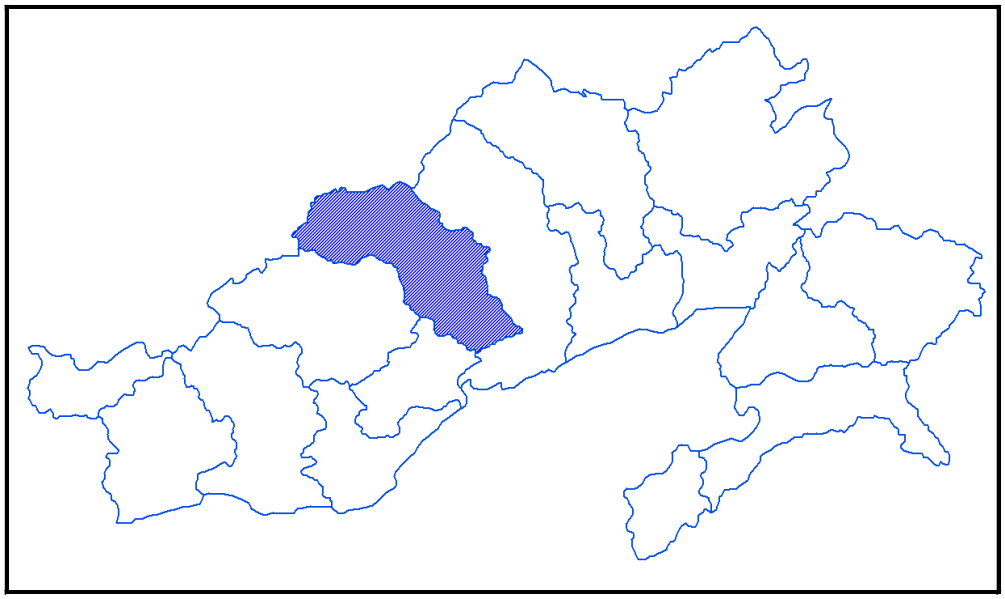
Technical Report Series: D

No:

Ground Water Information Booklet
Upper Subansiri 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)	7032
	ii) Administrative Divisions (As on 31st March 2011) Number of Sub-divisions Number of Block Number of Circles Number of Villages	 1 7 13 405
	iii) Population (As on 2011 Census)	83205
	iv) Average Annual Rainfall (mm)	1703
2.	GEOMORPHOLOGY	
	Major physiographic units	
	Major Drainages	Subansiri river and its tributaries
3.	LAND USE	
	a) Forest area:	NA
	b) Net area sown	8626.40 Hectare
	c) Cultivable area	10310.97 Hectare
4.	MAJOR SOIL TYPES	The soils in the valley areas are sandy loam with high acidic content. The P^H values range between 4.6

		and 6.5. The carbon content is high with medium phosphorous and potassium concentrations.
5.	AREA UNDER PRINCIPAL CROPS (As on 2011-2012)	
6.	IRRIGATION BY DIFFERENT SOURCES (Areas and numbers of Structures)	
	Dug wells	Nil
	Tube wells	Nil
	Tanks/ ponds	N.A
	Canals	
	Other sources	N.A
	Net irrigated area	
	Gross irrigated area	
7.	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-3-2013) No of Dug Wells No of Piezometers	Nil
8.	PREDOMINENT GEOLOGICAL FORMATIONS	Precambrian high grade gneisses and Schist and quartzites of Sela and Bomdila Group,Paleozoic Miri quartzites,sandstone and Recent alluvium and colluviums in the valley fills.
9.	HYDROGEOLOGY	
	Major Water bearing formation	Weathered and fractured Gneisses and Schists

		,quatzites and sandstones and Recent arenaceous alluvium and colluviums
	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	N.A N.A N.A
10.	GROUND WATER EXPLORATION BY CGWB (As on 31-03-2007)	Nil
	No of wells drilled (EW, OW, PZ, SH, Total)	-
	Depth Range (m)	-
	Discharge (litres per second)	-
	Storativity (S)	-
	Transmissivity (m^2/day)	-
11.	GROUND WATER QUALITY	
	Presence of chemical constituents more than permissible limit	Not reported excepting Iron showing values more than permissible limit at places
	Type of water	Fresh and suitable for all purposes
12.	DYNAMIC GROUND WATER RESOURCES (2009) in ham	
	Annual Replanishable Ground Water Resources	332.64
	Net annual Ground Water Draft	NA
	Projected Demand for Domestic and Industrial Uses upto 2025	27.30 Ha m

	Stage of Ground Water Development	Negligible
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	Nil

UPPER SUBANSIRI DISTRICT

1.0 Introduction

The name of the District is derived from the Subansiri River, a tributary of mighty Brahmaputra, that flows through Raga Circle of this District. Till 1914, the District was a part of Lakhimpur District of Assam. By the Government of India Notification of 1914, the area covered by this District became a part of Lakhimpur Frontier Tract of the “North East Frontier Tract”. In March, 1919, by another public Notification, the Lakhimpur Frotier Tract along with Western sector was renamed as the “Balipara Frontier Tract”. In 1946, the District area was curved out of the Balipara Frontier Tract in the name of “Subansiri Area” with its Headquarters at North Lakhimpur. In 1954, Subansiri Area was renamed as the “Subansiri Frontier Division” and its Headquarter was later transferred to Ziro.On 1st September, 1965, the Ministry of Home Affairs took over the Administrative charge of NEFA from the Ministry of External Affairs, and the Subansiri Frontier Division was renamed as Subansiri District. On 13th May’1980, Subansiri District was bifurcated into Lower and Upper Subansiri District. Upper Subansiri District(Fig-1) was formed by covering the area of the then Daporijo Sub-Division, and rest of the area of erstwhile Subansiri District was placed under Lower Subansiri district.

The Upper Subansiri headquarters naming Daporijio(Fig-1) is located 423 kms. away from Itanagar. Nearest railway stations are found in Lakhimpur and Silapathar of North Lakimpur and Dhemaji districts of Assam. There is one airport at Daporijo.However, one can avail regular air service from Lilabari airport of North Lakhimpur. The upper Subansiri district is endowed with lush green forest and with a rich variety of flora.

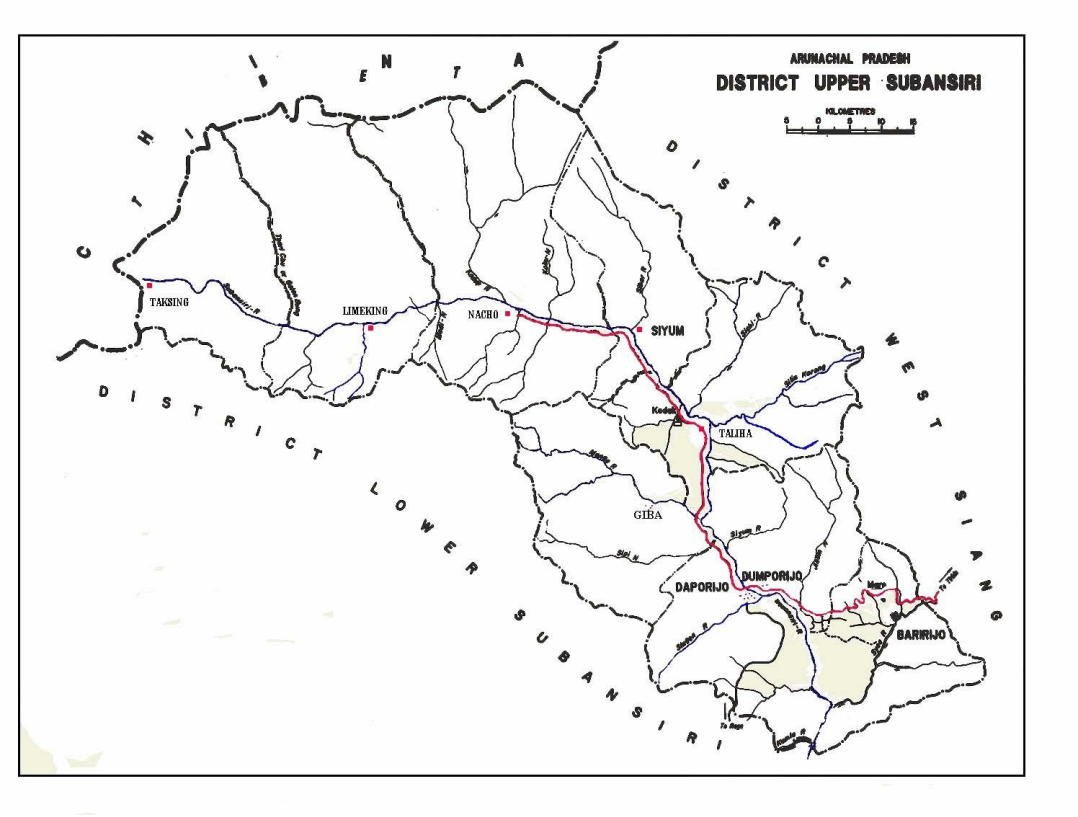


Fig-1 Map of Upper Subansiri District

Total geographical area covered by the district is 7032 sq.kms and it is bounded between $27^0 45'$ and $28^0 42'$ North latitude and $93^0 18'$ and $94^0 36'$ East longitude . West Siang district falls in the east and partly at South while lower Subansiri district is bordering the west as southern boundary. The Mc Mohan line designating its northern border is covered by China.

The district represent a mountainous, rugged and a difficult terrain. The river Subansiri has intersected the area. Snow-clad mountain ranges of height from 7000 ft. to 18000 ft. (above sea level) stand like barrier in the north. Most of the land area is barren and inhabitation is scanty. The region is mostly covered by dense forest consisting Alpine, moist temperature tropical pine and temperate wet evergreen forests in upper, upper middle, middle and lower region respectively.

Provisional population of the district is 55343, comprising 28240 male and 27106 female as per 2001 census. Indigenous population is scheduled tribes comprising Tagin, Galo, Nyishi and Hills-Miri.

Main occupation of indigenous people is agriculture. shifting cultivation is practiced in hilly areas . About 2634 Hectares of land is utilized by the Jhumia families in the district. Jhum cultivation has been significantly reduced now a days in the district with the adaptation of settled cultivation by the people. The settled cultivation has emerged as more productive and reliable.. Agriculture is mainly rainfed.

The literacy is 50.89 percent as per Census, 2001. Male and female literacy is 56.81: 42.74 respectively.

Due to lack of adequate infrastructural support, the mineral resource of the district is lying unexplored. However, availability of limestone and graphite has been reported. Forest is the major resource in the district. It provides building materials, cooking fuel and edible fruits to the rural as well the urban people. The district has immense potentiality of hydro electric power generation by taping the water resources. Two hydro electric projects have been taken up by the Govt. and works under NHPC is in full swing.

The district headquarters at Daporijo is linked by surface communication with Kimin and NH52 near Pohumara on NH52 in North Lakhimpur District, Assam via Ziro as also to Silapather of Dhemaji district, Assam via Basar. Similarly the circle head quarters are connected through road communication with the district headquarters. There are 423 villages in the district. For administravive convenience the district is having one sub-division having headquarters at Nacho (116 Km. from the district headquarter). The sub-division supervises four administrative circles along the international boundary, while the other nine circles are under the direct control of the Deputy Commissioner.

There are eight Community Development Blocks located at Nacho, Siyum, Taliha, Giba, Daporijo, Puchigeko, Baririjo and Dumporijo and one District Rural Development Agency at Daporijo.

2. 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. Winter temperature varies between 4.5^0c to 21.9^0c and in summer 13.8^0 to 39^0c.The minimum temperature during winter generally goes down below freezing point. Remote localities in the district experience snowfall. Tasking circle of Nacho subdivision remains snow bound throughout the year. Besides the Tasking area ,the areas around round Nacho, Siyum as also Taliha circles remain snow clad. The total snow cover in the District was 1250 sq.km. as revealed through Satellite imagery studies (CGWB,1993). However, the figure is in the decline due to the global warming phenomena and consequent retreat of glacier. Relative humidity in the district varies from 75 to 91%. Rainfall mainly occurs during the period of April to October. Average annual rainfall at Daporijo was recorded as 1644mm(1985-88). While the average rainfall recorded during the period of 2002-2005 was 1703 mm.

3.0 Geomorphology and soil types:

The district constitutes principally a hilly terrain covered by thick forests. The hill ranges are generally aligned in NE-SW and NW-SE directions with 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 rivers 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 maximum elevation of 5,664m above mean sea level exists in the North western side of the district and the lowest one is at the District Headquarters Daporijo located in the southern part of the Distict at an altitude of 305m above mean sea level.

Physiographically the district can be broadly subdivided into two divisions 1. Hilly terrain, underlain by gneisses and schists with subordinate quartzite and phyllite etc and 2. Limited alluvial deposits in the valleyfill. Majority of the district area is occupied by hills underlain by gneisses and Schists barring the restricted valley fills the Daporijo and Sippi.

Subansiri river originating from Tibet and its tributaries form the main drainage system of the district. It flows in N-S direction.The Siken river flow westerly while Singen and Kamla river have easterly flow direction. All these join Subansiri river in the southern part of the district. The other streams ans nalas namely Chukkro,Siaskro etc. also meets Subansiri river. 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 denude-structural hills and valley fill areas.

a) Denudo-structural hills are covering major parts of the district and composed of Phyllites,quartzites,biotite gneiss,Calc-gneiss and occasional Sillimanite bearing rock formations. The denudation processes were earlier active in the hills and remnants of original structural features like deep facets,strike trends could be seen in the formations. On the basis of elevations, this unit has been further subdivided as follows.

    i) High denudo-structural hills : These are elevated hills ranging in height from 1800 to more than 5000 m above mean sea level and occurring in major parts of the district.It occupies an area of around 6,325 sq.km(about 90% of the total geographical area).The unit has steep slopes and the hills are separated by ‘v’ shaped narrow valleys. It comprises high grade gneisses of Sela Group and Mica Schist,Calc-gneisses of Bomdila Group of rocks. The drainage pattern is mostly dendritic with coarse drainage density.

    ii) Moderate Denudo-structural Hills: These occur in the southern part of the district and the unit is characterized by moderate hills with elevation ranging between 1100 to 1800 m above mean sea level, having an area of about 700 sq km.(about 10% of the total geographical area).

The unit has flat tops and moderate to steep slopes. It comprises phyllite,quartzite,and Shales of Miri Quratzite and Buxa formation of rocks. The hills are separated by 'U' shaped valleys.The drainage pattern is dendritic to sub-parallel with medium drainage density.

b) Valley fills:

Valley fills comprise thin veneer of alluvial deposits occurring around Daporijo and Sippi towns in the southern part of the district. It is spreading over about 7 sq.km.(less than one percent of the total area).These alluvial sediments comprising sand,silt,clay ,silt and pebbles have been deposited by the rivers and also constitute weathered materials from surrounding hills. The valleys range in altitude from 305 to 320 m 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 4.6 and 6.5. The carbon content is high with medium phosphorous and potassium concentrations. The soils are good for paddy and wheat,maize,pulses sown in the valleys and in the hilly areas.

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,Buxa and Miri quartzite Groups of Paleozoic epoch. The Sela Group of rocks of Precambrian age consists of high grade gneisses, lit-per-lit gneisses and schists. It occurs in the central part of the district, around Daporijo extending towards north. Beyond the Subansiri river the rocks have higher grade of metamorphism up to the grade of sillimanite.The overlying Buxa and Miri formations of lower Paleozoic age constitutes mainly quartzite with shale and phyllite association,in the southern part of the district.

Hydrogeologically the area incorporated in the district can be broadly subdivided into two units 1. Consolidated formations 2. Unconsolidated formations.

1. Consolidated Formations: These formations are underlain in the areas covered by the hills and mountains and occupy an area of 7025 sq.km. which is about 99% of the total geographical area of the district. The hills comprise phyllite,gneisses,quartzite and Calc gneiss. 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.

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 main water supplying springs varies from 10,290 lpd to 34,600 lpd. The discharge of the springs reported to emanate through the weathered horizon has been observed to yield high than those are seen to ooze through fractures. The yield 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.

2) Unconsolidated Formations: These formations comprise sand of various textures, silt , clay and pebbles with boulders occurring in the limited valley areas of Daporizo and sippi occur in the southern part of the district. Approximately 400 hectares of land is available for cultivation in the former while 150 hectares are cultivable in the latter valley areas. 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. The following table(Table-3) summarizes the hydro-geological outlines in the valleys.

Table-3 Summarized hydrogeology of the valley areas in Upper Subansiri District

Formation	District	Name & type of valley	Area (sq.km)	Rock Types	Ground water Potential
Consolidated Formations					
Fissured formation Metasediment	Upper Subansiri	Intermontane valley a. Daporijo b. Sippi	5.0 2.0	Phyllite,Schist,Slate,Quatzite Gneissic complex with acid and basic intrusives	Low yield upto 5-15 m^3/hr. Yield upto 5m^3/hr. In areas having lineament and structural weak planes, the yield may go upto 25-30m^3/hr.

4.2 Ground water resources: The entire district is occupied by hill ranges with very steep slopes that are more than 20%. Moreover, no details about the recharge potential in these hills are available. As per GEC, 97 these hilly areas are not taken into account for resource computation. Due to lack of data especially on population, number of ground water structures, Draft and other important parameters on watershed basis, the smallest administrative unit, i.e. the R.D. Block has been taken as the unit of computation. Water level trend is also not available due to lack of ground water abstraction structures, hence the annual ground water recharges of all the assessment unit have been computed by the Rainfall Infiltration Factor method.

The annual replanishable ground water resource of the district is estimated as 332.64Ham. Net ground water availability of the district is 299.38Ham. Projected demand for domestic and industrial uses up to 2025 is 27.30Ham. Ground water availability for future irrigation use is 272.08Ham. Stage of ground water development is thus negligible and the district can be categorized as safe.

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.

It has been observed that the ground water in the district is slightly alkaline having P^H value ranging within 7.33 to 8.15.Electrical conductivity values range within 41-122 micro-Siemens/cm barring few locations. Carbonate content in ground water is nil. Concentration of bicarbonate ranges from 18-153 ppm. Concentrations of Ca, Mg is ranging from 6-15 ppm and 1-7 ppm. Total hardness values of ground water vary between 20-58 ppm .Sodium and potassium values ranges within 2-8 and 1-4 ppm. Total dissolved solid which is a measure of quality of ground water ranges between 30-170 ppm. Concentrations of other constituents like Chloride range from 4-11 ppm , nitrarte and fluoride vary between 0.39-0.71 and 0.1-1.2 ppm respectively. Range of concentration of iron fluctuates between 0.05-0.3 ppm excepting few high values found at Bui and Lida village where concentration values found a bit higher as 0.7 and 0.75 ppm.

Therefore , based on the above chemical analysis data , ground water in the district can be designated as 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 Daporijo. The chemical analysis done by PHED has also not so far 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 is not developed in the district, even not in the restricted valley areas of Daporijo or Sippi through ground water structures. 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. The following table(Table-4) gives an account of status of drinking water supply in the district mostly through tapping spring sources .

Table: 4 Status of drinking water supply by PHED in East Kameng District as on 31.3.2006

No of towns Covered under drinking water Supply in the district	No of habitations covered under drinking water supply scheme	P ercentage of Net covered under water supply to total villages	Population benefited (in thousand)	
			Urban	Rural
1	441+13*	99.78%	15.676	39.590

(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 redundant. 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.

5.2 Water conservation and artificial recharge: Although considerable rain to the tune of 1703 mm per annum is received at Daporijo valley(the rainfall in many other parts of the district is much higher) , 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 Subansiri 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, Water Resources Department(WRD),Govt. of Arunachal Pradesh 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 Subansiri 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 Subansiri district .

6.0 Ground water related issues and problems: In spite 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 geological weak zones having good ground water potential.

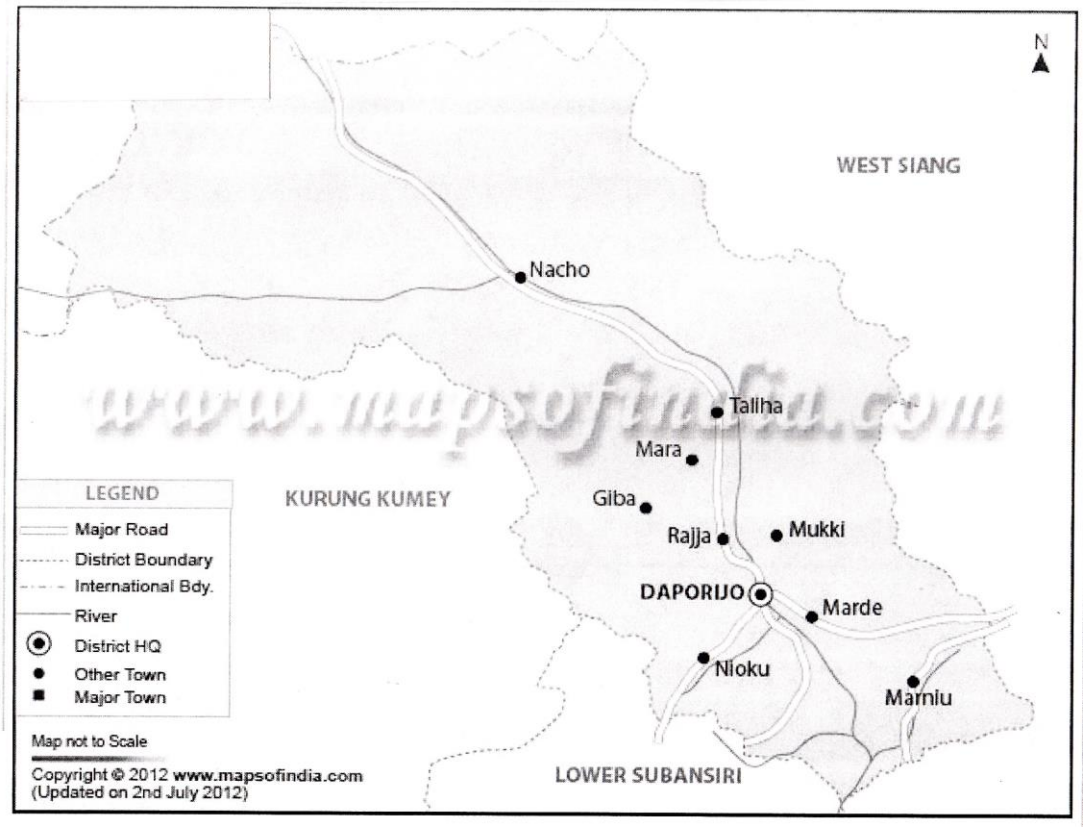
7.0 Awareness and training activity: Nil

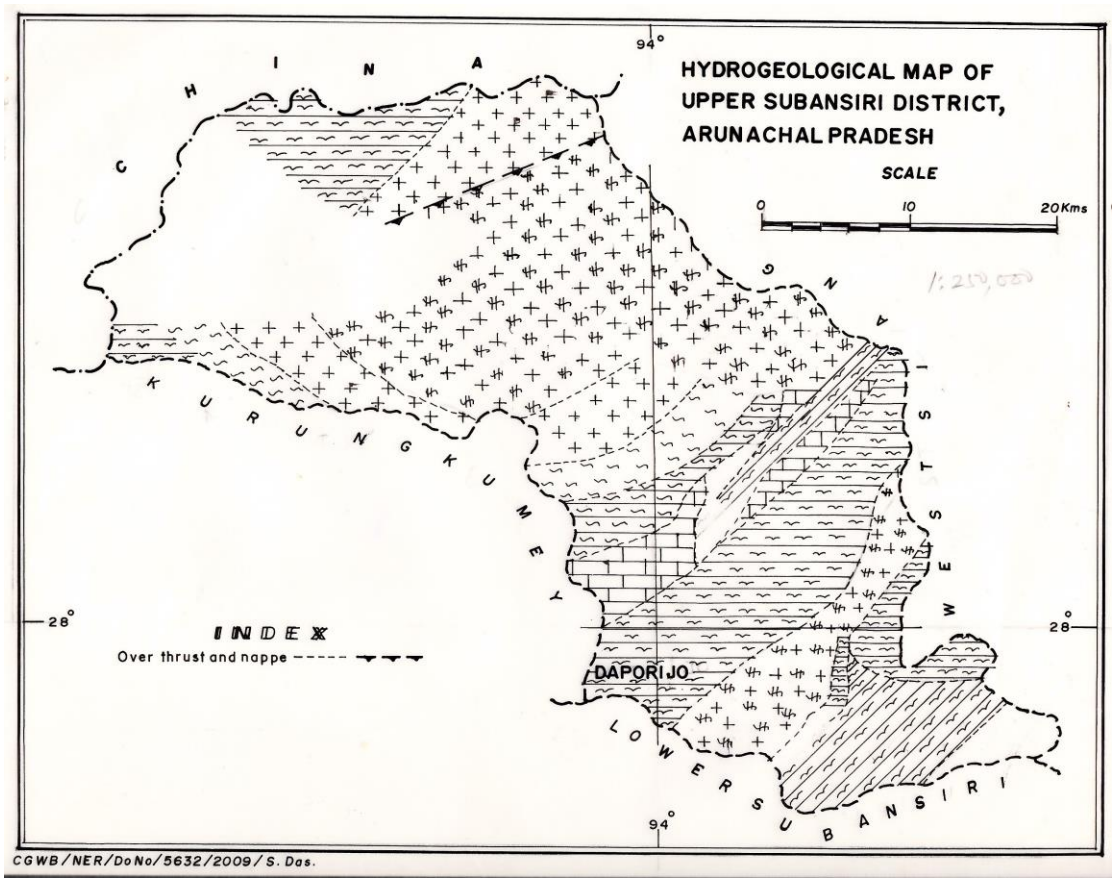
8.0 Areas Notified By CGWA / SGWA: Nil

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 SUBANSIRI DISTRICT
ARUNACHAL PRADESH




HYDROGEOLOGICAL MAP OF
UPPER SUBANSIRI DISTRICT,
ARUNACHAL PRADESH
SCALE
0
10
20Kms
1:250,000
94°
28°
INDEX
Over thrust and nappe
DAPORIJO
CHINA
KURUNGKUMEY
HIGH WESTS
LOWER SUBANSIRI
CGWB/NER/DoNo/5632/2009/S. Das.

UPPER SUBANSIRI DISTRICT, ARUNACHAL PRADESH