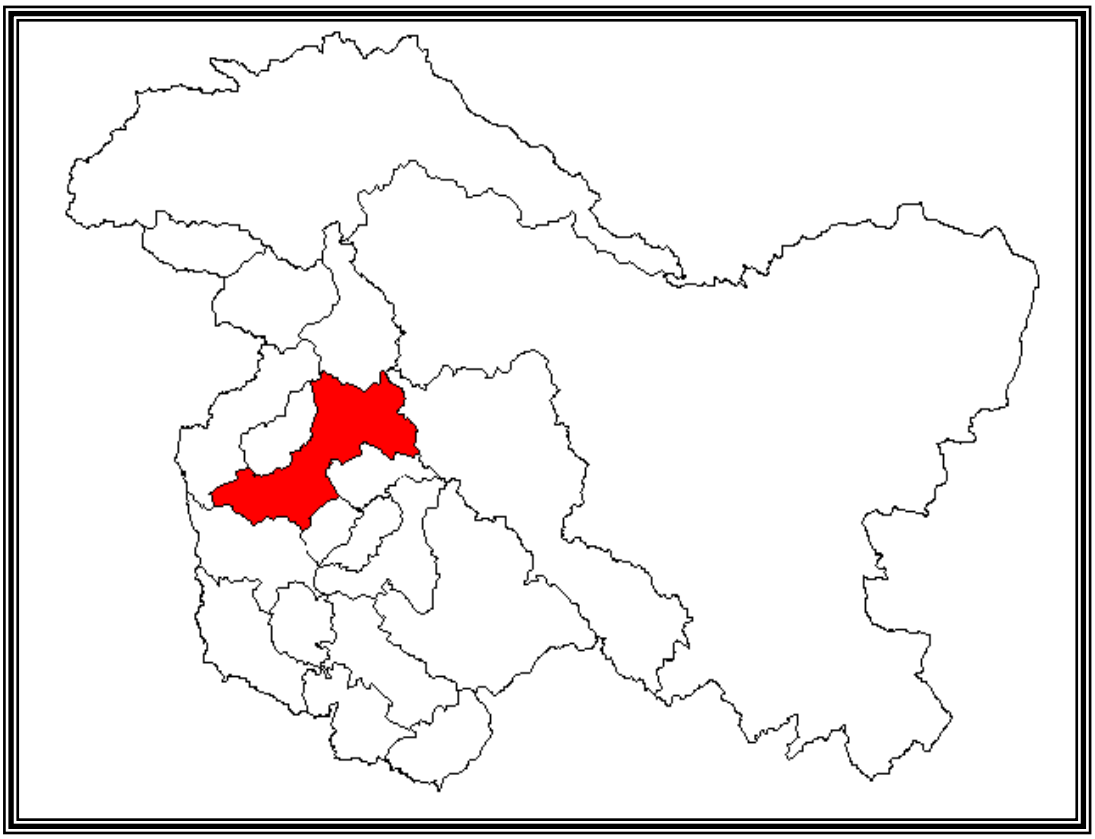
Government Of India
Ministry Of Water Resources
CENTRAL GROUND WATER BOARD

GROUND WATER INFORMATION BOOKLET

BARAMULLA DISTRICT, JAMMU & KASHMIR



NORTHERN WESTERN HIMALAYA REGION
JAMMU

SEPTEMBER 2009

GROUND WATER INFORMATION BOOKLET

BARAMULLA DISTRICT, JAMMU & KASHMIR

CONTENTS

BARAMULLA DISTRICT AT A GLANCE

S. NO	ITEMS	STATISTICS
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	4,588
	ii) Administrative Divisions (2001) • Number of Tehsil & Sub-tehsils • Number of CD Blocks • Number of Villages	 9 16 660
	iii) Population (2001 Census) • Total population • Population Density (pers/sq km) • Rural & Urban Population • Muslim & Others Population (%) • Sex Ratio	 11,69,780 persons 254 83.05% & 16.95% 96.30 % & 3.70% 907
	iv) Average Annual Rainfall (mm)	1115.3 mm
2.	GEOMORPHOLOGY	
	Major Physiographic units	• High Karewa Plateau lands • Sharp ridges of hard rock Intervening valleys & River Terraces
	Altitude Range	550 – 3960 m amsl
	Major Drainages • Jhelum Basin	 Pohru river, Varnsu nala, Kalruch and Manchhar are the distributaries of Jhelum Natural lakes: Wular lake, Haigam Jheel, Mirgund Jheel
3.	LAND USE (2006-07) sq.km (Source- Digest of Statistics 2007)	
	• Forest area • Gross irrigated area • Net irrigated area • Gross area sown • Nat area sown • Horticulture area	2,690 439.71 418.97 911.17 871.25 361.02
4.	MAJOR SOIL TYPES	• Soils developed on Karewa tops and upland areas are medium to fine textured and known as Hapludalf • Soils found on plains are clay loam in nature and dark brown in colour

S. NO	ITEMS	STATISTICS
5.	IRRIGATION BY DIFFERENT SOURCES (Source- Digest of Statistics 2007)	
	• Dug wells & shallow TW • Surface water • Springs • Others	Net Area(sq.km.) 1.18 399.23 13.65 4.91
6.	NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (As on 01.1.2008) • No. of Dug Wells • No. of Piezometers	 9 Nil
7.	PREDOMINANT GEOLOGICAL FORMATIONS	• Quaternary Alluvium • Karewa formations • Panjal Traps • Dogra slates • Zewan beds/Gondwana formations
8.	HYDROGEOLOGY	
	Major Water Bearing Formations	
	1. Consolidated Formations/ Hard Rocks (Panjal Traps, Dogra slates, Zewan beds/Gondwana formations)	Covering about 15% of the district
	• Yield prospects • GW structures	Very Low (<2 lps) Springs & Dugwells
	2. Unconsolidated layered formations- (Karewa formations – Both upper and Lower Karewa formation)	Covering (50%)
	• Yield prospects • GW structures	Low to Moderate (10-20 lps) Handpumps, Dugwells & Tubewells
	3. Unconsolidated porous sediments (Alluvium)	Intermontaine small valleys and main Kashmir Valley area (35%)
	• Yield prospects • GW structures	Low to Moderate (10-20 lps) Handpumps, Dugwells & Tubewells
	Avg. Depth to water level • Pre-monsoon • Post-monsoon	 2.70 m bgl 3.50 m bgl
10	GROUND WATER EXPLORATION BY CGWB (As on 31.12.2008)	
	• No of wells drilled	37 EW
	• Depth Range (m)	10.00 – 450.00
	• Discharge (lps)	1.00 – 70.00
	• Transmissivity (m^2/day)	10 – 2953

S. NO	ITEMS	STATISTICS
11.	GROUND WATER QUALITY	
	Presence of Chemical constituents more than permissible limit (eg. EC, F, As, Fe)	Fe is present more than permissible limits in pockets
12.	DYNAMIC GROUND WATER RESOURCES (2004) in MCM	
	• Annual Replenishable Ground Water Resources	450.79
	• Net Annual Ground Water Draft	37.24
	• Projected Demand for Domestic and industrial uses up to 2025	62.57
	• Stage of Ground Water Development	9 %
13.	AWARENESS AND TRAINING ACTIVITY	
	• Mass Awareness Programmes	Nil
	• Water Management Training Programmes	Nil.
14.	EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING	Nil
15.	GROUND WATER CONTROL AND REGULATION	
	• Number of OE Blocks	Nil
	• No of Critical Blocks	Nil
	• No of blocks notified	Nil
16.	MAJOR GROUND WATER PROBLEMS AND ISSUES	• Presence of Gas & High Iron Content are the main hazards around Pattan area
	Water logging	• In isolated pockets around Wular Lake

GROUND WATER INFORMATION BOOKLET

BARAMULLA DISTRICT, JAMMU & KASHMIR

1.0 INTRODUCTION

Baramulla District is the largest district in the entire Kashmir valley both with reference to the area and population. The district with its head quarter at Baramulla town lies between 33°55'00" & 34°35'00" North latitude and 73°50'00" & 75°20'00" East longitude and is covered by SOI degree sheet no 43J, and bounded by Kupwara district in the North and Northeast, Srinagar & Badgam districts in the east and southeast and has **L**ine **O**f **C**ontrol towards the west. The lofty Pir-Panjal ranges towards south and southwest separates this district from Poonch district of Jammu province.

The district has a total geographical area of 4,588 sq km, comprising of 660 villages (646 inhabitant villages and 14 un-inhabitant villages). Administratively, the district is divided into 09 tehsils (Baramulla, Sopore, Pattan, Tangmarg, Sumbal, Bandipora, Rohama, Uri, Gurez) and 16 CD blocks (Baramulla, Sopore, Pattan, Tangmarg, Sumbal, Bandipora, Rohama, Uri, Gurez, Boniyar, Wagoora, Hajin, Zaingeer, Rafiabad, Singhpora, Kunzer).

As per 2001 census, the district has a population of 11,66,722 persons, with density of population 254 persons per sq. km. The male and female population in the district is 6,14,816 and 5,54,964 persons respectively with a male/female sex ratio of 902. The schedule Caste population in the district is 377 persons i.e 0.03% of the total population and Scheduled Tribe population is 89714 persons i.e 7.6% of the total population. The district has recorded population growth of 31.18% during the decade 1991-2001 as compared to 29.04% at state level.

The main source of Irrigation is canals and an area of 41,897 hectares is brought under irrigation by various sources like canals, tanks, wells and other sources.
Central Ground Water Board has carried out extensive hydrogeological studies both by conventional and non-conventional methods in the district. Under Ground Water Exploration, 37 exploratory tube wells have been drilled ranging in depth from 50 m to 450 m. CGWB monitors 9 NHS, where ground water levels, fluctuations and quality monitored.

2.0 CLIMATE AND RAINFALL

The Climate of the district is Temperate cum Mediterranean type. In the higher reaches the temperature remains cold through out the year. Average minimum and maximum temperature varies from –5°C to 32°C. The winter season starts from the middle of the November and severe winter conditions continues till the middle of February/March.

The district receives an average annual precipitation of about 1200 mm in the form of rain and snow for about 60 days. Gurez, Gulmarg and Bandipore receive heavy snowfall during winter season in comparison to other places.

3.0 GEOMORPHOLOGY AND SOILS

Baramulla district is hilly and mountainous in the north and eastern regions comprising of Pir-panjal ranges of Lesser Himalayas with broad intermountain valley. The altitudes of the hill ranges ranging from 2150 m to 5600 m AMSL. Valley has flat to mildly undulating topography with its elevation about 1600 m AMSL and has an area about 1100 sq km .The district forms part of the Jhelum sub basin of Indus basin. Master slope is towards southeast.

River Jhelum is the major river flowing in the valley area where as Kishanganga River in the northern part with several tributaries mainly drain the area. The most striking feature of the district is the presence of *Wular* Lake in the central part, a vast expanse of surface water body of about 160 sq km in area.

Soil in hilly areas is poor and fertile in plain areas. Productivity in higher ranges is poor while in central regions is fertile.

4.0 GROUND WATER SCENARIO

4.1 GEOLOGY

The rock formations underlying the district ranging in age from Cambrian to Quaternary. The brief generalized geological succession in the district is given below

.Stratigraphic Unit	***Litho logy***	***Thickness (m)***	***App. Age***
Alluvium	Clay, Silt and sand	15	Recent
Upper Karewa	Alternate greenish sandy and grey clay bed layers with calcareous Laminae	750	Plio-pliestocene
	Second fluvio-glacial boulder bed	130	
Lower Karewa	Clay (bluish grey) & Conglomerates with coarse to fine sand (greenish in colour) alternate with grey sandy clays. *Lignite and peat material*	2000	Plio-Pleistocene
	First fluvio-glacial Boulder bed	200	
Panjal Trap	Agglomeratic slates, grits and effusive rocks		Permo-Carboniferous
Zewan beds	Shale, slates with quartzite and limestone.		Cambro-Silurian

Hard formations forming hilly and mountainous terrain mainly comprises of igneous and metamorphic rocks belonging to the Panjal traps and Zewan beds. The Karewas and alluvium of Quaternary and Tertiary age (Plio-Pleistocene) underlie the valley

area and consists of alternate bands of sand, silt, gravel & clay, interspersed at two to three levels locally by glacial boulder beds. This formation is important from ground water point of view and sustains the water supply system in the area. This formation of Plio-Pleistocene age lies dis-conformably over the older rocks ranging in age from Cambrian to Triassic.

4.2 HYDROGEOLOGY

Hydro-geologically, the district is divided into two distinct and well-defined aquifer systems, viz., *hard rock or fissured aquifer* constituted mainly by semi-consolidated to consolidated rock units and *soft sedimentary or porous aquifer* constituted mainly by unconsolidated sediments.

The fissured formation includes the semi-consolidated to consolidated rock formations exposed in the district are igneous, metamorphic and sedimentary origin. These forms low and high hill ranges through out the district. Fractured and jointed igneous, metamorphic rocks form low to moderate potential aquifers with poor to moderate yields. Occurrence and movement of the ground water is mainly controlled by secondary porosity originated due to fracturing and faulting and related tectonic disturbances and weathering. Ground water oozes in the form of springs, seepages in the hilly areas and is utilizing for domestic purposes. There are numerous springs in the district generally concentrated along the contact zones and also in the hilly area. At some places shallow hand pumps and tube wells fitted for ground water development. The yield of the shallow tube wells and hand pumps constructed along these secondary porous zones varies from 3-35 m^3/hr.

The unconsolidated sediments comprising of fluvio-glacial and lacustrine deposits of Karewas and recent alluviam, terrace deposits and alluvial fan deposits constitute the porous aquifer system of the district. The sediments consist of sand, gravel, cobbles, pebbles, boulders interlayered with thick clay beds and form the prolific aquifer system. Occurrence and movement of ground water is mainly controlled by the primary inter-granular porosity in the soft sedimentary Quaternary alluvium and the Karewa formations. This unconsolidated sedimentary deposit forms multi-layer major aquifer system in the area. The sedimentary formation is +300m thick in the district as revealed by the study and ground water exploration carried out by CGWB. Ground water in the district occurs in phreatic and confined conditions in these formations. The depth of the tube wells ranges from 10 m at Watergam to 450 m at Gundi-jehangir. Most of the wells constructed show flowing conditions except those, which are located on high Karewas. The water table occurs under artesian conditions at some areas. The yield of the tube wells ranges from 125 lpm at Tragpora to 4164 lpm at Naugam for drawdowns ranging from 30 m to 39.0 m respectively. The depth to water level ranges from 7.71 m agl (artesian free flowing) at Gundi-jehangir to 25.52 m at Singhpora. The transmissivity values ranges from 39 m^2/day at Yakmanpur to 2983 m^2/ day at Naugam. The 'S' (storativity) values range from $1.12x\ 10^2$ to $2.32x10^{-3}$.

4.3 DEPTH TO WATER LEVEL

The water level from the national network of hydrograph stations (17 no) set up in the valley area of the district are available up to year 1989. A perusal of the data shows that in major part of the valley area the depth to water levels are shallow, less than 5 m bgl. The depth to water level however, ranges from 0.63 at Mirgund-II to 5.22 m

bgl at Botiung. In valley areas, open wells and tube wells are the main ground water withdrawal structures.

4.4 GROUND WATER RESOURCES

Precipitation in the form of rain and snow in the district is the major source of ground water recharge apart from the influent seepage from the perennial rivers, streams and lakes, irrigated fields and inflow from upland areas. Discharge of ground water mainly takes place from wells, tube wells and effluent seepages of ground water in the form of springs and base flow in streams.
The Ground Water Resources for the district were computed in the year 2005 for valley areas only as per the GEC-1997 methodology and are given below:-

1	Total Geographical Area	Ha	4,58,800
2	Valley Area	Ha	11,000
3	Net Ground Water Availability	MCM	405.71
4	Ground water Draft For Irrigation	MCM	2.36
5	Allocation For Domestic & Industrial Use up to 2025	MCM	62.57
6	Net Ground Water Availability For Future Use	MCM	340.78
7	Stage of Ground Water Develop-men	%	9.18

The stage of ground water development in the valley portions of the district is less than 10% and falls in the safe category. Thus, there is scope for further ground water development.

4.5 GROUND WATER QUALITY

CGWB monitors the quality of ground water of shallow aquifers at nine National Hydrograph Network Stations. In addition to these, water samples are collected during the scientific studies whenever taken up. The range of chemical parameters in the district is summarized below.

S.No	*Parameter*		*Range*	
			Min	Max
1	pH		7.05	7.58
2	EC	µS/cm	285	1060
3	HCO_3	mg/l	153	464
4	Cl	mg/l	07	75
5	NO_3	mg/l	0.24	8.6
6	F	mg/l	0.02	0.66
7	Ca	mg/l	42	100
8	Mg	mg/l	03	48
9	Na	mg/l	5.2	83
10	K	mg/l	0.2	10
11	TH as $CaCO_3$	mg/l	150	370

From chemical quality point of view, ground water in the area is fresh and potable with electrical conductivity (EC) generally less than 1200 µS/cm at 25°C. However,

in ground water or aquifer strata at deeper levels in (lower Karewa) at places contain methane gas that makes the water non-potable at times.

4.6 STATUS OF 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 the tube wells, dug wells in addition to various water supply schemes based on rivers/Nallahs. Public Health Engineering and Irrigation and Flood control departments are the nodal agencies in the state concerned with the water supplies for drinking and irrigation respectively. In hilly areas the supplies depends upon the springs and shallow tube wells and hand pumps. In valley portions these state departments has drilled number of tube wells with the depth ranges from 50-100 meters, with discharges varies from 5 lps to 10 lps. Apart from the tube wells number of Hand pumps with the depth ranging from 30-60 mts depending upon the lithology of the area with a discharge varying from 0.5 lps to 2 lps. feeds the drinking water requirements of the district.
Central Ground Water Board had constructed 21 tube wells up to the year 1989. Exploratory activities again resumed during the AAPs of 2005-2006 and 2006-2007 and constructed 16 tube wells in the district. The depth of tube wells ranging from 10 mts to 450 mts with a discharge varying from 125 lpm to 4164 lpm.

5.0 GROUND WATER MANAEMENT STRATAGY

5.1 GROUND WATER DEVELOPMENT

Most of the district is in concentrated in valley portion drained by major river Jhelum and its tributaries. In the past development of ground water was mainly through dug wells and percolation wells along the riverbeds, 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

Extraction of ground water through dug wells, hand pumps, tube wells, and the springs are the major sources of water supply to both rural and urban areas, but the availability of the water during summer is limited particularly in drought areas and requires immediate attention to augment this resources. Based on the climatic conditions, topography, hydrogeology of the area, suitable structure for rain water harvesting and artificial recharge to ground water is required. Roof tap rainwater harvesting needed to be adopted in the urban areas and proper scientific intervention for spring development and revival is required in water scarce areas.

In the hilly areas roof tap rainwater harvesting structures like storage tanks are recommended while in low hill ranges, check dams and roof tap rain water harvesting structure can be adapted.

6.0 GROUND WATER RELATED ISSUES AND PROBLEMS

In the valley portions, the Karewas are deposited under fluvio-glacial and lacustrine conditions. Due to the deposition under the lacustrine environment, occurrence of methane gas is the common phenomenon in the various part of the district. The lateral and vertical extent of the sediments of karewas varies and represents different hydro-geological set up. In the hard rock areas, the aquifers are discontinuous and localized and of different hydrogeological set up.

Some of the common issues are the occurrence of methane gas and accompanied silt, quality related problems particularly for 'Fe'. and occurrence of silty aquifers and boulders for development of ground water. These ground water issues and problems are localized and need to be focused by taking micro level studies in a particular area.

7.0 AWARENESS AND TRAINING ACTIVITY

So far neither Mass Awareness Programme (MAP) nor Water Management Training Programme (WMTP) is conducted by CGWB.

8.0 AREAS NOTIFIED BY CGWA/SGWA

The stage of ground water development in the district is 10% only and falls in safe category. Thus, no area or block has been notified for ground water development.

9.0 RECOMMENDATIONS

- In Valley areas, in addition to the traditional ground water structures like dug wells and springs, shallow to medium depth tube wells can be constructed for developing the ground water resources. Ground water resources can also be developed by constructing infiltration galleries (Percolation wells).

- In hilly terrain, springs and perennial nallahs are the major sources of water. Medium to shallow bore holes and hand pumps are useful ground water structures for meeting the domestic needs.

- Monitoring of water levels and chemical quality at representative areas required to keep a check on any adverse effect that ground water development may have in future.

- 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 nallas/tributaries in the downstream at favourable locations.

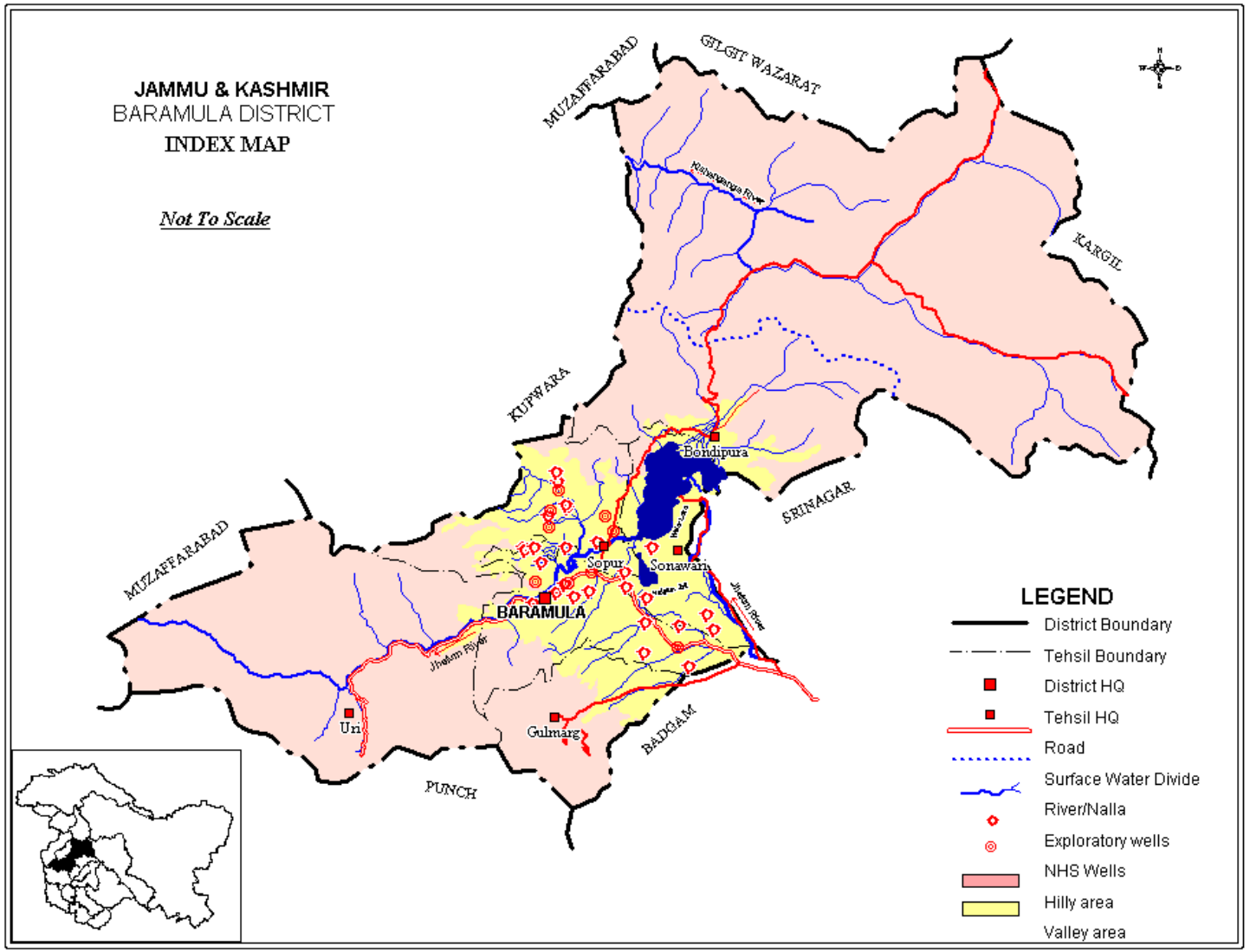
- Small ponds/tanks can be utilized for recharging ground water. These structures can be constructed for harvesting water and utilized for both recharging and meeting the domestic needs.

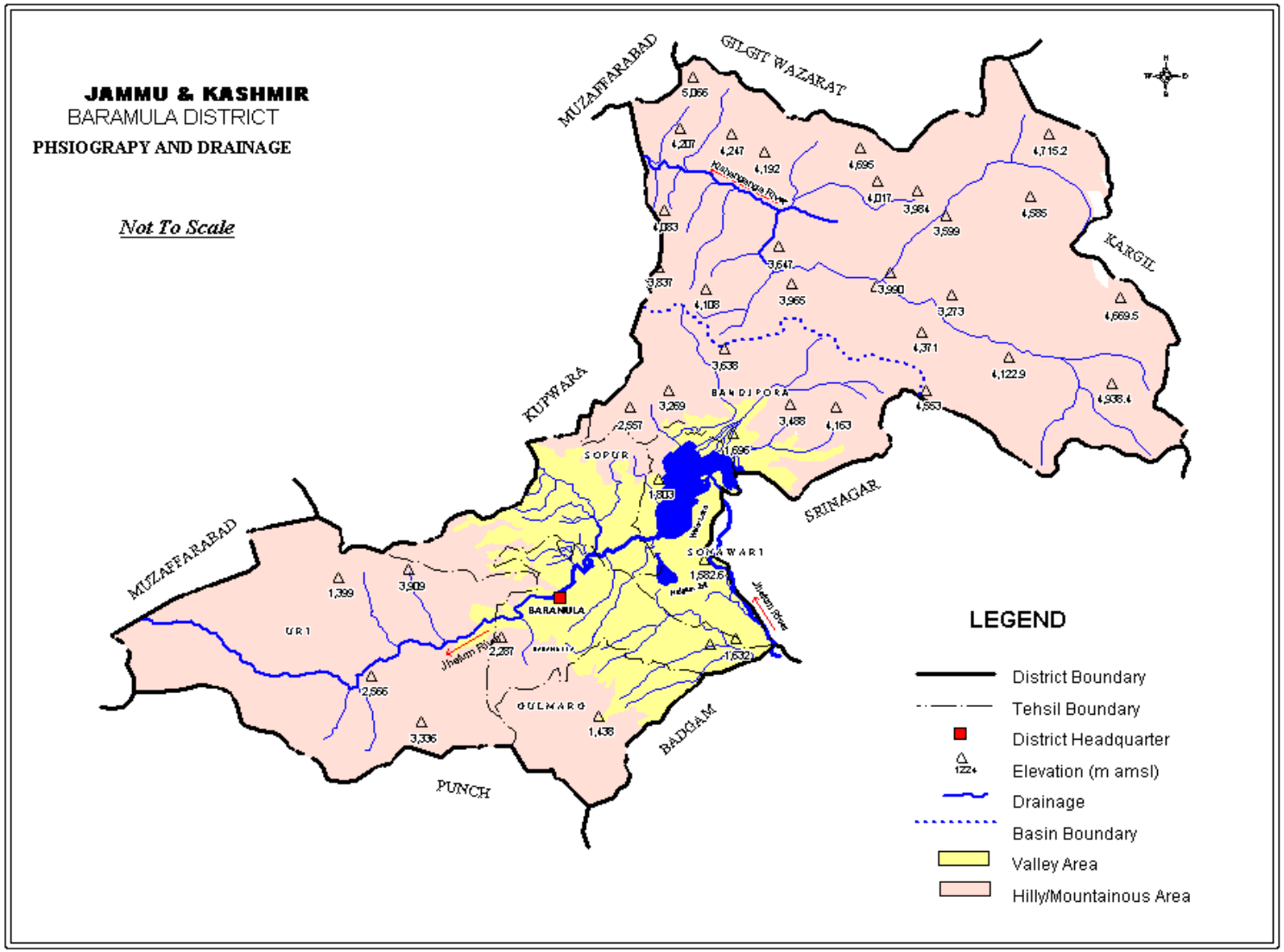
- Roof top rainwater harvesting practices must be adopted in hilly areas since the district receives precipitation in the form of snow and rain.

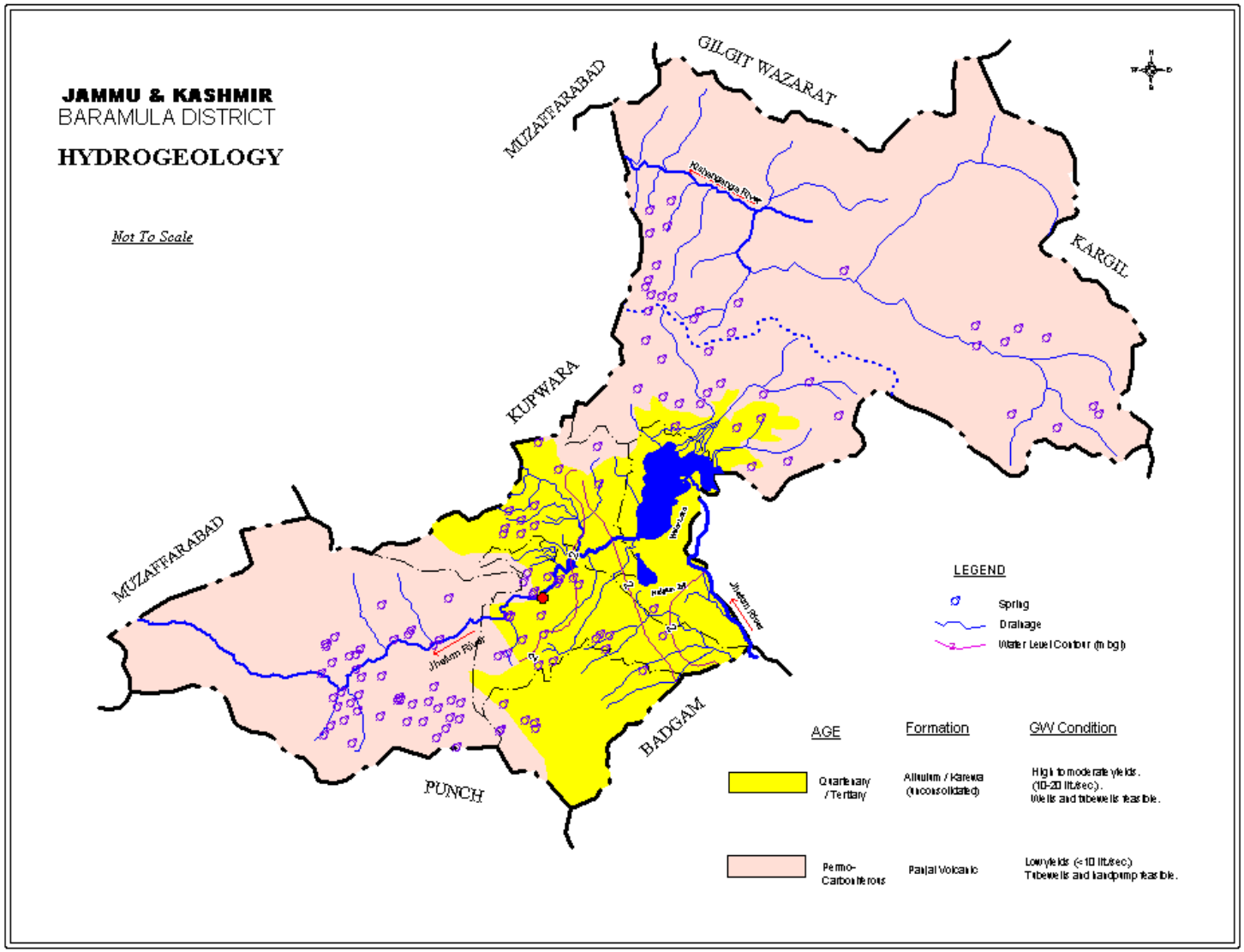
- Rainwater harvesting in general & RTRWH in particular is an ideal solution for augmenting water resources particularly in sloppy hilly & chronic water scarce areas. There is thus need to create awareness for water conservation and augmentation and proper waste disposal for protecting water sources.

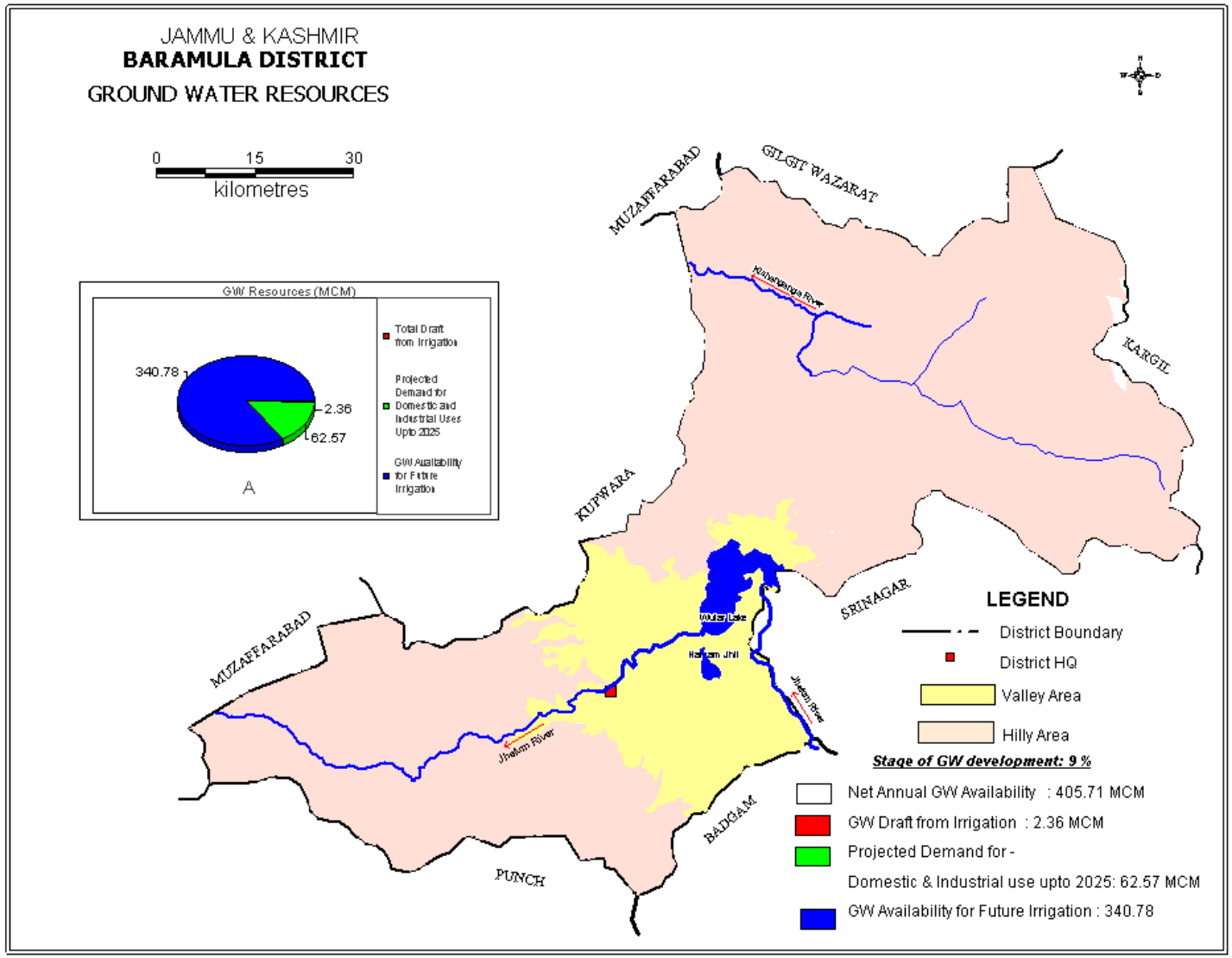
- Mining of the riverbeds should be prohibited as it leads to fall in the water levels & it also damages the natural river system.

- 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.


JAMMU & KASHMIR
BARAMULA DISTRICT
INDEX MAP
Not To Scale
MUZAFFARABAD
GILGIT WAZARAT
KARGIL
KUPWARA
SRINAGAR
MUZAFFARABAD
PUNCH
BADGAM
Bandipura
Sopur
Sonawari
BARAMULA
Uri
Gulmarg
LEGEND
District Boundary
Tehsil Boundary
District HQ
Tehsil HQ
Road
Surface Water Divide
River/Nalla
Exploratory wells
NHS Wells
Hilly area
Valley area


JAMMU & KASHMIR
BARAMULA DISTRICT
PHSIOGRAPY AND DRAINAGE
Not To Scale
MUZAFFARABAD
GILGIT WAZARAT
KARGIL
KUPWARA
SRINAGAR
BANDIPORA
SOPUR
SONAWARI
BARAMULA
URI
GULMARG
BADGAM
PUNCH
Jhelum River
Wular Lake
LEGEND
District Boundary
Tehsil Boundary
District Headquarter
Elevation (m amsl)
Drainage
Basin Boundary
Valley Area
Hilly/Mountainous Area


JAMMU & KASHMIR
BARAMULA DISTRICT
HYDROGEOLOGY
Not To Scale
MUZAFFARABAD
GILGIT WAZARAT
KARGIL
KUPWARA
MUZAFFARABAD
BADGAM
PUNCH
Jhelum River
LEGEND
Spring
Drainage
Water Level Contour (m bgl)
AGE
Formation
GW Condition
Quarternary /Tertiary
Alluvium / Karewa (Unconsolidated)
High to moderate yields. (10-20 lit/sec). Wells and tubewells feasible.
Permo-Carboniferous
Panjal Volcanic
Low yields (<10 lit/sec) Tubewells and handpump feasible.


JAMMU & KASHMIR
BARAMULA DISTRICT
GROUND WATER RESOURCES
0
15
30
kilometres
GW Resources (MCM)
340.78
2.36
62.57
A
Total Draft from Irrigation
Projected Demand for Domestic and Industrial Uses Upto 2025
GW Availability for Future Irrigation
MUZAFFARABAD
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District Boundary
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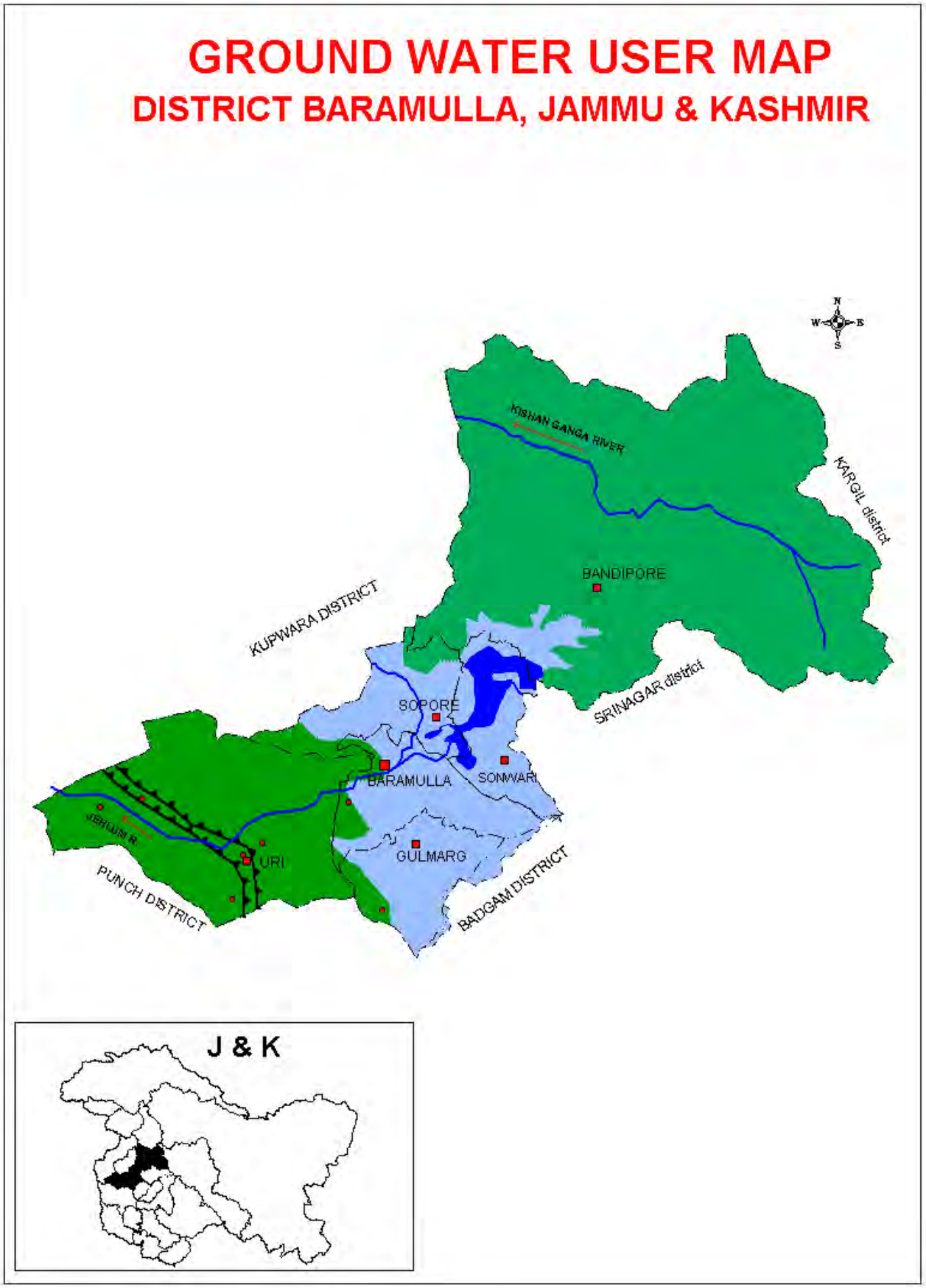
Plate-


GROUND WATER USER MAP
DISTRICT BARAMULLA, JAMMU & KASHMIR
N
W
E
S
KISHAN GANGA RIVER
KARGIL district
BANDIPORE
KUPWARA DISTRICT
SOPORE
SRINAGAR district
BARAMULLA
SONWARI
JHELUM R
URI
GULMARG
PUNCH DISTRICT
BADGAM DISTRICT
J & K

LEGEND

DISTRICT BARAMULLA

	Wells feasible	Rigs suitable	Depth of well (m)	Discharge (lpm)	Suitable artificial recharge structures
Soft rock aquifers	Tube well Dug Well	Percussion, Rotary, DTH with Odex Manual/Poclain	40 to 450 ✯ 10 to 15	160 to 700 400 to 700	Check dam, Recharge Shaft/pit
Hard rock aquifers	Tube well Dug Well Spring Development	DTH with Odex Manual/Poclain	20 to 40 ✯ 10 to 20	400 to 850 300 to 500 30 to 2000	

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

Springs

Reservior

Tehsil boundary

District boundary

Thrust

Major Drainage

Tehsil HQ

District HQ

OTHER INFORMATIONS

Total area	4588 sq.km
No. of tehsils	8
Major drainage	Jhelum, Kishanganga Rivers
Population	1166722 (2001 Census)
Rainfall	692 mm
Temperature	-4.9^0 C to 31.6^0 C
Regional geology	Soft rock : - Alluvium, Karewas
	Hard rock : - Panjal traps
Ground water quality	EC<750 micro mhos/cm at 25^{0}C
Utilizable ground water resources	574 mcm/yr
Stage of GW development	7 %
Name of watershed/ tehsil showing intensive GW development	Nil

Note : ✯ limited to explored depth Areas with depth to water level > 8 m bgl are suitable for artificial recharge

GROUND WATER INFORMATION BOOKLET
OF
BARAMULLA DISTRICT
JAMMU & KASHMIR STATE

CONTRIBUTORS

The Ground Water Information Booklet of Baramulla district of J & K State has been prepared by Sh. Ravi Kumar Gumma, Scientist 'B', North Western Himalayan Region, Jammu. This booklet has been scrutinized by Sh. S.K. Juneja, Scientist 'D' under the overall supervision and guidance of Sh. Arun Kumar, Regional Director, NWHR, Jammu.

The data generated in scientific studies carried out by various scientific officers and staff of the SUO Srinagar and NWHR, Jammu has been utilized in preparation of this booklet. The final scrutiny was done by Sh. R. C. Sharma, Sc-D, TS & OIC R&P Section. Ms Priya Kanwar, AHG has done lots of efforts in final processing and timely issuance of this booklet.

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

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SAVE WATER SERVE HUMANITY