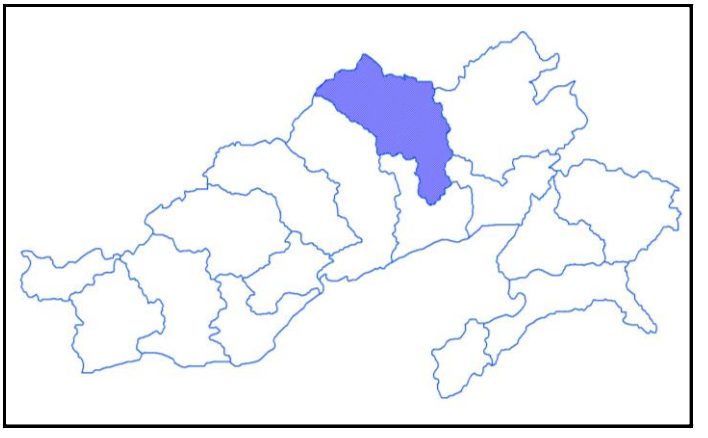
Technical Report Series: D

No:

Ground Water Information Booklet
Upper Siang District, Arunachal Pradesh



Central Ground Water Board

North Eastern Region

Ministry of Water Resources

Guwahati

September 2013

District at a Glance

Sl No	ITEMS	Statistics
1.	**GENERAL INFORMATION**	
	i) Geographical area (sq. km)	6188
	ii) Administrative Divisions (As on 31st March 2003) Number of Sub-divisions Number of Block Number of Circles Number of Villages	 03 05 11 92
	iii) Population (As on 2011 Census)	35289
	iv) Average Annual Rainfall (mm)	
2.	**GEOMORPHOLOGY**	
	Major physiographic units	
	Major Drainages	Siang river and its tributaries
3.	**LAND USE (sq. km)**	
	a) Forest area:	
	b) Net area sown	5716.39 Hectares
4.	**MAJOR SOIL TYPES**	The soils in the valleys are sandy loam in texture with high acidic content. The P^H

		values range between 5 to 6. The carbon content is high with medium to low phosphorous and potassium concentrations.
5.	**AREA UNDER PRINCIPAL CROPS (as on 2011-12)**	6730Ha
6.	**IRRIGATION BY DIFFERENT SOURCES** (Areas and numbers of Structures)	
	Dug wells	Nil
	Tube wells	Nil
	Tanks/ ponds	NA
	Canals	
	Other sources	NA
	Net irrigated area	1562
	Gross irrigated area	1562
7.	**NUMBER OF GROUND WATER MONITORING** WELLS OF CGWB (As on 31-3-2013) No of Dug Wells No of Piezometers	Nil Nil Nil
8.	**PREDOMINENT GEOLOGICAL**	Precambrian high grade gneisses,Schists,phyllites,qua

	FORMATIONS	rtzites Paleozoic Gondwanas and Abor volcanics and Tertiary volcano-sedimentary sequence and shale representing Geku and Dalbuing formations and Recent valley fills comprising alluvium and colluviums.
9.	**HYDROGEOLOGY**	
	Major Water bearing formation Pre- monsoon Depth to water level during 2006 Post- monsoon Depth to water level during 2006 Long term water level trend in 10 yrs (1997 –2006) in m/yr	Weathered and fractured consolidated gneisses and schists,volcanics and semiconsolidated shales,sandstones and volcano-clastic materials and Recent alluvium and colluviums. N. A. N. A. N. A.
10.	**GROUND WATER EXPLORATION BY CGWB (As on 31-03-2013)**	Nil
	No of wells drilled (EW, OW, PZ, SH, Total)	
11.	**GROUND WATER QUALITY**	

	Presence of chemical constituents more than permissible limit	Not reported
	Type of water	Fresh and suitable for all purposes
12.	**DYNAMIC GROUND WATER RESOURCES (2009) in mcm**	GEC'97 couldn't adopt as the district area was more than 20% slope
	Annual Replanishable Ground Water Resources	NA
	Net annual Ground Water Draft	NA
	Projected Demand for Domestic and Industrial Uses upto 2025	NA
	Stage of Ground Water Development	NA
13	**AWARNESS AND TRAINNING ACTIVITY**	Nil
	Mass Awareness Programme organized	
14.	**EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING**	Nil
	Projects completed by CGWB (No & Amount spent)	
	Projects under technical guidance of CGWB	
15	**GROUND WATER CONTROL AND REGULATION**	Not applicable

	Number of OE Blocks	
	No of Critical Blocks	
	No of blocks notified	
16	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	

UPPER SIANG DISTRICT

1.0 Introduction

Upper Siang District(Fig-1) is one of the remotest districts of Arunachal Pradesh endowed with serene beauties of the nature. It is occupying a geographical area of 6188 Sq. Km composed of 92 villages, 125 gaon Panchayats and one Mahakuma Parishad. The village is the lowest administrative unit having its own traditional administrative system in the form of Village Council called "Kebang".

For convenience of administration the district is subdivided into 11 Administrative Circles , 5 CD Blocks and 3 subdivisions , Population of the district is 33, 363 as per 2001 Census, where 18057 are male and 15306 female. Yingkiong is the district head quarters which is located at a distance of 720 K.M. from the state capital Itanagar . Yingkiong is connected by metalled road with Itanagar and other parts of India which passes through the West siang and East Siang districts and finally along the districts Dhemaji and North Lakhimpur of Assam. One can avail train at Silapathar in Dhemaji district and the air service from Lilabari airport nearby North Lakhimpur district head quarters. It is bounded by Tibet region of China in the North, Dibang Valley District in the East, West Siang District in the West, and East Siang District in the South. It is inhabited by Adi, Memba, Khamba and Idu Mishmi tribes who have been harmoniously living in the cradle of nature since time immemorial with colourful festivals like Solung, Aran, Reh, Lossar, Dihang, etc.

The District is mountainous and enriched in rich natural resources and biodiversity. The area is characterised by deep gorges and fast flowing streams and rivulets , which form the tributaries of the mighty Siang River. The Siang River flows through the heart of the district running into Indian territory at a point near Gelling in the Indo-China border. In the early days of geographical exploration, the Siang River was referred to as the "Missing Link" - the unexplored channel that formed link between the Tsangpo of Tibet and the Brahmaputra of Assam.

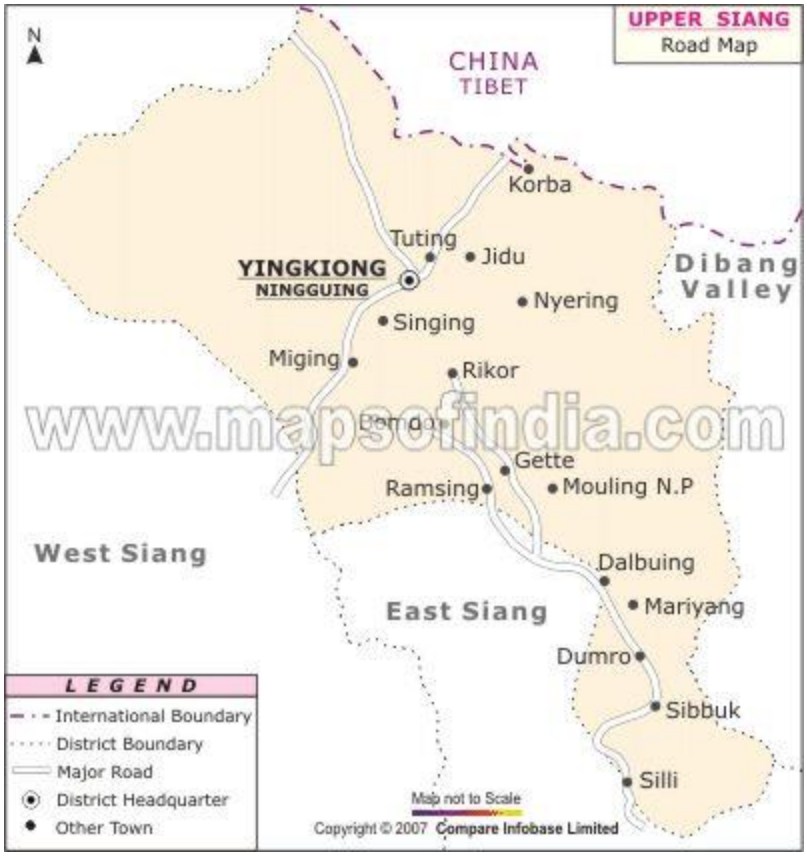


Fig-1 Location map of Upper Siang District

Agriculture is the mainstay of people. It is the major source of livelihood in the district. About 69% of the main working force in the district pursues agricultural activities. It can be substantiated from the fact revealed through the census record that out of 14091 total working population, 9649 persons are cultivators and 220 as agricultural labourers . With its geographical area of 6188 Sq. Km of land, Upper Siang is one of the largest districts in terms of area. However, only 2.9% of land is put to agricultural uses and the net area sown in the district was around 800 hectares only in 1991. However, with the rapid increase in population, the land brought under cultivation is increased to 3277 Ha in 2006. Agriculture is mainly rainfed barring a meagre irrigated tract of 1562 hectares from all sources while 124 hectares of land gets irrigation water from minor(surface)irrigation sources.The status of ground water irrigation in the district is nil.

Agriculture plays a vital role in the economy of the district. The development of agriculture in the district is affected significantly by its typical topography. The topography by and large is dominated by hilly-mountainous terrains with few pockets of flat land in low-lying areas. The tribal people of the district from time-immemorial followed two distinctive agricultural practices, namely 1. Shifting or Jhum Cultivation and 2. Sedentary or Settled Cultivation in the form of Wet Rice Cultivation (WRC) and Terrace Rice Cultivation (TRC).

The shifting cultivation(Jhum) and settled cultivation are known as Adi-Arik and Asi-Arik respectively in its local terms. The shifting cultivation, which is economically wasteful, practiced largely in hilly areas . About 7077 Hectares of land is utilized by the Jhumia families in the district. Jhum cultivation has been to some extent reduced now a days with the adaptation of settled cultivation by the people. The settled cultivation, which has emerged as more productive and reliable.

Rice, Maize and Millet are the principal food crops produced in the localities. Rice being the staple crop of the district is cultivated throughout . The horticultural crops like orange, banana, pineapple, guava, pear, cowpea, plum, ginger are successfully cultivated in the district. The district is known for orange production.

2.0 Climate and Rainfall: Climate in the district is varied as rainfall and temperature differs from place to place. The district experiences temperate and sub-tropical humid set of climatic condition with maximum and minimum temperature recorded in the months of June and December repectively. Maximum and Minimum temperature in the tract during summer and winter vary between13^0c -39^0c and 4^0c to 21^0c while relative humidity in the area varies from 75 to 91% as envisaged from the recordscontiguous Upper Subansiri district. The minimum temperature during winter at many places generally goes down below freezing point.Remote localities in the district experience snow fall. The higher reaches in the north remains snow clad. The total snow cover in the District is on the wane due to the global warming phenomena and consequent retreat of glacier. Rainfall mainly occurs during the period of April to October. Average annual rainfall at Yingkiong was recorded as 3240mm(2002-2005).

3.0 Geomorphology and soil types:

The district constitutes principally a hilly terrain covered by thick forests. The hill ranges are generally having moderate to steep slopes and narrow valleys and It occupies the lesser and inner Himalayan zones of the Great Himalayan Range. The hills are separated by the Siang river and its tributaries which flow mostly towards south and have deep gorges. The hills are comparatively higher in the northern side than the southern parts. The elevation, in general varies from 1,100 to more than 4000m above mean sea level. The elevation at the District Headquarters Yingkiong is 500m above mean sea level.

Physiographically the district can be broadly subdivided into two divisions 1. Hilly terrain, underlain by Proterozoic gneisses and schists with subordinate quartzite and phyllite, volcanics, Gondwanas and Tertiary sedimentaries etc and 2. Very limited alluvial deposits in the valley fill. Majority of the district area is occupied by hills underlain by gneisses,Schists,volcanics,Gondwanas and Tertiary sedimentaries barring the highly restricted valley fills along Siang river.

Siang River, originated from Tibet and its tributaries form the main drainage system of the district. It flows in almost N-S direction. The drainage pattern is dendritic to subparallel and follow the general geomorphological trend of the hills and structural lineaments.

Based upon the geomorphic elements such as relief, drainage, lithology etc. the district has been divided into two major units namely denudo-structural hills and valley fill areas.

i) Denudo-structural hills are covering major parts of the district and composed of Phyllites,quartzites,biotite gneiss and Gondwana sedimentary formations. The denudation processes were earlier active in the hills and remnants of original structural features like long faults, deep facets,strike trends could be seen in the formations.

ii) Valley fills:

Valley fills comprise thin veneer of alluvial deposits occurring along the Siang rivers in the form of terrace. The valleys range in altitude from 500-550m above mean sea level.

Soils of the district have been derived from the country rocks of schists,gneisses in hilly areas and form alluvial and colluvial materials in the valleys.The soils in the valley areas are sandy loam in texture with high acidic content. The P^H values range between 5 to 6. The carbon content is high with medium to low phosphorous and potassium concentrations.

4.0 Ground Water Scenario

Groundwater is available in all geological formations in the district depending upon their primary or secondary porosities,geomorphologic and hydrogeologic set up.

4.1 Geology and Hydrogeology: The district is underlain by rock formations of Recent to Precambrian age. The Precambrian rocks comprise high grade gneisses and Schists of Sela Group, followed by quartzite,phyllite, conglomerate,Shales,Biotite gneiss,Calc and Graphite Schist of Bomdila Group and Miri quartzite,Shale and conglomerates belonging to Miri Formations of Lr Gondwana Group and Abor volcanics of Paleozoic epoch and Tertiary sedimentaries comprising Geku and Dalbuing formations of Yingkiong Group. The Sela Group of rocks of Precambrian age consists of high grade gneisses, lit-per-lit gneisses and schists. It occurs in the west and north-western part of the district . Bomdila Group of rocks representing low to medium grade metasediments comprising quartzites,mafic meta volcanics and carbonates, associated with ortho-gneisses,granites and mafic intrusive.The overlying Miri formations(Gondwana) of lower Paleozoic age constitutes mainly quartzite with shale and phyllite association occur along a N-S trending patch inside the Bomdila Group of rockc. The Miri formation is having tectonic contact with the underlying Bomdila Group of rocks. Paleozoic Abor volcanics representing basaltic flows with fossiliferous intertrappean shale and sandstone are rimming around the Tertiary Yingkiong Group representing Shale,sandstone with welded tuff and mafic volcanics of Geku formation and Foraminiferal limestone and shale of Dalbuing formation.

Hydro geologically the area incorporated in the district can be broadly subdivided into two units 1. Consolidated and Semi-consolidated formations 2. Unconsolidated formations

Consolidated and Semi-consolidated Formations: These formations are underlain in the areas covered by the hills and mountains and occupy the

lions share of the area which is about 99% of the total geographical area of the district.The hills are constituted by phyllite, gneisses,quartzite and Calc gneiss comprising the crystalline consolidated formations representing Sela Group and Bomdila Group. Abor Volcanics and the volcanics in Geku Formations are also representing the consolidated formations.The Semiconsolidated formations represent Gondwana sedimentariris comprising ortho-quartzite,Shale and the sedimentaries of Yingkiong Group and the Dalbuing formations . These rocks are highly jointed and fractured with high degree of weathering. Ground water occurs in weathered zone as also in the fractured zones which form the zones of secondary porosity in these formations. Since there is no ground water development structures tapping all these water yielding horizons in the form of dugwells,dug-cum-bore wells or bore wells,ground water is discharged in the topographic lows in the form of springs. Rainfall forms the main source of recharge which gets recharged through the weathered mantle and finally reaches the fractures and openings through percolation. Because of high and steep slopes of the hill surfaces good amount of rainwater flows down as surface run-off while a meager portion of precipitation seeps inside to vitalize the shallow weathered and deeper fractured horizons in the consolidated formations.

Unconsolidated formations: These formations comprise sand of various textures, silt , clay and pebbles with boulders occurring in the limited valley areas along Siang river. These occur as terraces along the rivers. An average thickness of 3-4m of alluvial veneer could be seen in the valleys while average thickness of weathering in the underlain consolidated formations may vary from 5-10m as estimated during the studies carried out by CGWB. These valley areas could be fully developed through portable DTH-Percussion combined rig for augmentation of water supply and irrigation.

Groundwater investigations carried out in the district revealed that springs which form the main source of water supply for drinking water supply belongs to gravitational category. Mostly topographic and fracture springs are seen to occur in all hydro geological units in the district. The discharge of the springs seen to dwindle in the lean period. However, in the areas where spring discharge show significant decline and cause a shear crisis in the water supply in summer, needful measures of artificial recharge

technique is to be adopted to augment the yield and sustainability of discharge.

4.2 Ground water resources: The dynamic ground water resources of the districts of Arunachal Pradesh was estimated by the Central ground water Board based upon the ground water resources estimation methodology of 1997 and it was published for the assessment year of 2004. In the report the dynamic ground water resources potential of Upper Siang has not been shown as it could not be estimated due to paucity of data required for ground water resources estimation.

4.3 Ground water quality:

The quality of ground water in the district is ascertained as per the chemical analysis done at the chemical laboratory of the water samples collected from various spring sources during the investigations carried out by CGWB.

Ground water in the district is fresh, potable and it is suitable for domestic, irrigation and any future industrial uses.

To adjudge the chemical quality of drinking water, PHED of Govt. of Arunachal Pradesh has established one chemical laboratory at Yongkiong. The chemical analysis so far done by PHED has also not reported occurrence of any toxic constituents or higher concentration of chemical constituents beyond permissible limit.

4.4 Status of ground water development : It is already mentioned that ground water through ground water structures is not developed in the district . Hence till date the status of ground water development in the district is nil. Whatever ground water uses is in practice it is through tapping of the sources of gravitational springs which are freely flowing at the topographic lows. As per the record of PHED the entire district is covered by water supply arrangement (Table-3).

Table- 3 coverage of town/villages under drinking water supply as on 31.3.06

No of towns Covered	No of habitations	P ercentage of	Population benefited (in thousand)

under drinking water Supply in the district	covered under drinking water supply scheme	Net covered under water supply to total villages	Urban	Rural
1	90+2*	100%	8.698	33.363

(Source : Dir. Econ and Stat.,Govt. of A.P)

5.0 Ground Water Management Strategy: Since the ground water development is yet to be initiated in the district , the question of its management is superfluous. However, in view of extreme necessity of sustainable water management for drinking and irrigation, the scope of development of ground water in the district should be examined forthwith with the deployment of portable percussion-DTH combined rig as also through application of needful artificial recharge and conservation measures of water supplying springs.

5.1 Water conservation and artificial recharge: Although lot of rain to the tune of 3240 mm per annum is received in the district , many villages and the district town regularly experience scarcity of drinking water supply as also of irrigation water during lean period which extends from November to April. Due to terrain condition lot of rainfall is wasted through surface run-off. Furthermore due to climatic change as also due to the deleterious effect of global warming and recession of glacier there will be direct impact on the water availability scenario in entire India especially along the Trans Himalayan Region including Arunachal Pradesh as envisaged by the scientific community. Hence endeavour should be made to study on various methods of sustainability and conservation of water resources practices especially through Artificial recharge as also rainwater harvesting and to find out its success in Arunachal Pradesh in general and Upper Siang district in particular. In many places in Arunachal Pradesh lot of water scarcity is noticed both in Irrigation and drinking water sector in lean months what could be achieved through application of various scientific measures for sustainable water availability. Rainwater harvesting and artificial recharge is the prime important methods in achieving such sustainability. For doing artificial recharge a potential source of water is also needed. The rainfall in higher tune in the district could be a good source of recharge. Now for easy availability of rain water for its recharge to the ground water and its utilization through conservation for various domestic purposes as also for easy demonstration to the rank and file,

Govt., Semi Govt. Institutions and NGOs , the roof top rainwater , preferably from larger rooftops could be the best option. However, there are many other means of artificial recharge and rain water harvesting what could be applied in the district. The needful studies to find out the specific sites and methods are to be taken up through the collaborative studies by CGWB,WRD and other water user Departments of Govt. of Arunachal Pradesh like PHED etc., So that the research and developmental studies could be promulgated . As a beginning currently a DPR encompassing eight districts of Arunachal Pradesh barring Upper Siang district has been prepared envisaging rooftop rain water harvesting and artificial recharge and it is submitted to CGWB for allocation of funds for execution by Water Resources Department. If these schemes to be taken up are proved worth then the same type of rainwater harvesting structure could be taken up also in the Upper Siang district.

6.0 Ground water related issues and problems:

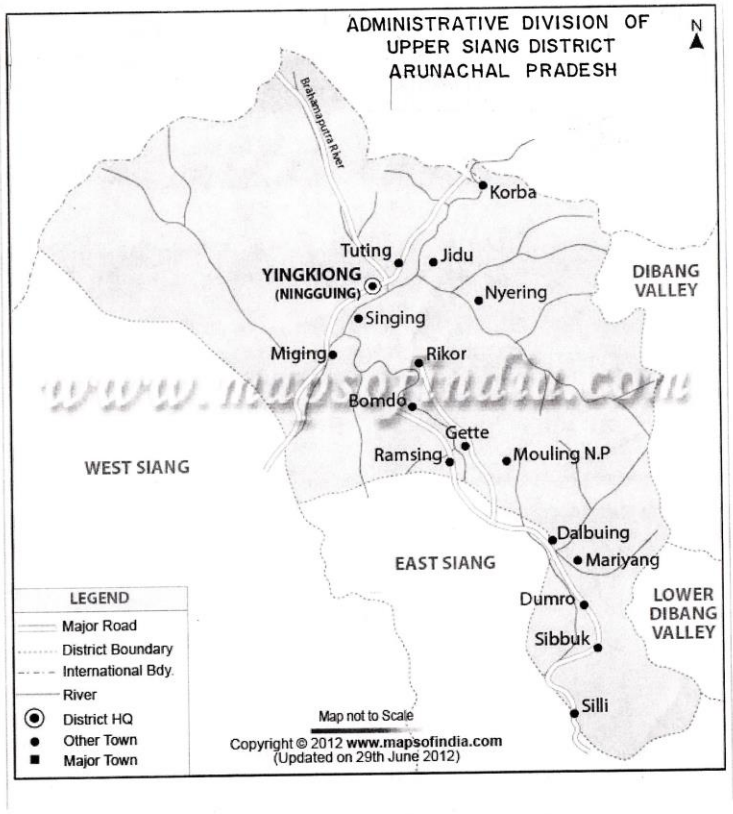
Inspite of copious rainfall to the tune of 3240mm per annum the district suffers from acute shortage of drinking and irrigation water where groundwater may form a dependable source of supply. It is already indicated that the springs which form the main base of water supply, its yield often dwindles during the lean period which is required to be solved. Groundwater has not at all developed in the district which is to be explored forthwith especially in the valleys and along the stream courses which signify the weak zones.

7.0 Awareness and training activity: Nil

8.0 Areas Notified By CGWA / SGWA: Nil

9.0 Recommendations: In view of low economic status and agrarian condition of the district, for its all out development water resources particularly rain water and ground water is to be developed in a sustainable manner. Keeping in view of the copious rainfall received in the district, rainwater harvesting through various means should be popularized in the district. In needful areas artificial recharge mechanism may also be applied to augment the precious natural resources. Springs are the main source of water supply through gravity in such mountainous terrain. In view of its declining condition of yield, for sustainable management of water supply, needful artificial recharge mechanism is to be adopted. In the restricted

valley areas as also along the structurally weak zones ground water development activities should be initiated through ground water exploration deploying portable percussion-DTH combined rigs. To enhance artificial recharge and rainwater harvesting along landscapes, terrace cultivation should be popularized abandoning the age old Jhum cultivation which is degrading the environment, soil and water resources. Similarly the indigenous method of fish-cum- paddy culture should be popularized which will not only upgrade the economy of the district, it will help in enhanced return circulation of impounded rainwater for accelerated groundwater recharge. Ponds are to be constructed in large number in valleys for harvesting lot of rain water as also for tapping ground for successful watershed development while in sloping terrain rainwater may be harvested in the ponds coated with impervious polythene sheets, bamboo cement etc. for utilizing the water for irrigation during the stress period as also for pisciculture.


ADMINISTRATIVE DIVISION OF
UPPER SIANG DISTRICT
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Korba
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VALLEY
Sibbuk
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LEGEND
Major Road
District Boundary
International Bdy.
River
District HQ
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Major Town
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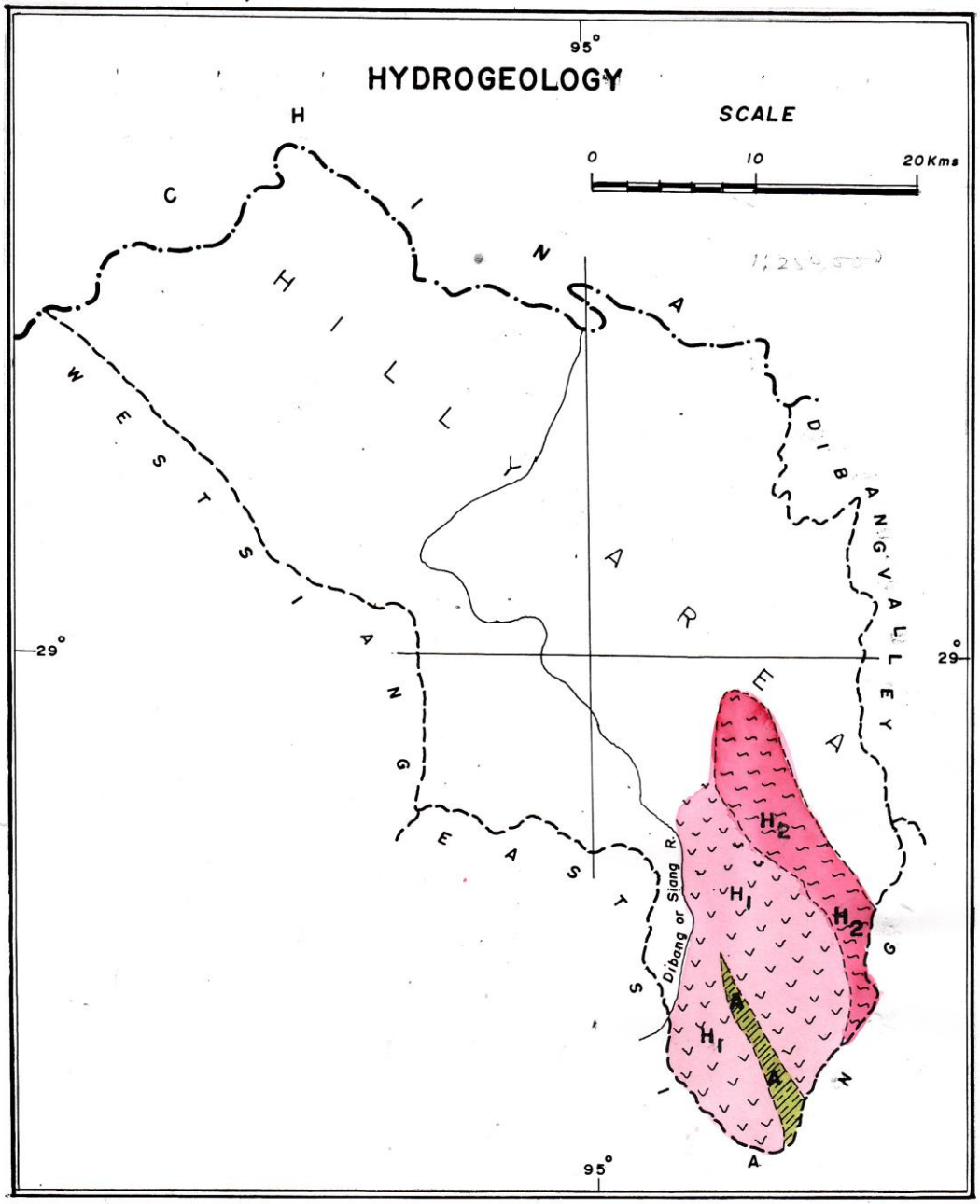
UPPER SIANG DISTRICT, ARUNACHAL PRADESH



CGWB/NER/DoNo/5634/2009/S.Das.

UPPER SIANG DIST. ARUNACHAL PRADESH