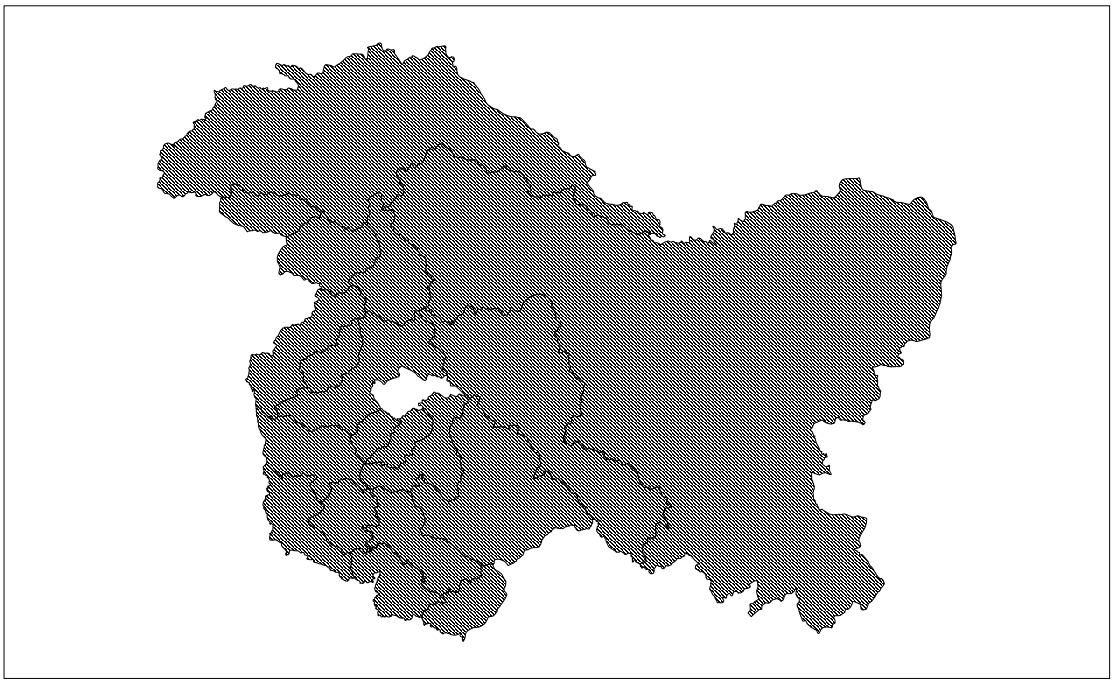
GOVERNMENT OF INDIA

MINISTRY OF WATER RESOURCES

CENTRAL GROUND WATER BOARD



GROUND WATER INFORMATION BOOKLET OF

SRINAGAR DISTRICT, JAMMU & KASHMIR

March 2013

CONTENTS

SRINAGAR DISTRICT AT A GLANCE

1.	**GENERAL INFORMATION**	Old Srinagar district including new Srinagar and Ganderbal districts
	i) Geographical area (sq km)	2,228
	ii) Administrative Divisions (2009-10) • Number of Tehsil • Number of CD Blocks • Number of Panchayats • Number of Villages	 3 5 113 170
	iii) Population (2001 Census) • Total population • Population Density (per/sq km) • SC Population • ST Population • Sex Ratio • Muslims and Other Population	 12,02,447 Persons 540 1,065 Persons 45,427 Persons 851 94.66% and 5.34%
	iv) Average Annual Rainfall- 2011 (mm)	671 mm
2.	**GEOMORPHOLOGY**	
	i) Major Physiographic units	• High Hill Ranges • Valleys & Terraces
	ii) Important Lakes	• Dal , Anchar
	iii) Important Hill Range	• Zabarvan mountains, Hari Parbat
	iv) Altitude	• 1730 m amsl
	v) Major Drainages • Basin • Sub Basin vi) Rivers	 Indus Jhelum Jhelum, Kankanag,Sindh
3.	**LAND USE (2009-10) (Sq.KM)**	
	• Forest area • Net area sown	380 388
4.	**MAJOR SOIL TYPES**	Hapludalfs and Ochraqualfs
5.	I**RRIGATION** (2009-10) (Sq.KM) Net Area Irrigated • Canals • Wells	 150.16 139.31

	• Other Sources • Tanks	4.28 2.96 3.61
6.	**NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (As on 20.03.2013)** • No. of Dug Wells • No. of Piezometers	 02 03
7.	PREDOMINANT GEOLOGICAL FORMATIONS	• Quaternary Alluvium • Tertiary (Karewas) • Paleozoic Sedimentary & Volcanic rocks
8.	**HYDROGEOLOGY**	
	Major Water Bearing Formations	
	1. Consolidated sediments / Hard Rocks (Fractured and jointed)	Covering major part (50%)
	• Yield prospects • GW structures	Moderate (1-3.0 lps) Springs/Percolation Wells / Handpumps /Tubewells
	2. Semi consolidated sediments (Karewas)	Covering (25%)
	• Yield prospects • GW structures	Low (5-20 lps) Springs/ Handpumps/Dugwells
	3. Unconsolidated porous sediments (Alluvium)	Valley area (25%)
	• Yield prospects • GW structures	Moderate (10-40 lps) Tube wells/ Handpumps/Dugwells
	Depth to water level (m bgl) • *Pre-monsoon* • Post - monsoon	 2.00-3.00 1.50-2.50
9.	**GROUND WATER EXPLORATION BY CGWB (As on 01.12.2012)**	
	• No of wells drilled • No. of Piezometer	17 EW 03
	• Depth Range (m) • Discharge (lps)	42.65-357.20 4.0-3000
10.	**GROUND WATER QUALITY**	
	i) Range of Chemical constituents in Ground water • EC (micro mhos/cm)	 335 - 1380

	• pH • Chloride (mg/l) • Fluoride (mg/l) • Iron (mg/l)	7.00 – 7.69 7.1 - 92.00 0.01 – 0.42 0.03 – 0.16
11.	**DYNAMIC GROUND WATER RESOURCES(2009)**	Hectare meter
	Annual Replenishable Ground Water Resources	14,895
	Net Annual Ground Water Draft	9,277
	Projected Demand for Domestic and Industrial Uses up to 2025	12,368.40
	Stage of Ground Water Development	62.28%
12.	**AWARENESS AND TRAINING ACTIVITY**	
	Mass Awareness Programmes	01
	Training programme	01
	Work Shop	01
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

GROUND WATER INFORMATION BOOKLET
OF
SRINAGAR DISTRICT, J & K STATE

1.0 INTRODUCTION

Srinagar district is located in the center of Kashmir valley. Etymologically, 'Srinagar' is composed of two Sanskrit words, namely, Sri – meaning abundance and wealth, and Nagar – which means a city. It is the most pivotal center of economy of the Kashmir Valley and the city of Srinagar has remained a center of tourist attraction for centuries. It is situated on the bank of Jhelum River. District Baramulla occupies the Northern and Western boundary whereas Badgam district forms the Western and South – Western limits. In the south, Srinagar district is bounded by Pulwama district. The district lies between 34°01'00" to 34°29'10" North latitudes and 74°33'30" to 75°30'00" East longitudes. (Plate-I)

Srinagar city is located about 300 km from Jammu and National Highway NH-IA connects Srinagar with Jammu. All the major carrier operate regular daily flights to Srinagar from Delhi, Mumbai and Jammu.

Srinagar District was bifurcated in to Srinagar & Ganderbal Districts in the year 2006. As the data for these separate districts was not available with the state administration, this reports has taken into consideration older Srinagar District as a whole including newly created Srinagar & Ganderbal Districts. For administrative purpose, the district is divided into 3 tehsil and 5 blocks and 113 panchayats in the district.

District Srinagar is spread over an area of 2228 sq km comprising three Tehsils of Srinagar district are, Srinagar, Ganderbal and Kangan and five administrative blocks. The total population of the district as per 2001 Census was 12,02,447 persons of which 649491 is male population and 552956 is female population with a male / female sex ratio of 851. The schedule caste population in the district is 1065 persons and scheduled tribe population is 45,427, of the total population 946166 souls account for urban population and 256281 as rural population. The growth rate of population during 1991-2001 recorded an increase of 29.04%.

In Srinagar district major portion of cultivable land has irrigation facility. There is network of canals and *kholas* which provide desirable irrigation facility during the cropping season. During the year 2009-10, an area of 13931 ha was under canal irrigation, 361 ha under tanks 428 ha under dug wells and tube wells. Net area under irrigation was 15016 ha.

CGWB has carried out extensive hydrogeological studies both by conventional and non-conventional methods in the district. Time to time CGWB has carried out hydrogeological investigations in number of defence establishments in this district and recommended suitable areas for ground water development. Under groundwater exploration, 17 exploratory wells have been drilled ranging in depth from 42.0 m at Pantha Chowk to 359.0 m at Karan Nagar in proper Srinagar while discharge varied from 240 lpm (Upper Ishber) to 3006 lpm (Badampur).

CGWB monitors 2 No's NHNS stations where ground water levels and ground water quality is monitored and constructed 3 Piezometers in 2012 in part of National Aquifer Mapping Programme.

2.0 CLIMATE & RAINFALL

Srinagar district falls under the Temperate to Mediterranean type of climate and is characterized by mild summers and chilling winters. Due to latitudinal variation from 1,600 meters to 5,000 meters above mean sea level there is a wide variation in climatic conditions in different parts of the district experiencing a typical temperate climate in high altitude which experience snowfall and severe cold in the winter and tropical climate at low altitude. The winter commences from early November and lasts till end of March. Most of the precipitation received during this period is in the form of snow & the temperature, at times falls as low as -13^0C. In December-January the minimum temperature is generally below freezing point. The period from March to June constitutes warm summers with temperature rising upto 33^0C.

Precipitation takes place in the form of rainfall as well as snow with occasional hailstorms. The average rainfall in the district is about 680 mm. About 60 to 70% of the precipitation is received in the form of snow during December to February. March to April are the months of heavy rainfall. May to September are relatively dry months.

3.0 GEOMORPHOLOGY AND SOIL TYPES

The district in general shows the conspicuous physiographic variations comprising moderately high hills, mountain ranges and alluvial tract. Nearly 50% of the area is covered by high hills characterized by hilly rugged and undulating topography. The district forms a part of hilly terrain of the Great-Himalayas and consists of parallel hill ranges. Flat alluvial terrain/Karewa table lands of late Pliocene to Pleistocene - Recent sediments occur in the flood plains of rivers and major nallahs of the district. The alluvial tract occupies the lower elevations and is located at a height of about 1600 meters above mean sea level. (Plate-II)

The general topographic slope in the northern part is towards the south, in the southern part is towards north while in the central part the master slope is towards west.

The district is bounded by the Great Himalayas on the South Eastern, Northern, & North Western side, Jhelum River in the South & it extends and forms the contiguous portion of the Kashmir Valley in the West. The highest peak is 5148 m above mean sea level. There are many hill tops in the eastern part of the district with an average height of 3,000 to 4,500 m amsl. Alluvial fans are predominant feature occurring at foothills. In the Valley portion typical Karewa table lands are noticed. These table lands are flat at the top with a very gentle slope towards the valley in the periphery portion the Karewas abut against the mountains.

3.1 SOILS

The soils of the Kashmir Valley are broadly divided into two types viz, Hapludalfs & Ochraqualfs and the same is true for the Srinagar district also. These soils are described below:-

i) Hapludalfs

These soils are found on Karewa tops & uplands with a slope variation of 1-3%, These are very deep soils, well drained with moderate permeability. These soils are severely eroded resulted in the formation of gullies and ravines.

These are medium to fine textural soils and the surface texture varies from clay loam to silty clay loam. The colour of the soils varies from Yellowish Brown to dark Brown. These soils are mostly used for cultivation of Wheat, Maize & pulses.

ii) Ochraqualfs

These soils are found in plain to mid upland topography. These soils are moderately fine textured with clay loam as the predominant surface texture. The extent of erosion on such soils is much less. These are dark brown to dark yellowish Brown in colour. These soils are mostly used because of their low permeability for the cultivation of Paddy, Mustard & at places Wheat.

3.2 LAKES

The most distinctive feature of the district is Dal lake in the Srinagar City having an area of about 15 sq.km. This lake has unique life of its own with floating vegetable gardens, fields of lotus blossom and communities depended upon Dal living in house boats. The Shikaras with colourful appearance attracts tourists. Jhelum valley is surrounded by Zabarwan Mountains in the East. Jhelum River flows almost through the center of the Srinagar city. Another lake Anchar lies in north western part of the district.

4.0 GROUND WATER SCENARIO

4.1 GEOLOGY

The main geological formation in the district are Karewas & Paleozoic Sedimentaries and Volcanics. These formations are overlain by a thin mantle of Recent alluvium. The Karewas are overlying the folded Zeewan formation & Panjal volcanics. In the northern extremity of the valley portion Karewa formations rests over the Cambrio-Silurians. The general geological successions of the area is as under:-

Group /Formation	Lithology	Age
Scree material & Alluvium	Heterogeneous Clastic sediments comprising of Sand, Silt, Clay	Sub-Recent to Recent
Upper Karewas Naugam Formation	Loams, Silts & Silty brown-grey Clays unstratified, laminated to marls, sands, silts, and plastic clays. Glacier boulder bed II, glacial stage	Lower to middle Pleistocene to Lower Pliocene
Lower Karewas Hirpur Formation	Plastic bluish grey clays, sandy clays and sand with lignite at places Glacier boulder bed I, glacial stage	
UNCONFORMITY (Not exposed)		
	Limestone	Triassic Limestone
Zeewan beds	Limestone & Shale	Middle to late Permian
Panjal Traps	Andesitic flows	Permian
Agglomreatic Slate Series	Slates, quartztite	Late Carboniferous to early Permian
Muth Quartztite	Quartzite,Shale,Siltstone,Dolomitic Limestone	Late Silurian to Early Devonian
	Shale,Silt stone. Quartz Arenite	Cambrio-Silurian

4.2 HYDROGEOLOGY

The hydrogeological conditions of the district are dependent on the lithology, structure and geomorphic set up. Groundwater in the area occurs both under water table and confined conditions in Soft Rock Aquifers, Groundwater in the alluvial sediments consisting of valley fills & Karewas occurs in the pore spaces of the individual grains under water table and confine conditions and a form a prolific aquifer in the district where are hard rocks lack primary porosity & ground water is confined mainly to the fractured & jointed formations. From the ground water point of view, these rocks are grouped into Panjal Traps & Triassic limestone. The overburden generally consisting of boulders of hard rocks & clay at places also form good aquifers with moderate yields ranging upto 5.0 lps. Panjal traps located along the Jhelum River are highly jointed & fractured with a good/potentials aquifer. Two exploratory wells drilled by CGWB, for the first time with DTH rigs in the Valley, has yielded 12.0 (Upper Athwajan) & 33.0 lps (Sofi Mohalla) of water.

4.3 DEPTH TO WATER LEVEL

Based on the data of water levels of permanent hydrograph network stations, it is observed that the depth to water table varies widely in different hydro geomorphic depending upon rainfall, the draft and the topography of the area. There were five National Hydrograph Network Stations monitored up to the year 1989 by the Central Ground Water Board in the district and the same are shown in Plate-III. All the five hydrograph stations falls in Valley fills/ Karewas. At present only two National Hydrograph Network Stations are being monitored from the year 2007

As there is no monsoon rainfall in the valley and precipitation is received in the form of snow in the winter (December-March) & rain fall in the early summer (April-May) is only due to western disturbances, the terms Pre-monsoon & Post-monsoon as used in the other parts of the country are not relevant in the Kashmir Valley & Summer and Winter water levels are used for these terms respectively. The depth to summer water levels in the ranges from 1.5 to 4.00 m bgl (Plate-IV) while winter water levels vary from 1.75 to 6.00 m bgl. It is important to mention here that water level behavior in the Kashmir Valley is entirely different from the other parts of the country. This is mainly because of the fact that about 60 to 70% of the precipitation is received in the form of snow during December to February while March to April are the months of heavy rainfall. May to September are relatively dry months. Hence recharge to the ground water takes place in the valley in the months of April to June with the melting of snow and with the onset of rainfall. Therefore water level shows trends of rising from April onwards and falling from August onwards.

4.4 SPRINGS

Ground water also emerges in the form of springs at contact of pervious and impervious beds, along fault planes and other structural features. A good number of springs are present in the district. Springs are formed when the water table is intercepted by the topography like river terraces, the morainic masses and the alluvial fans.

In the Panjal Traps the springs are found in the joints & fissures where as in the limestone formation the springs are seen in the solution cavity and cavernous structures. The famous Chashma-Shahi spring emanate through this aquifer its water is sweet &

digestive and was used by the people from time immemorial. Pandit Nehru used to get this water to Delhi.

4.5 GROUND WATER RESOURCES

The dynamic ground water resources of Srinagar district have been estimated for valley areas only. Total area has been taken as unit for final computation Ground water resources have been computed as per GEC 1997 methodology & are summarized as under:-

1.	Area considered for GW Assessment (valley area)	550	sq km
2.	Annual Replenishable GW Resource during monsoon & non-monsoon period	14,895	Ham
3.	Annual Ground Water Draft	9277	Ham
4.	Projected Demand for Future Domestic and Industrial uses.	12368	Ham
5.	Stage of Ground Water Development	62.28	%

The Stage of Ground Water Development was 62.28% as on 2009 which is categorized as SAFE for future ground water development.

4.6 GROUND WATER QUALITY

The range of various parameters of samples collected from various sources indicates the suitability of ground water for drinking purposes.

S. N.	Constituents	Range in Srinagar district	Desirable limit	Permissible limit
1.	pH	7.00-7.69	6.5-8.5	6.5-8.5
2.	EC mmho/cm	335-1380	300	1200
3.	Ca^{++}(mg/l)	44.0-112.0	75	200
4.	Mg^{++}(mg/l)	9.7-57.0	30	100
5.	CO_3^{--}(mg/l)	-	-	-
6.	HCO_3^{--}(mg/l)	177-481	-	-
7.	Cl (mg/l)	7.1-92.0	250	1000
8.	NO_3(mg/l)	0.48-90	45	100
9.	F(mg/l)	0.01-0.42	1.0	1.5
10.	Na^{+}(mg/l)	3.7-100.0	-	-
11.	K^{+} (mg/l)	0.2-80.0	-	-
12.	Fe++	0.03-0.16	0.3	1.0
13.	Total Hardness as $CaCO_3$	105-425	300	600

4.7 STATUS OF GROUND WATER DEVELOPMENT

The Stage of Ground Water Development was 62.28% as on 2009 which is categorized as SAFE for future ground water development. Ground water development in the district is on moderate scale restricted to the valley portions. All the major irrigation and drinking water supplies depend on Tube wells, natural springs and rivers and nalas. In addition to this PHE department constructed number of handpumps in villages to mitigate the drinking water problems. Public Health Engineering and Irrigation and Flood control departments are the nodal agencies in the district concerned with the water supplies for drinking and irrigation respectively. The depth of the hand pumps is about 60 to 70 m bgl. Under groundwater exploration, 17 exploratory wells have been drilled ranging in depth from 42.0 m (Pantha Chowk) to 359.0 m (Karan Nagar in proper Srinagar) while discharge varied from 240 lpm (Upper Ishber) to 3006 lpm (BadamPur).

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 GROUND WATER DEVELOPMENT

Most of the district is in concentrated in valley portion drained by major perennial river Jhelum and its tributaries. In the past development of ground water was mainly through dug wells and tubewells, base flow in nallas and also some springs has played a major role for sustainable domestic and irrigational purposes. In some of the areas, at present too these are the only sources of water. However, in recent years modern means of ground water development have been employed. Public Health Engineering has been constructing number of hand pumps and shallow-moderate depth tube wells for large-scale water supplies.

5.2 SNOW HARVESTING AND ARTIFICIAL RECHARGE

Snow harvesting is a technique of preservation of snow and delaying the melting so that snow melt water is available for longer duration in a year. Selection of sites for snow harvesting shall depend on Insulation of an area, wind direction, wind velocity and Relative Humidity.

6.0 GROUND WATER RELATED ISSUES & PROBLEMS

Chemically, ground water of the area is by and large fit for drinking and irrigation requirements.

As depth to water level in the district is shallow there is no scope for artificial recharge to ground water.

7.0 MASS AWARENESS & TRAINING ACTIVITY

A Mass Awareness Program on "Rainwater Harvesting and Artificial Recharge to Ground Water" was organized by Central Ground Water Authority and Central Ground Water Board, North Western Himalayan Region, Jammu, at Ganderbal, District Srinagar, on 22.02.05 in association with the Department of Rural Development, Srinagar, J&K. The officers from Sher-I-Kashmir Agriculture University of Science and Technology and Department of Rural Development, Srinagar, participated in the Program.

Central Ground Water Board, North Western Himalayan Region, Jammu has successfully organized a one day training Program on the Rainwater Harvesting and Artificial recharge to ground water in association with Project Formulation Cell, Rural Development Department, Srinagar at Lal Mandi Complex, Srinagar on 18.02.05. More then hundred officers from various Departments participated in the training Program.

8.0 AREAS NOTIFIED BY CGWA / SGWA

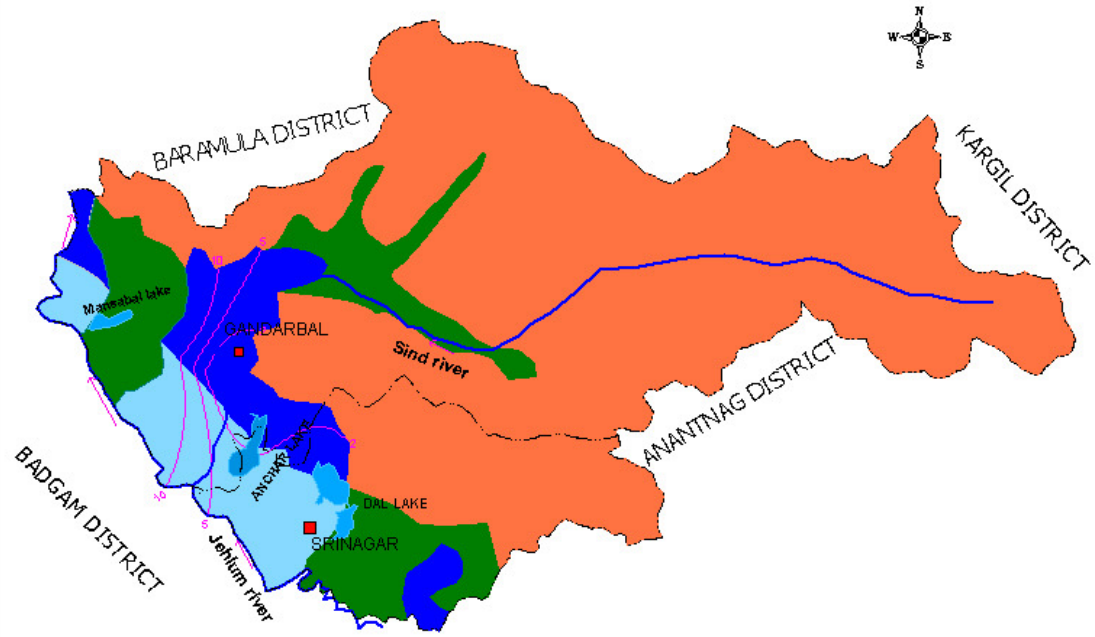
The stage of ground water development in Srinagar district is 62.28% only and falls in safe category. Thus, no area or block has been notified for groundwater development point of view.

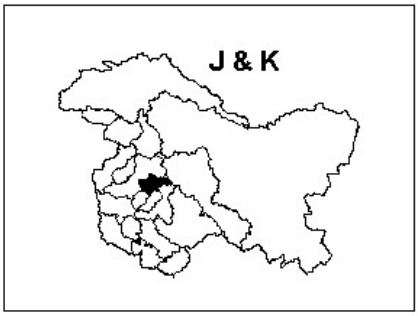
9.0 RECOMMENDATIONS

- As the Stage of Ground Water Development is only 62.28% as on March, 2009 which is categorized as SAFE for future ground water development there is sufficient scope for the ground water development through construction of different ground water structures.
- Since the depth to water levels in valley portions of the district are within 5 m bgl the ground water development is required to be given a fillip by funding agencies through State Government providing soft loans on liberal terms may be considered by the State Government agencies for construction of Shallow Tube wells, dug wells, hand pumps etc. The construction of such structure tapping the shallow aquifers will also minimizes the chances of getting comparatively higher Iron content which is regular problem in the Karewas.
- At moderate to higher reaches of the district the water conservation techniques are required to be adopted wherein various structures like gabions, check dams, contour bunding, treatment of catchments of village ponds etc. should be taken up. This will help to mitigate drinking and irrigation water need of the villagers at large.
- Since there are data gaps in monitoring of depth to water levels in the district it is recommended to reestablish National Hydrograph Network Stations and / or install piezometers so that behavioral changes of water levels could be observed over a long period of time in order to know the trends.

GROUND WATER USER MAP

DISTRICT SRINAGAR, JAMMU & KASHMIR





LEGEND PLATE-V

	Wells feasible	Rigs suitable	Depth of well (m)	Discharge (lpm)	Suitable artificial recharge structures
Soft rock aquifers	Tube well	Percussion, Rotary, DTH with Odex	60 to 250*	150 to 1000	Check dam, Check Dam cum ground Water dam, Recharge Shaft/pit
	Dug Well	Manual/Poclain	6 to 10	150 to 400	
Hard rock aquifers	Tube well	DTH with Odex	40 to 80	150 to 600	
	Dug Well	Manual/Poclain	4 to 8	150 to 600	
	Spring Development			30 to 1200	

Hilly area

5 Water level contour (m bgl) (Pre monsoon decadal mean, 1993-2002)

Springs

Tehsil boundary

District boundary

Major Drainage

Tehsil HQ

District HQ

Resevior

OTHER INFORMATIONS

Total area	2228 sq.km
No. of tehsils	5
Major drainage	Jhelum, Sind Rivers
Population	1202447 (2001 Census)
Rainfall	671 mm
Temperature	- 9^0 C to 35 C
Regional geology	Soft rock : - Alluvium, Karewas
	Hard rock : - Panjal traps
Ground water quality	EC<750 micro mhos/cm at 25^0C
Stage of GW development	62.28 %
Name of watershed/ tehsil showing intensive GW	Nil