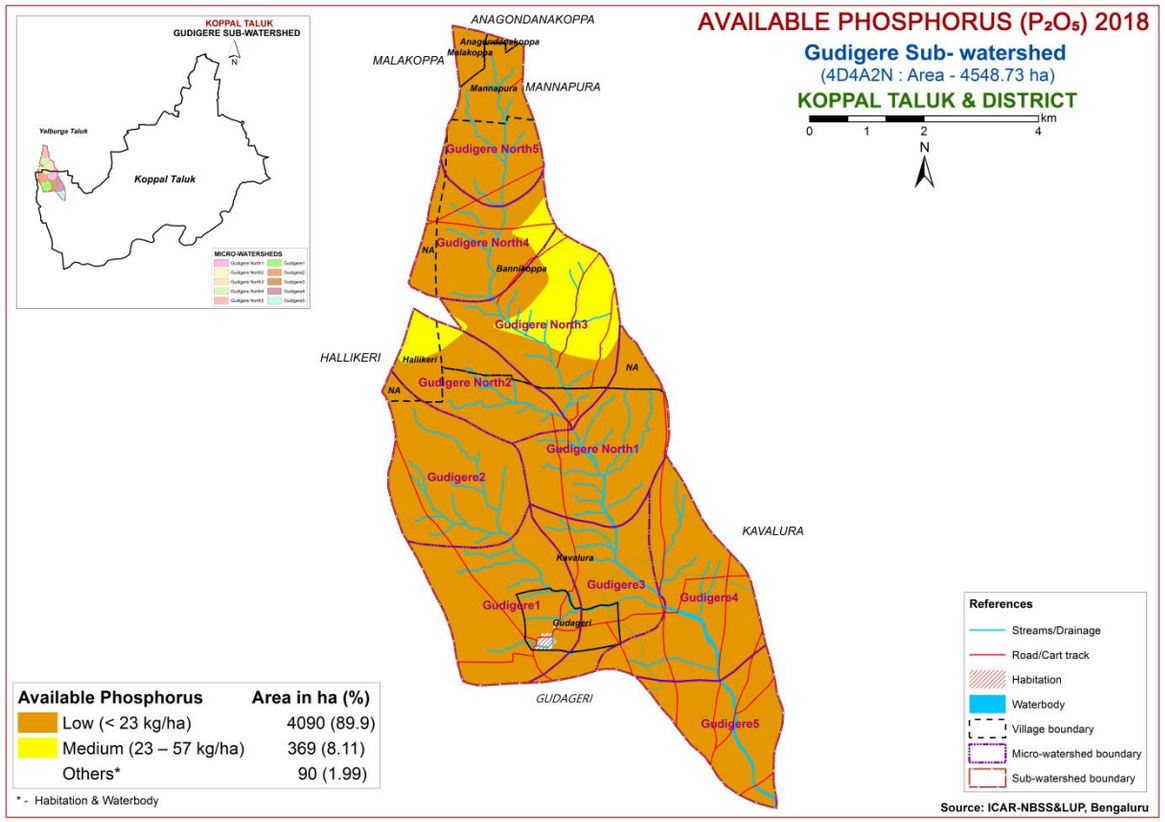
6.2. Electrical Conductivity (EC)



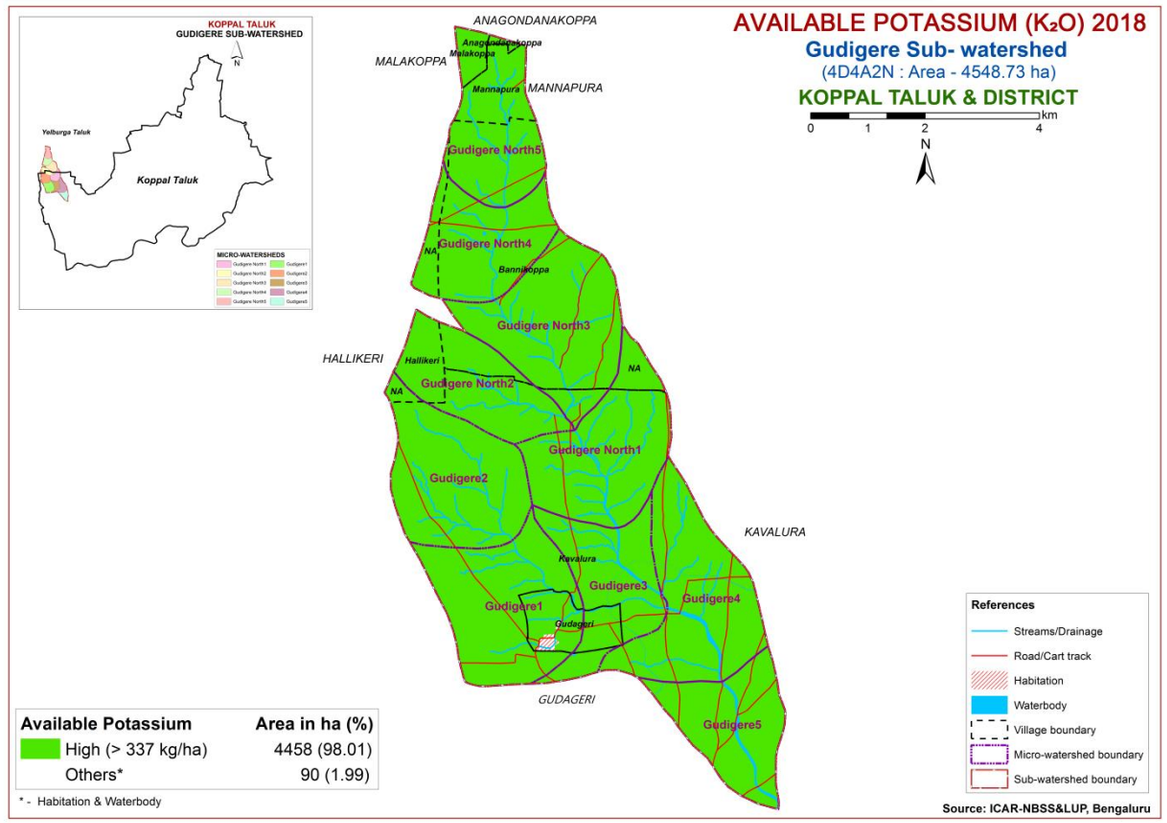
6.3. Organic Carbon



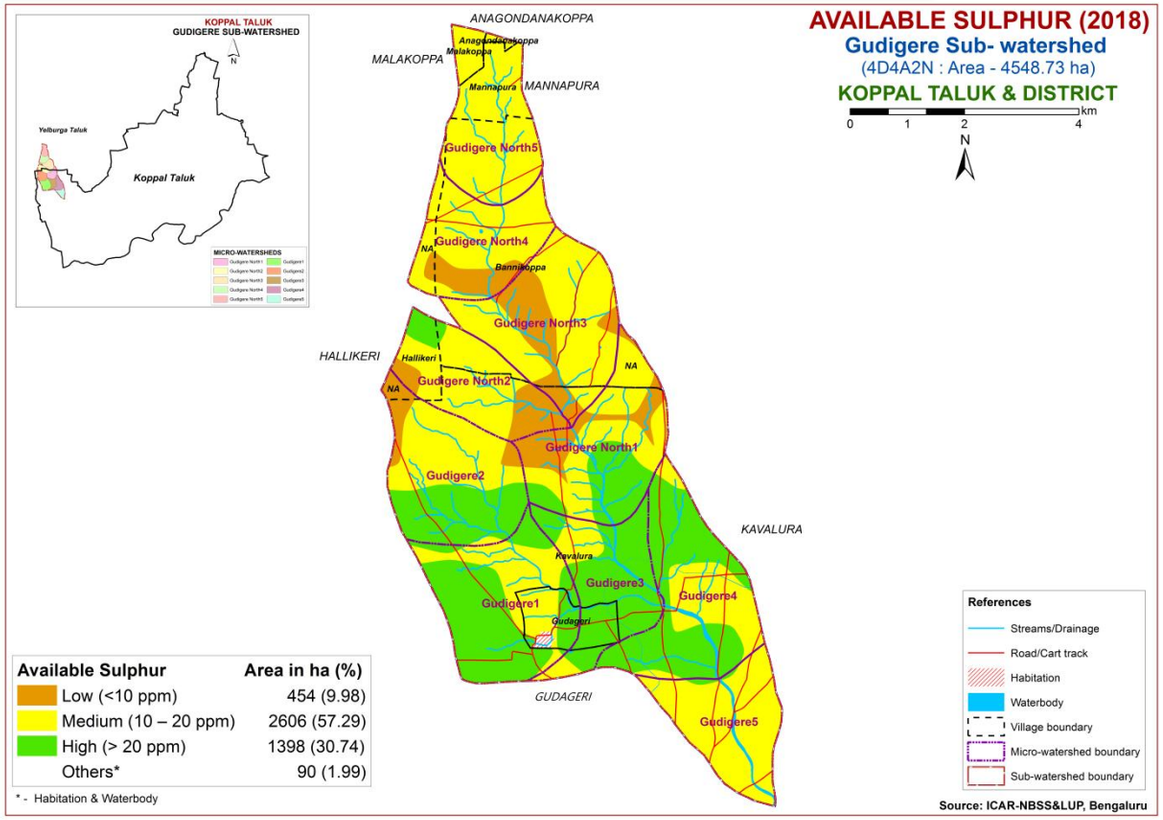
6.4. Available Phosphorus



6.5. Available Potassium



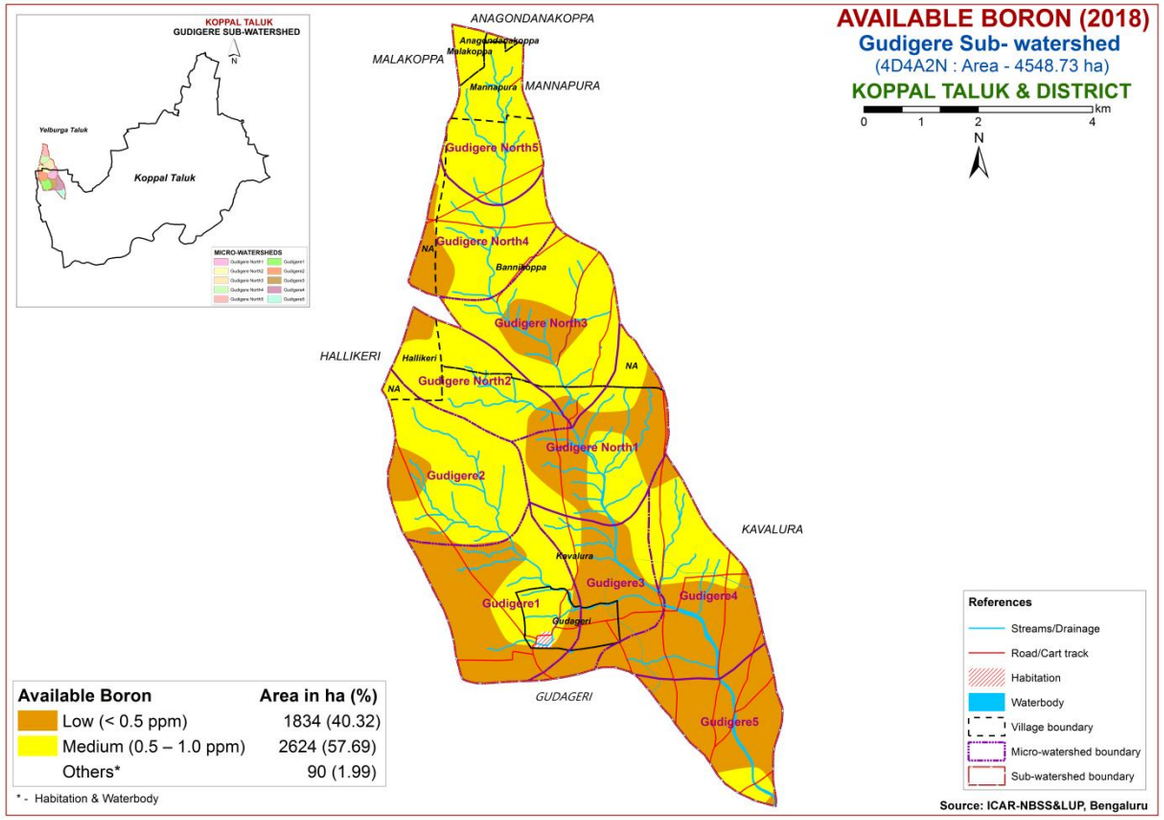
6.6. Available Sulphur



Available Sulphur	Area in ha (%)
Low (<10 ppm)	454 (9.98)
Medium (10 – 20 ppm)	2606 (57.29)
High (> 20 ppm)	1398 (30.74)
Others*	90 (1.99)

* - Habitation & Waterbody

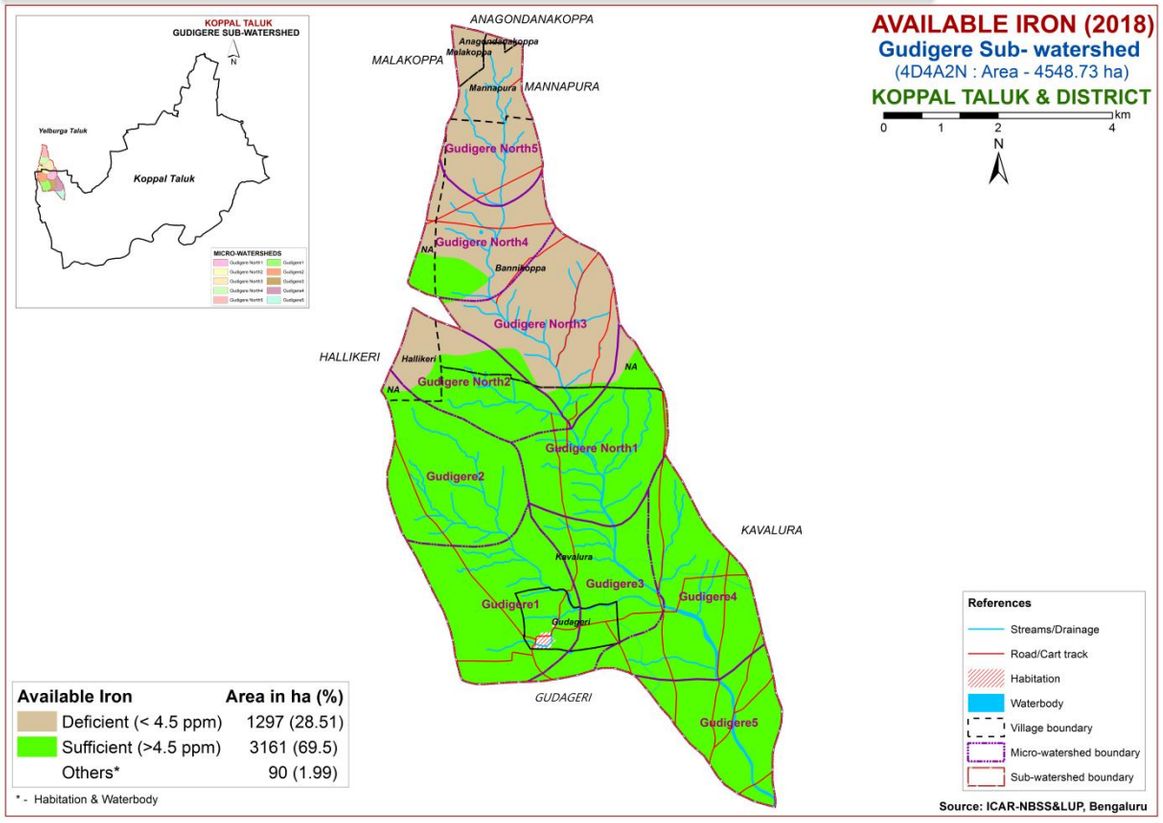
6.7. Available Boron



Available Boron	Area in ha (%)
Low (< 0.5 ppm)	1834 (40.32)
Medium (0.5 – 1.0 ppm)	2624 (57.69)
Others*	90 (1.99)

* - Habitation & Waterbody

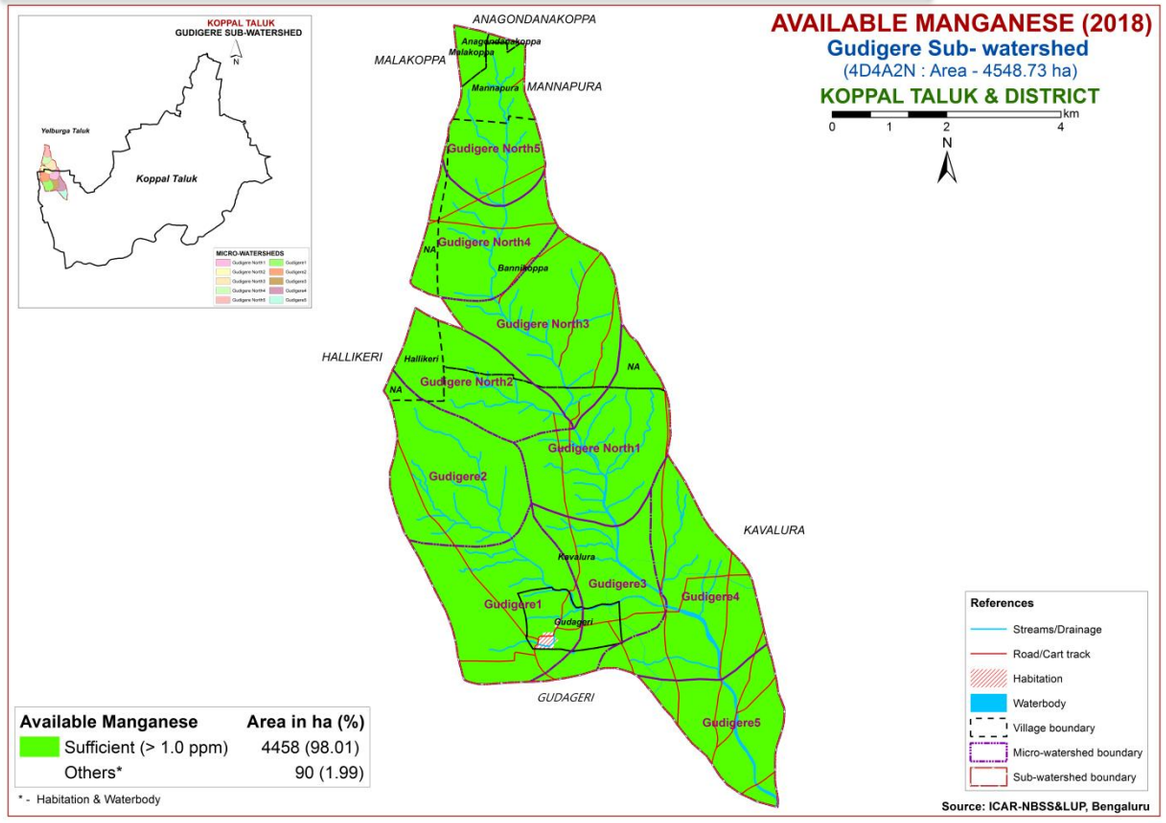
6.8. Available Iron



Available Iron	Area in ha (%)
Deficient (< 4.5 ppm)	1297 (28.51)
Sufficient (>4.5 ppm)	3161 (69.5)
Others*	90 (1.99)

* - Habitation & Waterbody

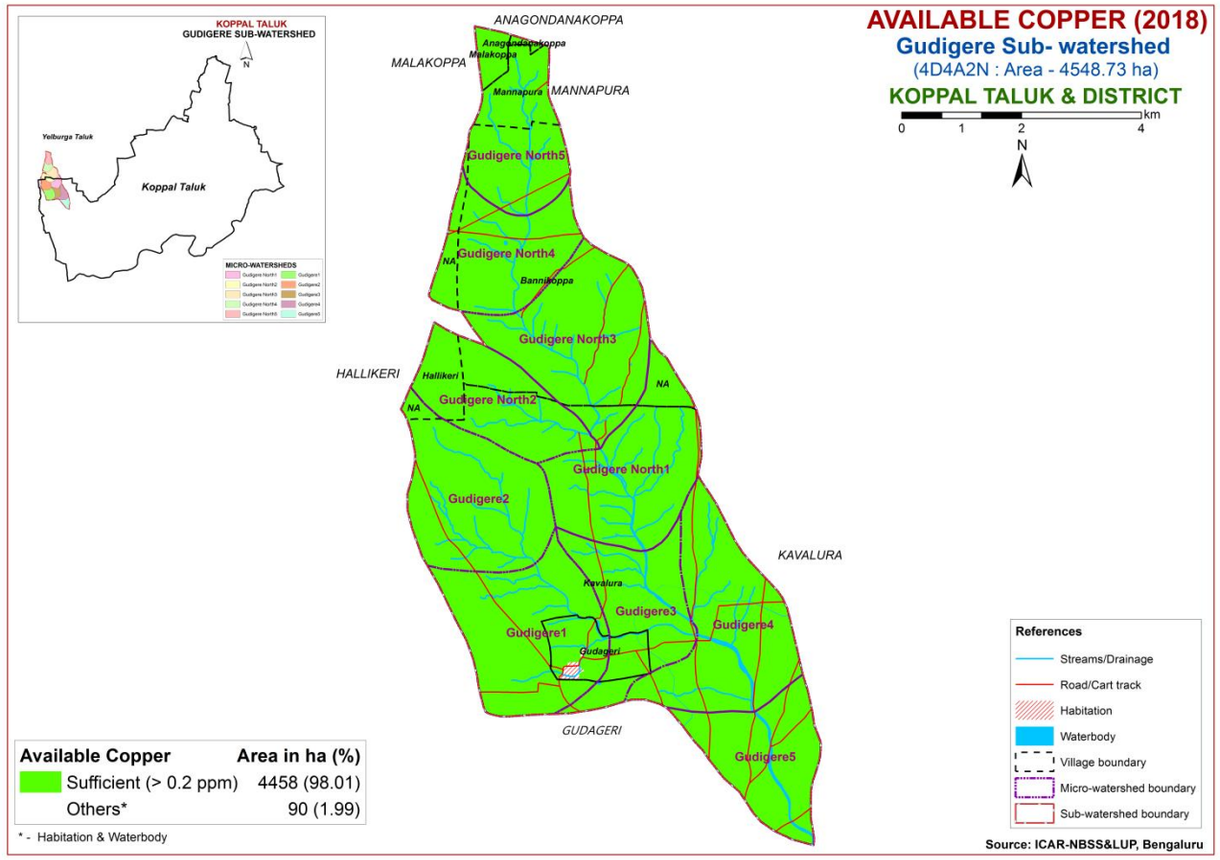
6.9. Available Manganese



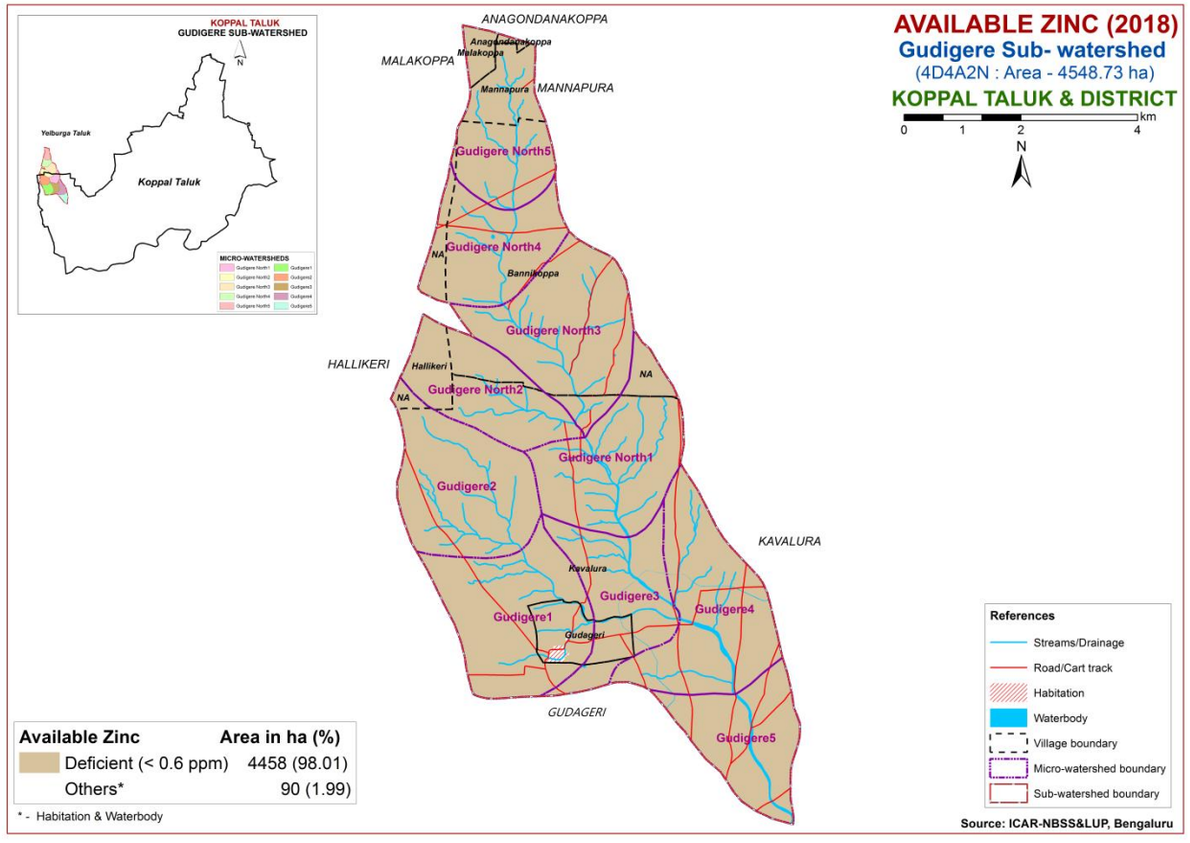
Available Manganese	Area in ha (%)
Sufficient (> 1.0 ppm)	4458 (98.01)
Others*	90 (1.99)

* - Habitation & Waterbody

6.10. Available Copper



6.11. Available Zinc



6.12. Correcting the Soil Nutrient Deficiencies

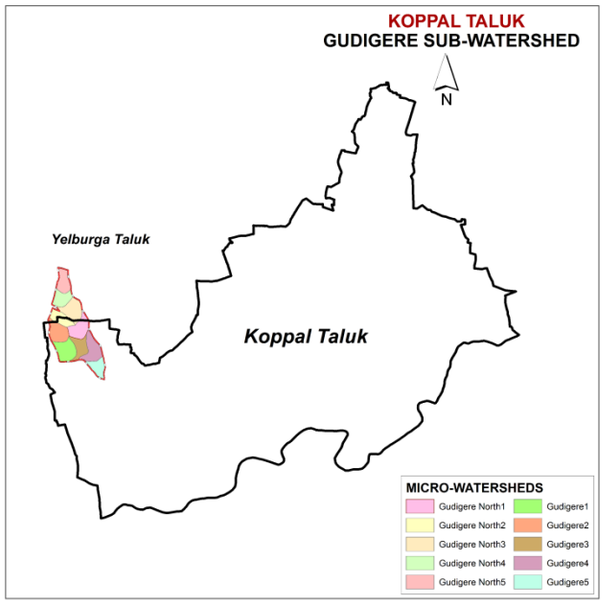
1. Reclamation of Salt affected soils
   a) When the soil is having neutral pH (6.5-7.5), no need of adding amendments (lime or gypsum)
   b) If the soil pH is <6.5, apply burnt lime to soil as per specifically recommended dosage and again after 2 years proper change has to be made based on soil test results.
   c) If the soil pH is 7.5-8.5 due to excess calcium content, drain out the excess calcium form the soil with good quality irrigation water.
   d) If the soil pH is more than 8.5 due to higher sodium content in soil, apply specifically recommended dose of gypsum & drain out the excess salts with good quality irrigation water.

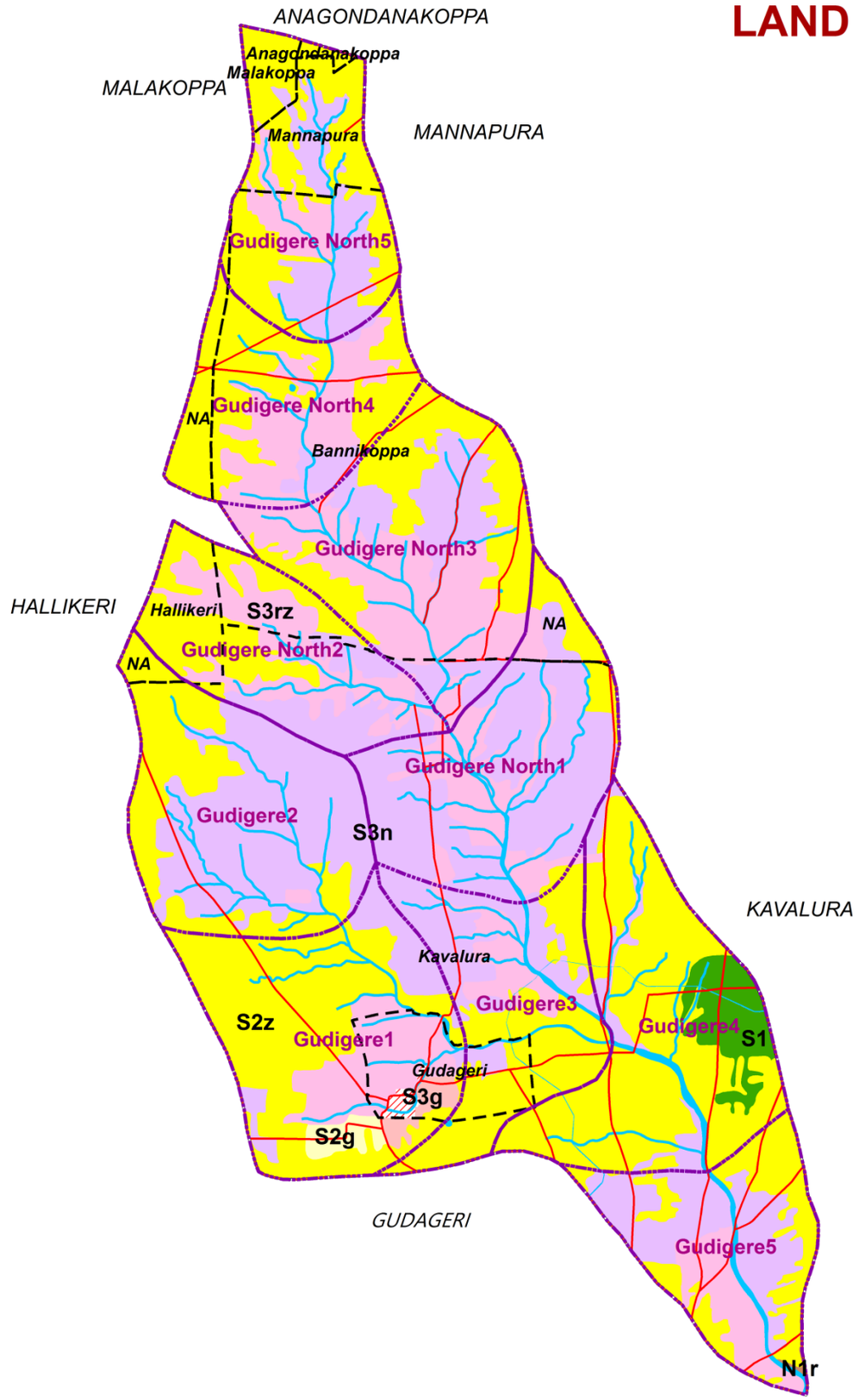
2. In case of low & high content of major nutrients in the soil, follow the modifications as given bellow:
   - N: P: K (N: P_2O_5: K_2O) **For low N content**, add 25 % extra to the Recommended Dose of Fertilisers (RDF).
     For high N content, reduce 25% from the RDF and apply to soil.
     Eg:- if 100kg N, then we have to apply
     100+25% for deficient soil.
     100% for medium available N content soil.
     100-25% for higher N content soil.
   - Follow the same in case of P & K.

3. Use or Incorporation of biofertilizers like Rhizobium, Azotobacter, Azospirillum, Phosphate Solubilizing Bacteria and mycorrhiza enhances normal available nutrients in soil to the plants and also reduce the input cost of cultivation.
4. For calcium deficient soil, apply N-fertilizers like calcium ammonium nitrate; Gypsum can also supply calcium ($CaSO_4.\ 2H_2O$)
5. Apply 405kg $MgSO_4$ per ha to the magnesium deficient soil. In case of perennial horticulture crops apply 150-200g/ plant.
6. In sulphur deficient acid soils (Humid region) apply phosphorus (in the form of) through SSP & use sulphur coated urea to the crops.
7. Apply 30-50kg ferrous sulfate ($FeSO_4$) per ha to the iron deficient soils. In case of perennial Horticulture crops apply 3-5g/ litre $FeSo_4$ /plant as foliar spray.
8. Apply 30-40kg/ha – manganese sulfate ($MnSO_4$) as soil application to the manganese deficient soils. In case of perennial Horticulture crops apply 3-5 g/litre $MnSO_4$ /plant as foilar application.
9. Apply Zinc – 10-25 kg/ha –$ZnSO_4$ – soil application to the Zinc deficient soils. In case of perennial Horticulture crops apply 3-5g/ litre – foliar application.
10. Apply Copper – 5-10 kg /ha – copper sulfate ($CuSO_4$) soil application for the copper deficient soils and for Perennial horticultural crops 3-5g/ litre – $CuSO_4$/plant as foliar application.
11. Apply borax 8-10 kg/ha in boron deficient soils and for Perennial horticultural crops as foliar application – 1g / litre.
12. Apply molybdenum – ammonium molybdate 200-250 gm/ha for Molybdenum deficient soils or dissolve 1g / litre ammonium molybdate for Foliar spray.
13. Soil sampling and testing needs to be done at every 2-3 years interval.

7. Land Suitability for Major Crops

7.1. Land Suitability for Sorghum





LAND SUITABILITY FOR SORGHUM

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
z- excess salt/calcareousness

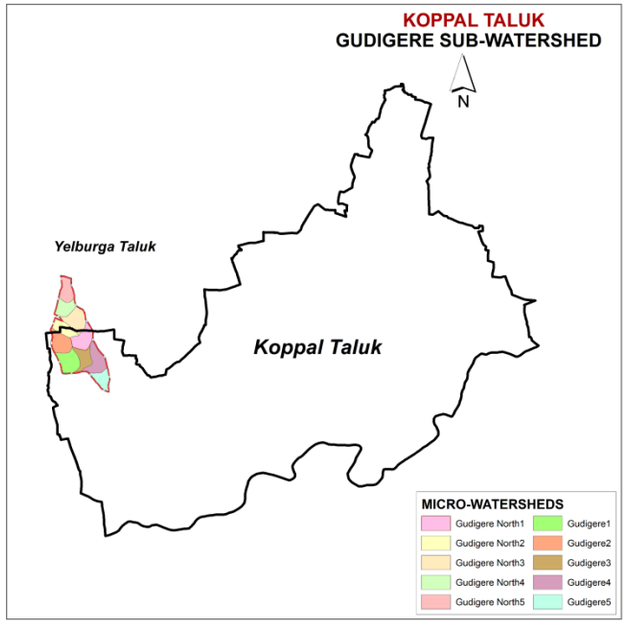
Suitability subclass	Area in ha (%)
S1	77 (1.7)
S2g	24 (0.52)
S2z	2024 (44.5)
S3g	21 (0.47)
S3n	1376 (30.25)
S3rz	935 (20.55)
N1r	2 (0.04)
Others*	90 (1.99)

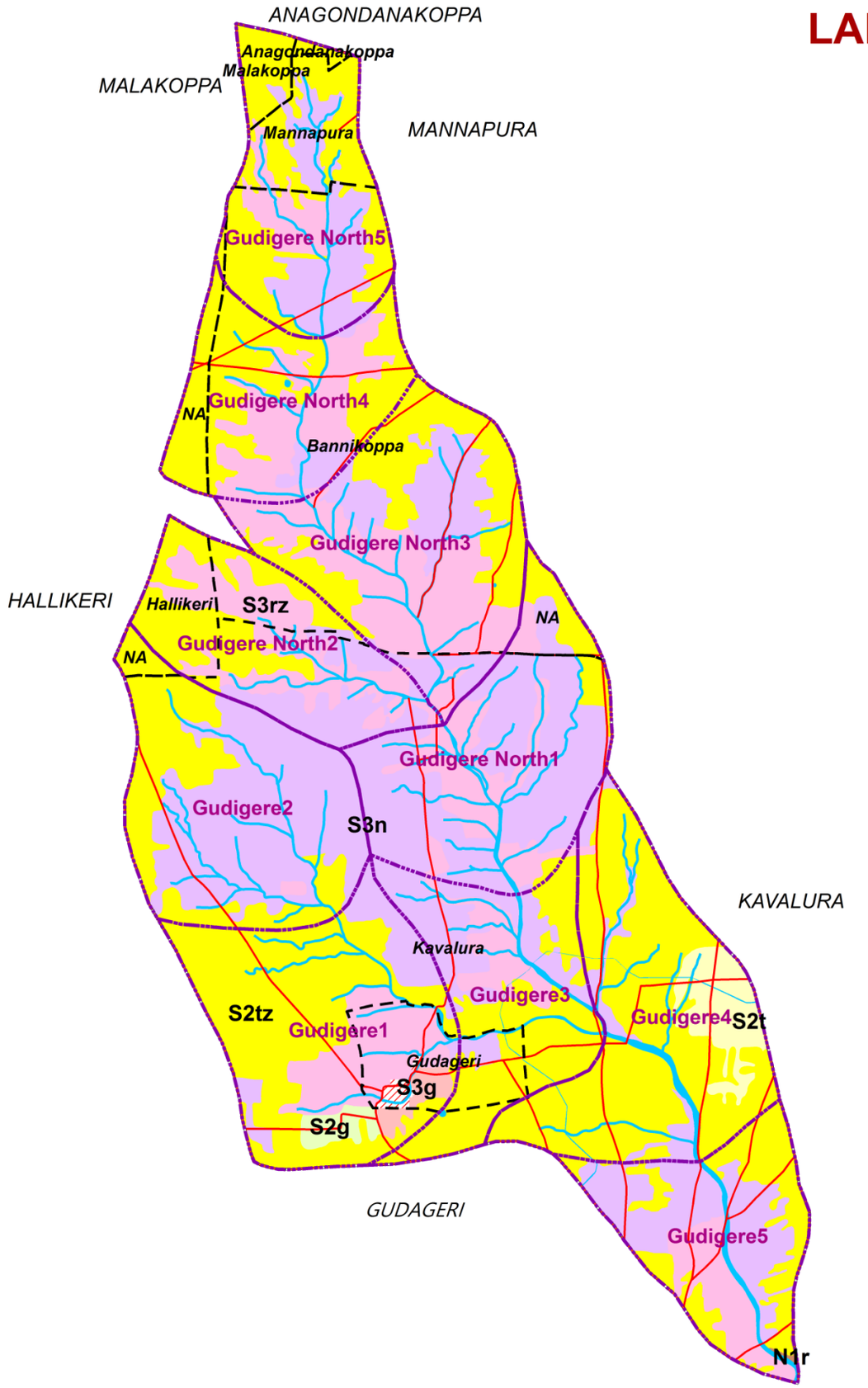
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.2. Land Suitability for Maize





LAND SUITABILITY FOR MAIZE

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

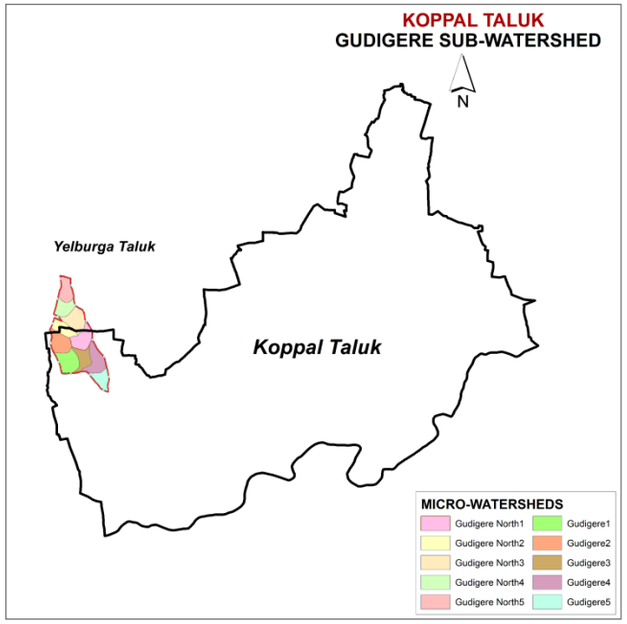
Suitability subclass	Area in ha (%)
S2g	24 (0.52)
S2t	77 (1.7)
S2tz	2024 (44.5)
S3g	21 (0.47)
S3n	1376 (30.25)
S3rz	935 (20.55)
N1r	2 (0.04)
Others*	90 (1.99)

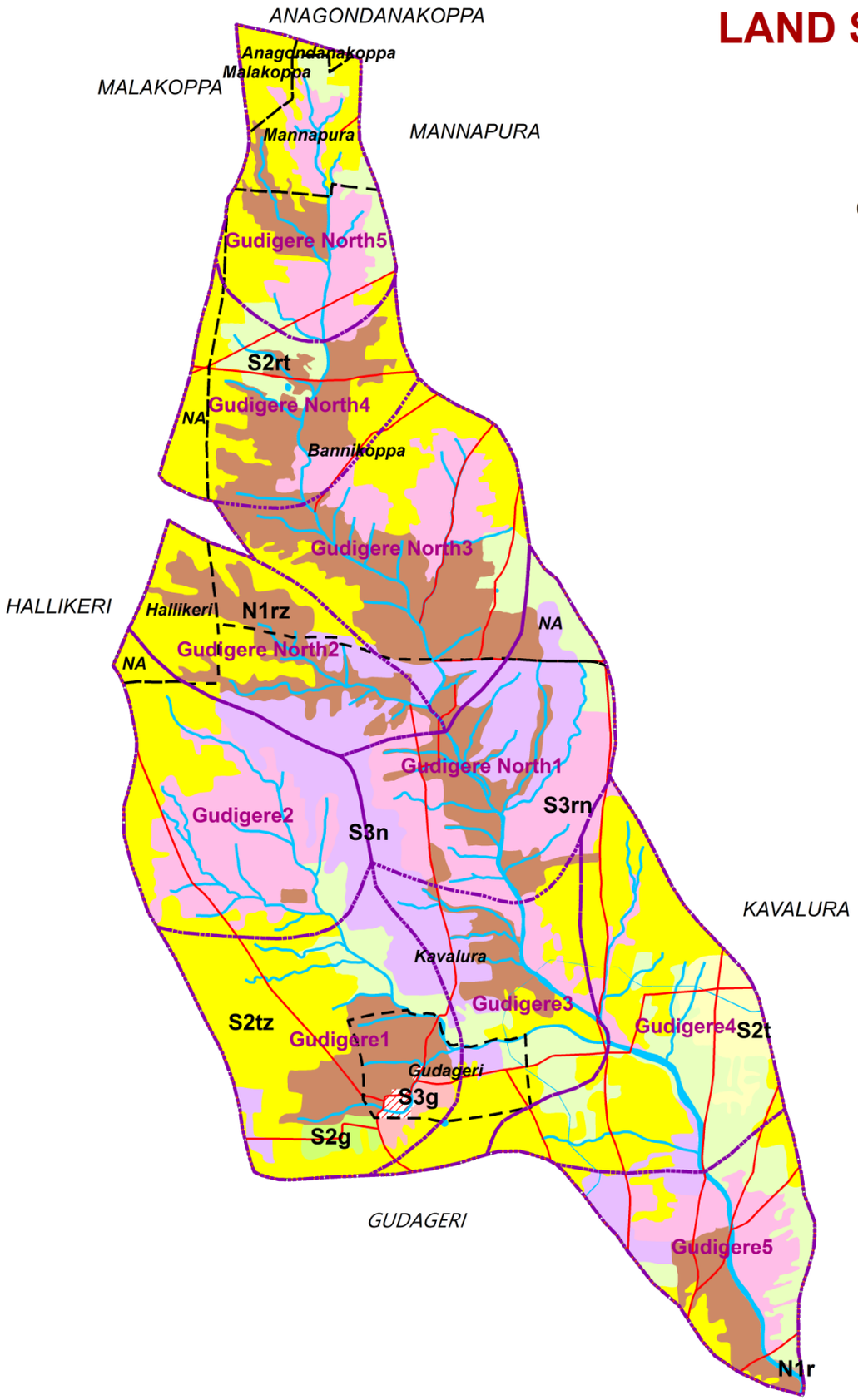
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.3. Land Suitability for Redgram





LAND SUITABILITY FOR REDGRAM

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

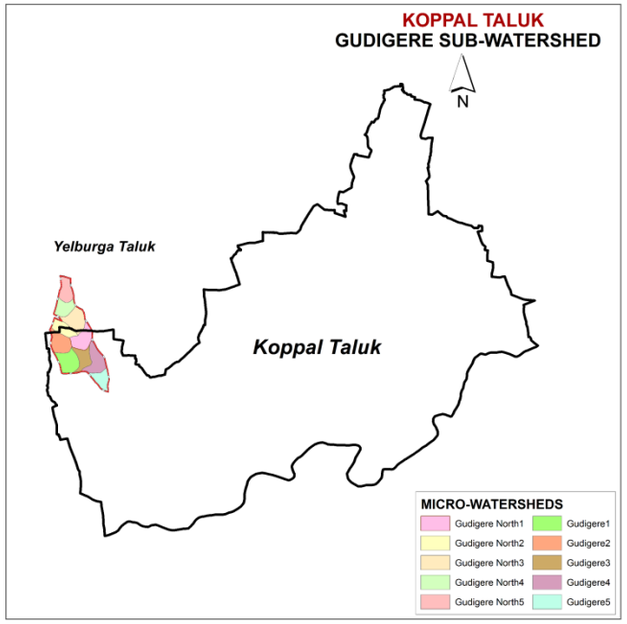
Suitability subclass	Area in ha (%)
S2g	24 (0.52)
S2t	77 (1.7)
S2rt	479 (10.53)
S2tz	1545 (33.97)
S3g	21 (0.47)
S3n	527 (11.58)
S3rn	849 (18.66)
N1r	2 (0.04)
N1rz	935 (20.55)
Others*	90 (1.99)

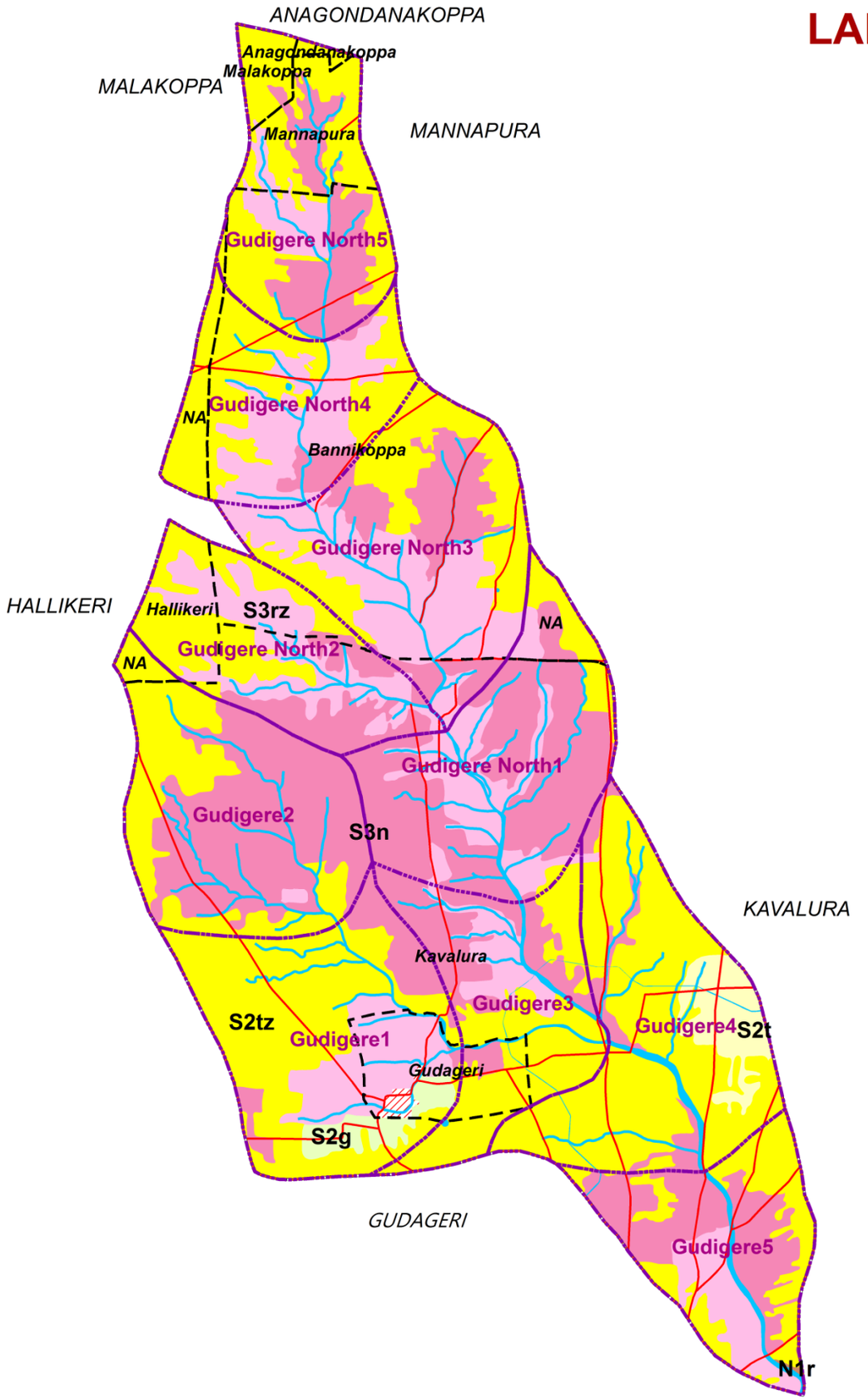
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.4. Land Suitability for Bajra





LAND SUITABILITY FOR BAJRA

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

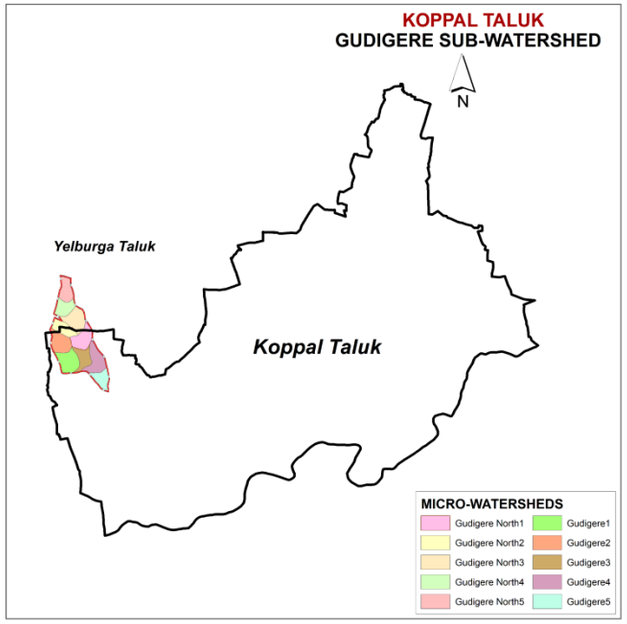
Suitability subclass	Area in ha (%)
S2g	45 (0.99)
S2t	77 (1.7)
S2tz	2024 (44.5)
S3n	1376 (30.25)
S3rz	935 (20.55)
N1r	2 (0.04)
Others*	90 (1.99)

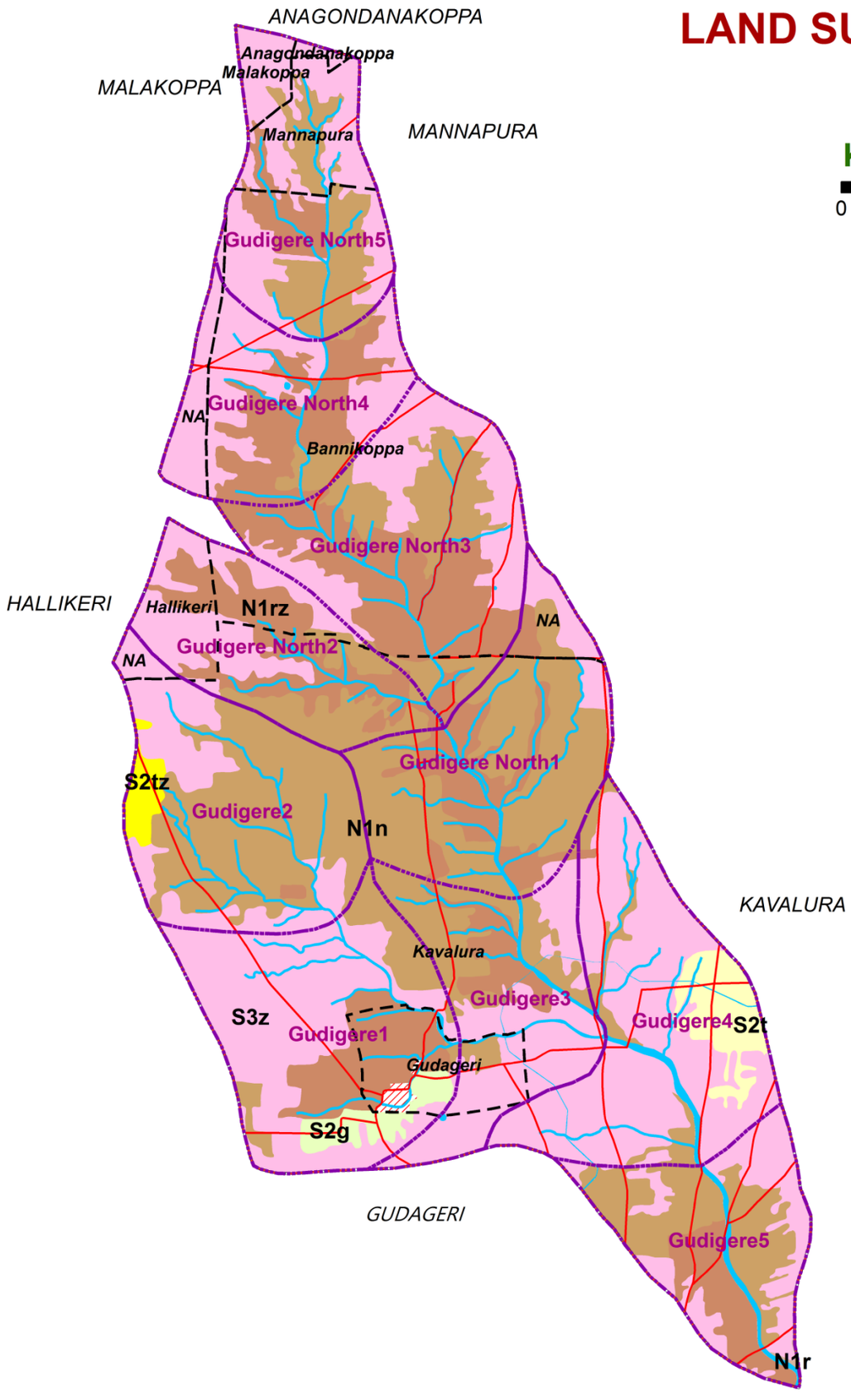
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.5. Land Suitability for Drumstick





LAND SUITABILITY FOR DRUMSTICK

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

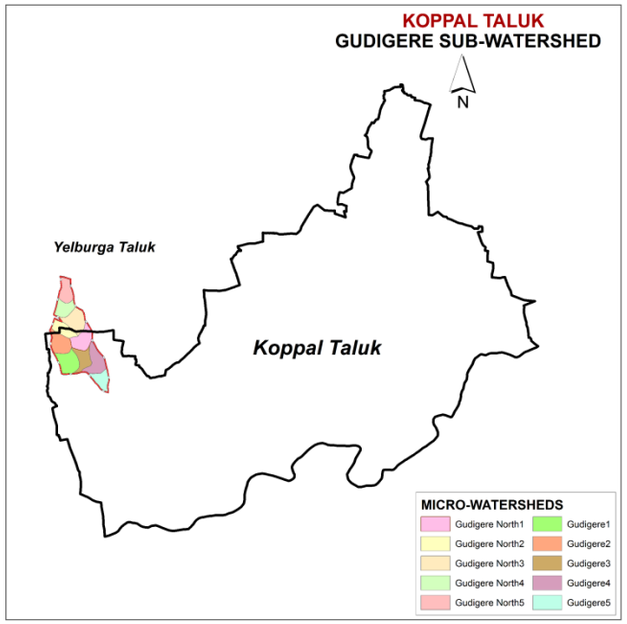
Suitability subclass	Area in ha (%)
S2g	45 (0.99)
S2t	77 (1.7)
S2tz	29 (0.65)
S3z	1995 (43.85)
N1n	1376 (30.25)
N1r	2 (0.04)
N1rz	935 (20.55)
Others*	90 (1.99)

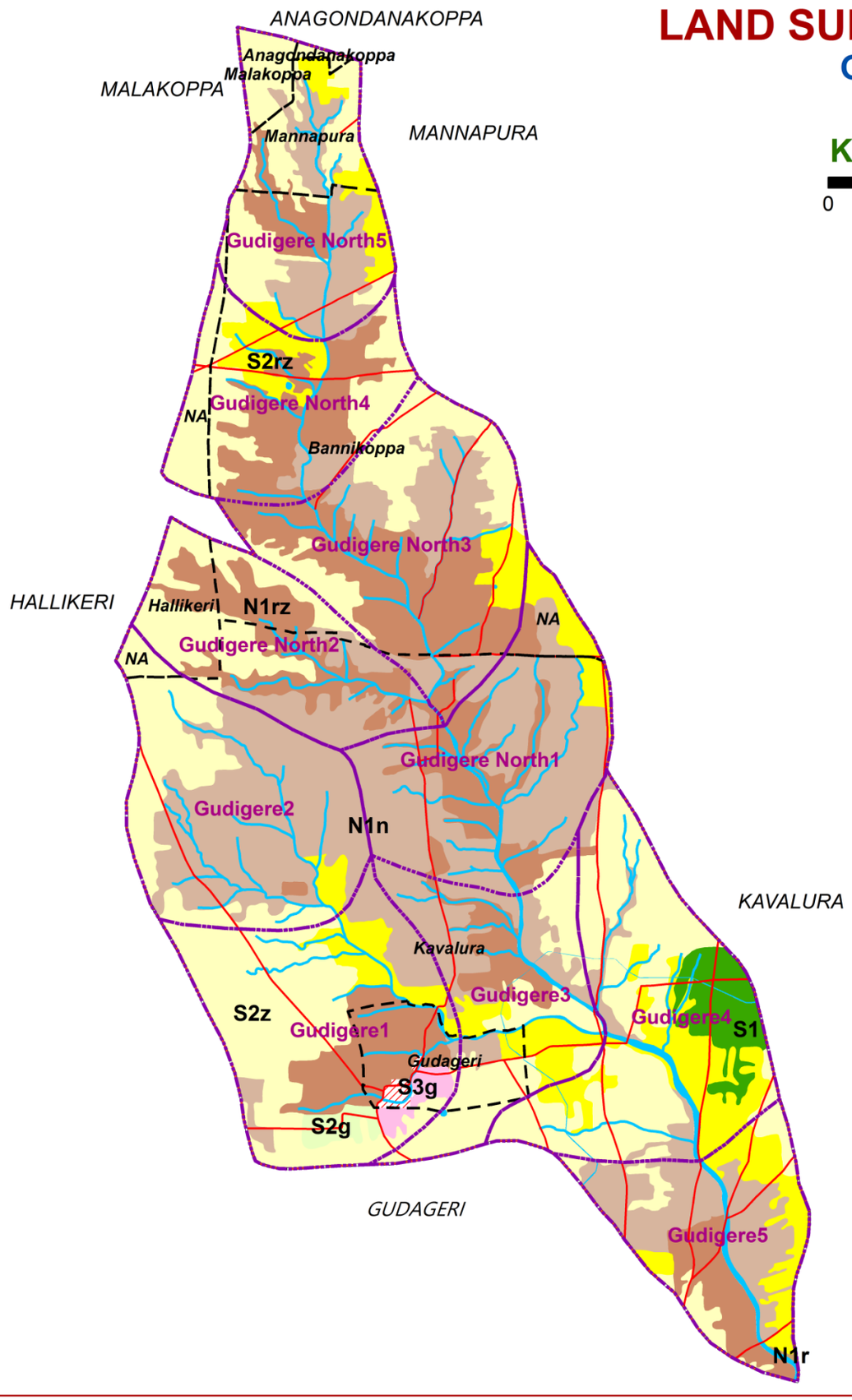
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.6. Land Suitability for Sunflower





LAND SUITABILITY FOR SUNFLOWER

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
z- excess salt/calcareousness

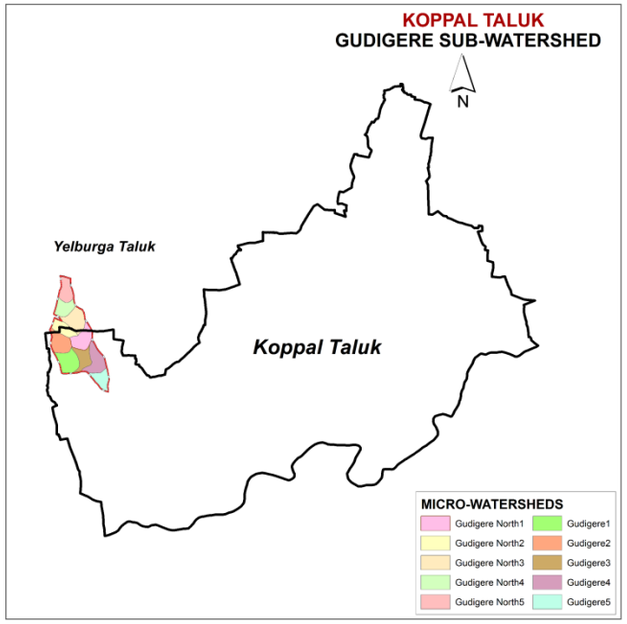
Suitability subclass	Area in ha (%)
S1	77 (1.7)
S2g	24 (0.52)
S2z	1545 (33.97)
S2rz	479 (10.53)
S3g	21 (0.47)
N1n	1376 (30.25)
N1r	2 (0.04)
N1rz	935 (20.55)
Others*	90 (1.99)

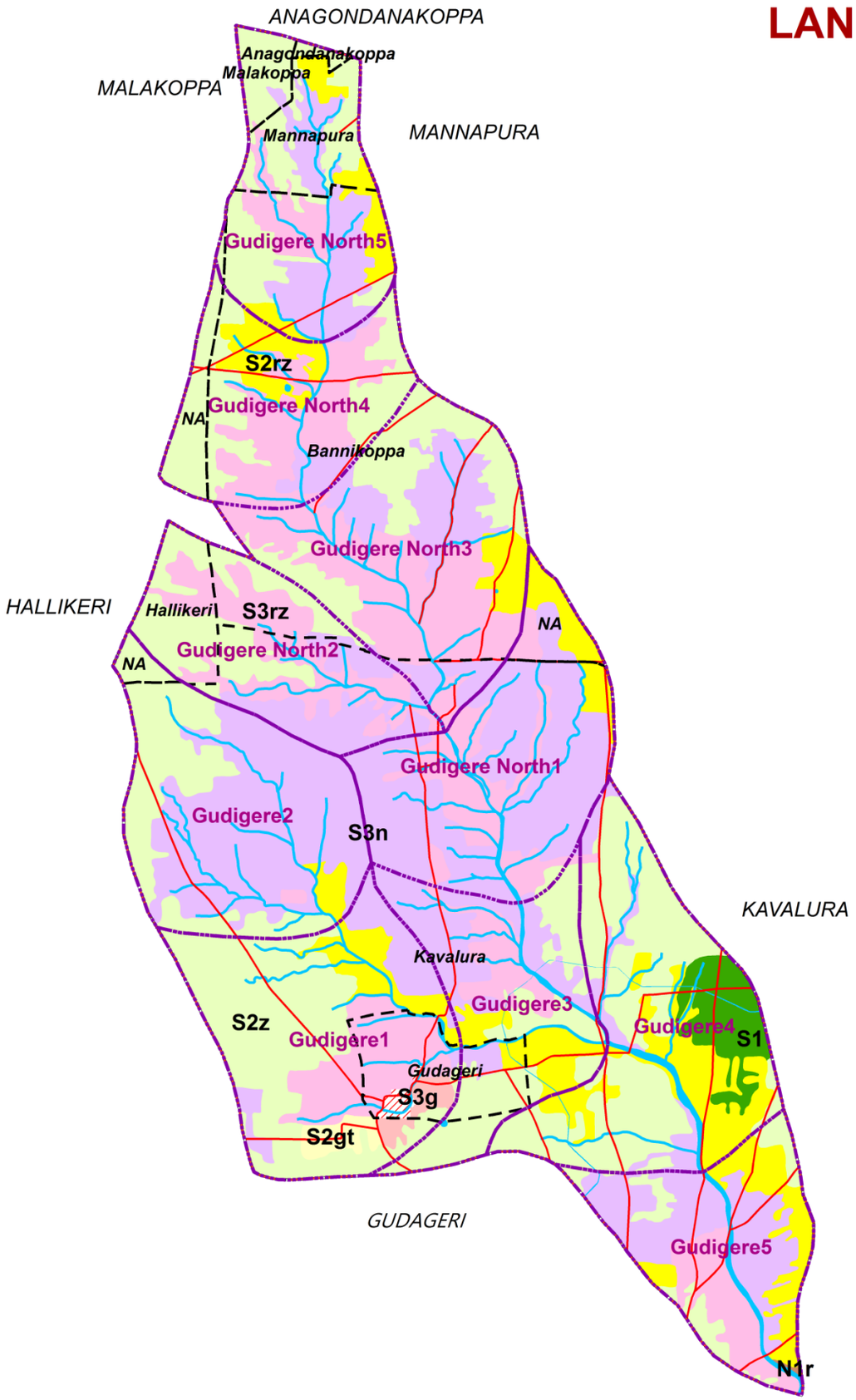
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.7. Land Suitability for Cotton





LAND SUITABILITY FOR COTTON

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

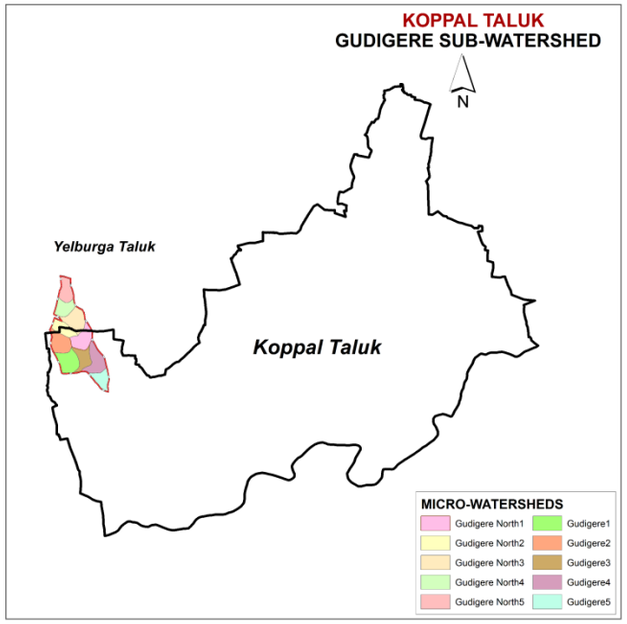
Suitability subclass	Area in ha (%)
S1	77 (1.7)
S2z	1545 (33.97)
S2gt	24 (0.52)
S2rz	479 (10.53)
S3g	21 (0.47)
S3n	1376 (30.25)
S3rz	935 (20.55)
N1r	2 (0.04)
Others*	90 (1.99)

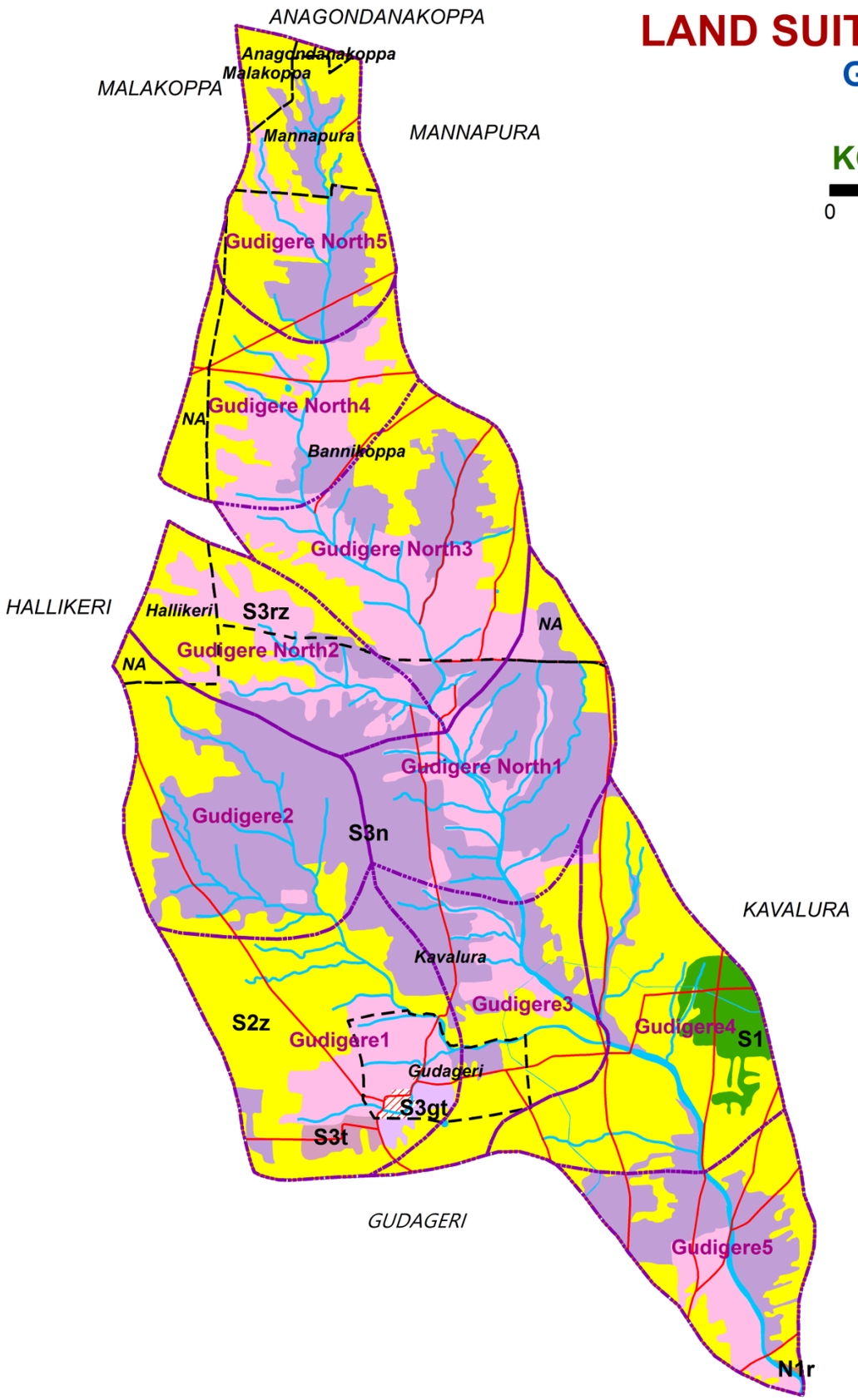
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.8. Land Suitability for Bengalgram





LAND SUITABILITY FOR BENGALGRAM

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

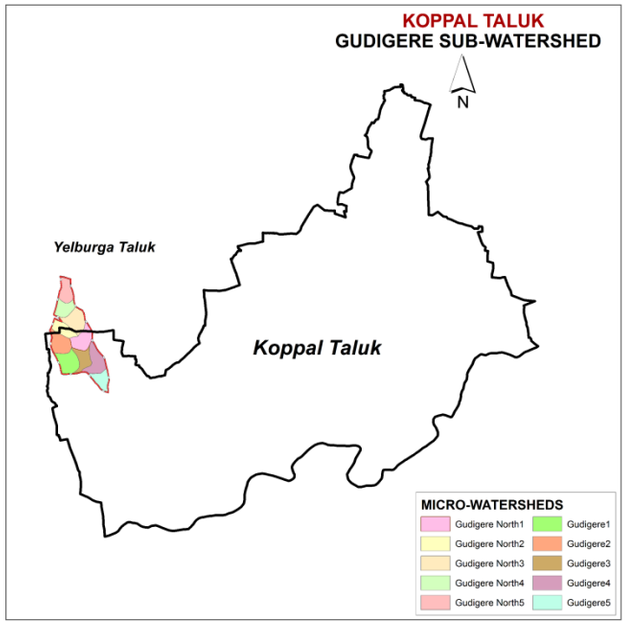
Suitability subclass	Area in ha (%)
S1	77 (1.7)
S2z	2024 (44.5)
S3n	1376 (30.25)
S3t	24 (0.52)
S3gt	21 (0.47)
S3rz	935 (20.55)
N1r	2 (0.04)
Others*	90 (1.99)

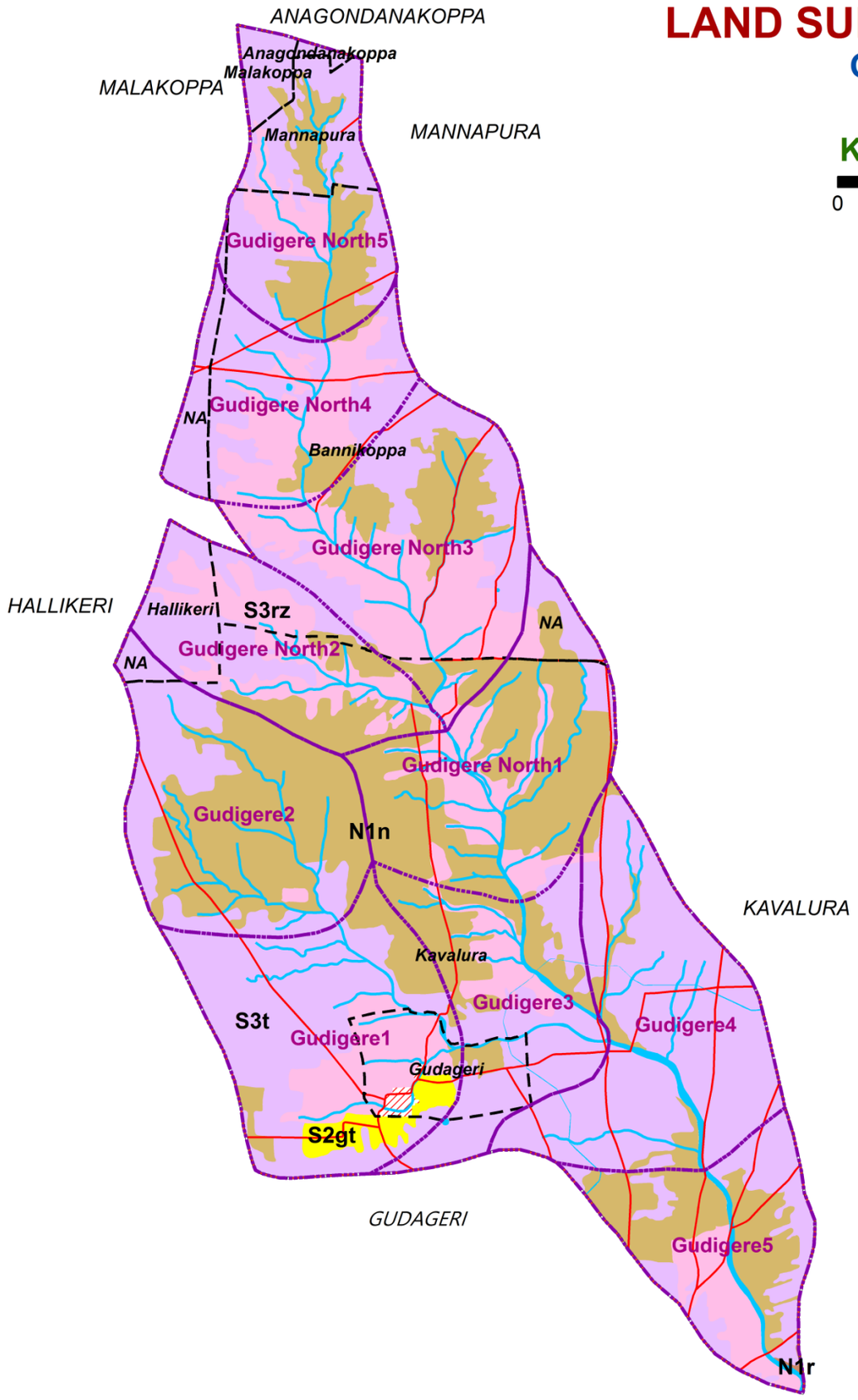
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.9. Land Suitability for Groundnut





LAND SUITABILITY FOR GROUNDNUT

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

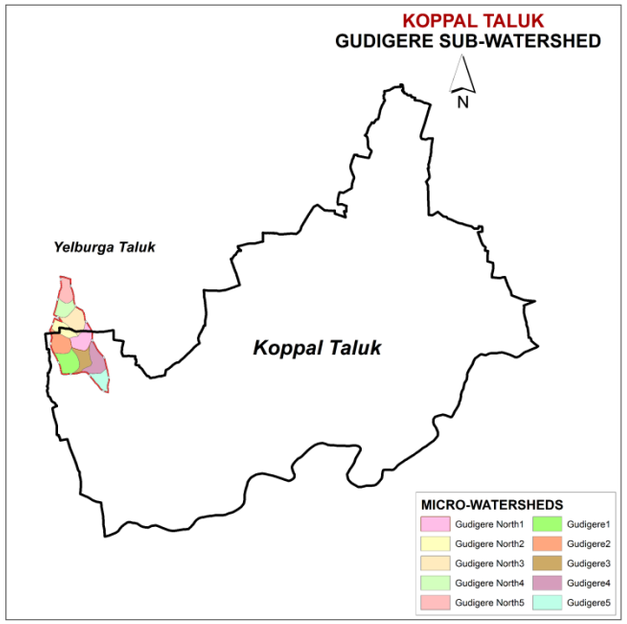
References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

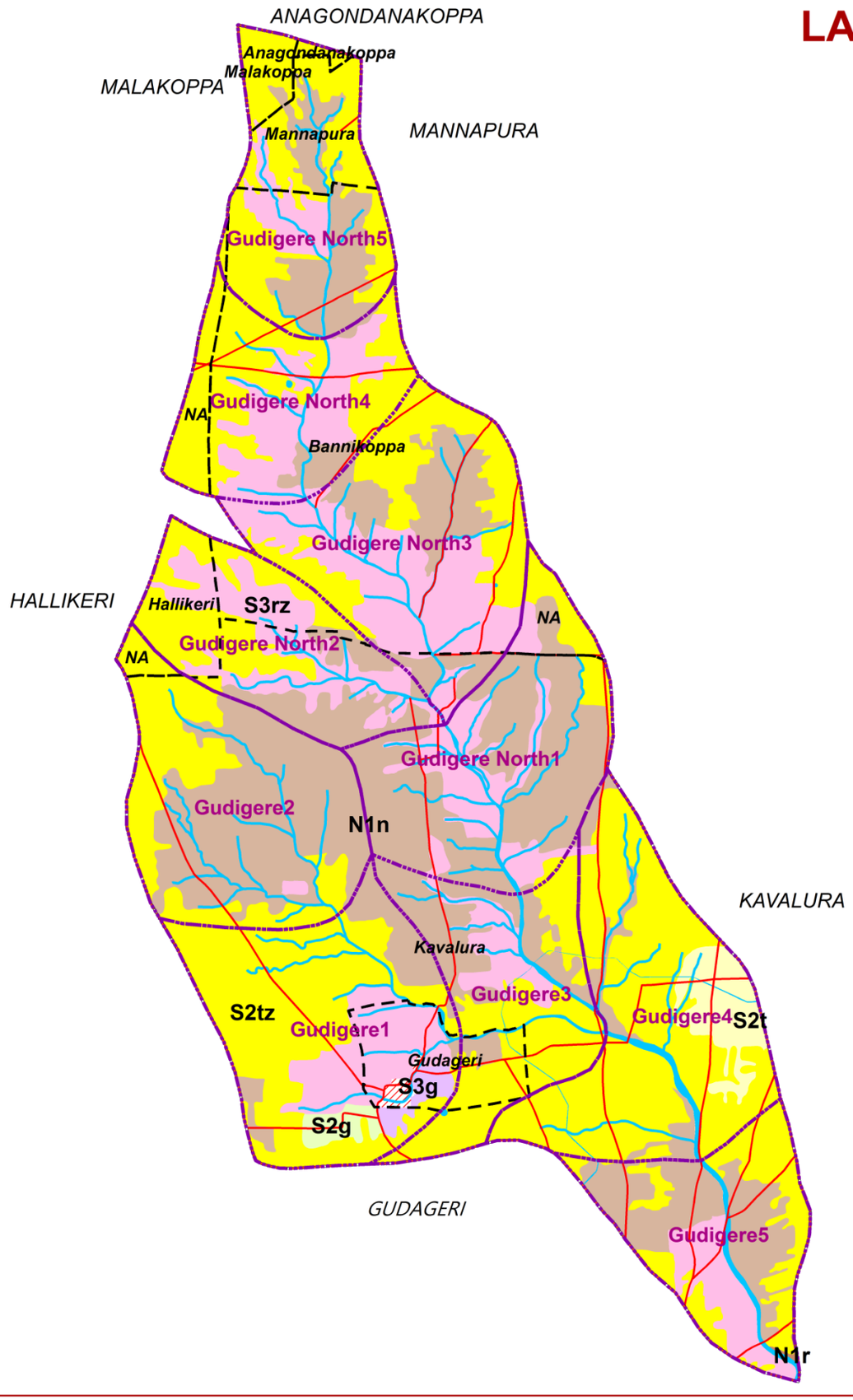
Suitability subclass	Area in ha (%)
S2gt	45 (0.99)
S3t	2101 (46.19)
S3rz	935 (20.55)
N1n	1376 (30.25)
N1r	2 (0.04)
Others*	90 (1.99)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

7.10. Land Suitability for Chilli





LAND SUITABILITY FOR CHILLI

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

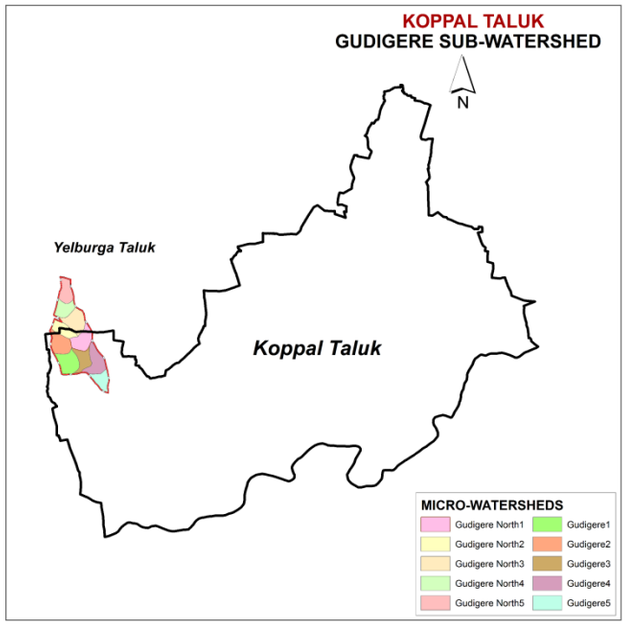
Suitability subclass	Area in ha (%)
S2g	24 (0.52)
S2t	77 (1.7)
S2tz	2024 (44.5)
S3g	21 (0.47)
S3rz	935 (20.55)
N1n	1376 (30.25)
N1r	2 (0.04)
Others*	90 (1.99)

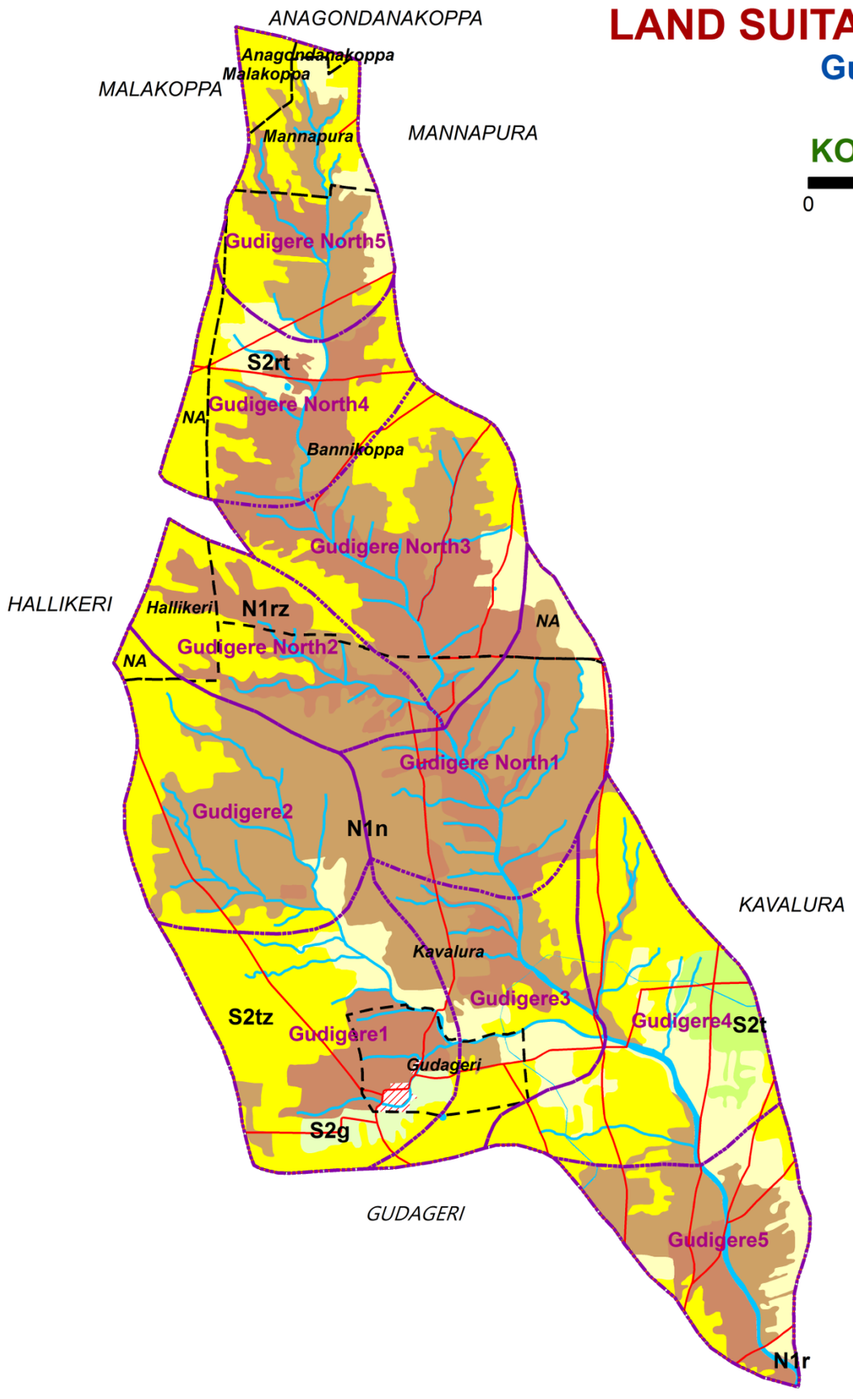
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.11. Land Suitability for Pomegranate





LAND SUITABILITY FOR POMEGRANATE

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S2g	45 (0.99)
S2t	77 (1.7)
S2rt	479 (10.53)
S2tz	1545 (33.97)
N1n	1376 (30.25)
N1r	2 (0.04)
N1rz	935 (20.55)
Others*	90 (1.99)

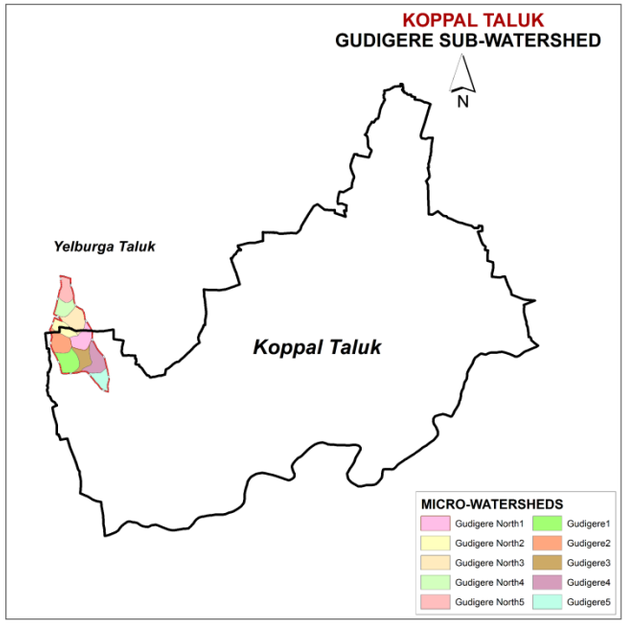
* - Habitation & Waterbody

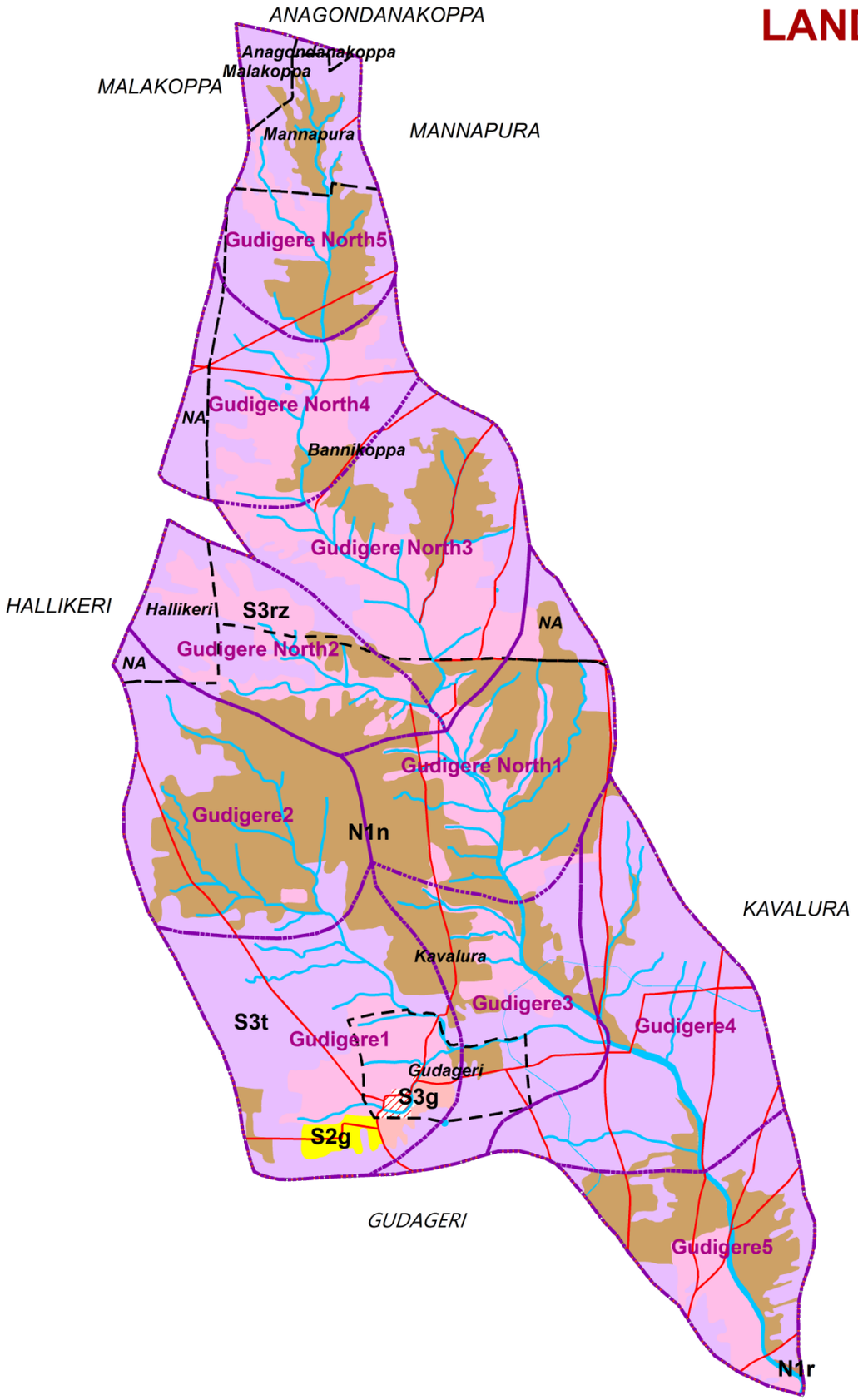
References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.12. Land Suitability for Tomato





LAND SUITABILITY FOR TOMATO

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

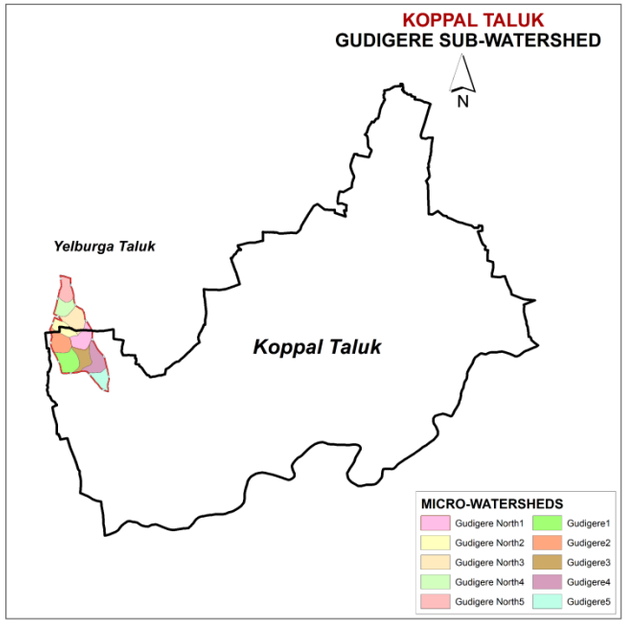
Suitability subclass	Area in ha (%)
S2g	24 (0.52)
S3g	21 (0.47)
S3t	2101 (46.19)
S3rz	935 (20.55)
N1n	1376 (30.25)
N1r	2 (0.04)
Others*	90 (1.99)

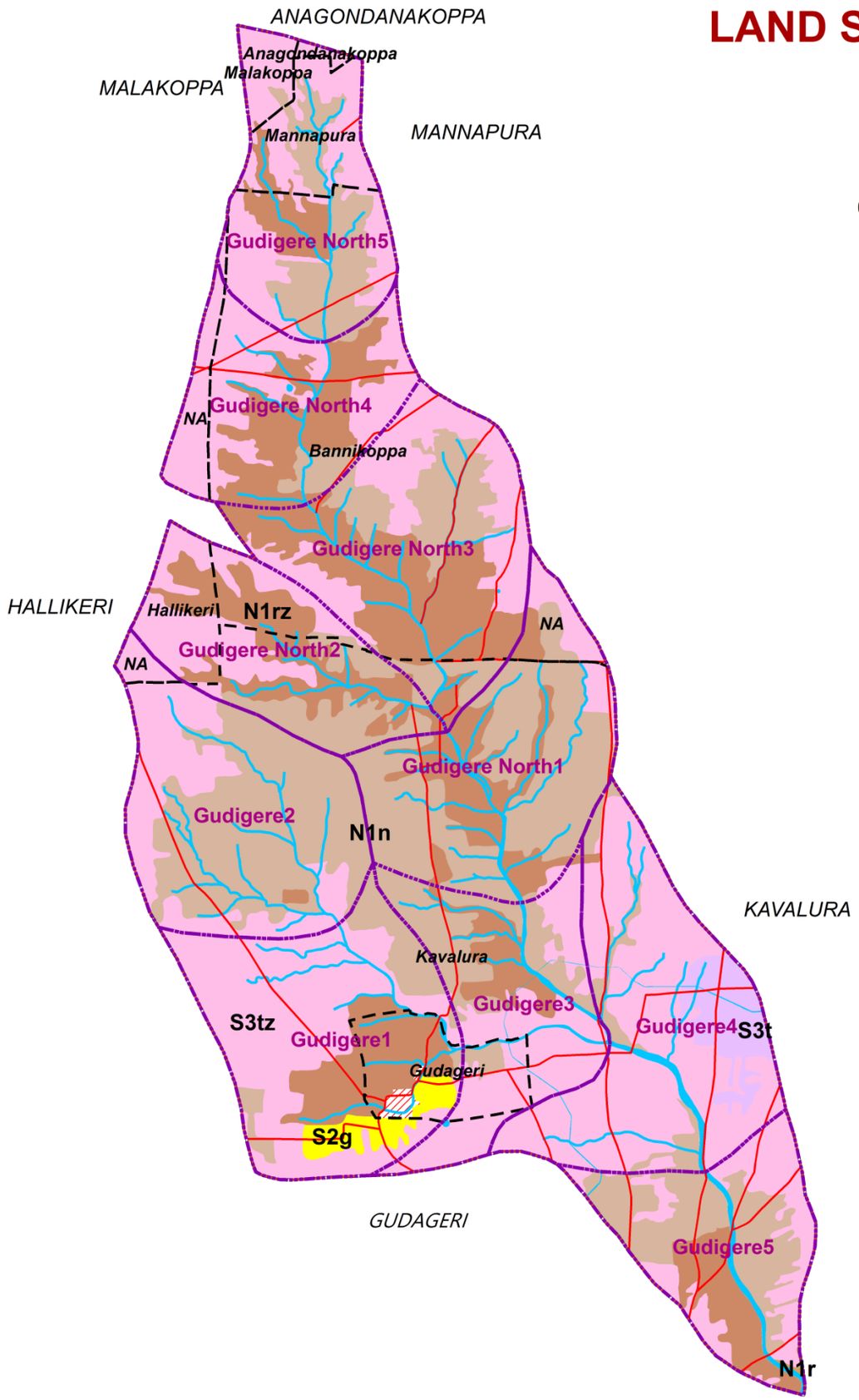
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.13. Land Suitability for Mulberry





LAND SUITABILITY FOR MULBERRY

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S2g	45 (0.99)
S3t	77 (1.7)
S3tz	2024 (44.5)
N1n	1376 (30.25)
N1r	2 (0.04)
N1rz	935 (20.55)
Others*	90 (1.99)

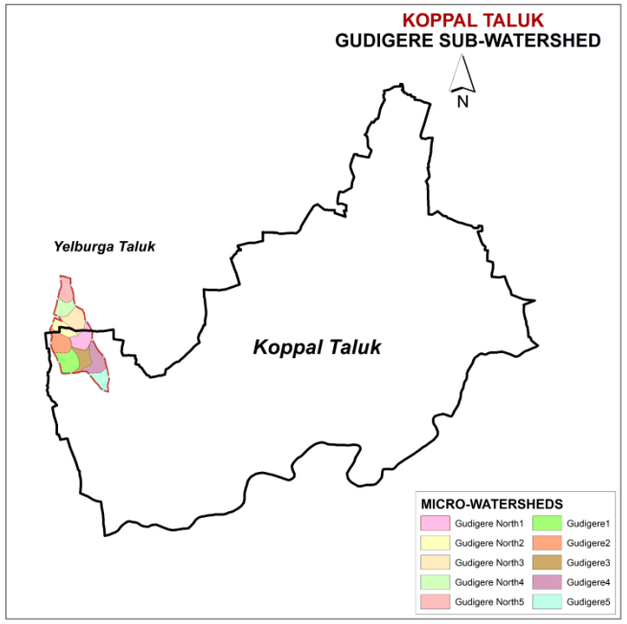
* - Habitation & Waterbody

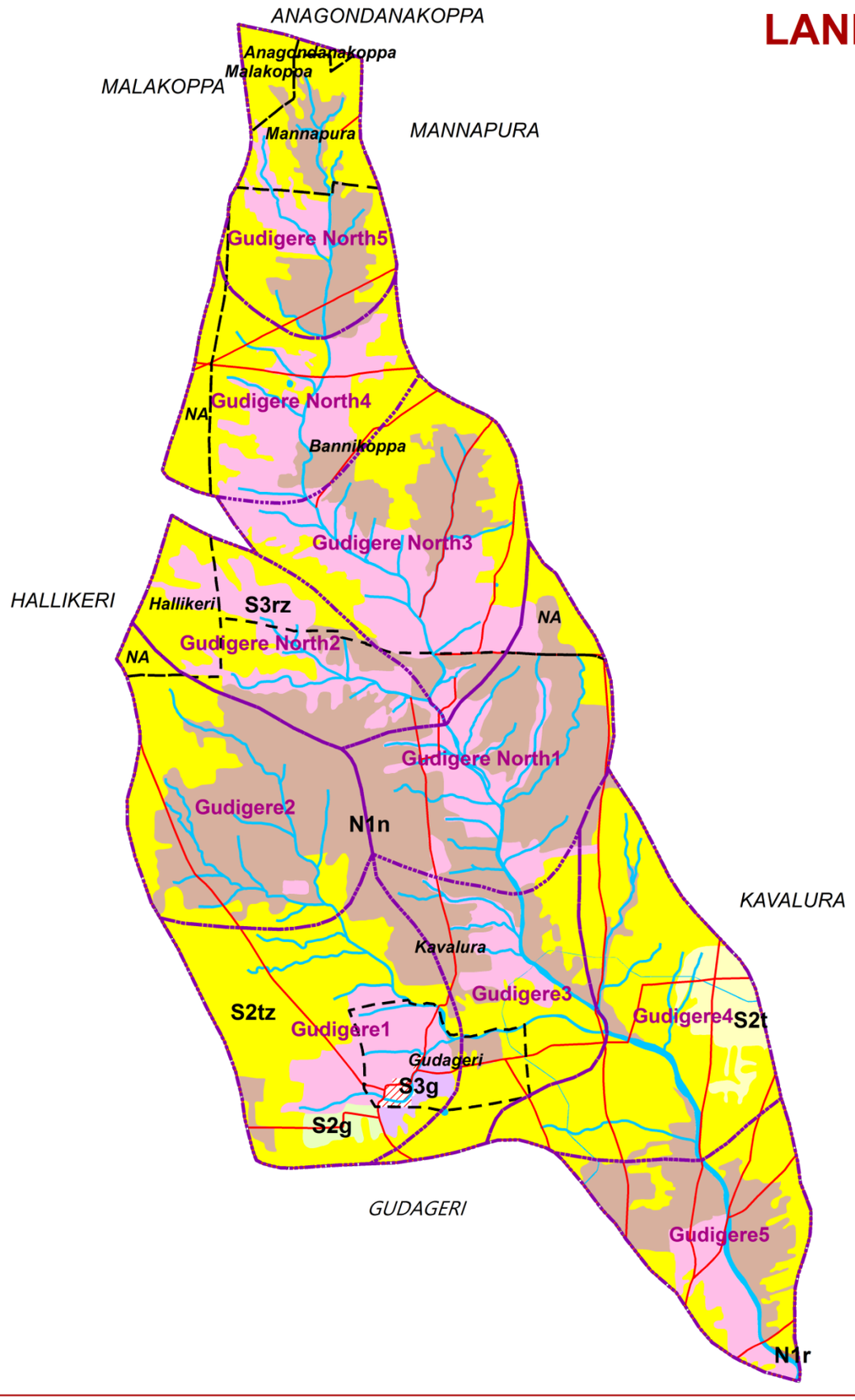
References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

NOTE: Mulberry suitability evaluation only for mulberry leaf, not for silkworm rearing

7.14. Land Suitability for Bhendi





LAND SUITABILITY FOR BHENDI

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

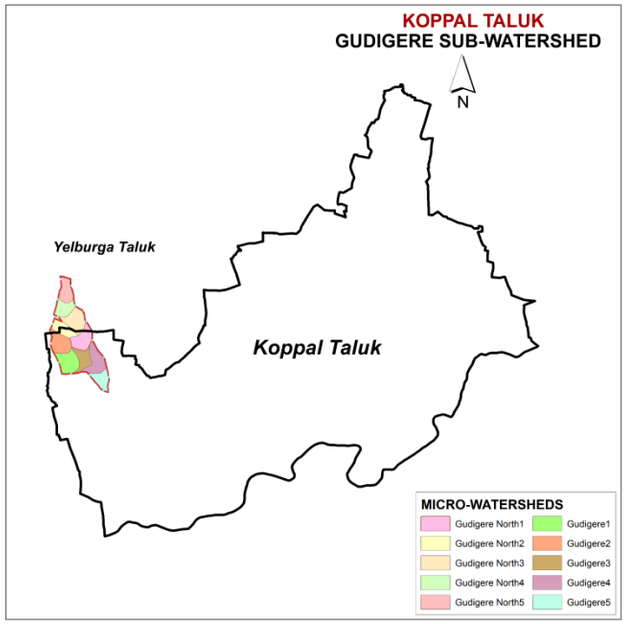
Suitability subclass	Area in ha (%)
S2g	24 (0.52)
S2t	77 (1.7)
S2tz	2024 (44.5)
S3g	21 (0.47)
S3rz	935 (20.55)
N1n	1376 (30.25)
N1r	2 (0.04)
Others*	90 (1.99)

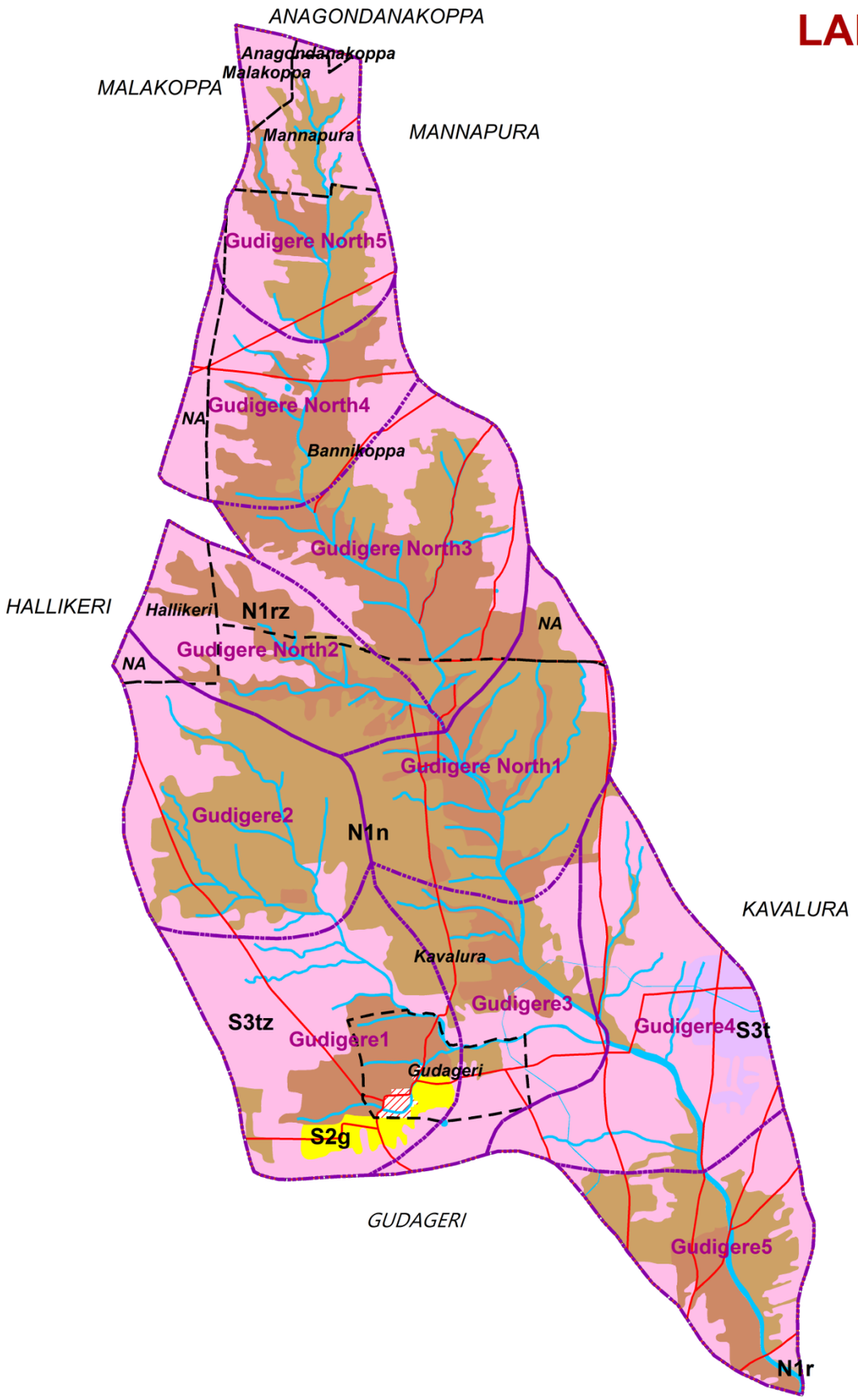
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.15. Land Suitability for Guava





LAND SUITABILITY FOR GUAVA

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

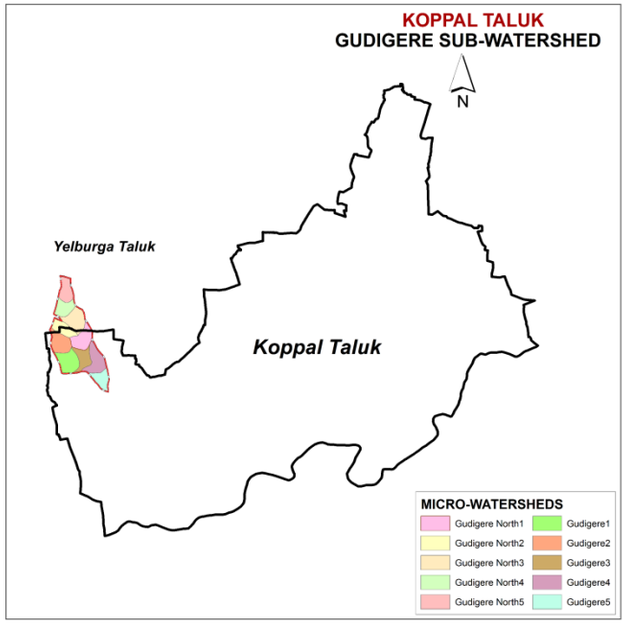
Suitability subclass	Area in ha (%)
S2g	45 (0.99)
S3t	77 (1.7)
S3tz	2024 (44.5)
N1n	1376 (30.25)
N1r	2 (0.04)
N1rz	935 (20.55)
Others*	90 (1.99)

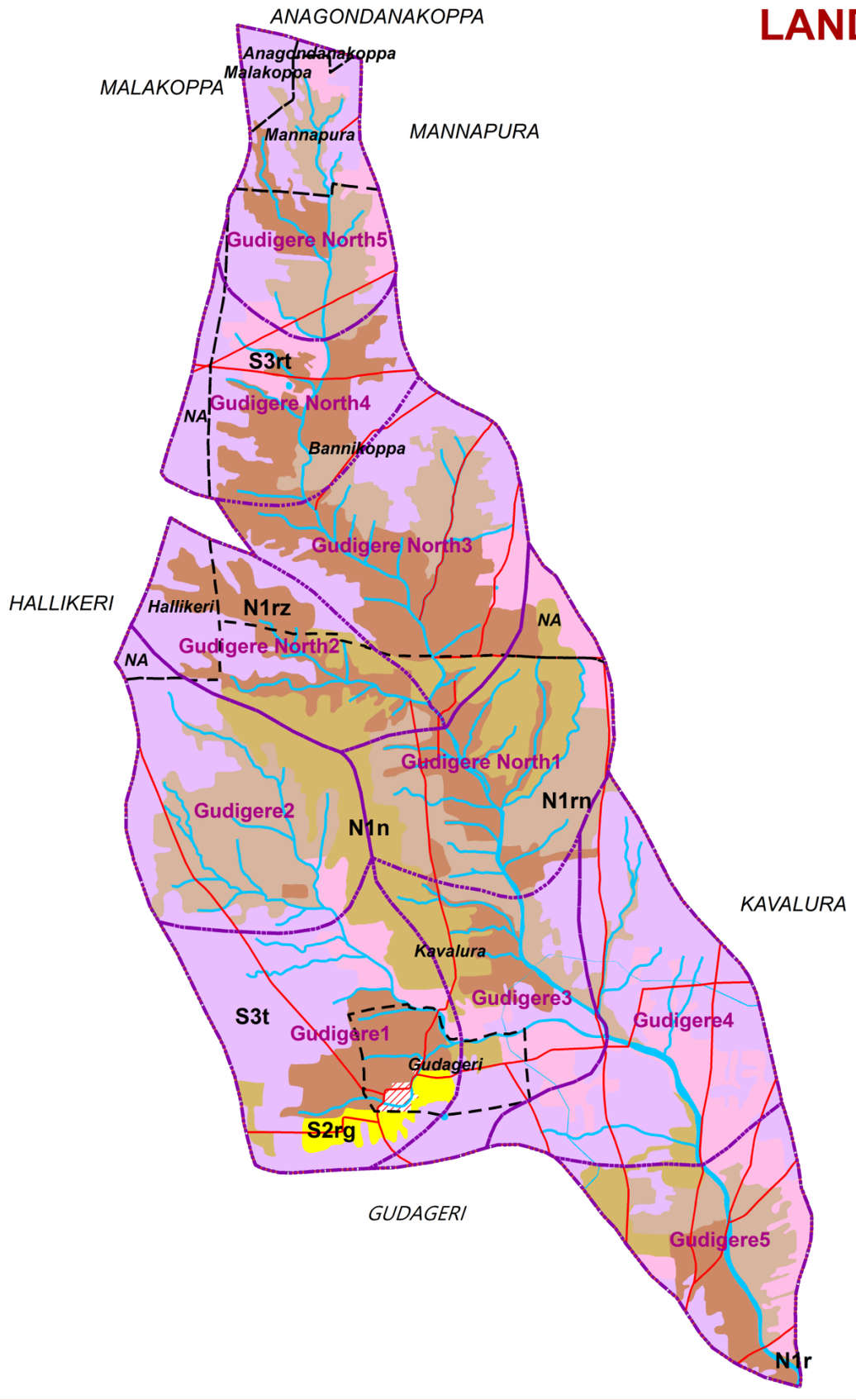
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.16. Land Suitability for Mango





LAND SUITABILITY FOR MANGO

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

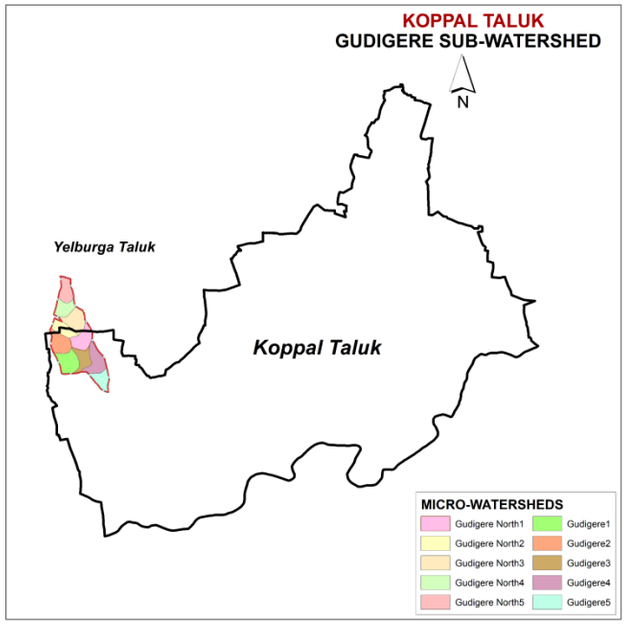
Suitability subclass	Area in ha (%)
S2rg	45 (0.99)
S3t	1622 (35.67)
S3rt	479 (10.53)
N1n	527 (11.58)
N1r	2 (0.04)
N1rn	849 (18.66)
N1rz	935 (20.55)
Others*	90 (1.99)

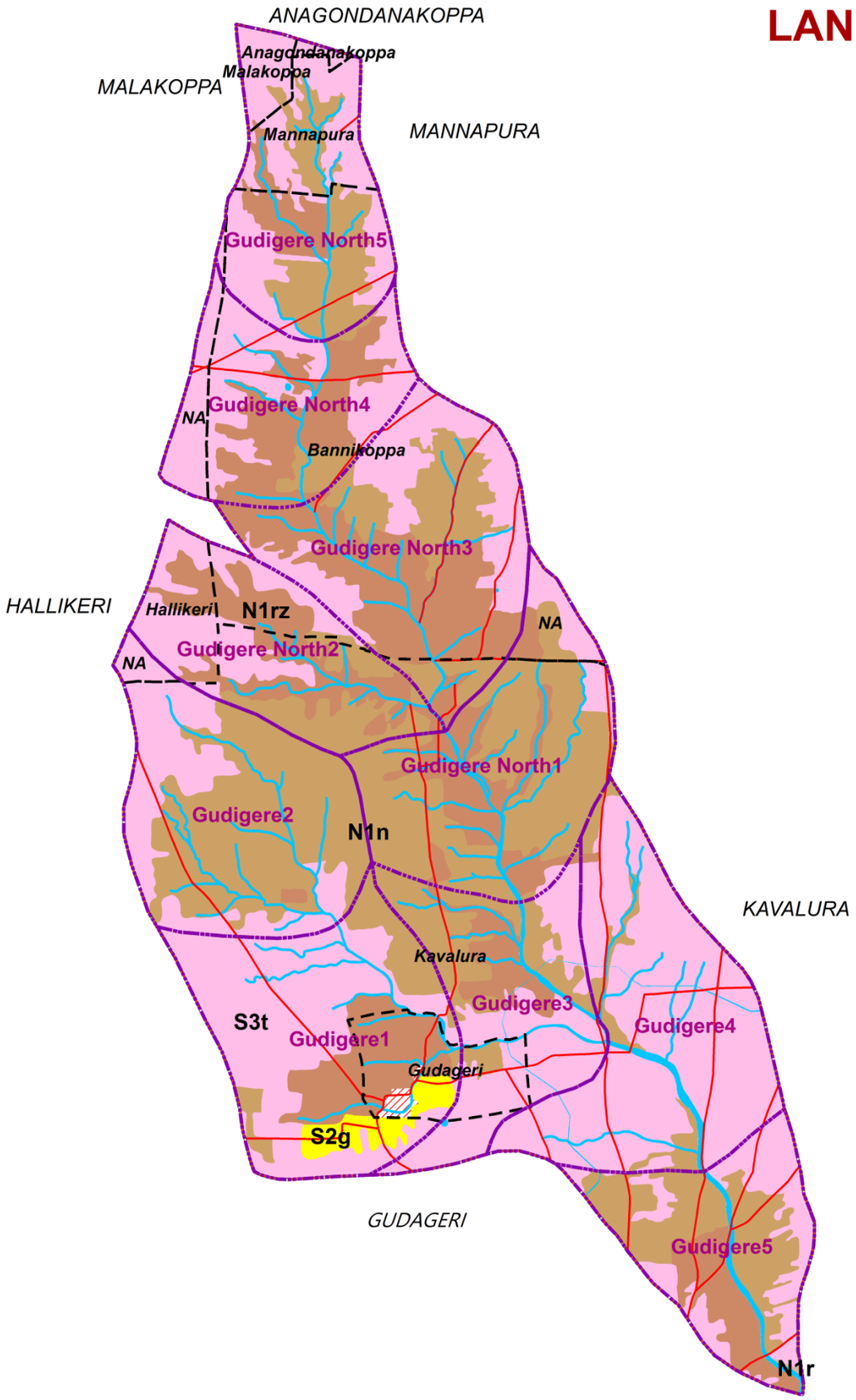
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.17. Land Suitability for Sapota





LAND SUITABILITY FOR SAPOTA

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

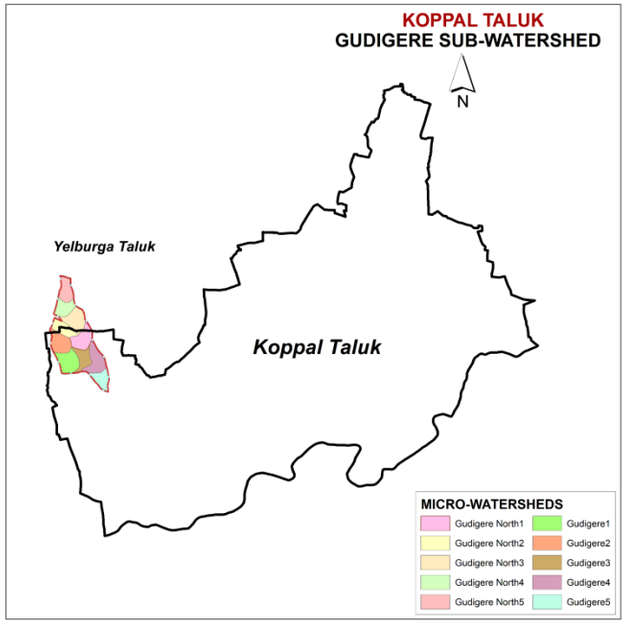
Suitability subclass	Area in ha (%)
S2g	45 (0.99)
S3t	2101 (46.19)
N1n	1376 (30.25)
N1r	2 (0.04)
N1rz	935 (20.55)
Others*	90 (1.99)

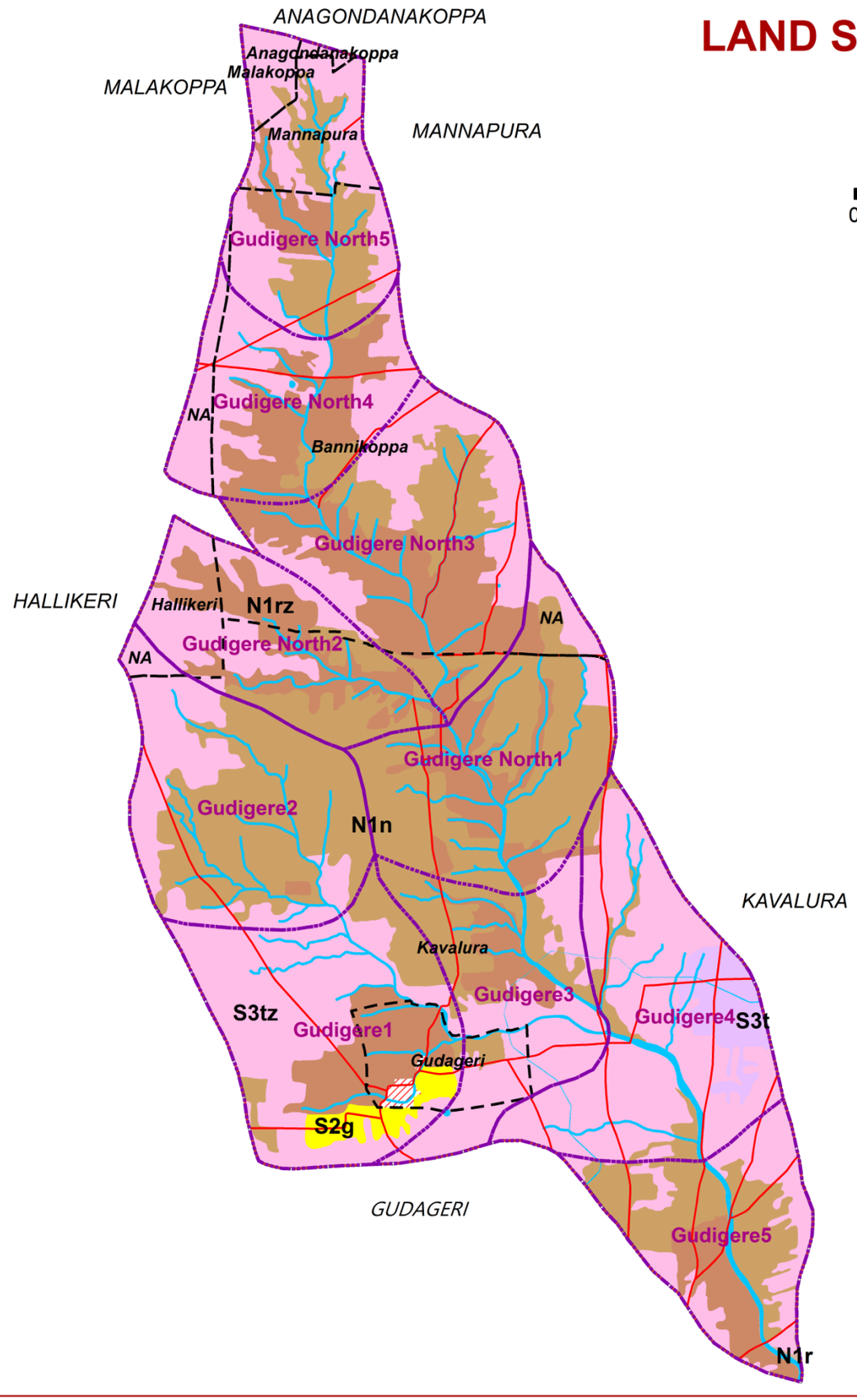
* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

7.18. Land Suitability for Jackfruit





LAND SUITABILITY FOR JACKFRUIT

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

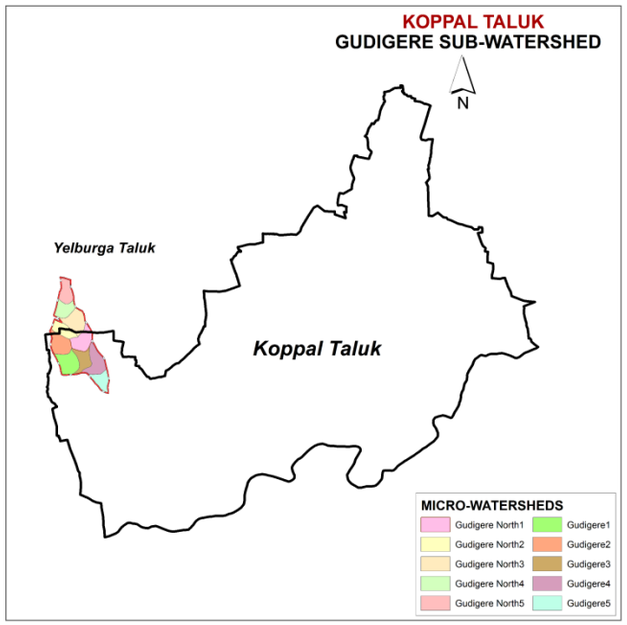
Suitability subclass	Area in ha (%)
S2g	45 (0.99)
S3t	77 (1.7)
S3tz	2024 (44.5)
N1n	1376 (30.25)
N1r	2 (0.04)
N1rz	935 (20.55)
Others*	90 (1.99)

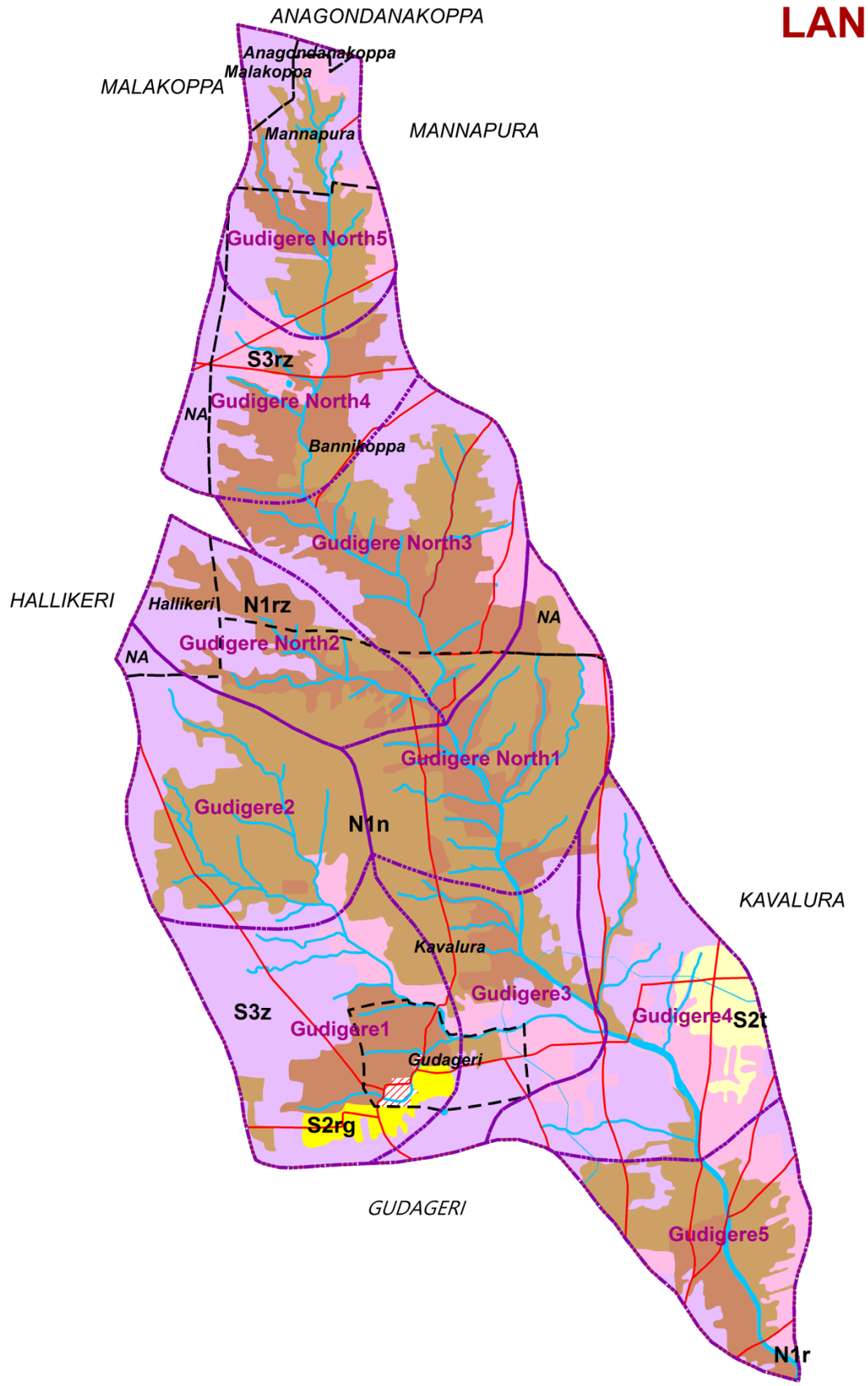
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.19. Land Suitability for Jamun





LAND SUITABILITY FOR JAMUN

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

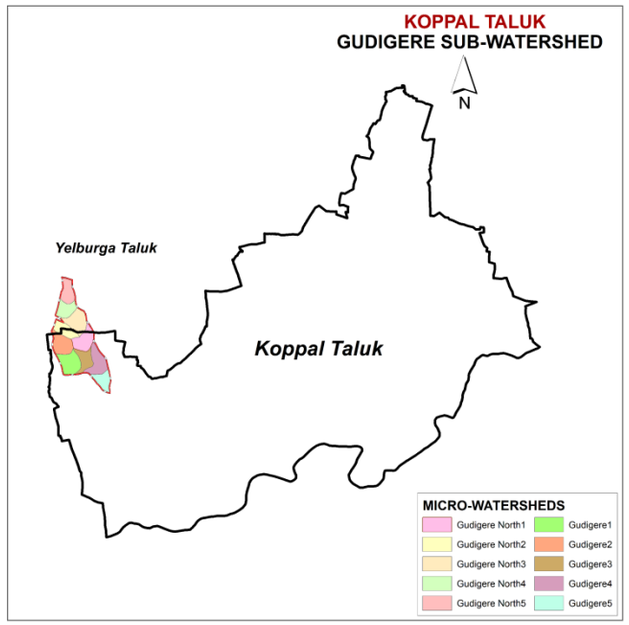
Suitability subclass	Area in ha (%)
S2t	77 (1.7)
S2rg	45 (0.99)
S3z	1545 (33.97)
S3rz	479 (10.53)
N1n	1376 (30.25)
N1r	2 (0.04)
N1rz	935 (20.55)
Others*	90 (1.99)

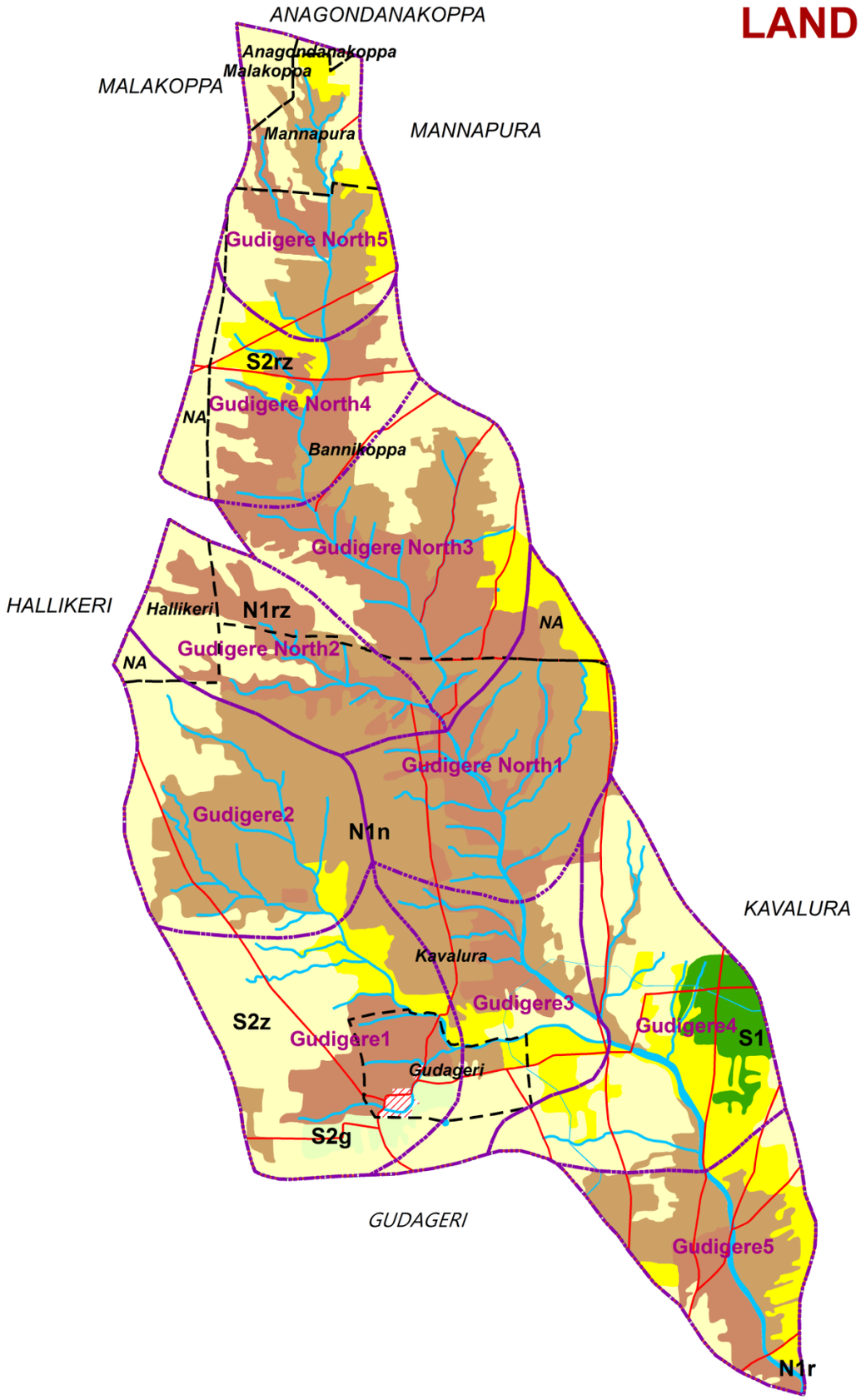
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.20. Land Suitability for Musambi





LAND SUITABILITY FOR MUSAMBI

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
z- excess salt/calcareousness

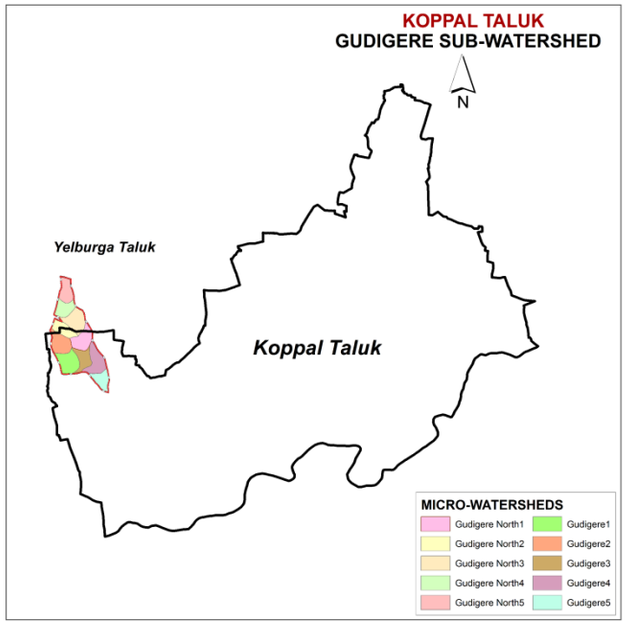
References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

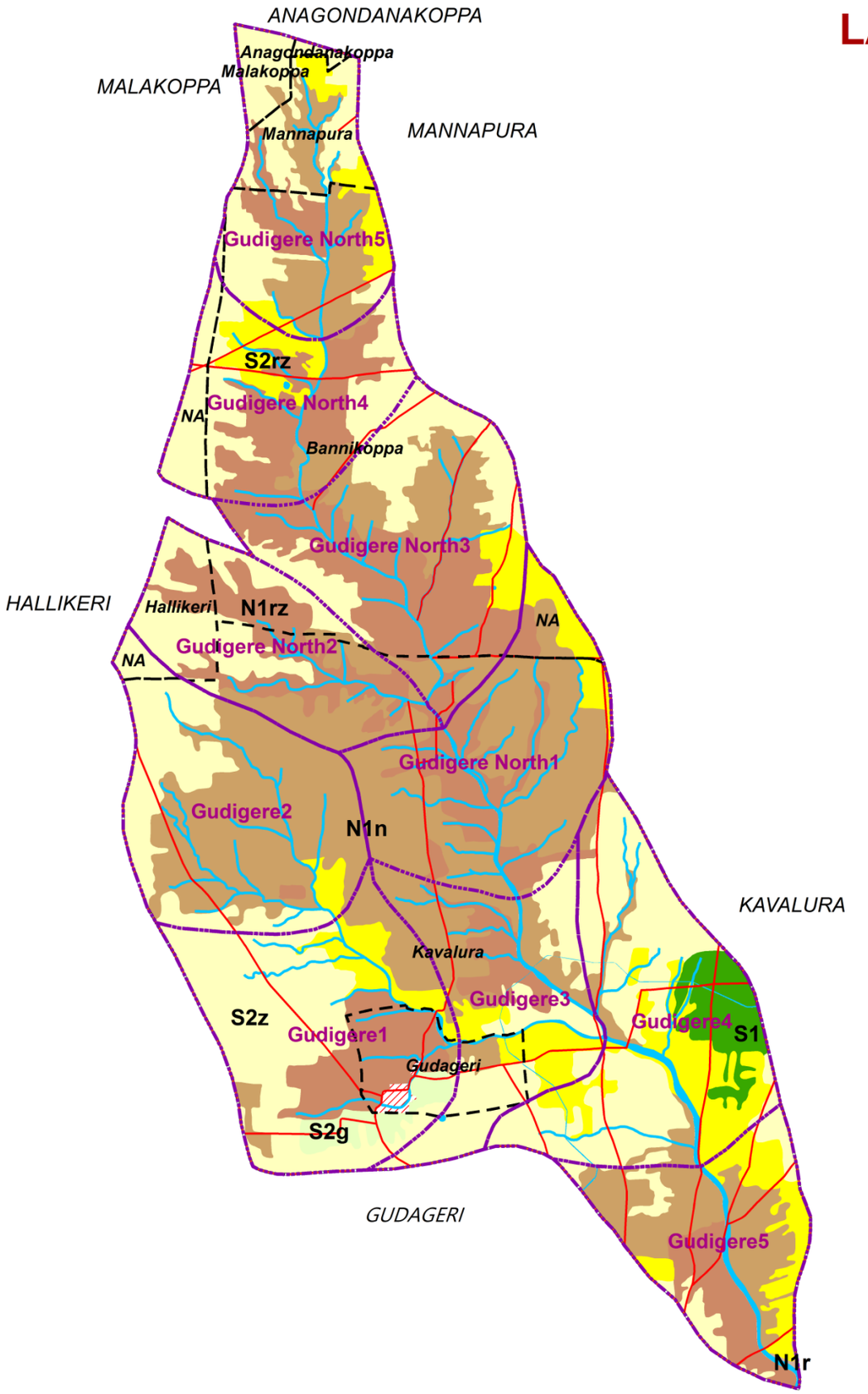
Suitability subclass	Area in ha (%)
S1	77 (1.7)
S2g	45 (0.99)
S2z	1545 (33.97)
S2rz	479 (10.53)
N1n	1376 (30.25)
N1r	2 (0.04)
N1rz	935 (20.55)
Others*	90 (1.99)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

7.21. Land Suitability for Lime





LAND SUITABILITY FOR LIME

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S1	77 (1.7)
S2g	45 (0.99)
S2z	1545 (33.97)
S2rz	479 (10.53)
N1n	1376 (30.25)
N1r	2 (0.04)
N1rz	935 (20.55)
Others*	90 (1.99)

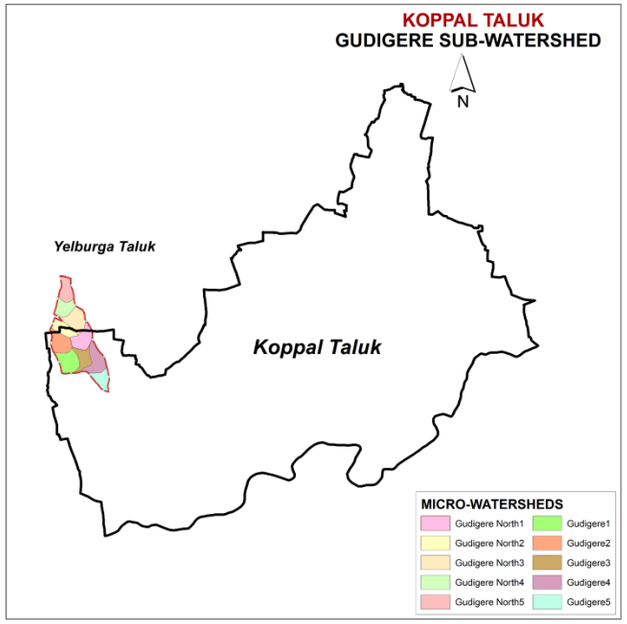
* - Habitation & Waterbody

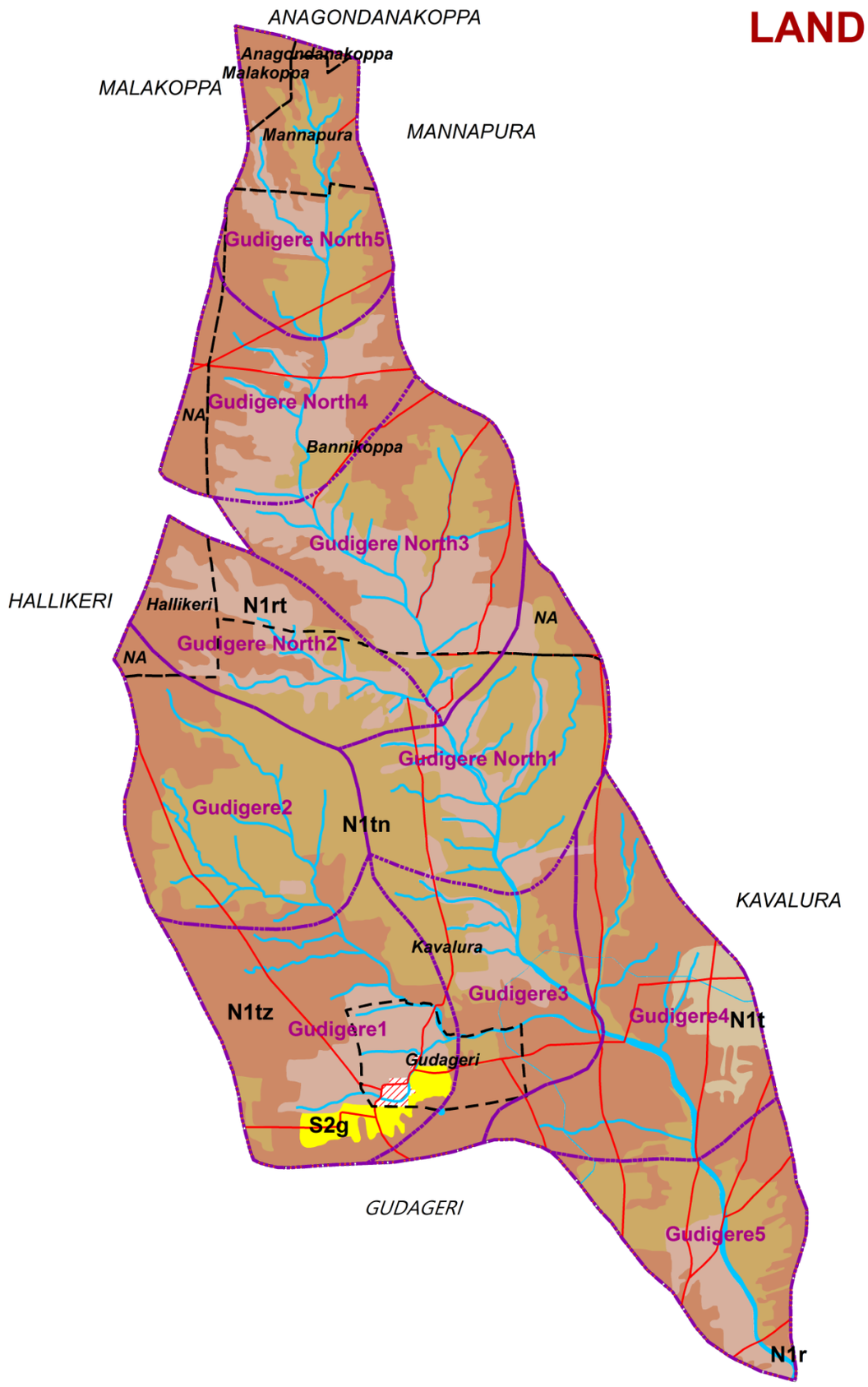
References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.22. Land Suitability for Cashew





LAND SUITABILITY FOR CASHEW

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

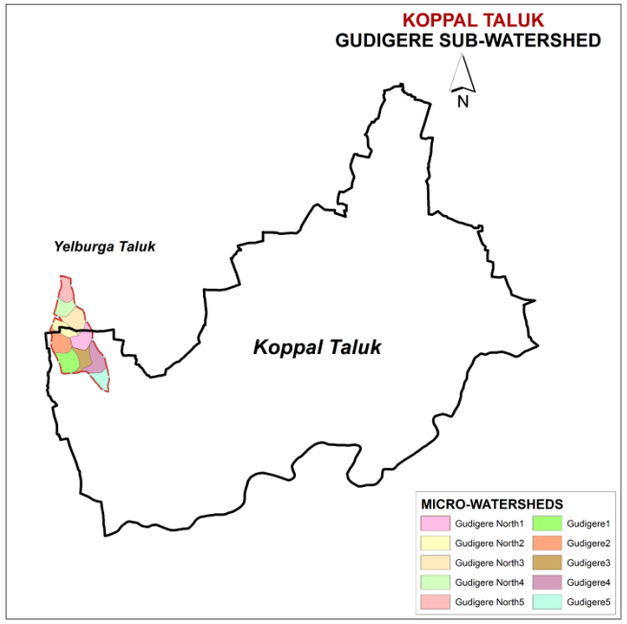
Suitability subclass	Area in ha (%)
S2g	45 (0.99)
N1r	2 (0.04)
N1t	77 (1.7)
N1rt	935 (20.55)
N1tn	1376 (30.25)
N1tz	2024 (44.5)
Others*	90 (1.99)

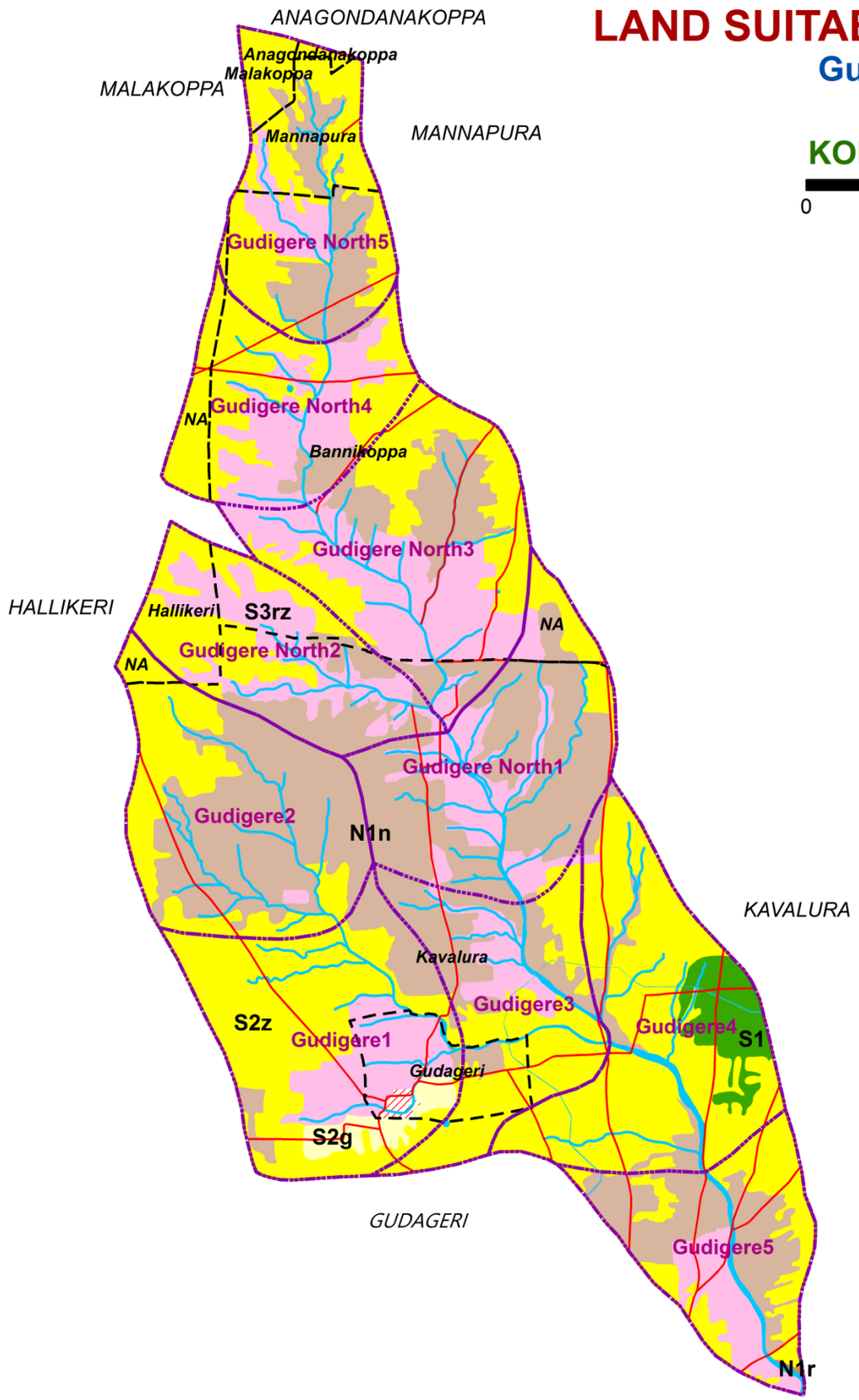
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.23. Land Suitability for Custard Apple





LAND SUITABILITY FOR CUSTARD APPLE

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
z- excess salt/calcareousness

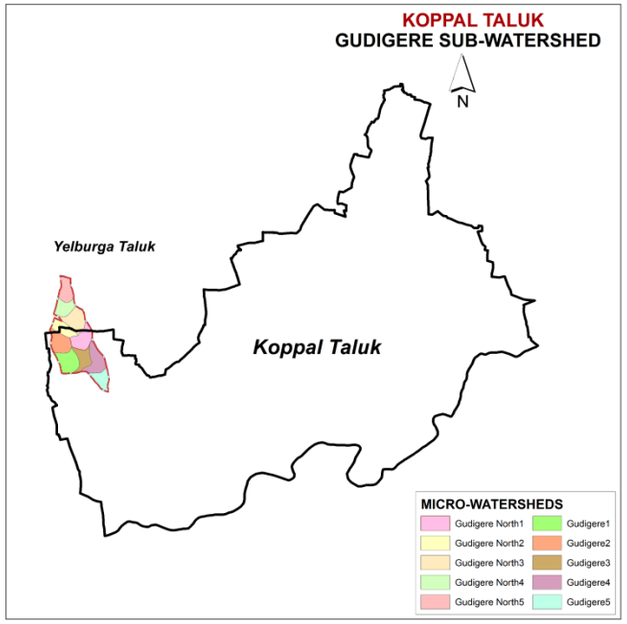
Suitability subclass	Area in ha (%)
S1	77 (1.7)
S2g	45 (0.99)
S2z	2024 (44.5)
S3rz	935 (20.55)
N1n	1376 (30.25)
N1r	2 (0.04)
Others*	90 (1.99)

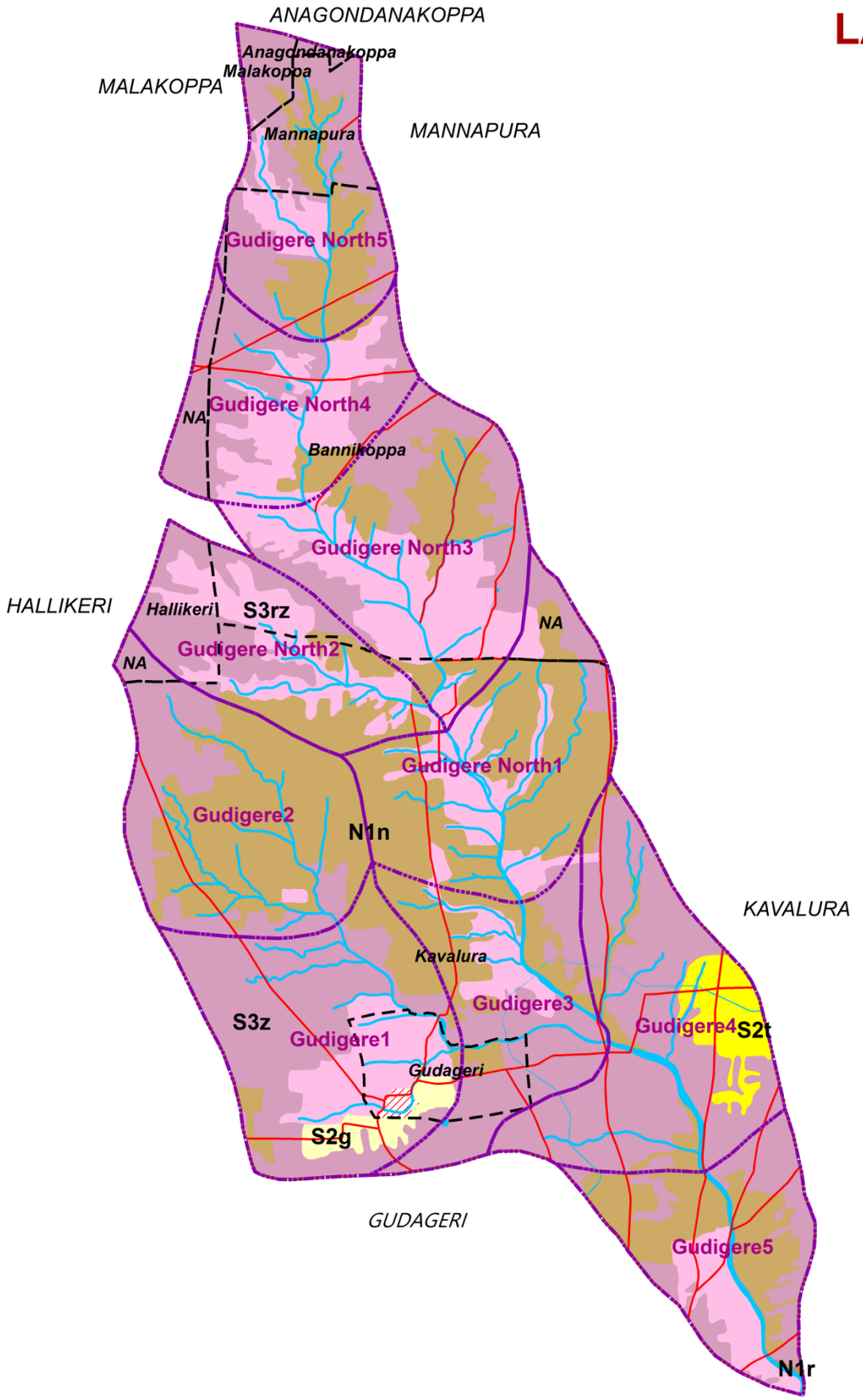
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.24. Land Suitability for Amla





LAND SUITABILITY FOR AMLA

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

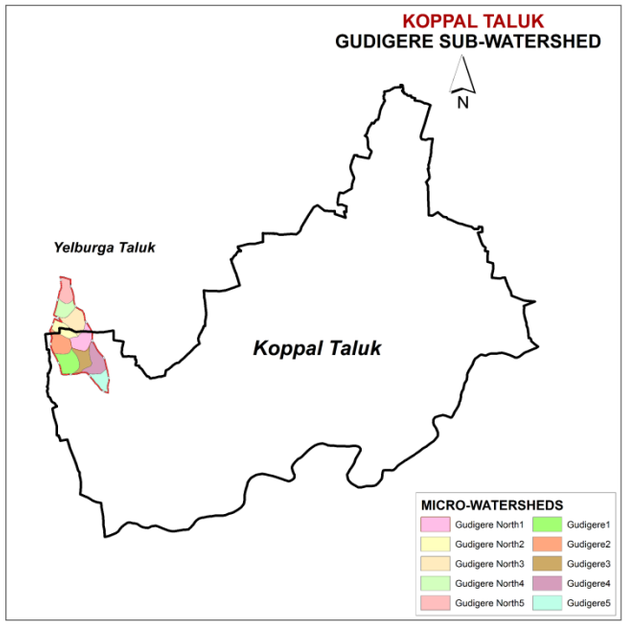
Suitability subclass	Area in ha (%)
S2g	45 (0.99)
S2t	77 (1.7)
S3z	2024 (44.5)
S3rz	935 (20.55)
N1n	1376 (30.25)
N1r	2 (0.04)
Others*	90 (1.99)

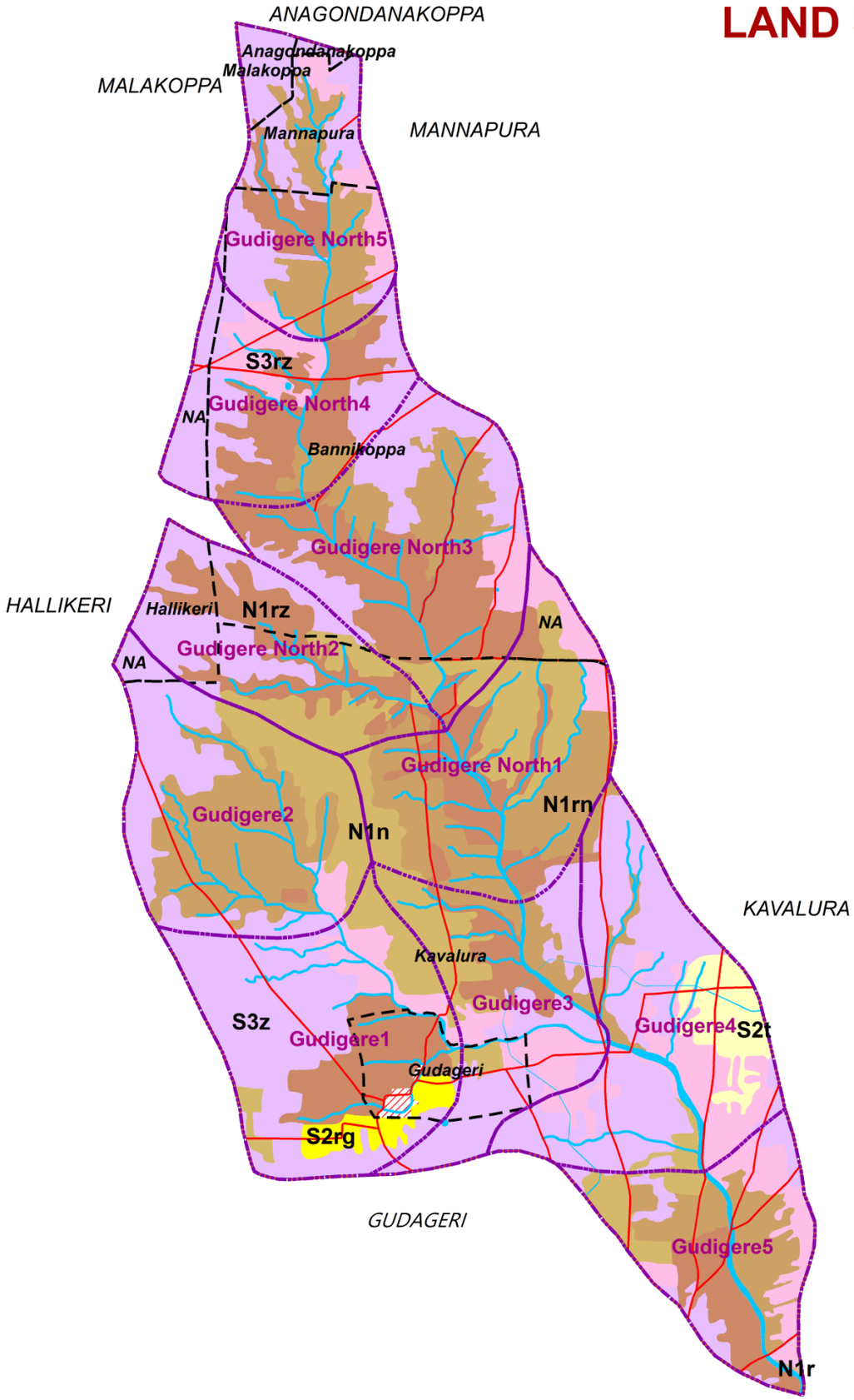
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.25. Land Suitability for Tamarind





LAND SUITABILITY FOR TAMARIND

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

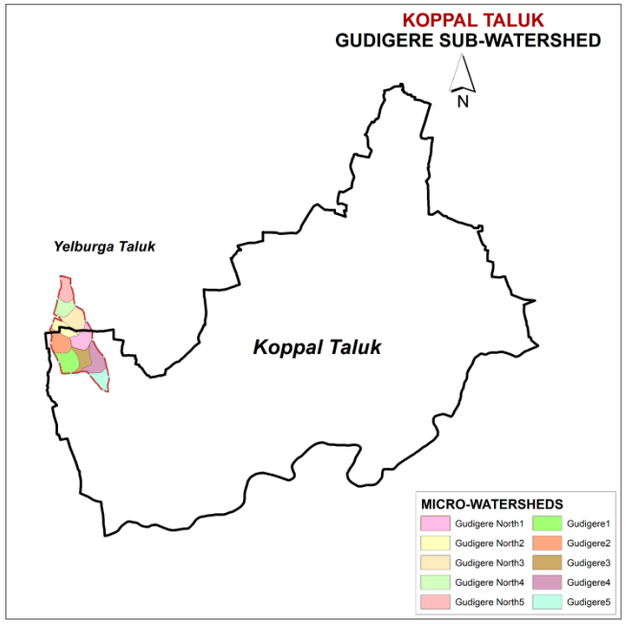
Suitability subclass	Area in ha (%)
S2t	77 (1.7)
S2rg	45 (0.99)
S3z	1545 (33.97)
S3rz	479 (10.53)
N1n	527 (11.58)
N1r	2 (0.04)
N1rn	849 (18.66)
N1rz	935 (20.55)
Others*	90 (1.99)

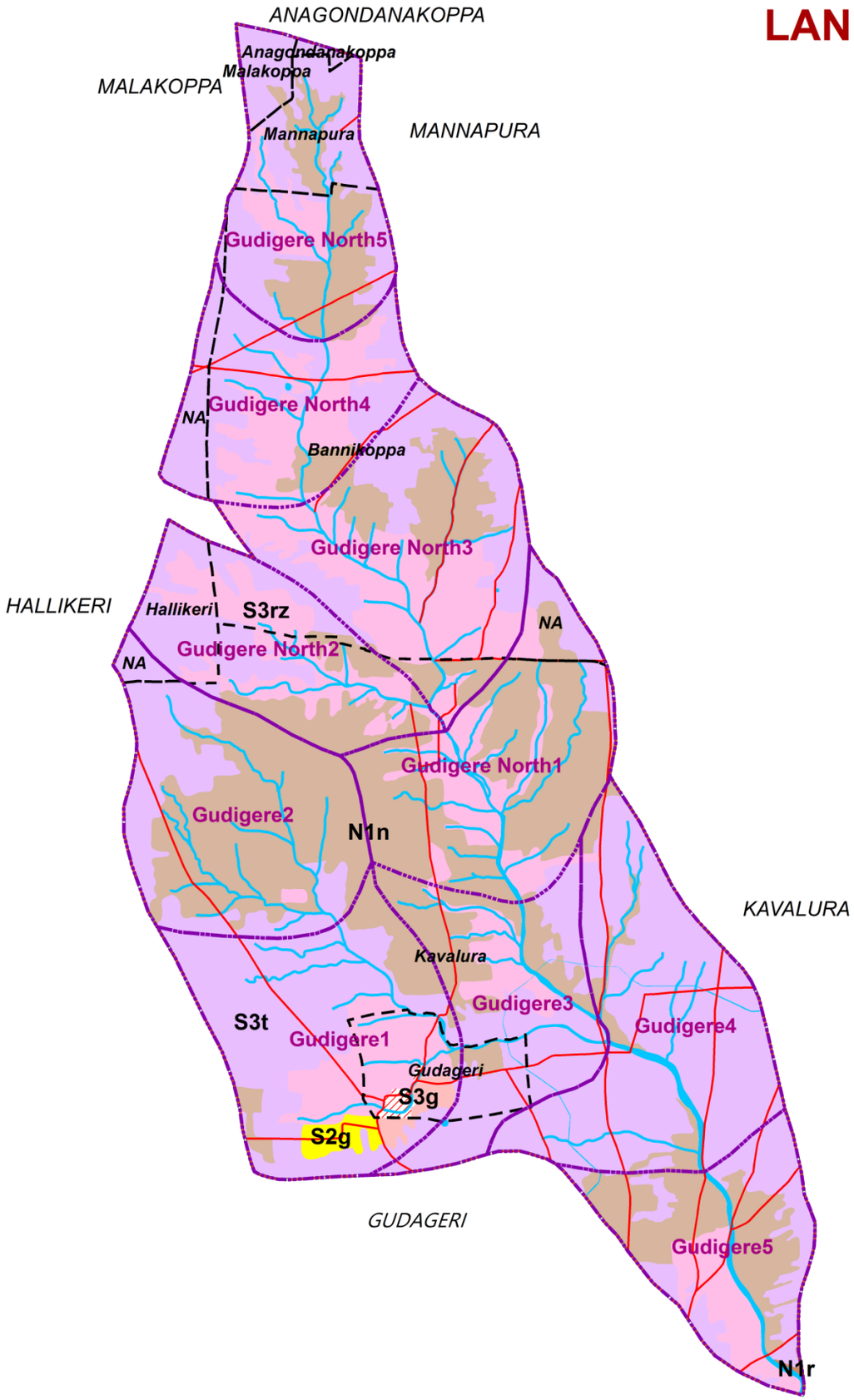
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.26. Land Suitability for Brinjal





LAND SUITABILITY FOR BRINJAL

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

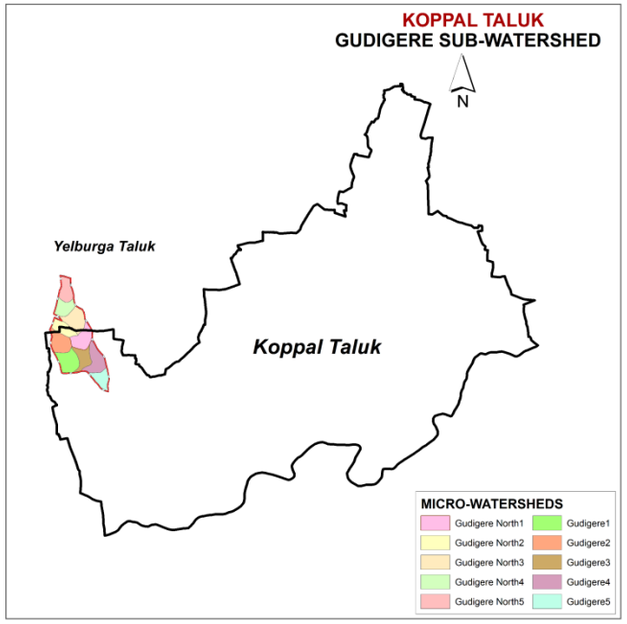
Suitability subclass	Area in ha (%)
S2g	24 (0.52)
S3g	21 (0.47)
S3t	2101 (46.19)
S3rz	935 (20.55)
N1n	1376 (30.25)
N1r	2 (0.04)
Others*	90 (1.99)

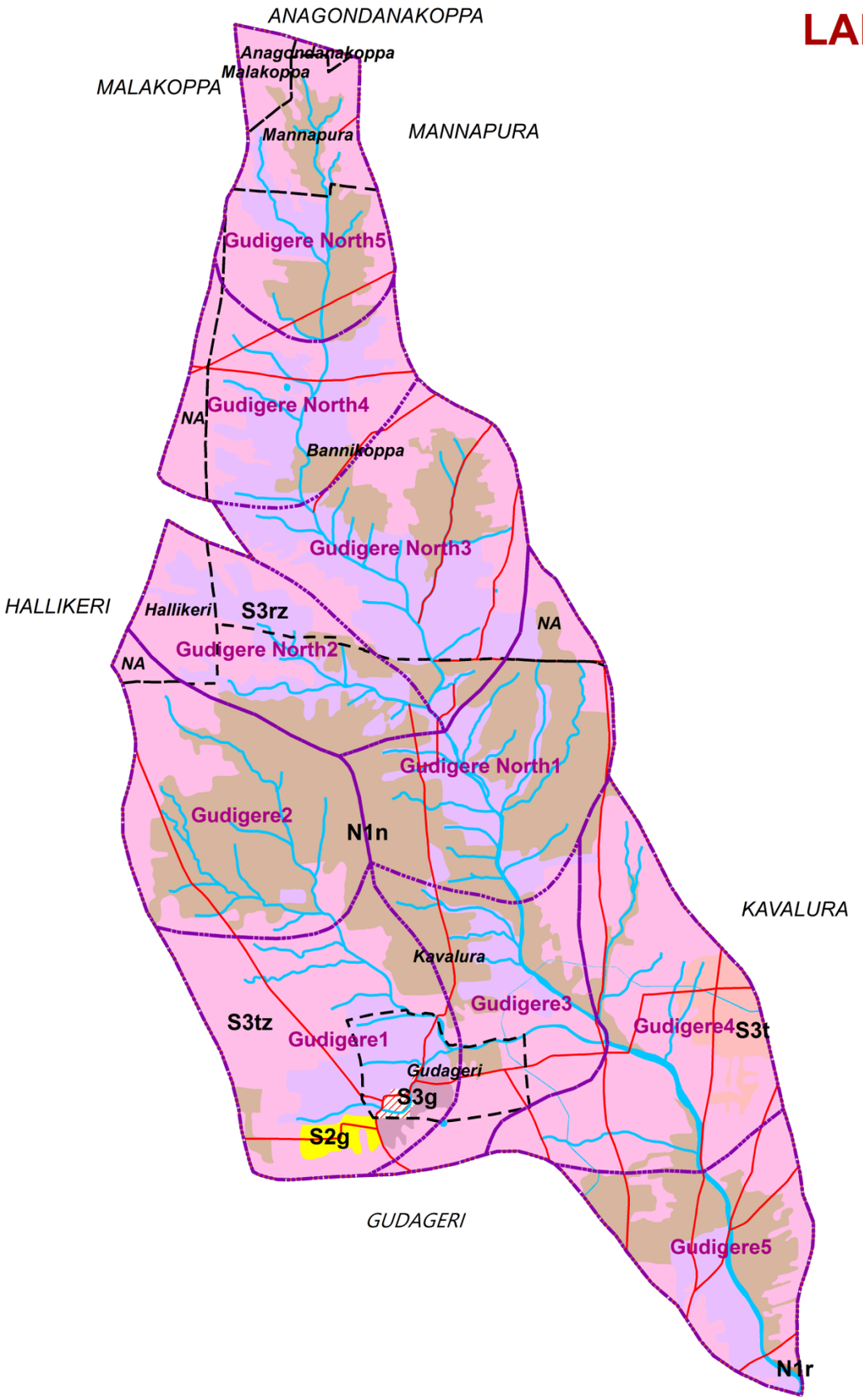
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.27. Land Suitability for Onion





LAND SUITABILITY FOR ONION

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

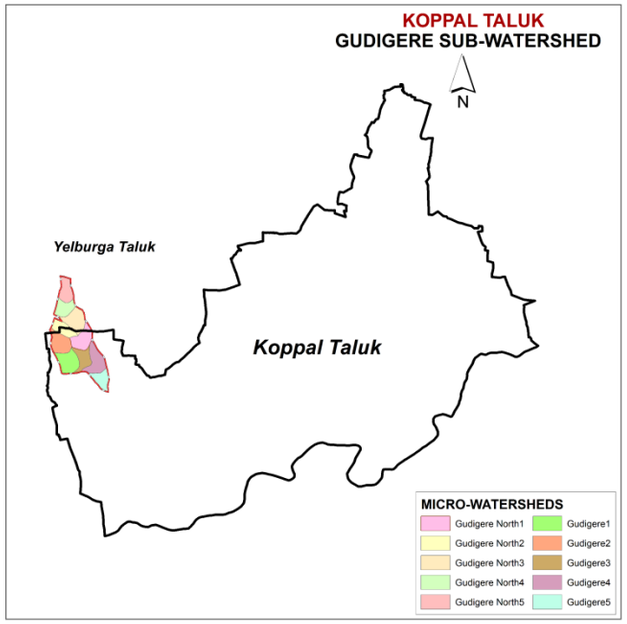
Suitability subclass	Area in ha (%)
S2g	24 (0.52)
S3g	21 (0.47)
S3t	77 (1.7)
S3rz	935 (20.55)
S3tz	2024 (44.5)
N1n	1376 (30.25)
N1r	2 (0.04)
Others*	90 (1.99)

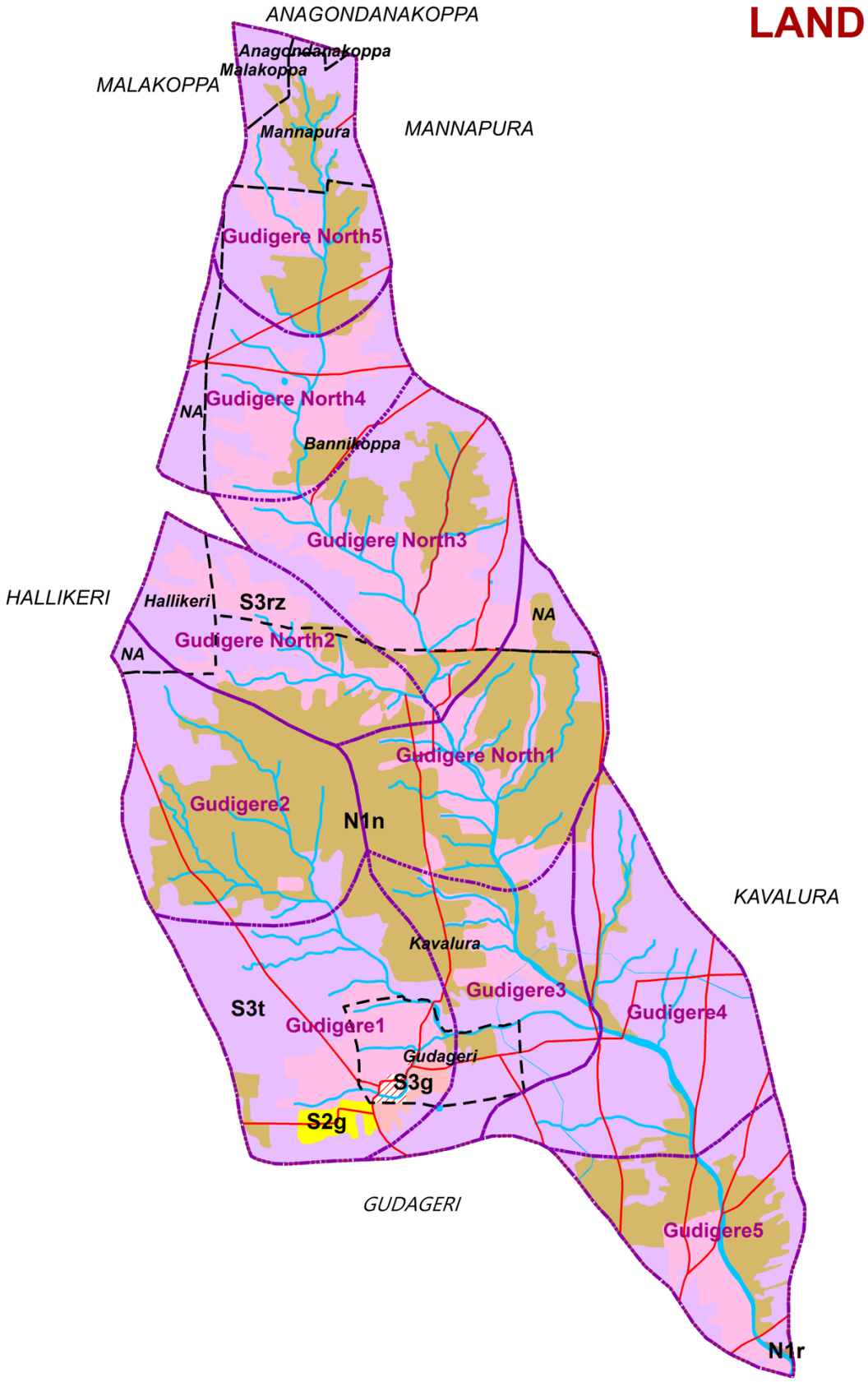
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.28. Land Suitability for Jasmine





LAND SUITABILITY FOR JASMINE

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

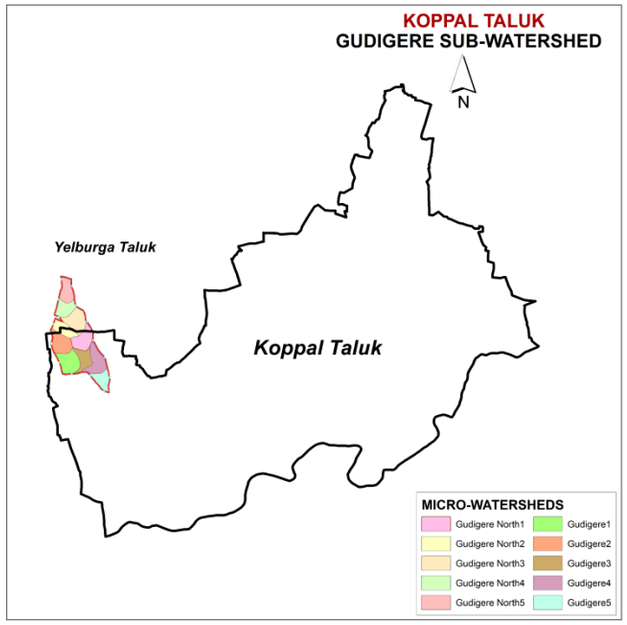
Suitability subclass	Area in ha (%)
S2g	24 (0.52)
S3g	21 (0.47)
S3t	2101 (46.19)
S3rz	935 (20.55)
N1n	1376 (30.25)
N1r	2 (0.04)
Others*	90 (1.99)

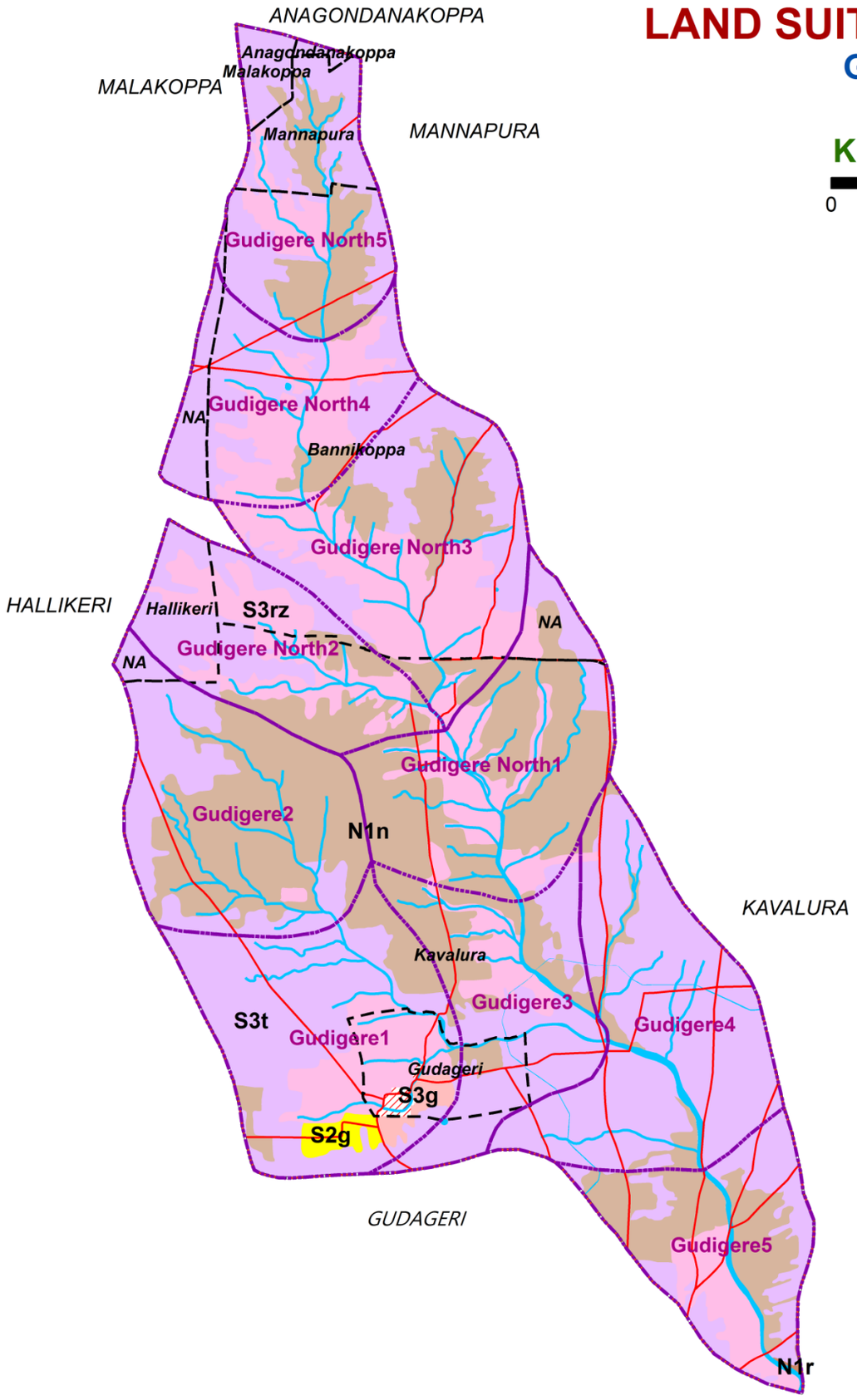
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.29. Land Suitability for Crossandra





LAND SUITABILITY FOR CROSSANDRA

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

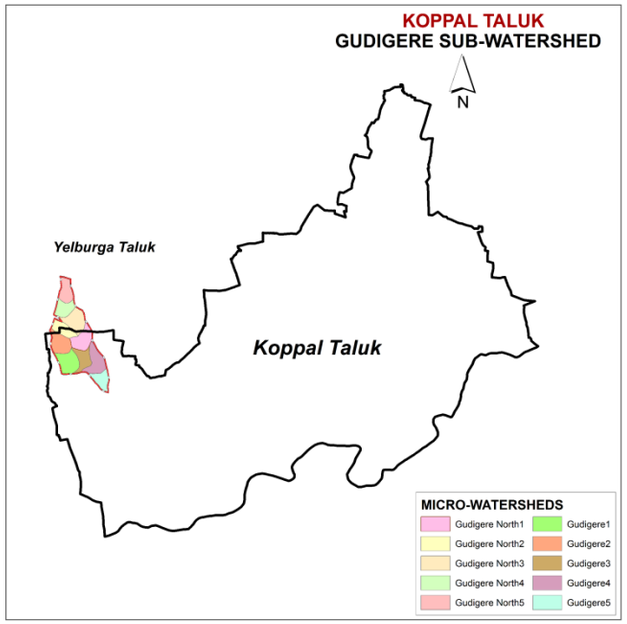
Suitability subclass	Area in ha (%)
S2g	24 (0.52)
S3g	21 (0.47)
S3t	2101 (46.19)
S3rz	935 (20.55)
N1n	1376 (30.25)
N1r	2 (0.04)
Others*	90 (1.99)

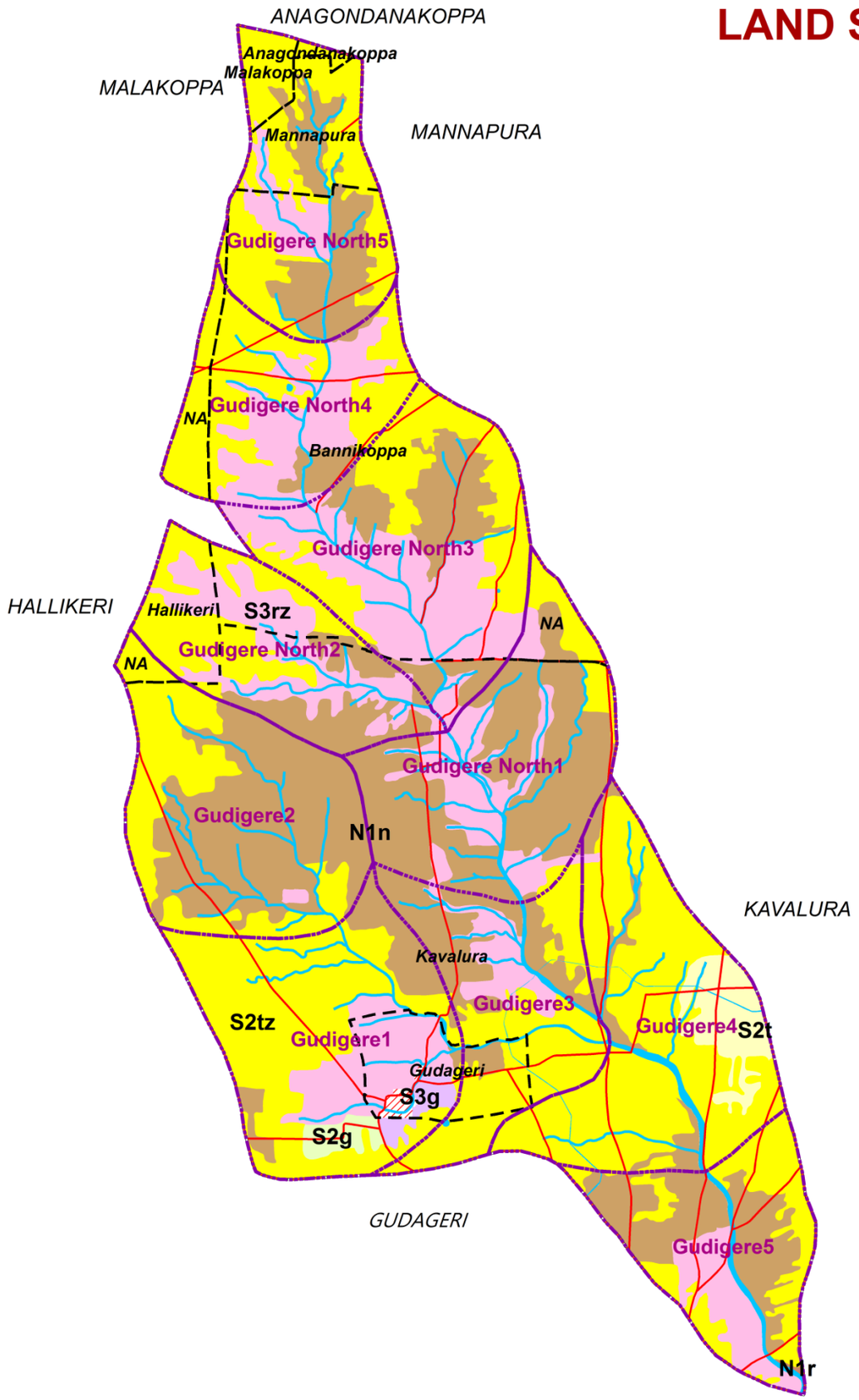
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.30. Land Suitability for Marigold





LAND SUITABILITY FOR MARIGOLD

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

References

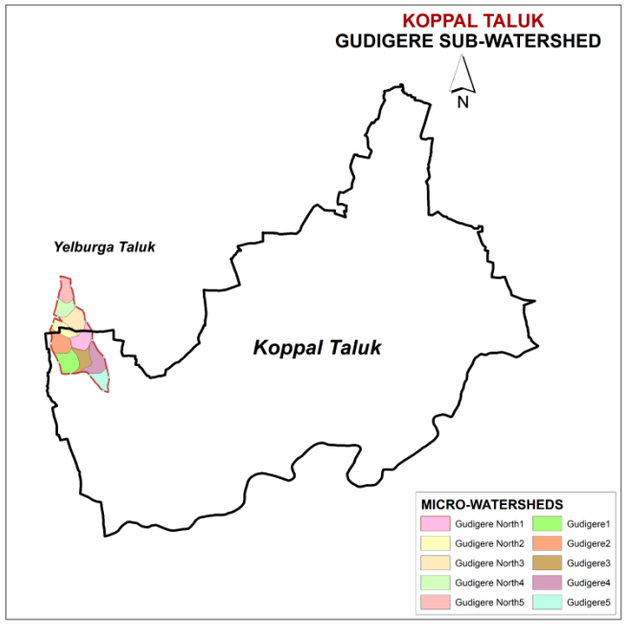
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

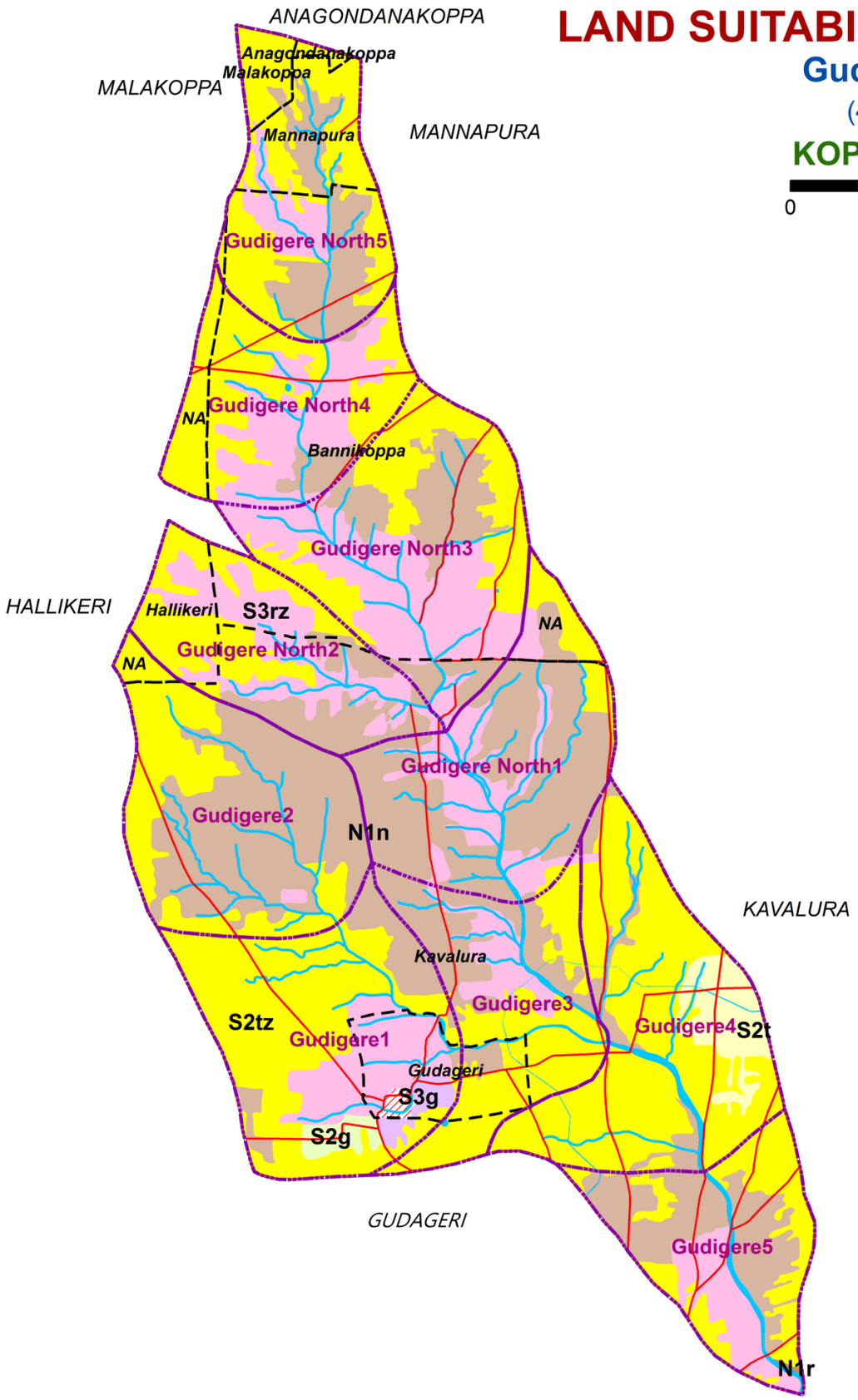
Suitability subclass	Area in ha (%)
S2g	24 (0.52)
S2t	77 (1.7)
S2tz	2024 (44.5)
S3g	21 (0.47)
S3rz	935 (20.55)
N1n	1376 (30.25)
N1r	2 (0.04)
Others*	90 (1.99)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

7.31. Land Suitability for Chrysanthemum





LAND SUITABILITY FOR CHRYSANTHEMUM

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S2g	24 (0.52)
S2t	77 (1.7)
S2tz	2024 (44.5)
S3g	21 (0.47)
S3rz	935 (20.55)
N1n	1376 (30.25)
N1r	2 (0.04)
Others*	90 (1.99)

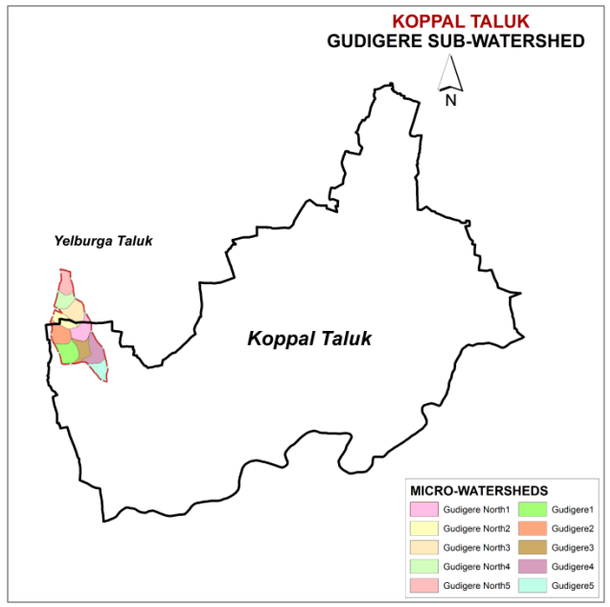
* - Habitation & Waterbody

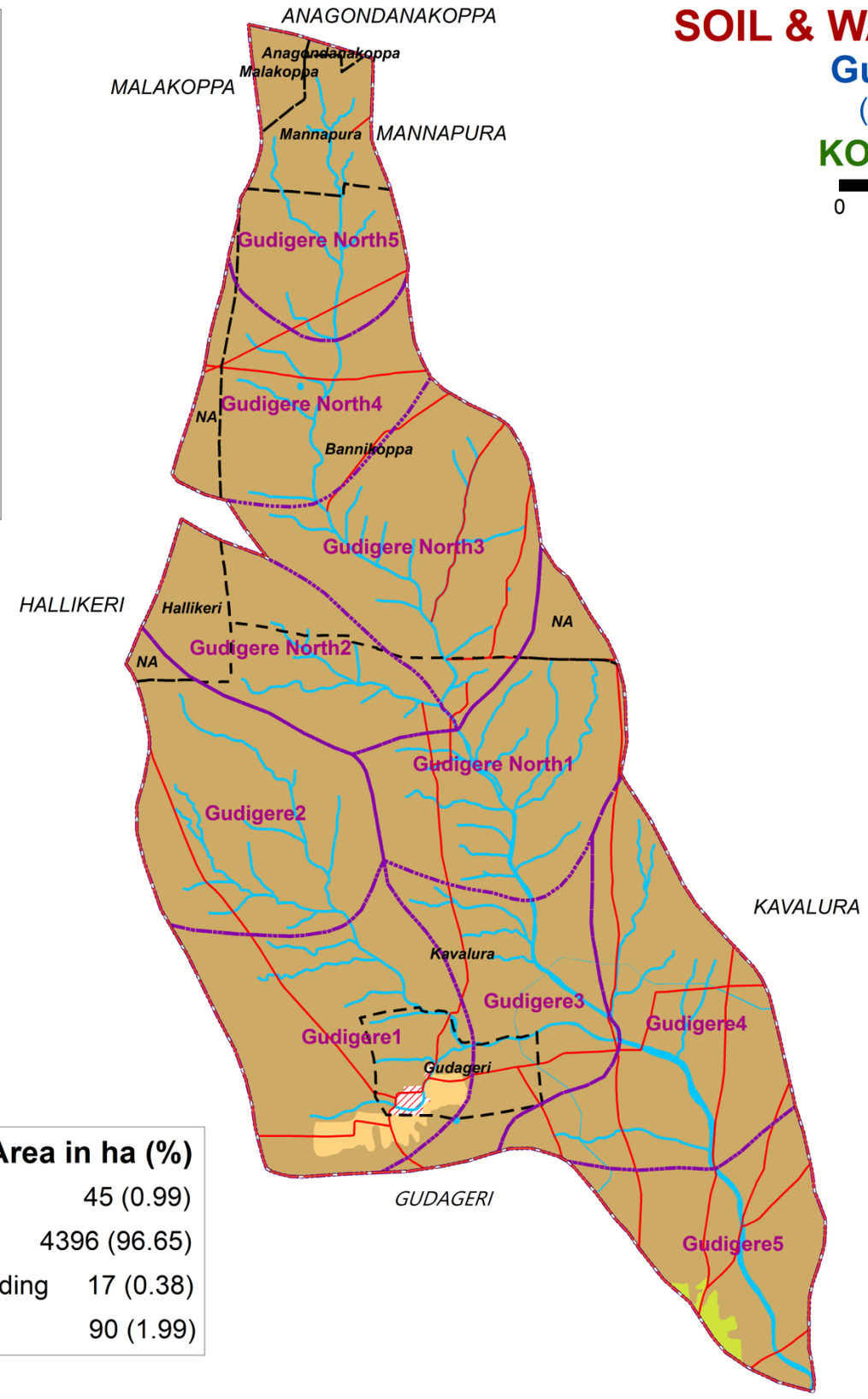
References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

8. Soil and Water Conservation Measures

8.1. Soil & Water Conservation Plan





SOIL & WATER CONSERVATION PLAN

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

Legend	Area in ha (%)
Trench cum bunding	45 (0.99)
Graded bunding	4396 (96.65)
Strengthening of existing bunds/bunding	17 (0.38)
Others*	90 (1.99)

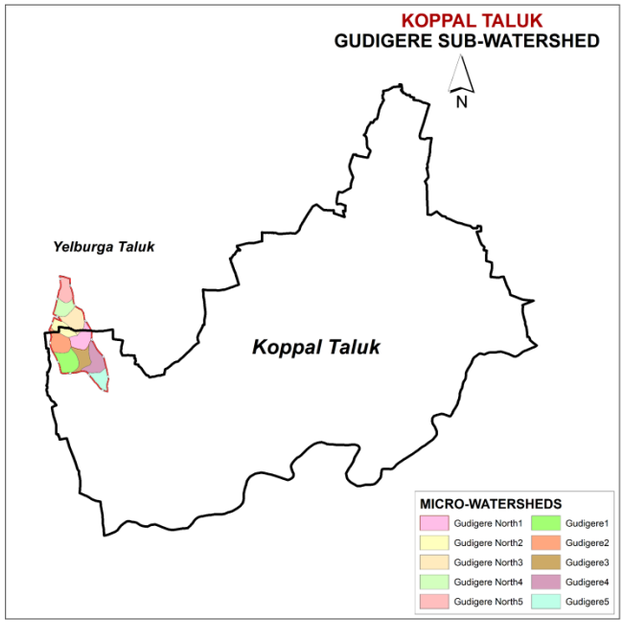
* - Habitation & Waterbody

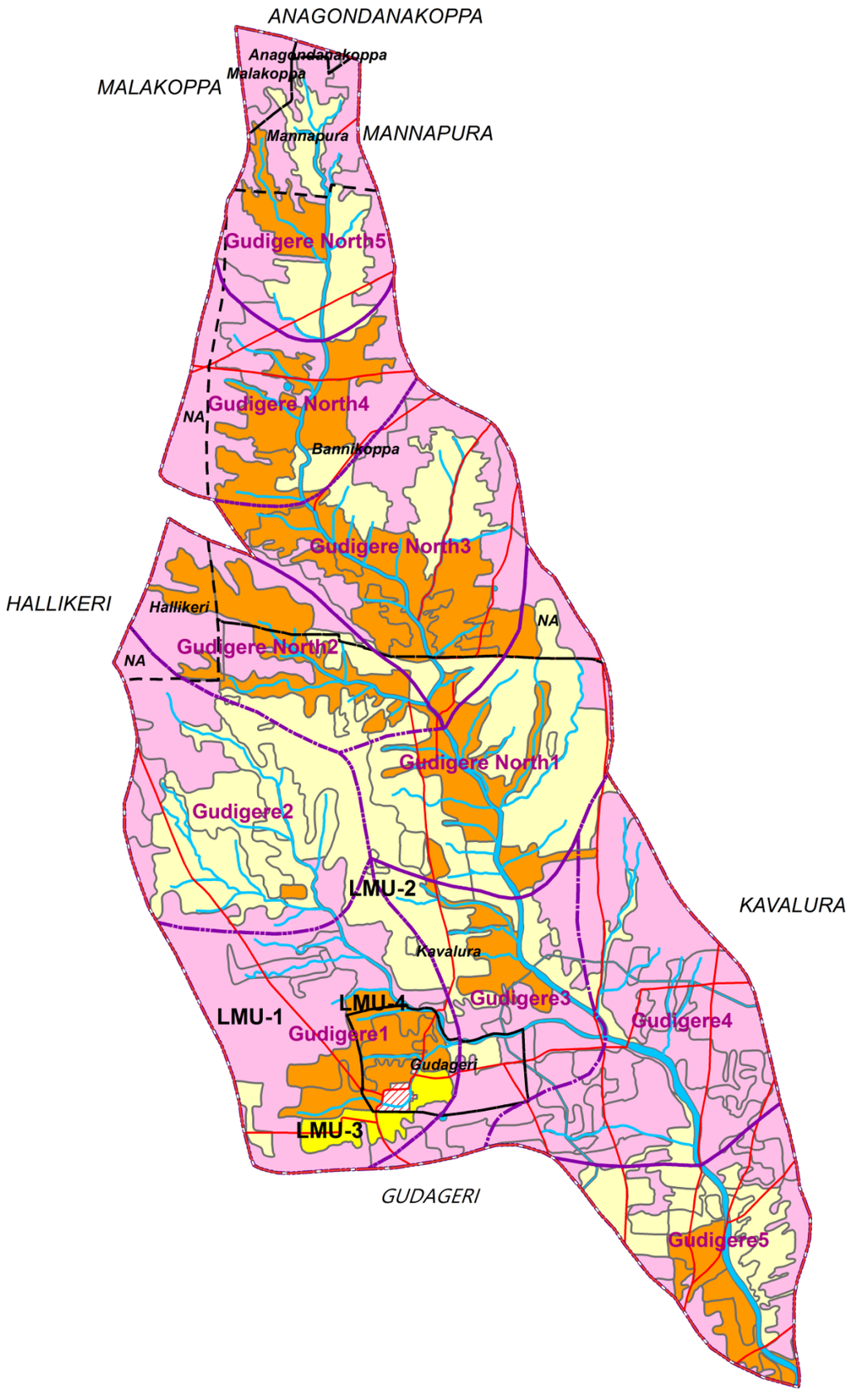
References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

9. Land Management Units





LAND MANAGEMENT UNITS

Gudigere Sub- watershed

(4D4A2N : Area - 4548.73 ha)

KOPPAL TALUK & DISTRICT

0 1 2 4 km

N

LMU	Area in ha (%)
LMU-1	2101 (46.19)
LMU-2	1376 (30.25)
LMU-3	45 (0.99)
LMU-4	936 (20.59)
Others*	90 (1.99)

* - Habitation & Waterbody

References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

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

10.Table. Proposed Crop Plan for Gudigere Sub-watershed, Alavandi hobli, Koppal taluk, Koppal district based on soil-site–crop suitability assessment

LMU. No	Soil Map Units	Survey Number	Field Crops/ Commercial crops	Horticulture Crops (Rainfed/Irrigated)	Suitable Interventions
1	350.DRLmB2 351.DRLmB2g1 352.DRLmB2g2 382.HDLmB2 386.KVRmA1 388.KVRmB1 389.KVRmB1g1 390.KVRmB2g1 406.KDTmB2g1 418.MLRmB2 419.MLRmB2g1 424.AWDmB2 433.BDRmB2 (Moderately deep to Very deep, black calcareous soils)	**Bannikoppa :** 273,336,337,340,341, 347,348,351,352,353 **Hallikere :** 279,280,63,64,66,67, 69,71,72,74,75,76,77, 78,80,81 **Kavalura & Gudigeri :** 13,14,15,16,28,29,30,31,34,42,43, 53,116,117,118,121,122,124,125, 126,153, 164,165,166,17,170,184, 185,186,187,188,189,193,194,195, 196,197,198,199,200,201,202,203, 204,205,214,215,216,217,218,219, 220,221,225,226,230,233,235,239, 240,241,244,249,250,251,252,254, 255,256,257,258,259,261,273,275, 279,280,282,302,303,304,305,306, 307,308,309,310,319,32,320,321, 322,323, 33,331,332,333,334,391, 393,394,395,396,397,398,399,400, 401,402,403,404,405,406,407,408, 409,410,411,412,413,414,415,417, 433,434,435,438,439,44,45,456, 459,461,462,465,466,467,468,469, 470,471,472,473,475,478,479,480, 481,482,483,487,488,489,490,50,5 1,526,527,528,529,530,531,543, 547,548,550,551,552,553,554,555, 556,557, 558	Maize, Sorghum, Sunflower, Bajra, Cotton, Red gram, Bengal gram, Soybean, Safflower, Linseed	**Fruit crops**: Pomegranate, Lime, Musambi, Custard apple **Vegetables:** Drumstick, Chillies, Bhendi, Coriander **Flowers:**Marigold, Chrysanthemum,	Application of FYM, Biofertilizers and micronutrients, drip irrigation, mulching, suitable soil and water conservation practises

To be continued…

LMU. No	Soil Map Units	Survey Number	Field Crops/ Commercial crops	Horticulture Crops (Rainfed/Irrigated)	Suitable Interventions
2	336.RNKmB2 337.RNKmB2g1 338.RNKmB2g2 339.RNKmB2g3 363.NSPmB2g1 373.GRHmB2 374.GRHmB2g1 397.BGPmB2g1 (Moderately shallow to deep, sodic clay soils	**Bannikoppa :** 272 **Kavalura & Gudigeri :** 10,11,12,171,227,228,229,234, 260,262,263,264,265,266,267, 268,269,270,271,272,274,276, 277,285,286,287,288,289,290, 291,292,293,294,295,296,297, 298, 300,301,313,314,315,316, 317,318,324,325,326,327,328, 329,330,335,336,337,338,339, 340,341,342,343,344,345,346, 347,348,349,350,351,352,353, 354,357,358,359,363,364,366, 367, 369,376,377,379,380,381, 382,384,388,392,416,418,419, 420,422,447,448,449,450,451, 452,453,457,458,460,463,464, 476,477,484,485,486,493,494, 495,496,497,498,499,500,502, 507, 508,509,510,511,512,513, 514,515,516,517,518,519,521, 522,523,524,525,532,576,590, 591,592,593,594,595,596,597, 598,599,600, 601,605,610,613 **NA :** 101,102,259,260,261,262, 279,282,283,284,288,289, 290,319,321,322,324,327, 328,330,358,382,383,384, 387,396,397,398,399,400, 401,402	-	**Agri-Silvi-Pasture:** Ber, Aonla, Acacia sp. Dhaincha, Rhodes grass, Para grass ,Bermuda grass	Application of gypsum, iron pyrites and elemental sulphur. Addition of farm yard manures, green manures and providing subsurface drainage

To be continued…

LMU. No	Soil Map Units	Survey Number	Field Crops/ Commercial crops	Horticulture Crops (Rainfed/Irrigated)	Suitable Interventions
		561,562,563,564,565,566,567,568, 569,570,571,572,573,574,575,577, 578,579,58,580,581,582,583,584, 585,586,587,588,589,59,602,603, 604,606,607,608,609,611,612,614, 624,628,629,632,633,634,635,636, 640,641,642,643,652,653,655,656, 657,658,659,660,661,662,663,664, 665,666,667,668,669,670,671,73, 74,892,893,894,897,898,901,902 **NA :** 100,103,104,106,107,108,109,110, 111,112,113,114,115,116,206,207, 208,209, 210,225,226,227,228,237, 238,247,248,255,256,257,258,285, 286,287,291,292,297,298,299,300, 301,302, 303,304,305,306,307,312, 313,314,315,316,317,318,32,33, 335,336,337,34,340,341,347,348, 35,352,353,36,361,366,367,368,37, 371,373,374,375,377,378,379,380, 381,385,386,389,390,392,405,406, 407,408,411,412,42,43,44,442,443, 444,445,45,46,47,48,49,50,51,52, 58,59,90,91,94,95,96, 97,98,99			
3	258.NGPhB1g1 264.NGPiB1g2 (Very deep, red gravelly sandy clay soils)	**Kavalura & Gudigeri :** 18,19,46,47,48,49,52,123	Maize, Sorghum, Sunflower, Groundnut, Bajra, Cotton, Red gram	**Fruit crops** : Sapota, Pomegranate, Amla, Cashew, Guava, Custard apple, Jack fruit, Jamun, Lime, Musambi **Vegetables:** Tomato, Chilli, Drumstick, Onion, Bhendi, Brinjal, Curry leaves **Flowers:** Marigold, Chrysanthemum, Jasmine, Crossandra	Drip irrigation, mulching, suitable soil and water conservation practises (Crescent Bunding with Catch Pit etc)

To be continued…

LMU. No	Soil Map Units	Survey Number	Field Crops/ Commercial crops	Horticulture Crops (Rainfed/Irrigated)	Suitable Interventions
4	304.MTLiB2 310.MTLmB2 311.MTLmB2g1 312.MTLmB2g2 11.BGTmB2g2 (Very shallow to shallow, black calcareous clay soils)	**Bannikoppa :** 338,339,342,343,344,345, 346 **Hallikere :** 68,70,73 **Kavalura & Gudigeri:** 1,167,168,169,190,191,192,2,21, 278,281,283,284,299,3,311,312, 355,356,360,361,362,365,368, 370,371,372,373,374,375,378, 383,385, 386,387,389,390,4,436, 437,440,441,442,443,444,445, 446,454,455,491,492,5,501,503, 504,505,506,520,6,7,8,895,896, 9,906,907, 908,909,910 **NA :** 105,249,250,251,252,253,254, 263,264,265,266,267,268,269, 270,271,272,273,274,275,276, 277,278,280,281,308,309,310, 311,320,323,325,326,329,331, 332, 333,334,349,350,351,354, 355,356,357,359,360,362,363, 364,365,369,370,372,376,388, 391,393,394,395,403,404,507, 508,513	-	Hybrid Napier, *Styloxanthes hamata*, *Styloxanthes scabra*	Use of short duration varieties, sowing across the slope

PART-B

Hydrological Inventory of Gudigere Sub-watershed, Koppal Taluk, Koppal 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 Gudigere Sub-watershed, Koppal Taluk, Koppal 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:nbssrcb@gmail.com**

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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
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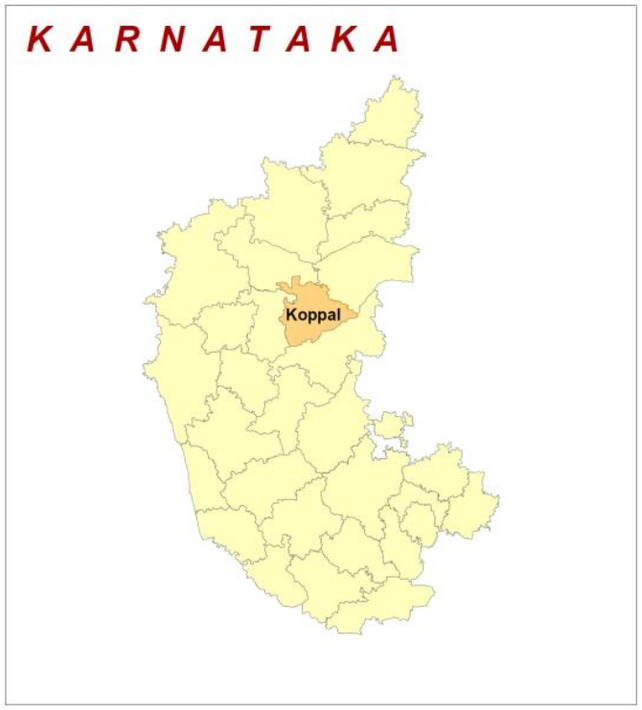
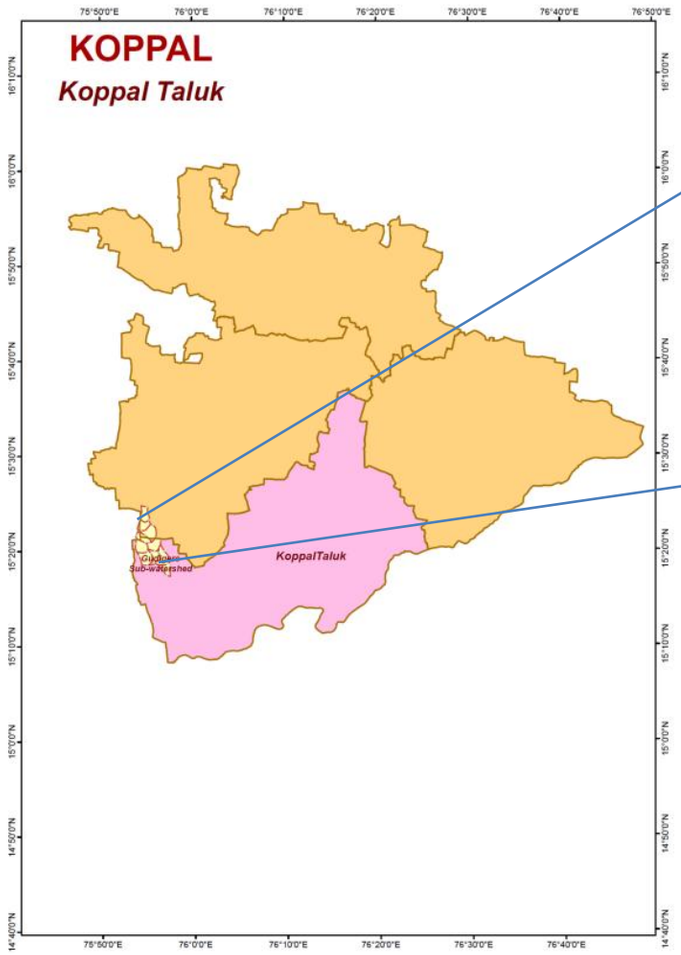
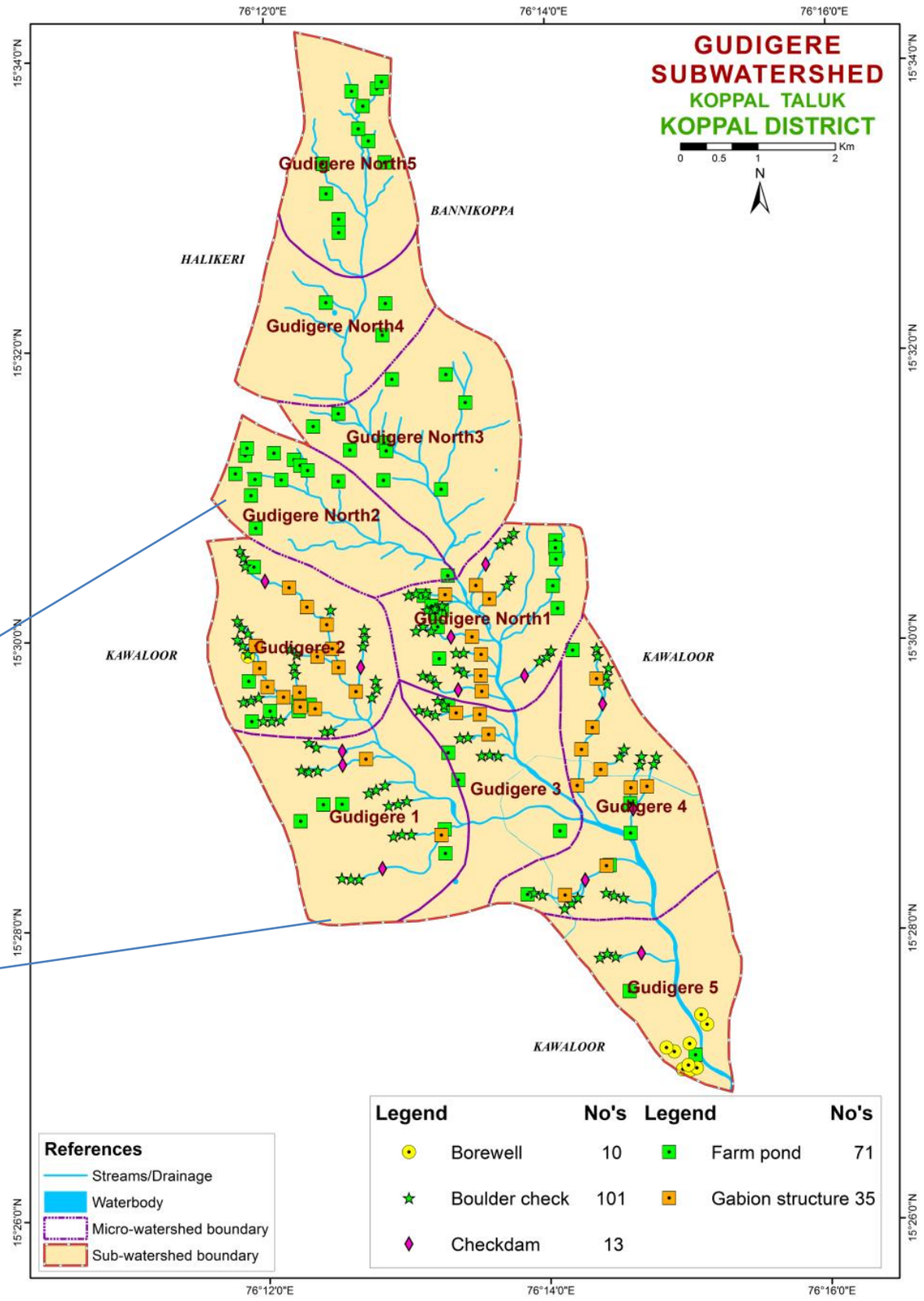
INTRODUCTION

- The inventory and documentation of spatial and temporal changes in hydrological components of Gudigere sub-watershed (4D4A2N) in Koppal Taluk, Koppal District, has been undertaken for integrated planning, development and management.
- Gudigere sub-watershed (Koppal Taluk, Koppal District) is located between $15^0$17’ 23’’–$15^0$24’ 40’’ North latitudes and 75^0 53’50’’- 75^0 57’25’’ East longitudes, covering an area of about 4436 ha.
- This sub-watershed encompasses of 10 MWs namely Gudigere North-1 (4D4A2N1e), Gudigere North -2 (4D4A2N1d), Gudigere North-3 (4D4A2N1c), Gudigere North-4 (4D4A2N1b), Gudigere North-5 (4D4A2N1a), Gudigere-1 (4D4A2N2b), Gudigere-2 (4D4A2N2a), Gudigere-3 (4D4A2N2c), Gudigere-4 (4D4A2N2d) and Gudigere-5 (4D4A2N2e). Land Resource Inventory (LRI) was generated for all the ten micro-watersheds .
- Average annual rainfall (1960-2014) of the Hobli (Block) pertaining to the sub-watershed is 631 mm.
- In this sub-watershed major *kharif* crops are Maize, Cotton, Sunflower , Bajra , Groundnut , Redgram and major *rabi* crops are Sorghum, Bengalgram and Safflower.
- 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 GUDIGERE SUB-WATERSHED

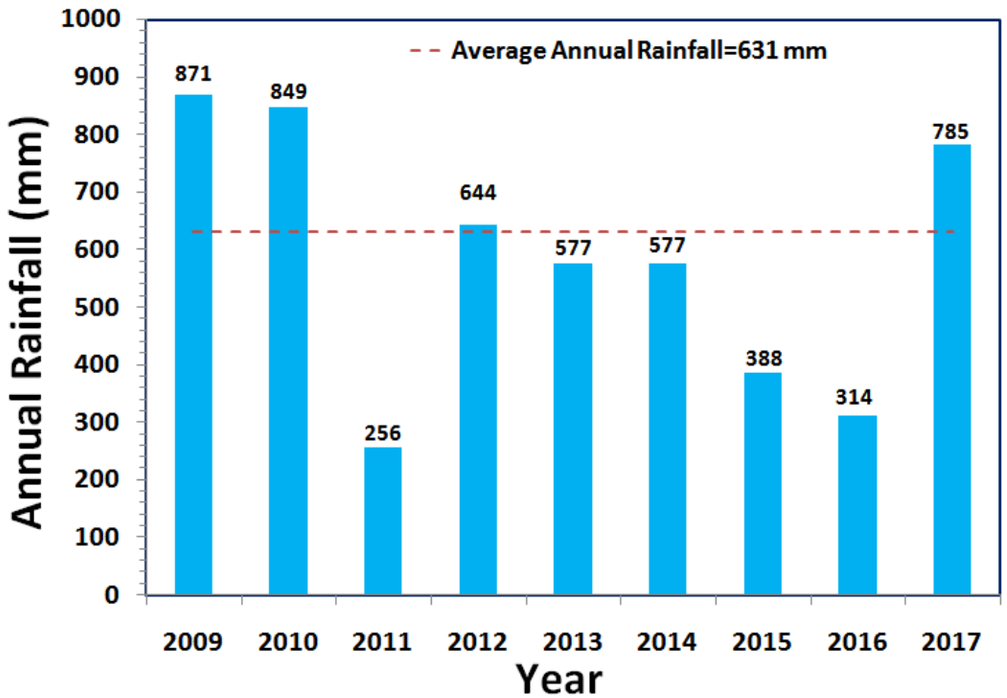






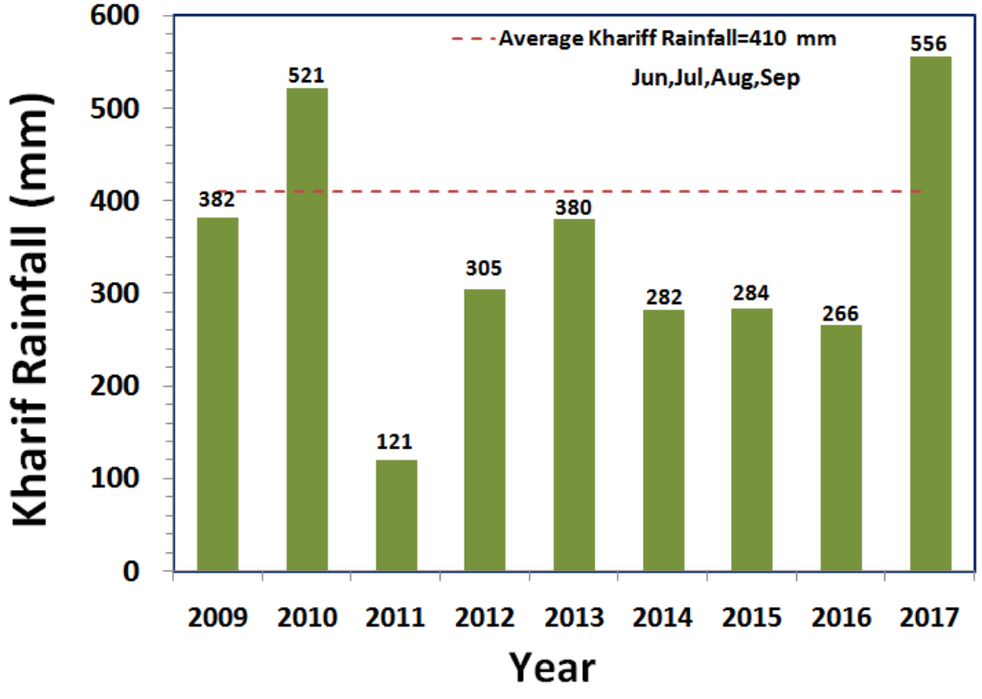
Soil & Water Conservation Structures in Gudigere Sub-watershed, Koppal Taluk, Koppal District

RAINFALL INDEX

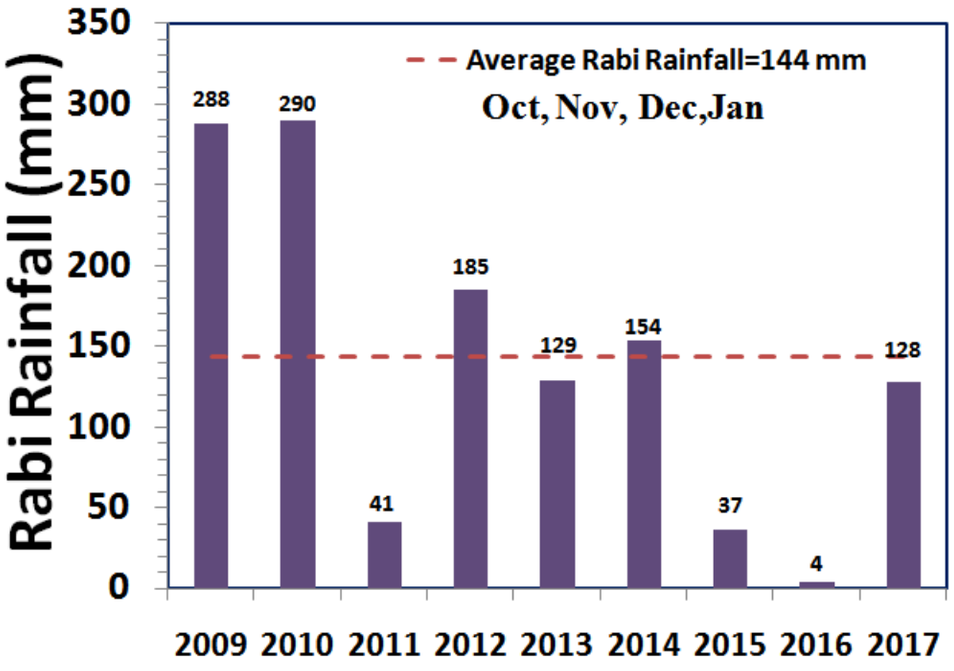


The average annual rainfall (1960-2014) recorded at the Koppal station in Koppal taluk of Koppal district is 631 mm. The annual rainfall at Alavandi station (Hobli H.Q.) is presented. During the years 2011, 2013, 2014, 2015 and 2016 the annual rainfall was deficient by 59%, 9%, 9%, 39% and 50% respectively.

The *kharif* rainfall (Jun–Sep) is an average about 60% of the annual rainfall and it typically follows the annual rainfall patterns. High variability found between annual *kharif* rainfall. During the years 2009,2011,2012,2013,2014,2015 and 2016 the *kharif* rainfall was deficient by 7%, 70%, 26%,7%,31%,31%,35% and 7% respectively.

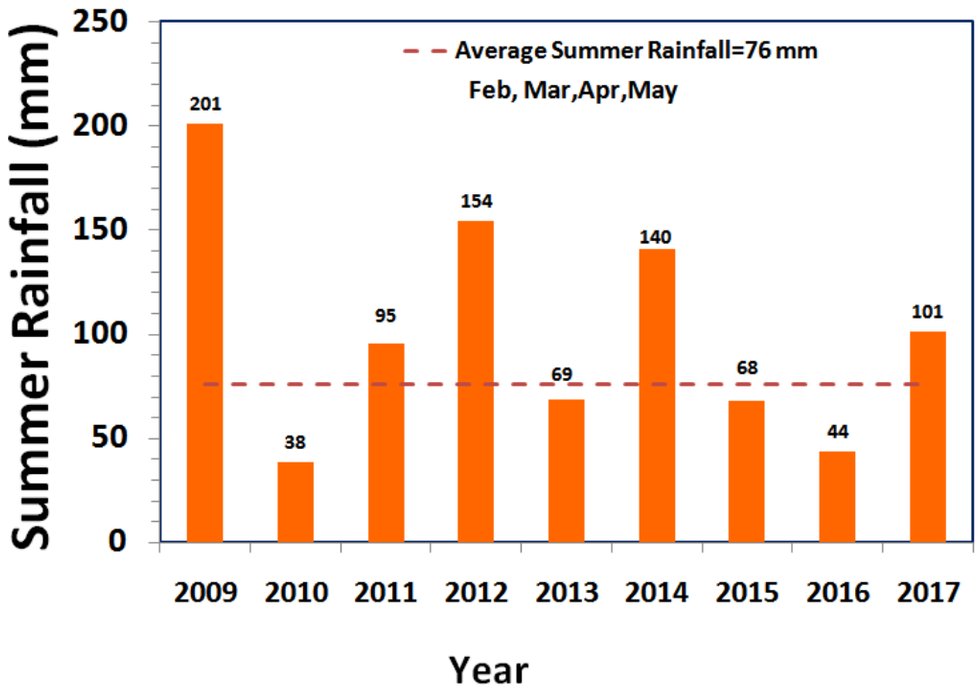


RAINFALL INDEX

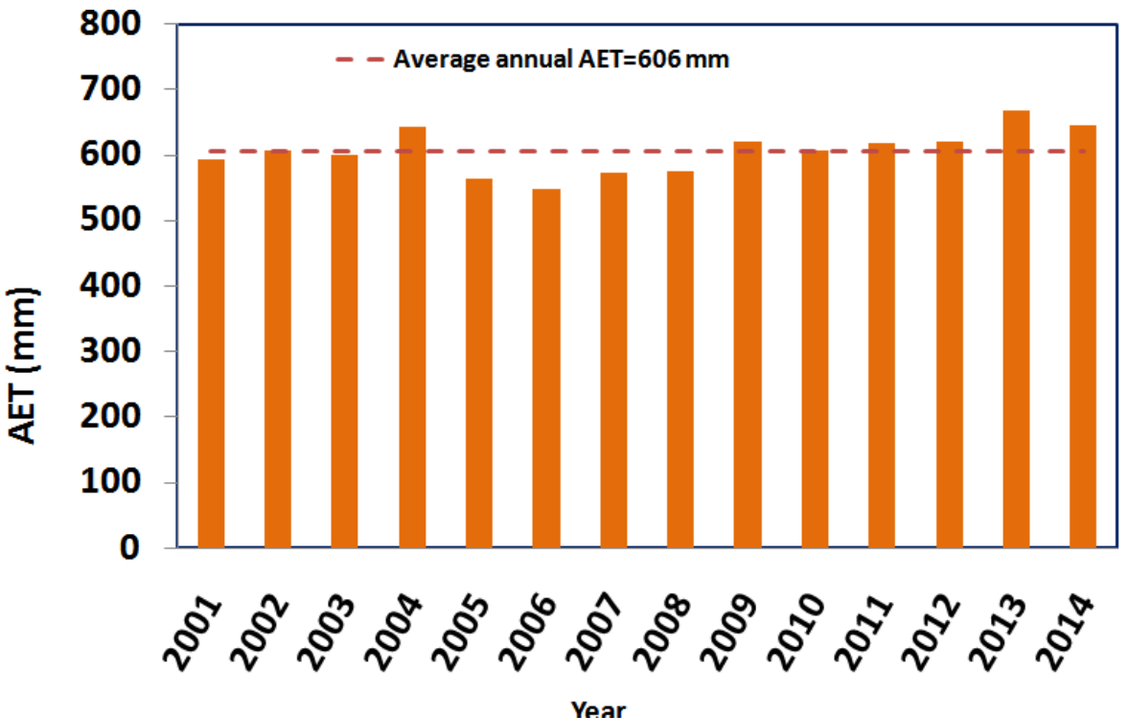


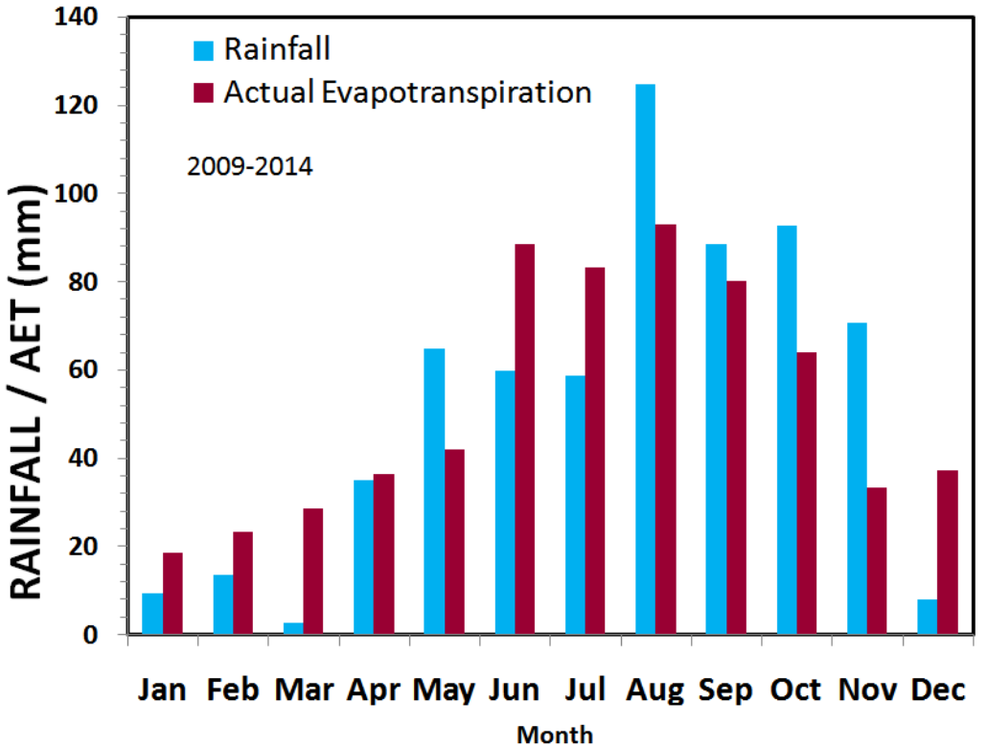
The average *rabi* rainfall (Oct-Jan) is about 21% of the Average annual rainfall. During the years 2011, 2012, 2013, 2015 and 2016 the *rabi* rainfall was deficient by 84%, 22%, 97% and 85% respectively.

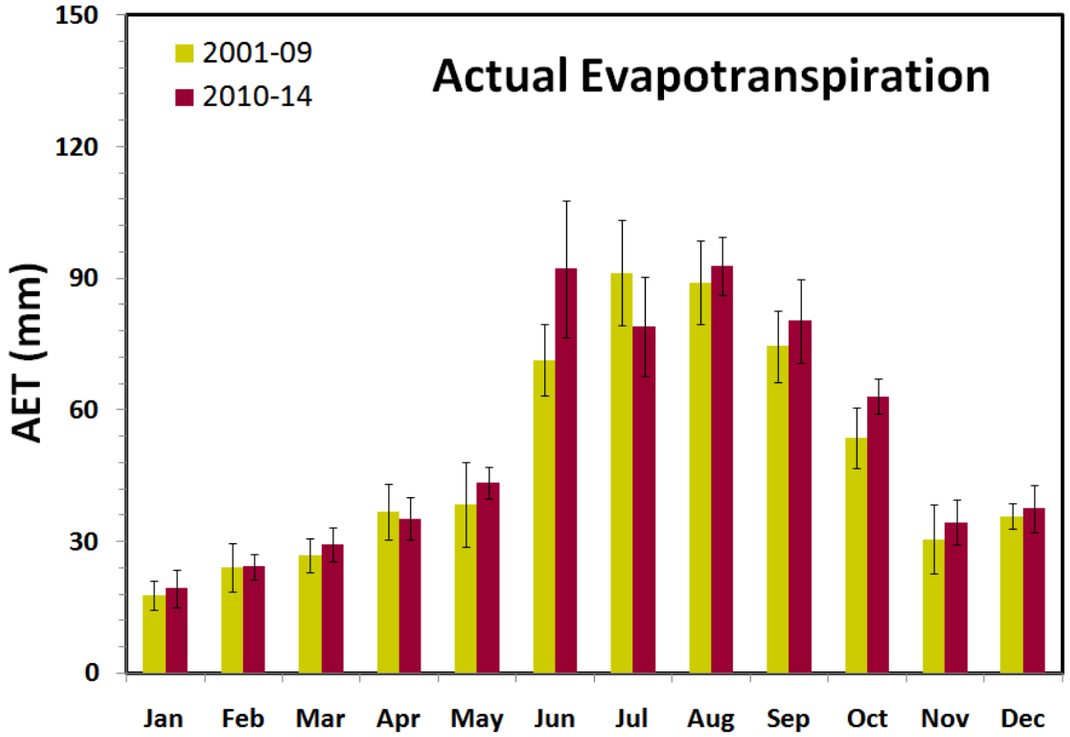
The average summer rainfall (Feb-May) is about 19% of the average annual rainfall. During the years 2009,2011,2012,2014 and 2017 high summer rainfall was received, where as other years showed deficient rainfall.



EVAPOTRANSPIRATION

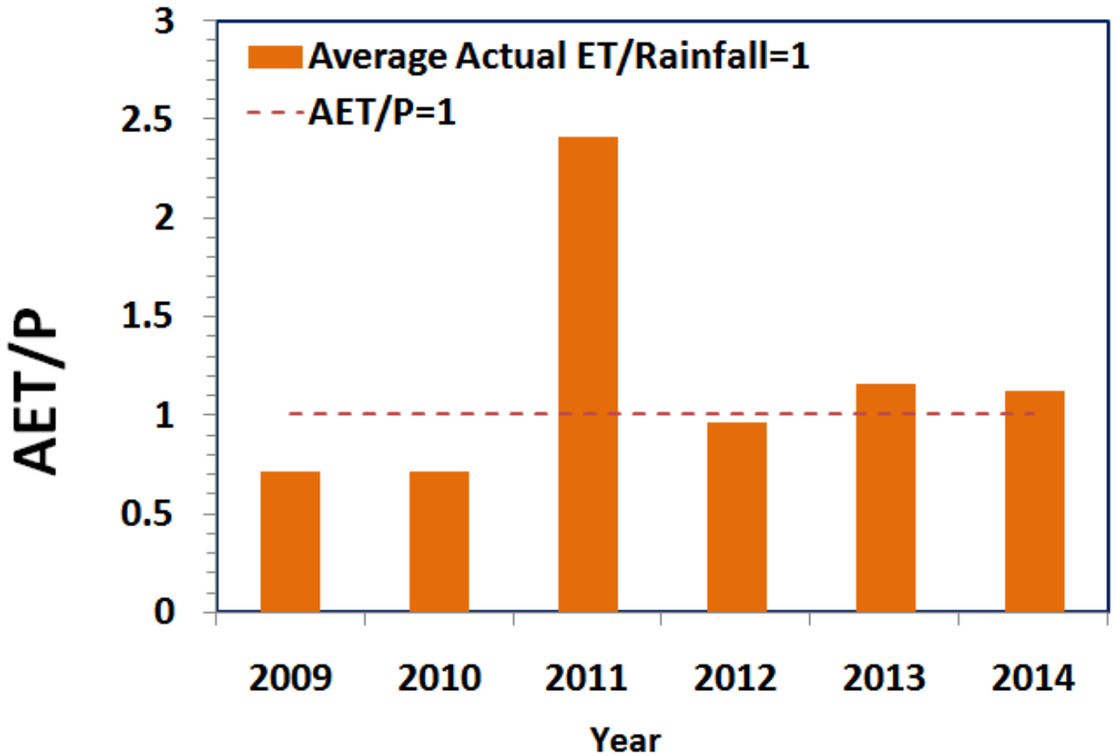


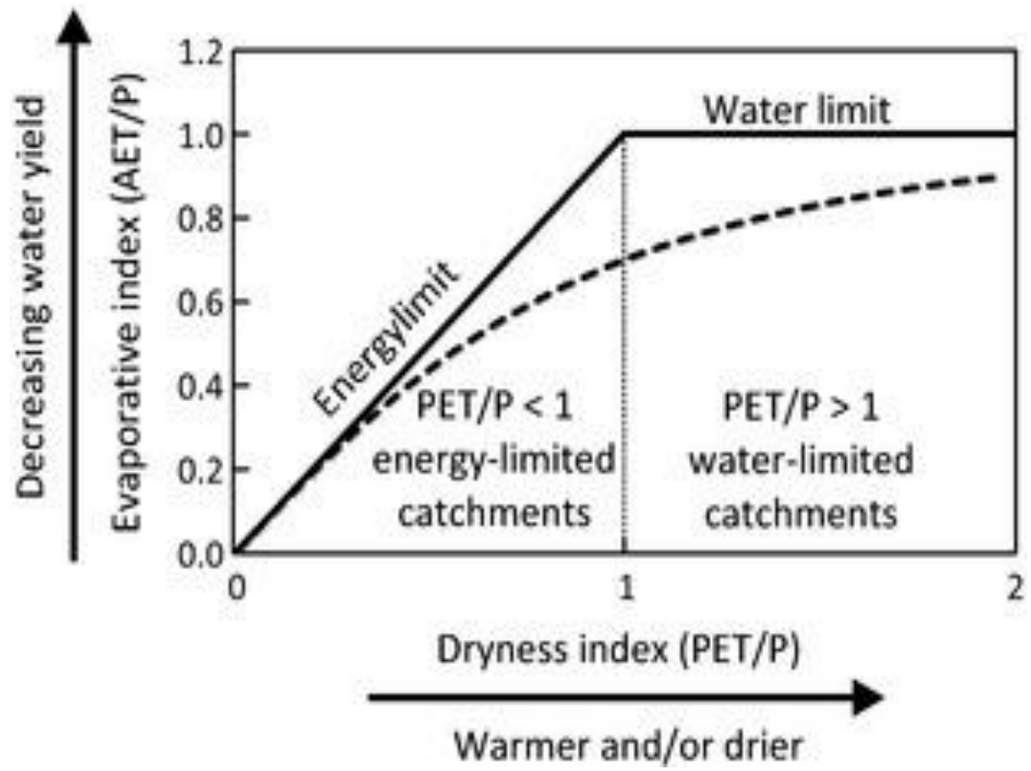




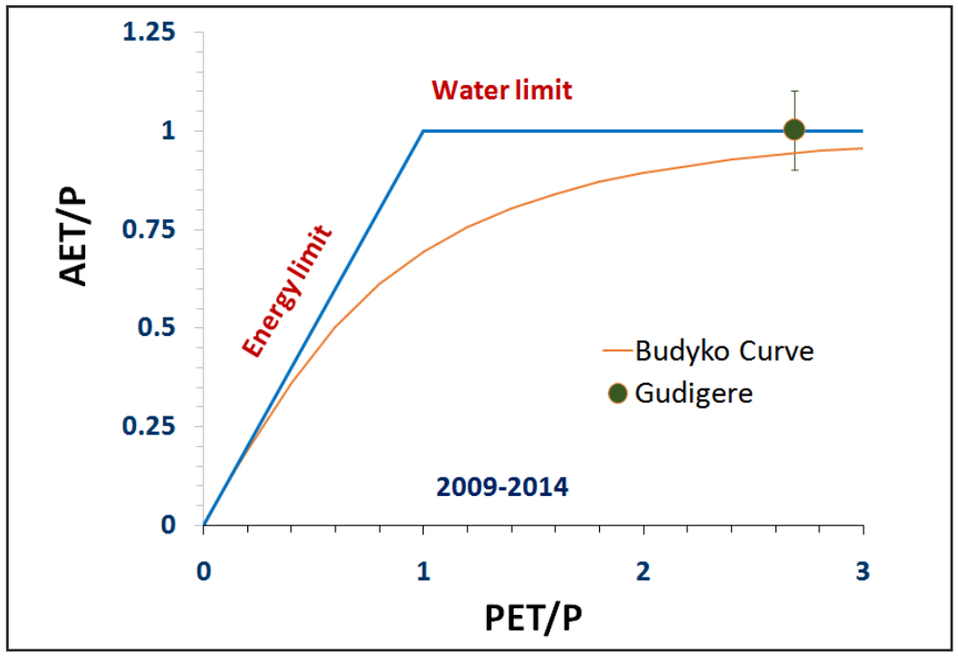
The average annual actual ET is lower than the average rainfall. During *kharif*, average rainfall and AET were found to be 410 mm and 346 mm respectively, whereas in *rabi* it was about 144 mm and 154 mm. The annual ET increased by 6% during 2010-2014 compared to 2001-2009

EVAPOTRANSPIRATION INDEX

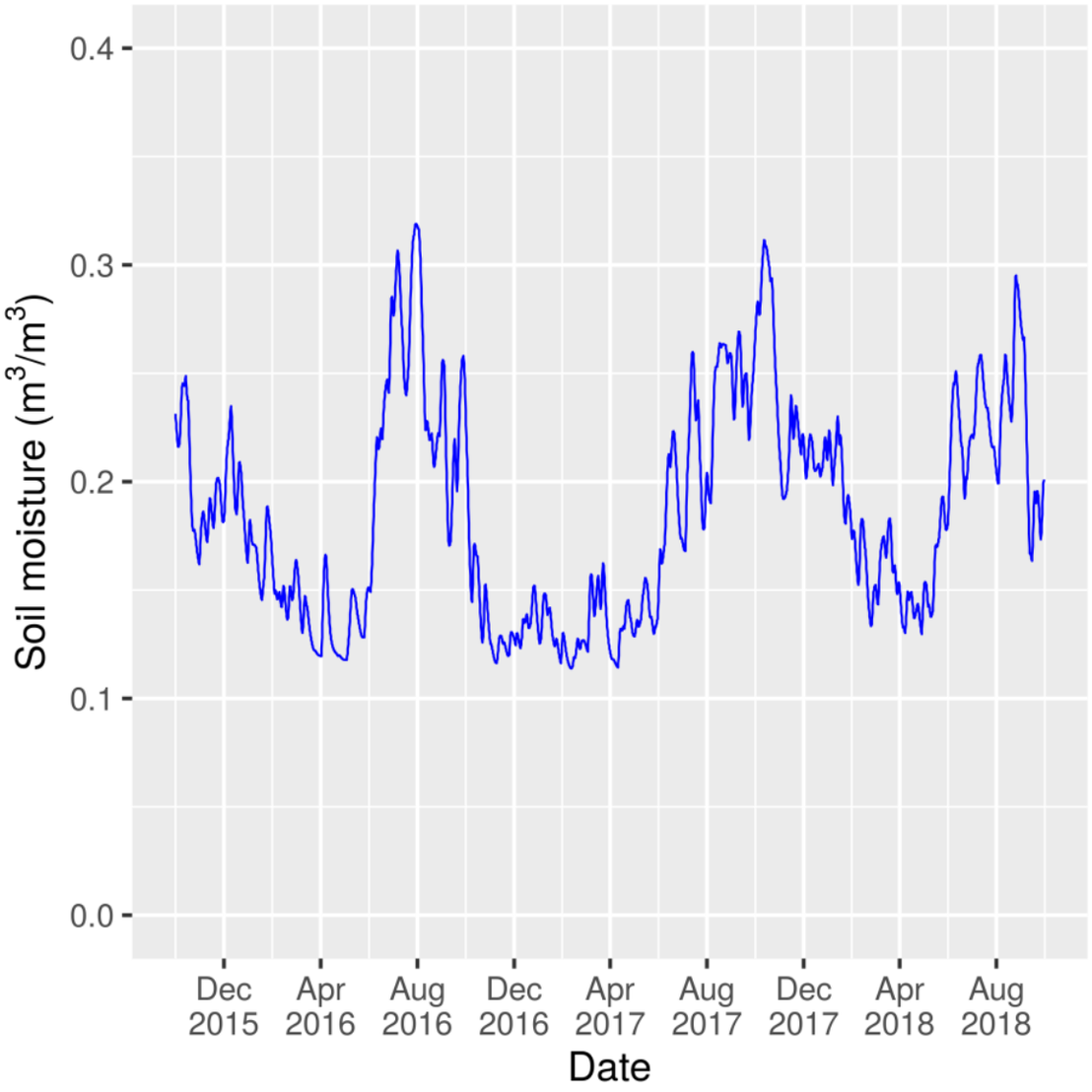




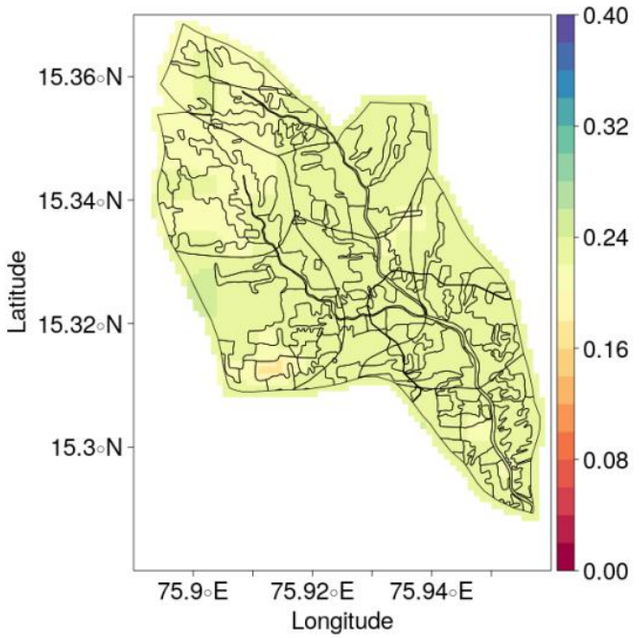
The average AET/P ratio was about 100%, which is higher than the sustainable limit of about 80%. Even during extremely lower rainfall year of 2011, AET was 610 mm. This suggests the presence of water storage and utilization from other sources such as groundwater, which buffered the lower rainfall.



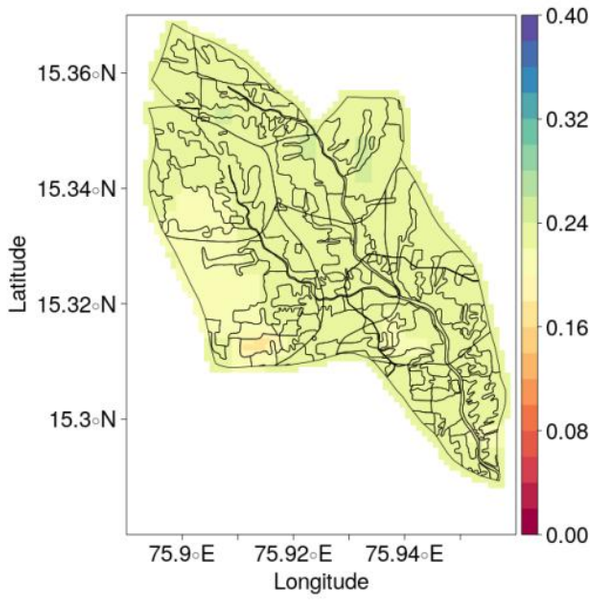
SATELLITE RETRIEVED SOIL MOISTURE



Gudigere– Rabi Soil Moisture



Gudigere– Kharif Soil Moisture

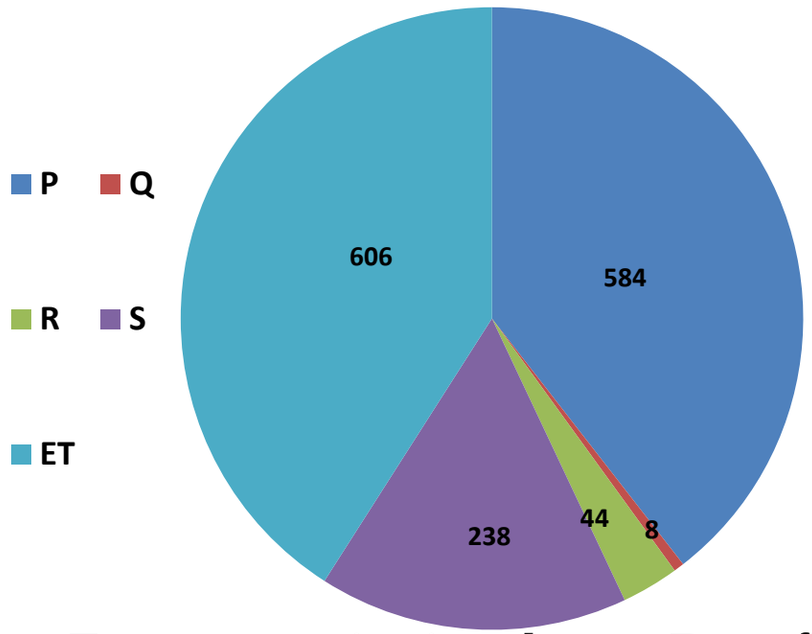


The method developed for retrieving soil moisture from multi-satellite observations allowed to map surface soil moisture behavior in the micro-watershed. The available surface moisture was varied in the range of 15-26 % in *Kharif* and 15-26% in *Rabi* seasons of 2016 and 17-23 % in *Kharif* and 20-27% 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

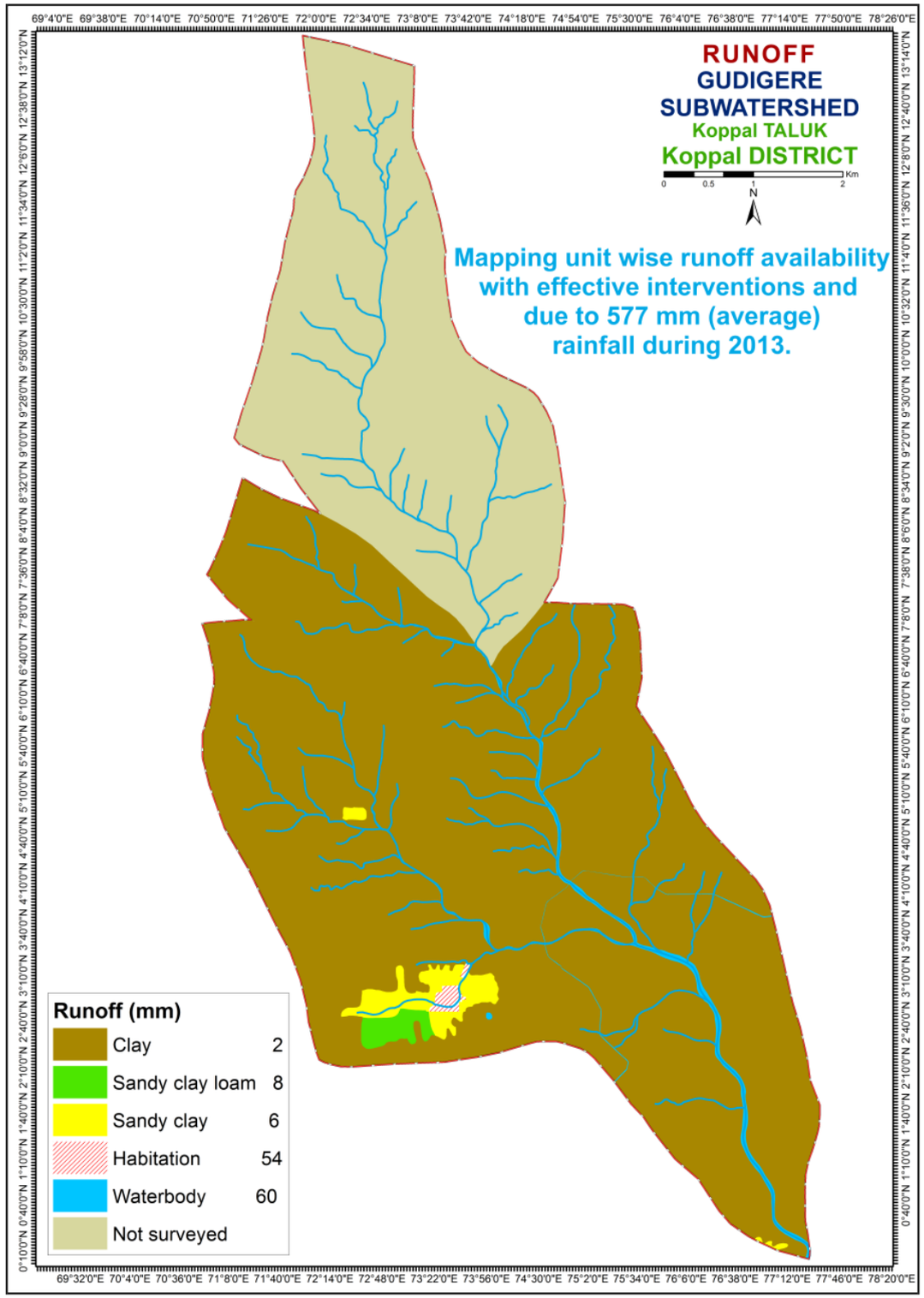


During Aug-Sep months, Precipitation is higher than Evapotranspiration, hence Runoff is less in the watershed.

P = 584 mm (average of 2009-2017) ET = 606 mm R = 44 mm S = 238 mm Q = 8 mm

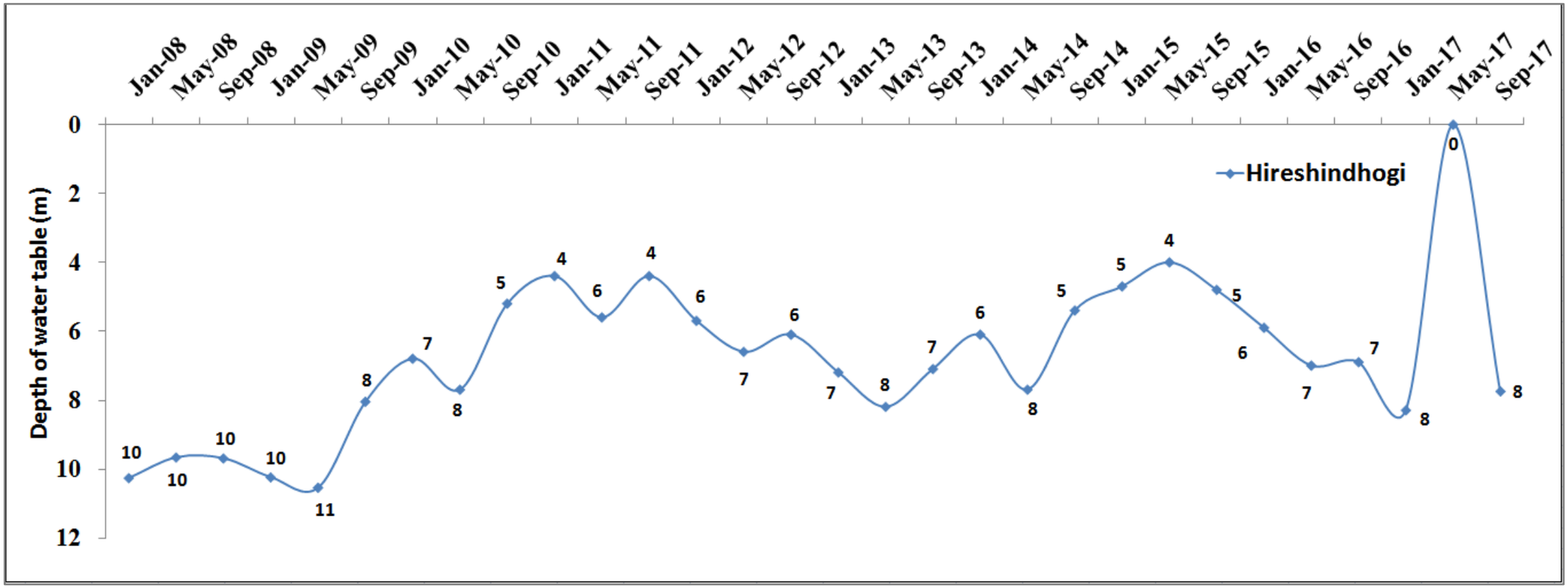
Sl. No.	Parameters	Average_ 2013 (mm)
1.	Rainfall	577
2.	Runoff availability with existing conditions	42
3.	Runoff availability with effective interventions	10
4.	Runoff allowed as environmental flow at the outlet	2
5.	Runoff excess for harvesting by construction of structures	8

RUNOFF


RUNOFF
GUDIGERE
SUBWATERSHED
Koppal TALUK
Koppal DISTRICT
0 0.5 1 2 Km
N
Mapping unit wise runoff availability with effective interventions and due to 577 mm (average) rainfall during 2013.
Runoff (mm)
Clay 2
Sandy clay loam 8
Sandy clay 6
Habitation 54
Waterbody 60
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

HIRESHINDHOGI STATION



The total number of wells present in Gudigere Sub-watershed as per LRI data is 10 (10-Borewells). The groundwater level shown above is from the data obtained from Dept. of Mines & Geology for the nearest station Hireshindhogi . The graph depicts shallow groundwater levels (3-4 m) during the years 2008-2017.

SUMMARY

- The average annual rainfall of 631 mm in the Gudigere sub-watershed as recorded from the Alavandi station data.

- 60%, 21% and 19% 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 8 mm for an average annual rainfall of 584 mm (2009-2017). The utilizable groundwater is 30.8 mm (70% of 44 mm recharge estimated). This means the total available water resource combining the soil moisture store for kharif & rabi (233 mm) and utilizable runoff plus recharge is 272 (=233+31+8)

- The average actual evapotranspiration estimated in the watershed based on the current land use and irrigation practices for the kharif and rabi seasons is 499 mm. Hence the amount of water use for kharif and rabi seasons may be estimated as 624 mm (i.e. 125% of AET). This demand for the two seasons is higher by 352 mm, i.e. (624-272). The AET in June-Sept months is more than (i.e almost 104%) rainfall. Hence, there is very less opportunity to harvest the excess water through watershed management practices for utilizing during rabi season.

- The total number of wells present in Gudigere Sub-watershed as per LRI data is 10 (10-Borewells). The groundwater level shown above is from the data obtained from Dept. of Mines & Geology for the nearest station Hireshindhogi.