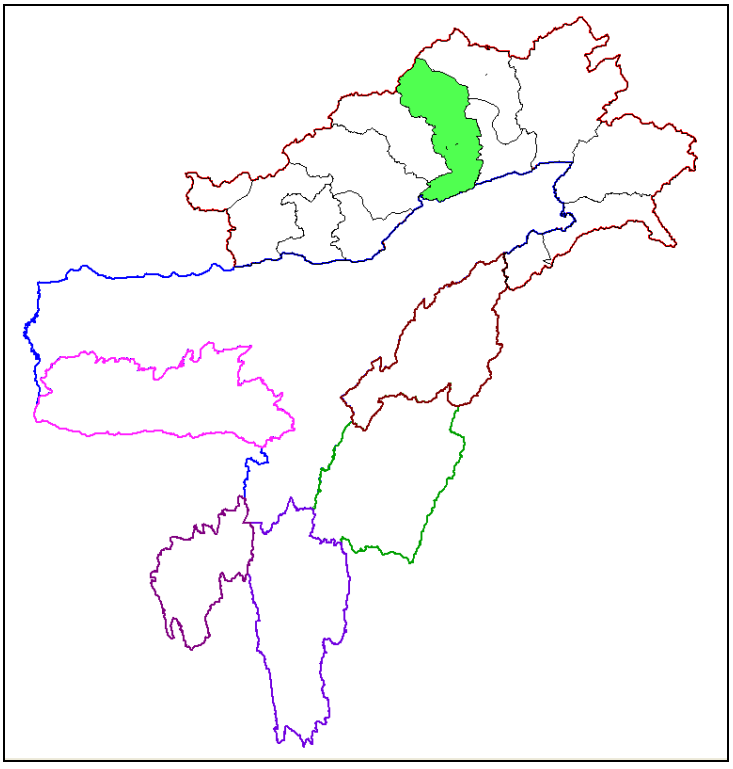
Technical Report Series: D

No:

Ground Water Information Booklet
West 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)	8325
	ii) Administrative Divisions (As per 2011Census) Number of Block Number of Circles	 398 :20
	iii) Population (As on 2011 Census, provisional)	1,12,272
	iv) Average Annual Rainfall (mm)	1,538.72
2.	**GEOMORPHOLOGY**	
	Major physiographic units	Hilly gnessic complex, foot hill zone, alluvial depo. In valley fill areas.
	Major Drainages	Siyom, Yagyapchu, Hiru, Sigen etc.
3.	**LAND USE (sq. km)**	
	a) Forest area:	
	b) Net area sown	193.54
	c) Cultivable area	222.20
4.	**MAJOR SOIL TYPES**	Sandy loam, Lateritic
5.	**AREA UNDER PRINCIPAL CROPS (As on 2010-11)**	
6.	**IRRIGATION BY DIFFERENT SOURCES (Areas and numbers of Structures)**	
	Dug wells	Nill
	Tube wells	Nill
	Tanks/ ponds	Nill
	Canals	Nill
	Net irrigated area	4455 ham
	Gross irrigated area	4456 ham
7.	**NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-3-2013)** No of Dug Wells No of Piezometers	 Nill Nill
8.	**PREDOMINENT GEOLOGICAL FORMATIONS**	
9.	**HYDROGEOLOGY**	
	Major Water bearing formation	Alluviam and partly Siwalik

	Pre- monsoon Depth to water level during 2011 Post- monsoon Depth to water level during 2011 Long term water level trend in 10 yrs (2001-2011) in m/yr	Nill Nill Nill
10.	**GROUND WATER EXPLORATION BY CGWB (As on 31-03-2013)**	Nill
	No of wells drilled (EW, OW, PZ, SH, Total)	Nill
	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	Nill
	Type of water	Fresh
12.	**DYNAMIC GROUND WATER RESOURCES (2009) in mcm**	
	Annual Replanishable Ground Water Resources	61.91
	Net annual Ground Water Draft Net annual ground water availibility	Nill/ Negligible 55.72
	Projected Demand for Domestic and Industrial Uses upto 2025	0.60
	Stage of Ground Water Development	Negligible
13	**AWARNESS AND TRAINNING ACTIVITY**	Nill
	Mass Awareness Programme organized Date Place No. of Participants	
14.	**EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING**	Nill
	Projects completed by CGWB (No & Amount spent)	
	Projects under technical guidance of CGWB	
15.	**GROUND WATER CONTROL AND REGULATION**	Nill
	Number of OE Blocks	
	No of Critical Blocks	
	No of blocks notified	
16.	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	Nill

GROUND WATER INFORMATION BOOKLET
WEST SIANG DISTRICT, ARUNACHAL PRADESH

1. INTRODUCTION:

West Siang district of Arunachal Pradesh constitutes a geographical area of 8325 sq. km. is bounded approx. by north latitudes 27˚ 33´ 43˝ to 29˚ 04´ 58˝ and east longitudes 93˚ 57´ 18˝ to 94˚ 56´ 45˝. The district occupies the central part of the state and Along (Aloo) is the Head Quarter West Siang district is bounded by East Siang and Dibang valley districts of Arunachal Pradesh in the east, Dhemaji district of Assam in the south, Upper Subansiri district of Arunachal Pradesh in the west and China occupies the northern portion of the district. For better administrative control the district has been devided into twenty circles.

The river Siyom or Yomgo originates from Tuting area and its tributaries from the main drainage system of the area. It flows from north to south and south to east. The other important rivers are Hirit, Sigen, Sipu korong, Tsangpo and Sigong. The drainage pattern is dendritic to sub-parallel and the rivers and stream follow the general rock formation strike.

Agriculture is the important land use class in the district. About 40% of the population depends on agriculture. Two types of cultivation namely valley cultivation (permanent) and shifting cultivation (Jhum) are practiced in this district. Principal crops are Paddy, Maize, Millet, Wheat, Oil seeds, Pulses etc.

Irrigation is done by diverting water from stream channels by means of gravity flow. There is no major or medium irrigation project in this district.

For the first time an area of 1,500 sq.km was covered by Sh. M. Borpujari , CGWB,NER under systematic hydrogeological survey in this district during F.S.P. 1986-87 (in the southern part of the district). Dr.S.Singh, AHG covered 3000sq.km under district ground water management study during FSP 2003-04.

2.0 RAIN FALL AND CLIMATE:

The district experiences sub-tropical humid climate with maximum and minimum temperature recorded as 37.1 and 8.1˚c in the month of July and January respectively. The average humidity recorded at Long is 84.12%. Occasional, snow fall occurs in the northern part in Mechuka and Tuting areas.

Rain fall occurs mainly due to south-west monsoon from April to October. Maximum and minimum rain fall recorded in the months of July and December respectively. The average annual rainfall of the district is 1538.72mm.

3.0 GEOMORPHOLOGY AND SOIL TYPE:

West Siang district is mainly hilly. Hill ranges trending in North East - South West to North West – South East directions with moderate to steep slopes, alternative with narrow valleys. The elevation of hills generally increases towards

the north. Based upon the factors of relief, drainage, lithology etc. the district can be divided into five geomorphic units which are:

a) High Denudo-Structural Hills: Covers mostly the northern part of the district. Elevation of the hills ranges from 900m – 5000m above msl with moderate to steep slopes. Valleys are narrow and 'V' shaped.

b) Moderate Denudo- Structural Hills---- This unit by moderate hills with flat tops and moderate to steep slopes. Elevation of the hills varies between 700 to 900m above msl. The unit occupies about 1,355 sq. km. area. Main rock formations are phyllite, quartzite and shale with occasional high grade sctists and gneiss. The rocks are highly, weathered and thickness of weathered mantle varies between 5 – 10 m in Basar area. Valleys are 'U' shaped.

The soils of the district have been derived from parent rock formation, e.g. phyllite, biotite- schist and gneiss, alluvial and colluvial deposits. The soils of the hill slopes were genetically derived from schists and gneiss that of the valley areas from alluvial and colluvial sediments. These are sandy loam in texture in the valleys and lateritic in hill areas. The soils are high is acid content with P^H value ranges between 5 to 6. The carbon content is also high with low Potassium and Phosphate is high to low.

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology:

Hydrogeologically the district can be categorized into three hydrogeological units which are consolidated, semi-consolidated and unconsolidated formations.

a) Consolidated Formation: These consists of gneisses of Bomdila group, quartzites, phyllites, of Buxa and Miri Formations and hard compact sandstone of Gondwana group. These occupy more than 90 percent of the district area and are continued in the northern part. There are joints, fractures and faults developed in the rocks. The degree of weathering is high in phyllite and shale. In Basar and Along areas, the thickness of weathered mantle was found to vary between 10 to 20 m.

Ground water occurrence, movement and storage is mainly controlled by the lithological formations, fractures, joints and the thickness of weathered mantle in the consolidated rocks. Ground water is manifested in the form of springs. Being a predominantly hilly area with steep slopes, most of the rainfall which is the principle source of recharge flows as surface runoff into the rivers, streams and nalas. The rest of the rainfall percolates down through thickly vegetated cover and weak planes and comes out as springs in different geological formations.

A number of springs were examined in this area. Their discharge varied between 1,920 and 86,000 lpd. All these belong to gravitational fractured spring category. In Along area, the spring discharges ranged from 24,000 to 24,827 lpd and towards north – west, i.e. in Darak area, it is between 28,800 lpd. In south – central part, i.e. in Basar area, it is between 28,800 and 86,400 lpd. It is observed

that the yield of the springs in gneisses, quartzite and phyllitic rocks of Bomdila Group, Miri and Buxa Formation were comparatively more, which appears to be due to the predominance of joints / fractures in the rock formations. In sandstone of Gondwana Group, the discharges of poor due to the hard and compact nature and les development of joints. However, it is also observed that some springs around Darak, Kabu, Dakpi, Bame and Garo – Basar road do not dry – up during lean period. The State Rural Works Department has supplied water by means of schemes covering more than 24 villages and towns distributed all over the district. The source points are located at higher elevation from where water flows under gravity to concrete reservoirs and is supplied through plastic pipes.

In lean period, scarcity of drinking water was felt because of the decrease in discharge of springs. To get a better yield in lean period, it is suggested to develop the springs by cleaning debris in the flow path and construction of sumps near the springs. It is suggested also to drill a few boreholes with 152 mm diameter down to about 100 m bgl along the main roads, where drilling rig (DTH type) can approach.

b) Semi – consolidated Formation: These are loosely cemented sandstone with boulder, pebble and clay of Siwalik Group of rocks. These comprise low lying hills and occur i9n the southern part of the district. These form a recharge zone and ground water development is possible by shallow ground water structures in selected areas. No ground water abstraction structure was available in these formations. For future development of ground water; large diameter dug wells of 2 to 3 m diameter and 10 to 12 m deep in the bouldery formation or in the sandstone bed are expected to yield 25 to 30 m^3 / day. The depths of water levels in these wells are expected to be deep. The wells are feasible in the south of check gate 5 km north of Likabali town in southern part of the district.

c) Unconsolidated Formations: These comprise loose sand, silt, clay and pebble, and occur in valley areas occupying about 18.5 sq. km. area and in piedmont alluvial plains covering about 60 sq. km. of the total district area. The thickness of alluvium is limited and varies between 3 and 4 m bgl in the valleys, but it has good potential for ground water development by shallow ground water structures.

4.2 Ground water resources:

The quantification of dynamic ground water resource of the district has been estimated based on methodology recommended by GEC, 97. Because of the paucity of block / circle wise hydrological data, resource of the district as a hole has been estimated. An annual replanishable ground water resource of the district is 61.91 MCM. Net ground water availability of the district is 55.72 MCM while net ground water draft for all uses may be considered as negligible. Projected demand for domestic and industrial uses upto 2025 is 0.60 MCM. Ground water availability for future irrigation use is 55.12MCM. Stage of ground water development is thus negligible and the district can be categorized as safe.

4.3 Ground water quality:

The chemical quality of ground water in West Siang district is good for drinking and irrigation purposes. All the chemical constituents are within permissible limit. Concentration range of different chemical constituents is given below:

Constituents	Range	Constituents	Range
P^H	7.15 -8.2	Fe	0.2-0.4
EC	12 - 316	CO_3	Nill
TDS	10-50	HCO_3	6-244
TH	15-200	Cl	4-11
Ca	2-25	NO_3	0.2-1.4
Mg	1-32	PO4	Nill
Na	1-3	F	0.4-0.6
K	1-2	SiO_2	4-23

4.4 Status of Ground Water development:

Structures like tube well, dug well etc. are not available in any block of this district. Only ground water in the form of spring is developed throughout the district. Therefore status of ground water development may be considered as negligible.

5.0 GROUND WATER MANAGEMENT STRATEGY

The district is a still in a virgin state from the point of ground water development. For utilization, total resources available in the valleys and foot hill areas are 27.44 MCM and therefore there is ample scope for the same.

Some suggestions put forward for the development of ground water in the piedmont zone and valley areas are below:

a. Along valley

Sub-division	Circle	Name of valley	Areal extent (in sq. km)	Composed of
Along	Along	Along	6.0	Alluvium underlain by highly fractured quartzites of Miri Fm.(Lower Palaeozoic)

Large diameter dug wells and shallow tube wells appear feasible in this valley.

b. Pesing valley :

Sub-division	Circle	Name of valley	Areal extent (in sq. km)	Composed of
Along	Rongong	Along	5.0	Alluvium underlain by highly fractured quartzites of Miri Fm.(Lower Palaeozoic)

The thickness of alluvium comprising sand, mixed pebbles, silt and clay is 3-4m as observed in river cuttings near Pesing village. Large diameter dug wells are suitable for this valley.

c. Kabu valley: Alluvium thickness is 3-4 m in this valley and consists of sand, pebble and clay. Construction of large diameter dug wells is feasible in this area.

d. Basar valley: The valley has deposits of sand mixed with clay, silt and pebble being underlained by mica schist, quartzities and phyllite of Palaezoic age.In this intermontane valley, weathered mantle of rocks has a thickness varying between 20-25.Dug wells of 6 to 8m depth and 1.5 to 2m diameter can be constructured in this valley.

Piedmont zone: In the foot hill region covers about 60 sq. km area bordering Assam. As this zone acts as a recharge zone, depth to water will be high. Construction of 15m to 20m deep and 2m to 3m diameter dug wells are advocated. Tube wells drilling at least 60m are likely to discharge 22 to 35m^3 / hour for a drawdown of 4 – 6m. Presence of boulder suggests deployment of percursion rig for this area. Iron content will be high as observed in some tube wells near by border of the district at Silapathar, Likabali area of Assam.

5.2 Water conservation and artificial recharge

Till date, no water conservation artificial recharge structure construction has been taken up for this district. Therefore, specific study for the same need to be taken up. Considering the high rain fall in this area, rooftop rain water harvesting may be taken up to reduce the stress on present water supply system. Roofs having slope more than 30˚ are to be avoided which otherwise may cause over flow or wastage of water from gutters and filters. Generally a roof area of 15 to 20 sq. m. is required for collecting sufficient water required for a house hold.

6.0 GROUND WATER RELATED ISSUES AND PROBLEMS:

No such problem yet been identified.

7.0 AWARNESS AND TRAINING ACTIVITY:

7.1 Mass awareness: Nil
7.2 Participation: Nil
7.3 Presentation and lectures: Nil

8.0 AREAS NOTIFIED BY CGWA / SGWA: Nil

9.0 RECOMMENDATION:

West Siang district of Arunachal Pradesh covers a geographical area of 7643 sq. km. and 99% of the area is hilly. Rest 1% area covers intermontane valleys and foot hill belt bordering Assam. In the hilly part, springs are the only and major source for domestic water supply. Therefore springs should be developed by cleaning flow path and construction of collector tanks nearby. Regular cleaning of collector tank and periodic water quality testing, specifically bacteriological test is needed. In the rainy days, often landslide or mass movement disrupt the water supply pipe lines. In the hilly terrain, where there is such type of problem and no other source of water is available nearby, roof top rain water harvesting will play a vital role. Roof top rain water harvesting not only curtail the dependence on spring or stream water supply but also it will make a sustainable water supply system for individual house owner at least for the rainy days. A number of valleys present in the district where resistivity survey need to be done for delineating bedrock topography and thickness of saturated granular zones for construction of tube wells.

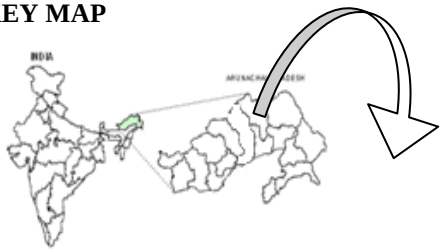
Moreover, construction of large diameter dug wells of 1.5 to 2m diameter and 6 to 8 m depth is also recommended.

Water supply in the show-bound areas (permafrost region) can be developed by locating water-bearing taliks in interpermafrost and interpermafrost features.

In the piedmont zone, tube wells of at least 60 m deep are recommended at two sites, 2 km South East and 1.5 km South West of Likabali Township. The tube wells are expected to yield 20 to 35m^3 / hour for a drawdown of 4 to 6m. For presence of boulder, percursion rig should be deptied. Iron treatment plant need to be constructed with each tube well for presence of high iron in the Ground Water as observed in Silapathar, Likabali area of Assam. Large diameter dug wells with 15 to 20 depth and 2 to 3 m diameter are also suggested in the piedmont plain area which are expected to yield 30 to 35 m^3 / hour.

ADMINISTRATIVE MAP OF WEST SIANG DISTRICT, A.P.

KEY MAP



N

C H I N A

U P P E R S I A N G D I S T R I C T

Monigong

Payum

Pidi

Mechuka

Taro

Kaying

U P P E R S I A N G
D I S T R I C T

Rumgong

Darak

Jomlu Mobuk

Liromoba

Along

Yomcha

Tirbin

Basar

L O W E R S U B A N S I R I
D I S T R I C T

Daring

Gensi

Likabali

Kongku

E A S T S I A N G D I S T R I C T

A S S A M

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State Boundary

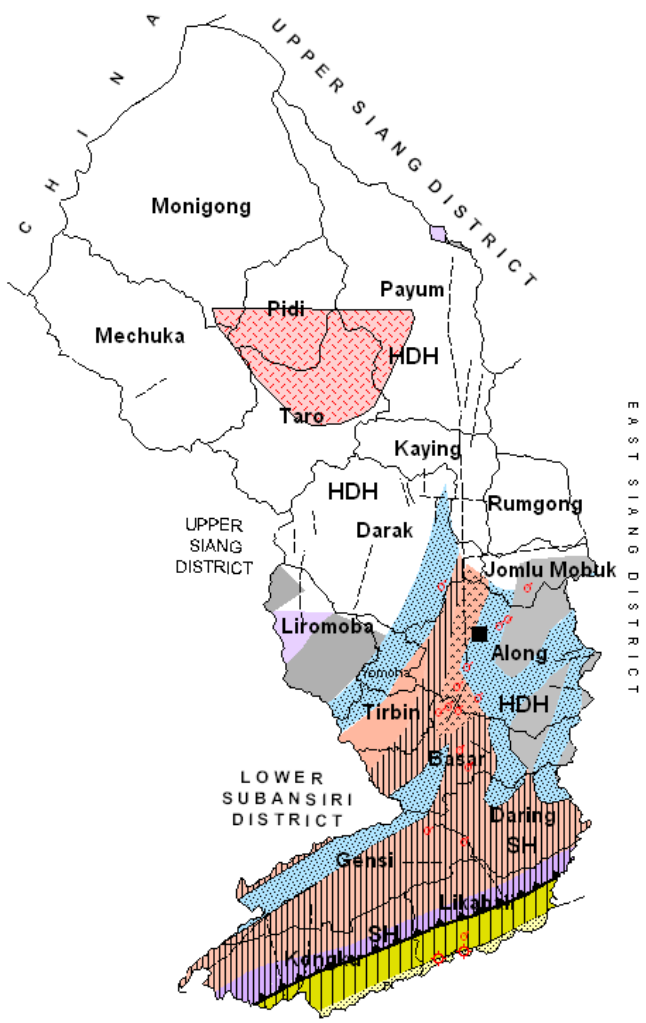
District Boundary

International Boundary

Circle Boundary

District H.Q.

HYDROGEOMORPHOLOGICAL MAP OF WEST SIANG DISTRICT, A.P.



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FORMATION/GROUP	AGE	GEOMORPHIC UNIT		
Alluvium	Recent -Pleistocene	Piedmont Alluvial Plain	PL	State Boundary
Undifferentiated Neogene and Pleistocene Continental Fm.	Mid. Miocene-Up. Pleistocene	Structural hills	SH	District Boundary
Lower Gondwana Fm.	Lower Palaeozoic			International Boundary
Abor volcanics	Middle Palaeozoic			Circle Boundary
Miri Fm.		Moderate denudo-structural hills	MDH	District H.Q.
Granodiorite	Permian-Carboniferous			Proposed Tube well site
Tenga Fm.	Lower Palaeozoic			Spring
Bomdila Gp.	Upper Proterozoic	High denudo-structural hills		Lineament
Sela Group	Archean			Thrust