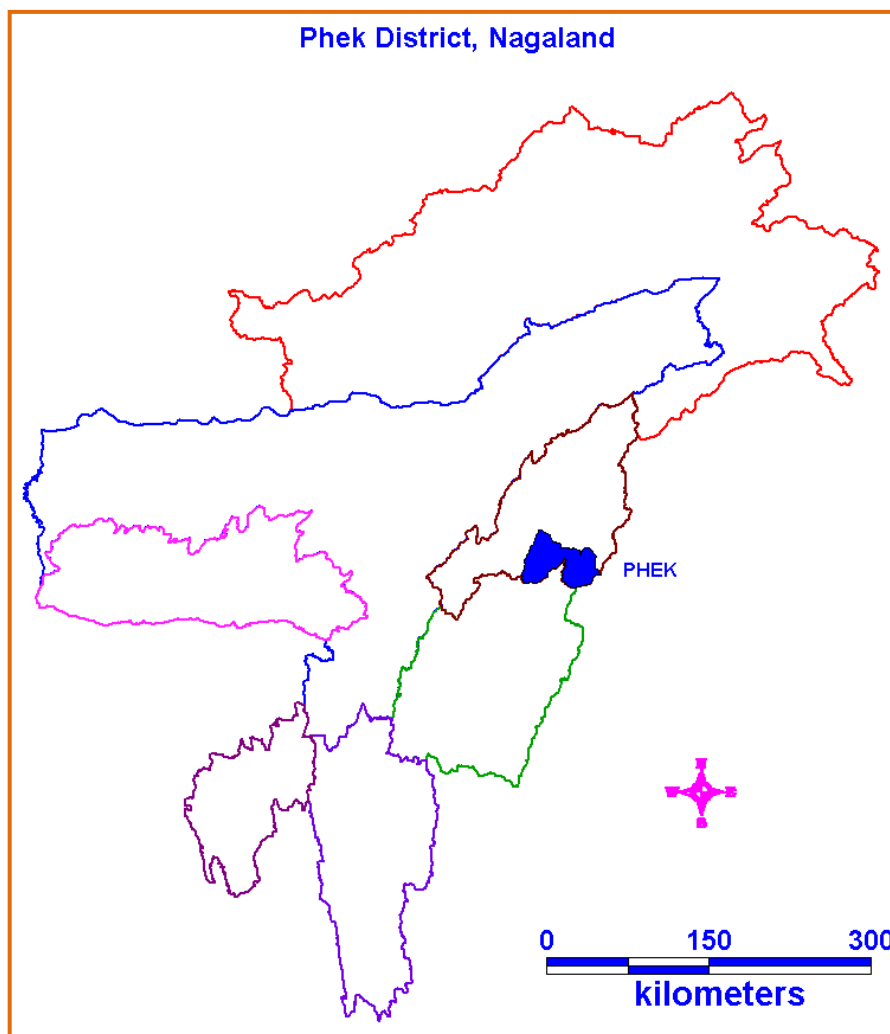




Ground Water Information Booklet

Phek District, Nagaland



Central Ground Water Board
North Eastern Region
Ministry of Water Resources
Guwahati
January 2009

**GROUND WATER INFORMATION BOOKLET
PHEK DISTRICT, NAGALAND**

DISTRICT AT AGLANCE

Sl. No.	ITEMS	STATISTICS
1	GENERAL INFORMATION	
	i) Geographical Area (sq.km.) a. Headquarters	2,026.00 Phek
	ii) Administrative Division (as on 2006) Number of Circle Number of RD Block Number of Villages	10 5 104
	iii) Population (as on 2001 Census) a. Rural b. Urban c.. Density (Person/sq.km) d. Sex Ratio (female per 1000 males)	1,48,246 1,35,383 12,863 73 923
	iv) Literacy (%) a. Male b. Female	71.35 78.97 63.08
	v) Climate a. Average Annual Rainfall (mm)	1,527
	2	GEOMORPHOLOGY i) Major Physiographic Units ii) Major Drainages
3	LAND USE (sq.km.) i) Forest Area ii) Gross Cropped area	565.89 455.00
4	MAJOR SOIL TYPES	Alluvial Soil, Non Laterite Red Soil, Forest Soil
5	IRRIGATION (2001 census) i) Net Irrigated area (Ha) ii) Gross Irrigated area (Ha)	15,450 17,400
7	PREDOMINANT GEOLOGICAL FORMATIONS	Semi-consolidated rocks of Tertiary age
8	HYDROGEOLOGY i) Major Water Bearing Formations	Semi consolidated formations of Tertiary rocks. Ground water occurs in the form of spring emanating through cracks/ fissures/ joints etc. available in the country rock.

9	<p>DYNAMIC GROUND WATER RESOURCES (2004) in ha m</p> <p>i) Annual Replenishable Ground Water Resources</p> <p>ii) Annual Ground Water Draft</p> <p>iii) Projected demand for Domestic and Industrial Use up to 2025</p> <p>iv) Stage of Ground Water Development</p>	<p>1,391.83</p> <p>45.17</p> <p>134.52</p> <p>3.25 %</p>
10	AWARENESS AND TRAINING ACTIVITY	Nil
11	<p>EFFORTS OF ARTIFICIAL RECHARGE AND RAINWATER HARVESTING</p> <p>i) Projects Completed by CGWB (No & amount spent)</p> <p>ii) Projects Under technical Guidance of CGWB (Numbers)</p>	Nil
12	<p>GROUND WATER CONTROL AND REGULATION</p> <p>i) Number of OE Blocks</p> <p>ii) Number of Critical Blocks</p> <p>iii) Number of Blocks Notified</p>	Nil

GROUND WATER INFORMATION BOOKLET PHEK DISTRICT, NAGALAND

1.0 Introduction

Phek district is located in the south-eastern part of Nagaland. It is bounded between $94^{\circ} 11'$ & 95° East Longitudes and $25^{\circ}28'$ & 26° North Latitudes. The name of the district headquarters is also Phek. The district is bounded by Myanmar in the East, Zunheboto and Tuensang districts in the North, Manipur state in the South and Kohima district in the West. The name Phek is derived from the word "Phekrekedze" meaning watch tower. On December 21, 1973, it was made a separate district, carved out of Kohima district. The main tribes of the district are "Chakhesangs" and "Pochurys."

Phek is blessed with evergreen sub-tropical and temperate coniferous forest which supports a variety of flora and fauna. There is a good reserve of limestone found at Wazeho. Crystalline limestone is also found in Moke and Satuza. Some other minor deposits in the district are Iron, Chromium, Nickel, Cobalt, Copper, Molybdenum, Chromite, Magnesite, Asbestos, Talc, Marble etc.

Summer is moderately warm and winter is cold. Monsoon sets in by the last week of May and retreats by the end of September.

Agriculture is the main occupation with 80.84 % of the population engaged in agriculture. Terrace Rice Cultivation (TRC) is predominant. Besides agriculture, people engage in salt making (in Meluri area), weaving, bamboo and wood carving, and in making fruit juice.

As per 2001 census, the total population of the district is 1,48,246 having total rural and urban populations as 1,35,383 and 12,863 respectively with a population density of 73 persons per sq. km. Administratively, the district is divided into five R.D. Blocks. These are Kikruma, Pfutsero, Sekruzu, Phek and Meluri. As per the land use pattern, the gross cropped area is 45,500 ha with gross irrigated area of 17,400 ha and net irrigated area of 15,450 ha. The total forest area is 56,589 ha.

The district receives southwest monsoon with annual average rainfall of 1,527 mm. The rainfall spreads over about 9 months of the year with heavy downpour during the period from July to August. Winter, in this district, is cold and summer is mild.

Physiographically, the district is mostly occupied by NE-SW trending hill ranges, with limited intermontane valleys.

Numbers of perennial streams flow through the district. Some of the major rivers that flow through the district are Sekizu, Laniye Tizu Rivers and three important lakes are called Shilloi, Chida and Dzudu.

Geologically, the district is predominantly occupied by Tertiary rocks, comprising sandstone, shale, grit etc. The eastern part of the district is occupied by ultra basic and basic rocks comprising basalt, gabbro and granulitic rocks.

Ground water occurs under phreatic condition in the shallow aquifer zone and under semi-confined to confined condition in the deeper aquifer.

The present ground water utilization in the district is mainly for drinking water purposes. Practically, there is no ground water draft for irrigation purposes. The stage of ground water development in the district is 3.25 %.

2.0 Rainfall and Climate

The district enjoys a humid sub-tropical climate. The annual average rainfall of the district is 1527 mm. The maximum rainfall occurs during the months of June and July. Rainfall generally begins from April and continues till the end of September. Annual rainfall recorded during 1998 to 2006 is presented as below.

Annual Rainfall and number of Rainy Days in Phek.

Year	Annual Rainfall (mm)	No. of Rainy days
1998	1393.0	129
1999	1714.9	134
2000	1625.3	156
2001	1380.8	162
2002	1529.4	145
2003	1560.5	190
2004	1836.8	175
2005	1503.4	175
2006	1198.8	132
Average	1526.99	155.33

The area enjoys a cold winter and mild summer. January and February are the coldest months when the night temperature comes down to around 0°C. In summer also, it is not at all hot, rather it is cold in comparison to the adjoining plains of

Assam. During summer also, the temperature does not rise beyond 32°C and the average summer temperature is 27°C.

3.0 Physiography and Drainage

The district is mostly occupied by hill ranges. Physiographically, the district can be divided into two distinct geomorphic units.²

1. High Hill Ranges
2. Intermontane Valleys

Entire district is occupied by NW- SE trending hill ranges and in between there are intermontane valleys. Zanibu is the highest mountain in the district which is more than 2,400 m above mean sea level (AMSL). Average altitude is 1,524 m AMSL.

4.0 Ground Water Scenario

4.1 Hydrogeology

Hydrogeologically, the area is underlain by unconsolidated and semi-consolidated formations ranging in age from Upper Cretaceous to Recent.

Disang Formation comprising shale and sandstone and Barail Formation comprising bedded fine to medium grained compact sandstone. In these Formations, ground water is restricted to only weathered mantles and fractures. Basically, most of the area being hilly, it acts as run-off zone. At places, ground water emanates as springs.

In between the hill ranges, there are a number of intermontane valleys. These valleys are underlain by assorted and discontinuous aquifers. Ground water yield prospect is low to moderate (10-20 m³/hr).

4.2 Ground Water Resources

Ground water resource of the district has been estimated by Central Ground Water Board, North Eastern Region based on GEC'97. Due to lack of ground water structures, resource estimation was carried out based on Rainfall Infiltration Factor Method.

The area suitable for ground water recharge has been worked out by excluding the areas with more than 20% slope. Out of a total district area of 2,026 sq.km, only 109 sq.km area was taken as area suitable for ground water recharge. Though, there is

ground water recharge, the possibility of ground water extraction is very limited, owing to its hilly terrain; difficult accessibility and fine nature of the most of the aquifer material. The detail of estimated ground water recharge through rainfall is given as follows.

**Table 1 Ground Water Resource potential of Phek District as on 31st March, 2004
(in ha m)**

Rainfall Recharge during monsoon season	Recharge from other sources during monsoon season	Recharge from Rainfall during non-monsoon season	Recharge from other sources during non-monsoon season	Total Annual Ground Water Recharge	Natural Discharge during non-monsoon season	Net Annual Ground Water Availability
1177.58	0	368.90	0	1546.48	154.65	1391.83

**Table 2 Stage of Ground Water Development
(in ha m)**

Net Annual Ground Water Availability	Existing Gross Ground Water Draft for Irrigation	Existing Gross Ground Water Draft for Domestic & Industrial	Existing Gross Ground Water Draft for all uses	Allocation domestic & industrial requirement supply upto 2025	Net annual ground water availability for future irrigation development	Stage of Ground Water Development (%)
1391.83	0	45.17	45.17	134.52	1257.31	3.25

The estimated gross annual dynamic groundwater resource is 1,546.48 ha m while net ground water resource is 1,391.83 ha m. Future provision for domestic and industrial use is 134.52 ha m. The net resource available for future irrigation is 1,257.31 ha m.

Phek district is under the **SAFE** category.

4.4 Status of Ground Water Development

As on date practically, there is no ground water development in the district. Ground water extraction is also difficult. Most of the district area being hilly with high slope, the rainfall infiltration is very limited. Though, there is a good amount of rainfall in the area, most of it goes out as surface run-off. In this type of hilly terrain, the scope for ground water storage is limited to mostly secondary porosity developed due to structural features like fractures and faults etc. Ground water emanates in the form of springs which is the only source of water for drinking.

As there is little use for irrigation in this district, ground water is mainly used for drinking purposes. People of the area mostly practise Jhum cultivation due to hilly terrain, spatial variation of rainfall, nature of soil, non-availability of irrigation.

5.0 Ground Water Management Strategy

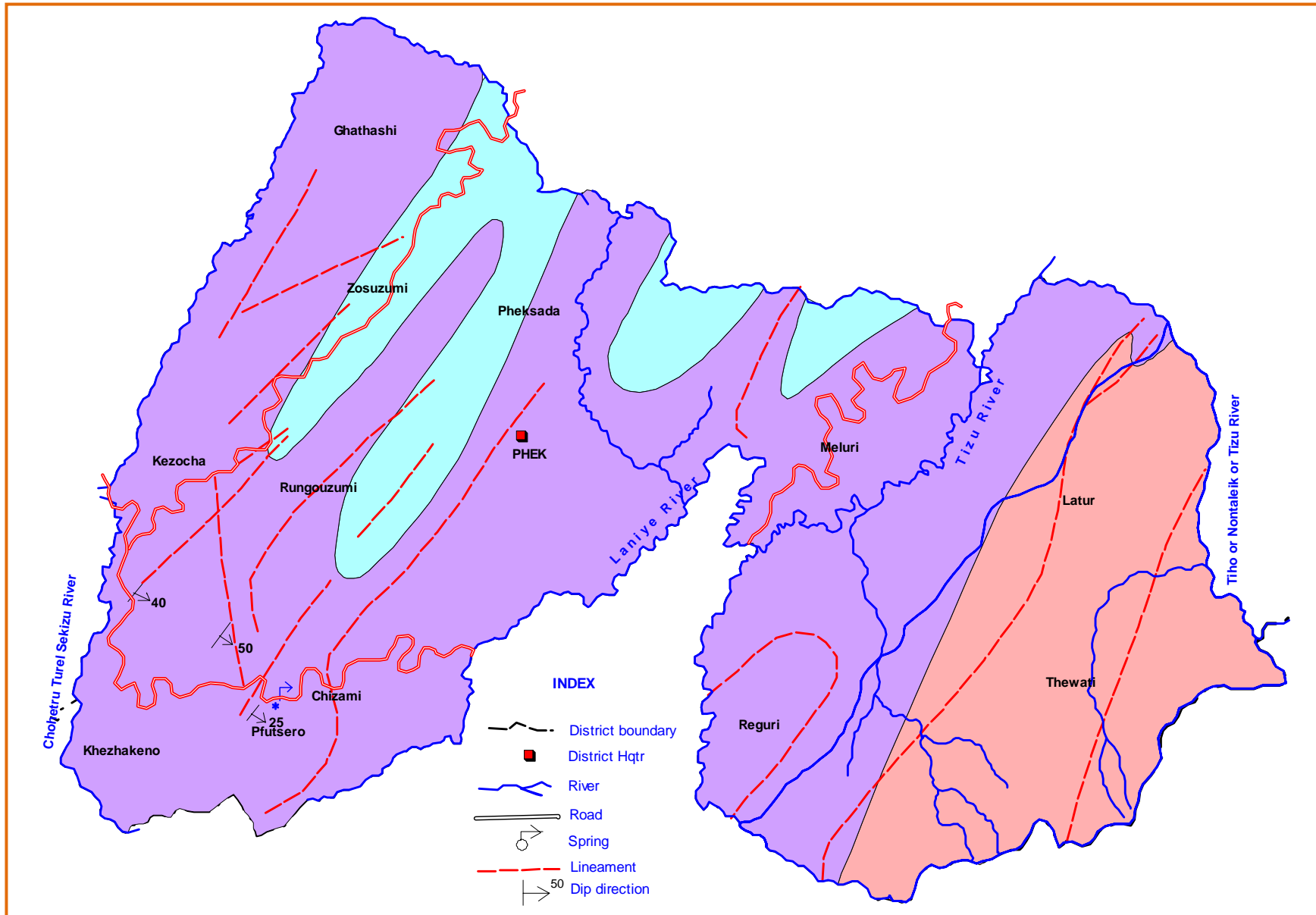
Ground water survey carried out in the district reveals that there is little scope for ground water development. However, detailed investigation has to be carried out in the area to assess the ground water resources, especially in the intermontane valleys. Accessibility is the main hindrance for the ground water exploration in the area. Only suitable source is springs. There are many perennial springs in the hills of this district. These springs can be scientifically developed for both drinking and local irrigation purposes. Suitable artificial recharge structures viz. Nala bund, Gabion structures, Contour bunding may be constructed for both irrigation and recharge to ground water.

6.0 Recommendations

Existing hydrogeological set up indicates the limited ground water development prospects in the linear intermontane valleys and foot-hill areas. Though, the valleys are underlain by shale, siltstone and sandstone; the intercalated sandstone layers may be productive for construction of shallow ground water structures. Thus, ring well with 2-3 m diameter and 10-15 m depth below ground level may be constructed in the suitable locations. These wells may be constructed with half baked bricks keeping weep holes.

In the major part of the district, perennial springs are the main sources for water supply to the local population. The spring should be properly developed and protected wherever they are used for domestic purposes. Some of the spring waters in lower altitudes can be impounded in some structures and pumped again to supply water.




HYDROGEOMORPHOLOGY OF PHEK DISTRICT, NAGALAND



LEGEND

AGE	FORMATION	LITHOLOGY	AQUIFER DISPOSITION	GROUND WATER POTENTIAL
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~~~~~ Unconformity ~~~~~

|                                                                                     |                                        |                                    |                                                                                                                                                                                               |                                                           |                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------|----------------------------------------|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | UPPER EOCENE<br>TO OLIGOCENE           | BARAIL                             | Denudo-structural hills, long linear ridges and highly dissected round to flat topped hills consisting of bedded compact, fine to medium grained sandstone mostly less susceptible to erosion | Ground water restricted to weathered mantle and fractures | Run-off zone, ground water occurs as springs. Infiltration to ground water is controlled by development of secondary porosity in rocks caused due to action of tectonic elements. |
|    | UPPER<br>CRETACEOUS –<br>MIDDLE EOCENE | DISANG                             | High structural hills, linear, curvi-linear and at places irregular hill ranges and narrow inter-montane valleys consisting of shale and sandstone.                                           |                                                           |                                                                                                                                                                                   |
|  | PRE-<br>CRETACEOUS                     | ULTRA<br>BASIC /<br>BASIC<br>ROCKS | Irregular moderate to high hill range consisting mostly of basalt, gabbro and granulitic rocks. The phyllite, serpentinite are also common.                                                   |                                                           |                                                                                                                                                                                   |