Series-E

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भारत सरकार

Government of India

जल संसाधन मंत्रालय

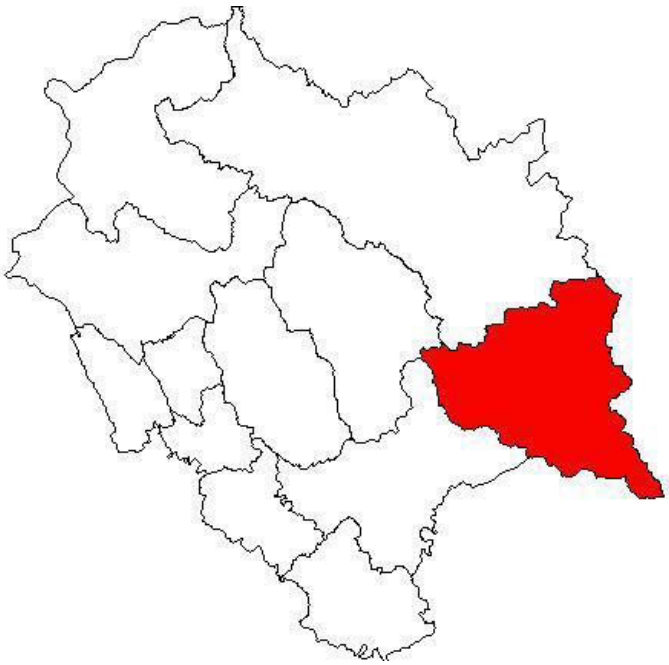
Ministry of Water Resources

केंद्रीय भूमि जल बोर्ड

CENTRAL GROUND WATER BOARD

GROUND WATER INFORMATION BOOKLET

KINNAUR DISTRICT, HIMACHAL PRADESH



उतरी हिमालय क्षेत्र

NORTHERN HIMALAYAN REGION

धर्मशाला

DHARAMSALA

सितम्बर, 2013

September, 2013

जल संरक्षण वर्ष 2013

स्वच्छ सुरक्षित जल – सुन्दर खुशहाल कल

CONSERVE WATER - SAVE LIFE

GROUND WATER INFORMATION BOOKLET
Kinnaur District, Himachal Pradesh

CONTENTS

KINNAUR DISTRICT AT A GLANCE

Sl. No	*ITEMS*	*Statistics*
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	6401
	ii) Administrative Divisions (2001) • Number of Tehsil & Sub-tehsils • Number of CD Blocks • Number of Panchayats • Number of Villages	 5 & 1 3 65 660
	iii) Population (2011 Census) • Total population • Population Density (pers/sq km) • Rural & Urban Population • SC & ST Population (in percent) • Sex Ratio	 84,121 persons 13 100 % & 0 % 17.5 % & 58 % 819
	iv) Average Annual Rainfall (mm)	816 mm
2.	GEOMORPHOLOGY	
	Major Physiographic units	• High Hill Ranges • Valleys
	General Altitude Range	1500 to >6000 m amsl
	Major Drainages • Satluj Basin • Ganga Basin	 Baspa R., Spiti R. Bhaba R. Chor Khad.
3.	LAND USE (2003-04) sq.km	
	• Forest area • Cultivated Area • Net area sown	1,754 104 857
4.	MAJOR SOIL TYPES	• Mountainous Soil • Sub-Mountainous Soil
5.	IRRIGATION BY DIFFERENT SOURCES (MI census 2000-02) (sq km)	
	Dug wells & shallow TW Surface Flow Irrigation Schemes Surface Flow Irrigation Schemes Tanks	*No/Scheme* / *Area (sq km)* Nil / Nil 235 / 77.86 Nil / Nil Nil / Nil
6.	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31.3.2013) • No. of Dug Wells • No. of Piezometers	 Nil Nil

7.	PREDOMINANT GEOLOGICAL FORMATIONS	• Alluvium • Older Crystalline / Sedimentary / Metamorphic rocks
8.	HYDROGEOLOGY	
	Major Water Bearing Formations	
	1. Consolidated sediments / Hard Rocks (Older crystalline & Metamorphics)	Covering major part
	• Yield prospects • GW structures	Low (<5 lps) Handpumps & Springs
	2. Unconsolidated / Semi-consolidated sediments	Valley areas
	• Yield prospects • GW structures	Moderate to High (5-15 lps) Handpumps & Springs
	Avg. Depth to water level (shallow bore well)	10-30 m bgl
9.	GROUND WATER EXPLORATION BY CGWB (As on 31.3.2013)	
	• No of wells drilled	Nil
	• Depth Range (m)	--
	• Discharge (lps)	--
	• Transmissivity (m^2/day)	--
10.	GROUND WATER QUALITY	
	Presence of Chemical constituents more than permissible limits (eg. EC, F, As, Fe)	Nil
11.	DYNAMIC GROUND WATER RESOURCES (2011)	Not estimated due to localized aquifers.
12.	AWARENESS AND TRAINING ACTIVITY	
	Mass Awareness Programmes • Place / Date / No of participants	Nil
	• Water Management Training Programmes	Nil
	• Place / Date / No of participants	Nil
13.	EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING	Nil
14.	GROUND WATER CONTROL AND REGULATION	
	Number of OE Blocks	Nil
	No of Critical Blocks	Nil
	No of blocks notified	Nil
15.	MAJOR GROUND WATER PROBLEMS AND ISSUES	1. Water scarcity in low rainfall area. 2. Effects of various hydroelectric projects on traditional sources.

GROUND WATER INFORMATION BOOKLET
KINNAUR DISTRICT, HIMACHAL PRADESH

1.0 INTRODUCTION

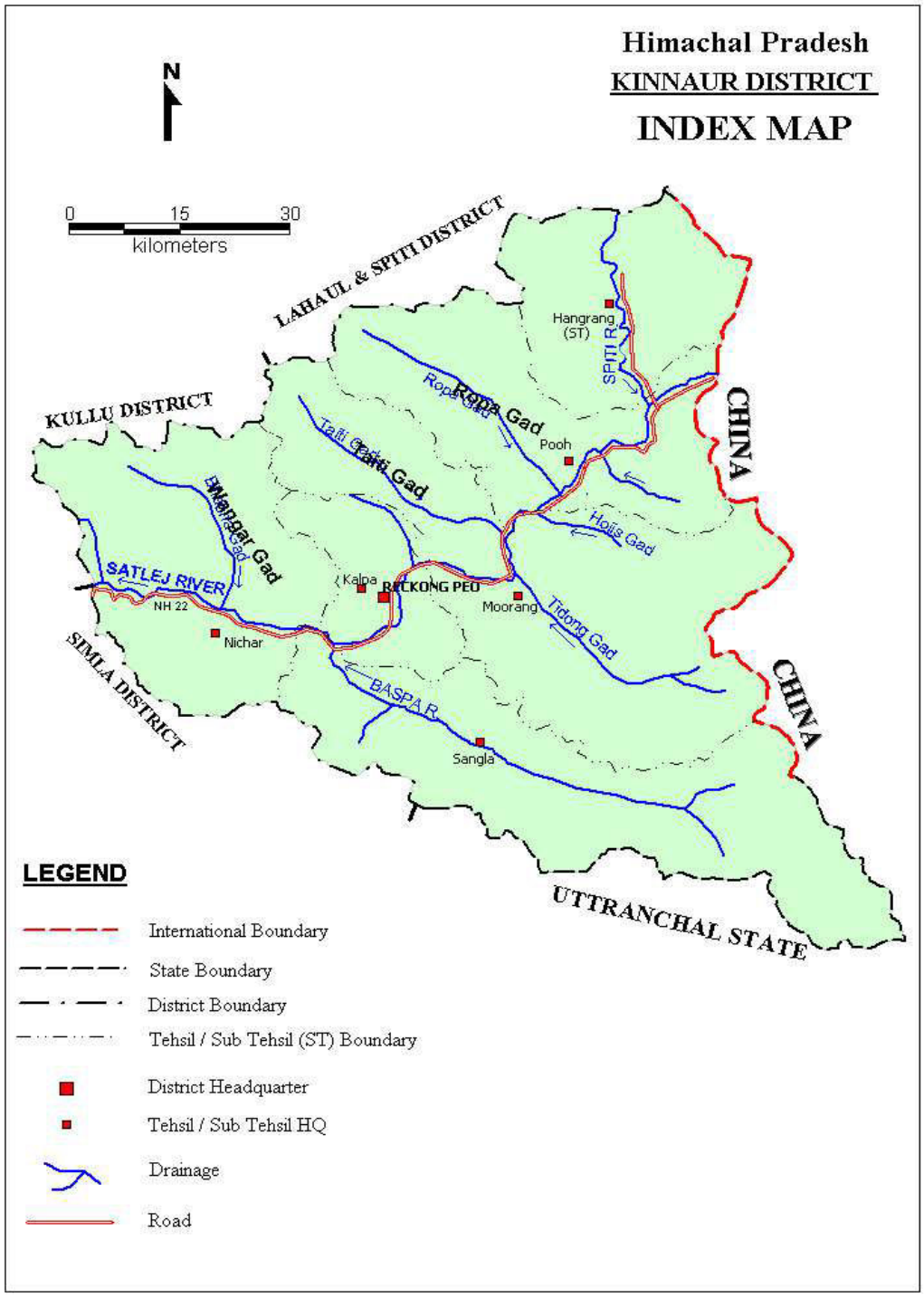
Kinnaur district is located in eastern part of Himachal Pradesh. The district is entirely hilly except few small, deep valleys in between. The district, with its headquarter at Recong Peo, lies between 31° 06' & 32° 06' North latitudes and 77° 45'& 79° 00' East longitudes. The district is covered by Survey of India degree-sheet no 53I, 53E and 52L. The district is bounded by Lahaul & Spiti district in the north, Tibet (China) in the east, Uttranchal State in the south, Shimla in the southwestern part and Kulu in the northwest.

The district has a total geographical area of 6,401 sq km, covers 11.5 % area of the State and ranks 3rd in the State. The district is divided into five tehsils and one sub-tehsil. The five tehsils are Nichar, Kapla, Sangla, Pooh and Moorang. The only sub-tehsil in the district is Hangrang. There are 660 villages in the district, of which 234 villages are inhabited and 426 are uninhabited. For development purpose, the district has been subdivided into 3 Community Development Blocks viz. Nichar, Kalpa and Pooh.

As per 2011 census, the district has a population of 84,121 persons with population density of 13 persons per sq. km. Population wise it ranks 11th in the State. The district is having 100% rural population. The sex ratio of the district is 819. The schedule cast population in the district is 17.5 % and the schedule tribe population is 58 %.

The major sources of irritation are small water channels or the K*uhls,* in the district and an area of 77.86 sq km is brought under irrigation by surface water sources like, major khads and nallahs. A sizeable part of the cultivated area of the district, is not having assured irrigation facilities and the agriculturists have to depend on the vagaries of weather. Under various plans, the construction of kuhls and lift irrigation schemes are being taken up in the district.

CGWB has carried out hydrogeological studies, both by conventional and non-conventional methods in the district. The area has not been covered so far either, under Ground water exploration programme or under the ground water regime monitoring.


Himachal Pradesh
KINNAUR DISTRICT
INDEX MAP
N
0
15
30
kilometers
LAHAUL & SPITI DISTRICT
KULLU DISTRICT
SIMLA DISTRICT
UTTRANCHAL STATE
CHINA
CHINA
Hangrang (ST)
SPITI R.
Ropa Gad
Pooh
Taili Gad
Hoilo Gad
Wangar Gad
SATLEJ RIVER
NH 22
Kalpa
RECKONG PEO
Moorang
Tidong Gad
Nichar
BASPA R.
Sangla
LEGEND
International Boundary
State Boundary
District Boundary
Tehsil / Sub Tehsil (ST) Boundary
District Headquarter
Tehsil / Sub Tehsil HQ
Drainage
Road

2.0 CLIMATE & RAINFALL

The variance of climate, is as varied as the area. One experiences change, from the heat of the tropical zone, almost to the freezing temperature of a lowland winter. In the outer Himalayas, which is partly under the influence of the periodical rain, the temperature is much more uniform than in the interior, where, the summer is sultry and the winter extremely cold at elevation of from 8000 to 10,000 feet, in favorable situations, such as Chango, Leo, and Moorang the temperature of July and August is 20° to 22° C and in October temperature is about 10° C. At and elevation of 12,000 feet the summer temperature is between 13° C to 18° C and in October it is 3° to 4°C. In summers it is fairly warm in lower hills. The winter is often rigorous, and in some parts people do not venture out of their homes because of heavy snow. The mean monthly temperature, varies from 5° C to 23° C.

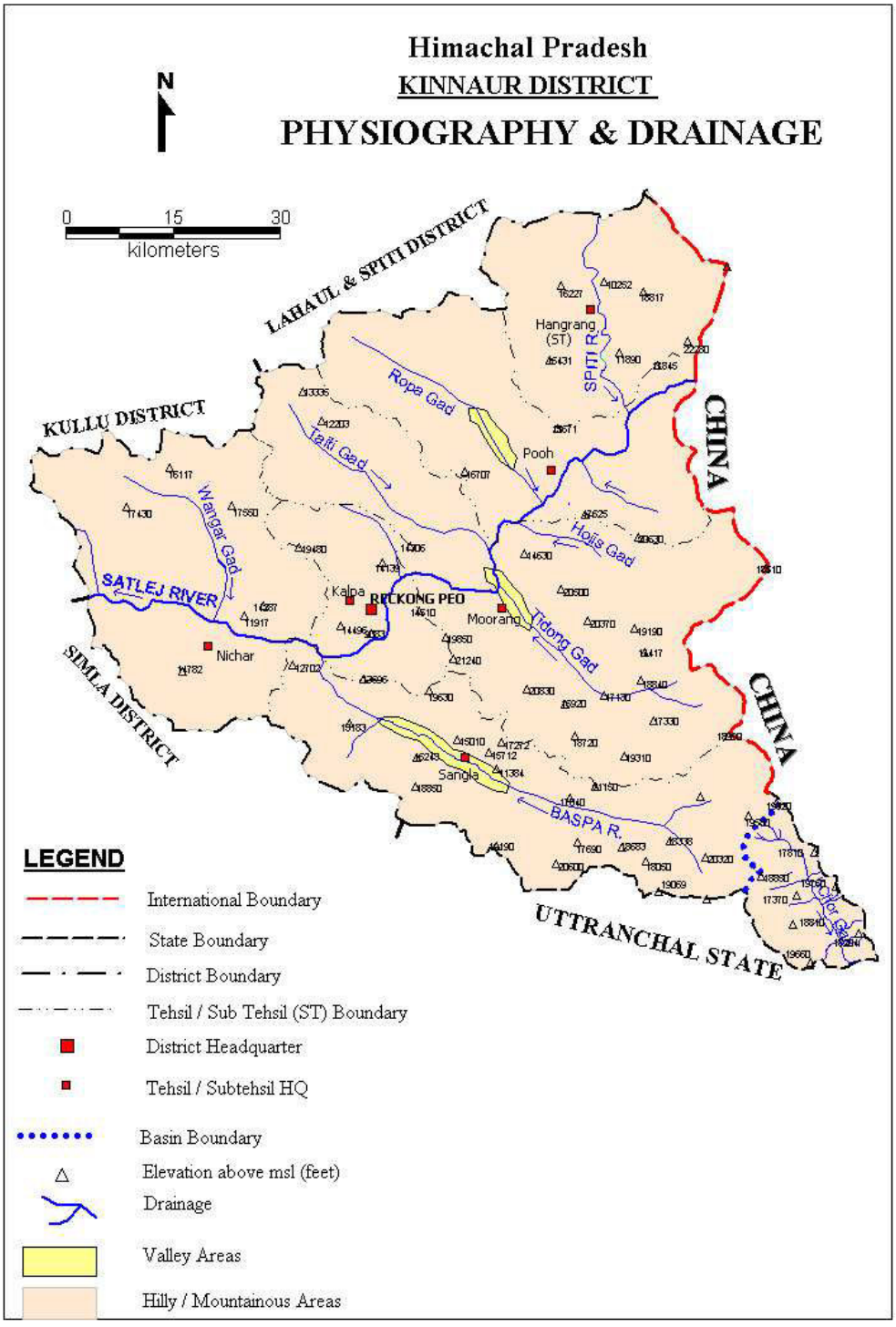
The district receives rainfall from the month of June till September. The marginal shift in the monsoon pattern has ben noticed over the period of years. The average annual rainfall in the district is 816 mm. However much of the rainfall is received in parts of lower Kinnaur. There is a progressive decrease in rainfall as one goes from west to east. The parts of upper Kinnaur receive more snowfall than the rainfall.

The district receives heavy snowfall from November end or early December till March or sometimes April. During this period, the area remains totally cutoff from rest of the area. The higher peaks of Kinnaur district are completely covered with snow throughout the year.

3.0 GEOMORPHOLOGY & SOIL TYPES

Kinnaur district presents an intricate mosaic of mountain ranges, hills and deep valleys. It is primarily a hilly district, with altitudes ranging from 1,500 m to more than 6,500 m asl. There is a general increase in elevation, from west to east and from south to north. Master slope is south-westerly. The drainage system of the district forms a part of the Indus River basin, except a small part in the northeastern area, which is apart of the Ganga River system. Geomorphologically, the district has been sub divided into the fluvial terrain, fluvio-glacial terrain, Alpines / meadows and Rocky terrain

Taking into consideration, the morphological and physio-chemical characteristics of the soils and general similarity in them, the various types of soils observed in the district can be grouped into three major types viz Type-I, Type-II& Type-III. ***Type-I*** soil is coarse loamy, mixed in nature. The soil is developed from granites, highly metamorphosed gneisses, schists and occurs on moderately sloping to steep lands. These soils are well drained, with moderately rapid permeability. Natural vegetation exists in these soils and various crops are cultivated according to the suitability.


Himachal Pradesh
KINNAUR DISTRICT
PHYSIOGRAPHY & DRAINAGE
N
0
15
30
kilometers
LAHAUL & SPITI DISTRICT
KULLU DISTRICT
SIMLA DISTRICT
UTTRANCHAL STATE
CHINA
CHINA
Hangrang (ST)
SPITI R.
Rope Gad
Talli Gad
Pooh
Wangar Gad
SATLEJ RIVER
Kalpa
RECKONG PEO
Moorang
Nichar
Hoijs Gad
Tidong Gad
Sangla
BASPA R.
LEGEND
International Boundary
State Boundary
District Boundary
Tehsil / Sub Tehsil (ST) Boundary
District Headquarter
Tehsil / Subtehsil HQ
Basin Boundary
Elevation above msl (feet)
Drainage
Valley Areas
Hilly / Mountainous Areas

Type-II soil is fine loamy, mixed, frigid in nature. They have developed on parent material consisting of granite-gneiss and mica schists, on steep to very steep slopes at an altitude of >3000 m amsl. These are grazing lands supporting alpine grasses. ***Type- III soil*** *includes various series like Sangla, Spilo, Kalpa, Leo, Rocky I, Rcky II and Scree series.*

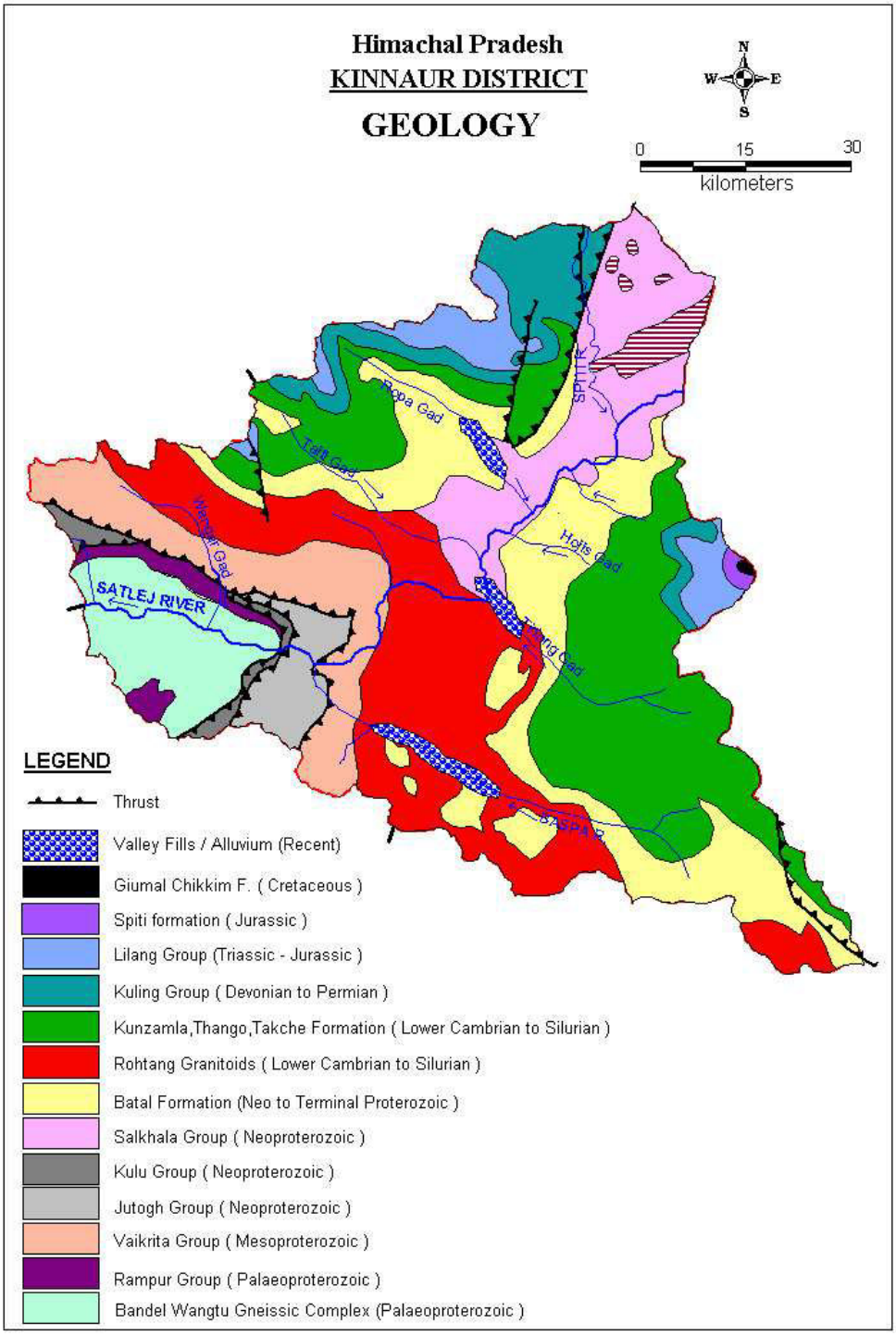
4.0 GROUND WATER SCENARIO

4.1 Hydrogeology

The rock formations occupying the district range from pre-Cambrian to Quaternary period. The generalized geological succession in the district is given below

Age / Period	*Group / formation*	*Lithology*
Quaternary	Alluvium, Terrace & Fluvial deposits	Alluvium, clay, sand, gravel, pebbles, boulders and cobbles
Tertiary	Nako Granitoid	Granitoids
Mesozoic	Giumal – Chikkim Spiti formation, Lilang Group	Shales Sandstone, Siltstone Carbonate rich sedimentary rocks
Palaeozoic	Kuling Group Kunzamla, Thango, Takche formation	Sandstones, shales, conglomerates
Proterozoic	Batal formation Salkhala, Kulu, Jutogh Vaikrita, Rampur Group, Bandal Wangtu Gneissic Complex	Slates, phyllites, quartzites and schists, Amphibolites, Gneisses, granites, Pegmatites

The hydrogeological framework of the district is essentially controlled by geological setting, distribution of rainfall / snowfall and movement of water through inter-connected primary and secondary porosities of the geological formations, constituting the aquifers. Based on the geological diversities and relative ground water potentialities of different geological formations, the district can be divided broadly into two hydrogeological units viz. ***Porous Formations*** comprising unconsolidated sediments and the ***Fissured Formations*** comprising hard rocks.


Himachal Pradesh
KINNAUR DISTRICT
GEOLOGY
N
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kilometers
SATLEJ RIVER
LEGEND
Thrust
Valley Fills / Alluvium (Recent)
Giumal Chikkim F. (Cretaceous)
Spiti formation (Jurassic)
Lilang Group (Triassic - Jurassic)
Kuling Group (Devonian to Permian)
Kunzamla,Thango,Takche Formation (Lower Cambrian to Silurian)
Rohtang Granitoids (Lower Cambrian to Silurian)
Batal Formation (Neo to Terminal Proterozoic)
Salkhala Group (Neoproterozoic)
Kulu Group (Neoproterozoic)
Jutogh Group (Neoproterozoic)
Vaikrita Group (Mesoproterozoic)
Rampur Group (Palaeoproterozoic)
Bandel Wangtu Gneissic Complex (Palaeoproterozoic)

The ***Porous Formations*** comprise of quaternary sediments. These sediments are fluviatile deposits, occurring along the Baspa River, Ropa Gad, Taiti Gad, Wenger Gad, Tidong Gad in the lower reaches and in the upper reaches generally underlain by glacio-fluviatile deposits. These are deposited as narrow elongated stripes, valley fills within the hard rock terrain. These form a potential aquifers. The thickness of these deposits, may be more along the soft rock formations or in structurally weak zones. Along the Baspa River in Sangla valley, about 40 sq.km and along Ropa River valley, 7 sq. km area is ground water worthy, with expected thickness of 20 to 30 m below Riverbed. However, there are other numerous isolated small valley fills, which are also ground water worthy.

Fissured formations are constituted by hard rock formations, belonging to crystalline rocks. Jutogh / Vaikritas Rampur group, Giumal and Chikkim formations. These rock formations consist of granites, gneisses, slates, pegmatites, phyllites, schists, quartzites, limestones, sandstone, shales, conglomerates and boulder beds. These rocks are generally, massive and devoid of primary porosity. However, due to the tectonic activities, secondary porosity has developed along fracture / joints and fault zones. Weathered zone, rarely form an aquifer because of the little thickness of the weathered mantle, due to the topographical slope in the area.

In hard rock terrain in district Kinnaur, the ground water is distributed either along structurally weak / fractured zones, faults and land slides zones or along the contacts of the different rock formation in the topographically favorable areas. In the Satluj River valley, the areas around Taranda, Tapri, between Oling and Lipa, Moorang and Tabling are most promising for Exploration. The other ground water potential areas are along Baspa River, Tidong Gad, Taiti Gad and Spiti River. The occurrence of the large numbers of springs in these zones, are indicative of existence of these zones.

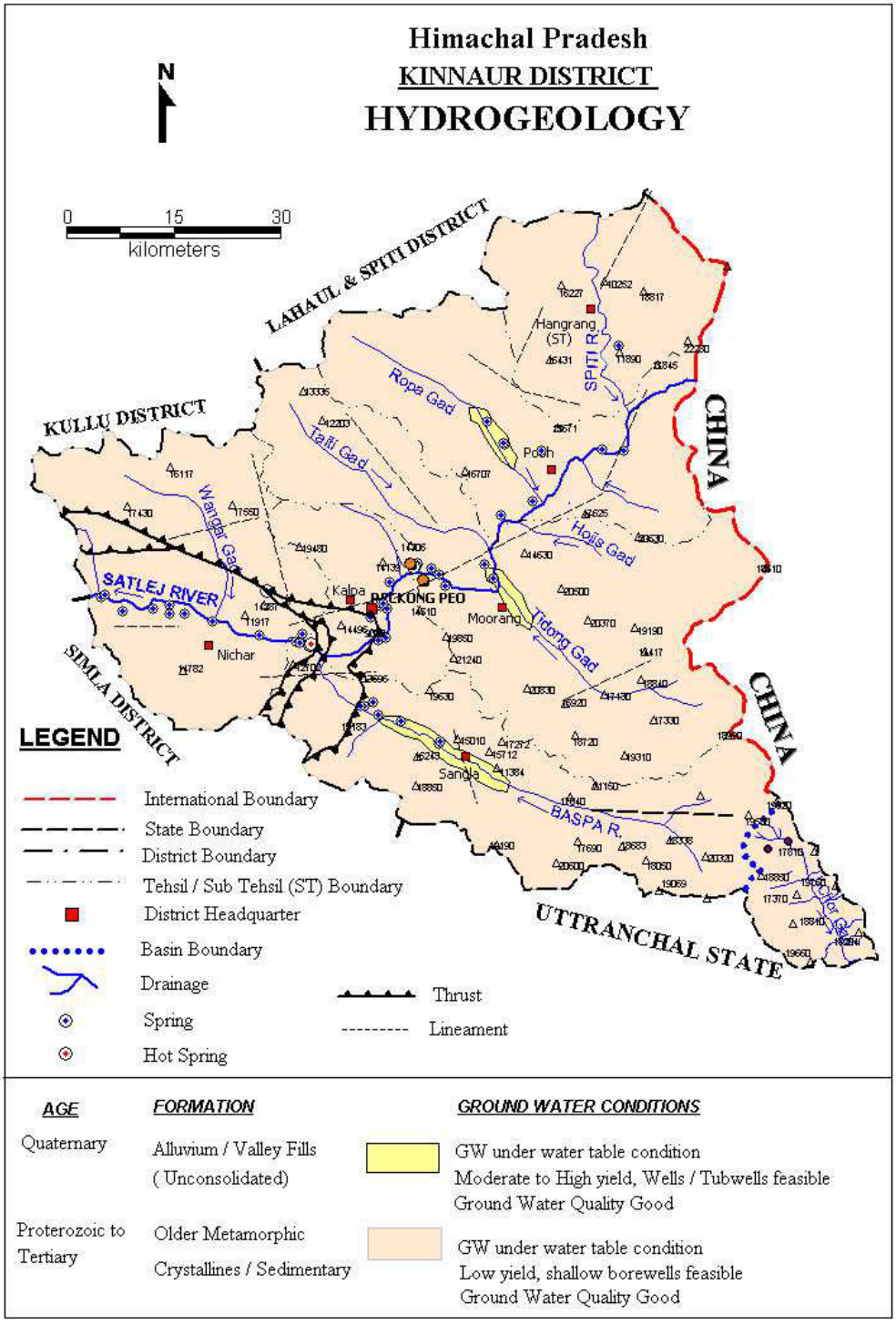
4.2 Ground Water Resources

Rainfall is the major source of groundwater recharge, apart from the influent seepage from the rivers, irrigated fields and inflow from upland areas, whereas, discharge from ground water mainly takes place from effluent seepages of ground water, in the form of springs and base flow in streams etc.

The district has a hilly terrain, having very high slopes. The valley areas are deep, narrow and isolated. The area therefore is not considered for estimation of the ground water resources, being discontinuous aquifers.

4.3 Ground Water Quality

National Hydrograph Network Stations have not been established in the district so far. However, the water samples were collected form various sources like spring and handpumps during the various hydrogeological studies, which reveal that revels that the overall ground water quality is good and is suitable for all type of uses.


Himachal Pradesh
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BASPA R.
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International Boundary
State Boundary
District Boundary
Tehsil / Sub Tehsil (ST) Boundary
District Headquarter
Basin Boundary
Drainage
Spring
Hot Spring
Thrust
Lineament
AGE
FORMATION
GROUND WATER CONDITIONS
Quaternary
Alluvium / Valley Fills
(Unconsolidated)
GW under water table condition
Moderate to High yield, Wells / Tubwells feasible
Ground Water Quality Good
Proterozoic to Tertiary
Older Metamorphic
Crystallines / Sedimentary
GW under water table condition
Low yield, shallow borewells feasible
Ground Water Quality Good

S. No	*Parameter*		*Range*	
			Min	*Max*
1.	pH		6.95	7.75
2.	EC	µS/cm	127	672
3.	Cl	(mg/l)	7.1	18
4.	NO_3	(mg/l)	1	10
5.	Ca	(mg/l)	18	93
6.	Mg	(mg/l)	3.6	25
7.	Na	(mg/l)	3.5	11
8.	K	(mg/l)	0.31	10
9.	TH as $CaCO_3$	(mg/l)	69	338

The pH of shallow ground water, ranges from minimum of 6.95 to maximum of 7.75. The EC ranges from 127 to 672. The EC values are less than 1000 and hence good for domestic and irrigational use. However, quality of water from hot springs in Karcham is brackish with EC 1780 µS/cm and fluoride concentration 3.5 mg/l. There is an urgent need to have proper water quality monitoring & checks on regular basis.

4.4 Status of Ground Water Development

The entire demand for domestic and irrigational use, is fulfilled by means of either spring or nallah sources. Most of these sources are perennial, with low to moderate seasonal fluctuation. Such sources, are tapped by the irrigation department for its further use.

So far ground water exploration has not been carried out by CGWB in Kinnaur district because of difficulty in transporting the heavy machinery. However, Irrigation department of the State has drilled number of shallow bore wells, fitted with handpump in various parts of the district for domestic use. The depth of these bore wells, ranges between 100 to 120 feet. At places, where the discharge is sufficient, depending upon the need, they are energized. These handpumps are installed in hardrocks, hilly terrain and also along river valleys. Tubewells are absent in all these valleys. In future, the areas of Sangla and Ropa valley, can be taken up for ground water exploration.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Ground Water Development

The district being hilly and mountainous, traditional sources of ground water, mainly springs, has played a major role since past in providing assured irrigation and water supply. These include, the nallas and springs. In some areas, even at present these are the only sources of water of the settlements. However, modern means for tapping ground water have been employed in recent years.

LEGEND

	Wells feasible	Rigs suitable	Depth of Well (m)	Discharge (lpm)	Suitable artificial Recharge structures
Soft rock aquifers	Tube well Dug well	DTH with Odex Manual	100-150 10-20	1200-2500 300-500	Check dam, Check dam cum ground water dam, Recharge shaft
Hard rock aquifers	Dug well Spring development	Manual	10-20	300-500 30-2000	
Hot water spring (40^0C) Spring			Fault/Lineament		
Major drainage			Tehsil boundary District boundary State boundary International boundary		

During the last 15-20 years, Irrigation and Public Health Department has constructed number of small depth bore wells, fitted with handpumps in these areas. High hill ranges occupy more than 95 % of area of the district. During the past years, traditional ground water source has served the settlements. Ground water development on small scale is seen in the valley areas, particularly in the Baspa valley. Handpumps have been installed in these areas and are energized for water supply. There exists, a scope to explore the ground water potential in remaining low lying valley areas. The area of the district is feasible only for drilling shallow to medium depth bore wells.

5.2 Water Conservation & Artificial Recharge

Ground water extraction through springs and hand pumps are the major sources of water supply, but the availability of water during summer is limited particularly in lean periods and requires immediate attention to augment the ground water resource. Based upon the climatic conditions, topography, hydro-geology of the area, suitable structure for rain water harvesting and artificial recharge to ground water are required. Proper scientific intervention for spring development and revival is required in water scarce areas. In the hilly areas, roof top rainwater harvesting structures like storage tanks are recommended while in low hill ranges, check dam and roof top rainwater harvesting structures can be adopted.

6.0 GROUND WATER RELATED ISSUES & PROBLEMS

The district being hilly and mountainous, most of the rainfall goes waste as runoff. This has resulted in varying degree of recharge to the ground water. In such hard rock terrain, since the aquifers are discontinuous and of different geological/hydrogeological setup, the ground water scenarios are different in various parts of the districts.

Most of the ground water issues and problems so far noted in the district are localized and need to be treated independently by taking micro level studies in a particular area. Some of the common issues are deeper water level because of the terrain and hydrogeological setup, effects of various hydroelectric projects on the traditional water sources like springs as noticed in the Nichar area of the district.

7.0 AWARENESS & TRAINING ACTIVITY

Mass Awareness Programme (MAP) & Water Management Training Programme (WMTP) by CGWB

Mass Awareness Programme/Water Management Training Programme have been conducted in the district and Water Management Training Programme has been recognized at Bed. College & Sr. Sec School Ponda, Tehsil Nichar and Reckong Peo.

Participation in Exhibition, Mela, Fair etc

CGWB has not participated in exhibition, Melas so far.

Presentation & Lectures delivered in public forum / Radio/TV/Institution of repute/Grassroots association /NGO/Academic institutions etc

So far presentation and lectures were delivered amongst the gathering during the MAP and WMTP only.

8.0 AREAS NOTIFIED BY CGWA / SGWA

None of the areas of the district are notified by CGWA / SGWA.

9.0 RECOMMENDATIONS

- In valley areas, in addition to traditional ground water structures like springs, shallow to medium depth tube wells can be constructed for developing the ground water resource.
- In hilly terrain, springs and perennial nallas are the major sources of water. Shallow to medium depth bore wells fitted with hand pump are useful ground water structures for meeting the domestic needs and are feasible at favorable areas.
- Traditional resources like springs needs to be revived, developed & protected on scientific lines for various use. The discharge of such springs can be sustained by construction of small check dams or subsurface dykes across the nallahs/tributaries in the downstream at favorable locations.
- Small ponds/tanks/talavs can be utilized for recharging ground water. These structures can be constructed for harvesting water and may be utilized for both recharging and meeting the domestic needs.
- Roof top rainwater harvesting practices must be adopted in hilly areas since the district receives ample rainfall. Because of hilly terrain, maximum rainfall goes of as runoff, and a very small quantity contributes towards ground water replenishment.
- Rainwater harvesting in general & Roof Top Rain Water Harvesting in particular is an ideal solution for augmenting water resources particularly in sloppy hilly & chronic water scarce areas. There is thus need to create awareness for water conservation, augmentation and proper waste disposal for protecting water sources
- People's participation is a must for any type of developmental activities. So they should be made aware for proper utilization and conservation of water resources available. In addition, micro level efforts are required for proper implementation of development programme.

SAVE WATER – SAVE LIFE

Contributors

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Scientist-C

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Regional Director Incharge
and
Dalel Singh
Suptdg Hydrologist

Our Vision

Water security through sound groundwater management

जल संरक्षण वर्ष 2013
स्वच्छ सुरक्षित जल – सुन्दर खुशहाल कल
CONSERVE WATER - SAVE LIFE

For Technical Assistance Relating to Rainwater Harvesting & Artificial Recharge to Ground Water

Contact:

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e-mail: rdnhr-cgwb@nic.in
website: www.cgwb.gov.in

SAVE WATER SERVE HUMANITY

जल संरक्षण वर्ष 2013
स्वच्छ सुरक्षित जल – सुन्दर खुशहाल कल
CONSERVE WATER - SAVE LIFE