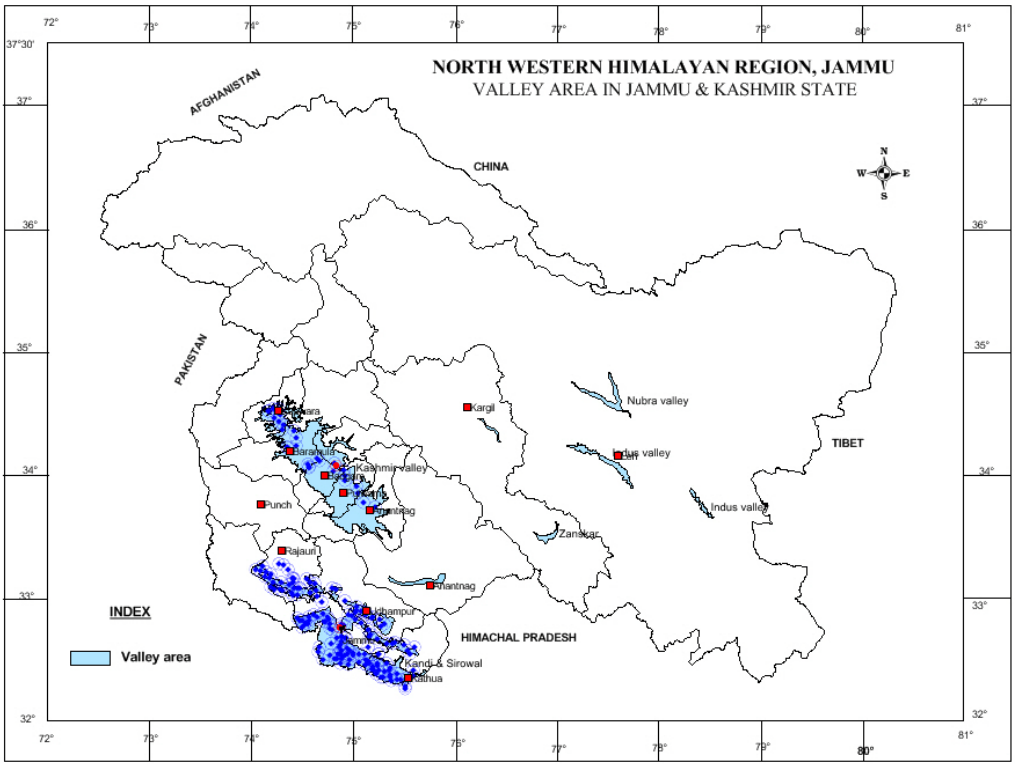
GROUND WATER YEAR BOOK

2013-14



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FOREWORD

Central Ground Water Board, An apex organization under Ministry of Water Resources, RD&GR, Government of India monitors behavior of ground water regime through a network of ground water monitoring wells spread across the country. The water level data collected from such observation wells in each state are compiled, processed and salient features brought out as a "Ground Water Year Book" every year. This report pertains to scenario of ground water regime in the state of Jammu and Kashmir for the year 2013-2014.

*WATER is one of the essential natural resources for sustaining life on blue planet "**Earth**". The demand of fresh / usable water has increased manifold globally due to rapid growth in population. Which in turn caused change in agricultural pattern and increase in industrial activities. To meet demand of fresh water of various sectors, there is an enormous stress on ground water resources as the surface water pollution is increasing day by day. This has resulted in water level decline in many parts of the country.*

Central Ground Water Board, North Western Himalayan Region, Jammu is monitoring groundwater regime in various hydrogeological setting through 240 Dug wells and 11 Peizometers in valley areas of Jammu and Kashmir State viz. Jammu, Kathua, Udhampur, Rajauri districts four times in a year (January, May, August and November) and in Anantnag, Baramulla, Srinagar, Pulwama, Budgam and Kupwara Districts monitored three times in a year (May, August and November). Due to heavy snowfall monitoring of January month is not being done. The effect of rainfall and snowfall on ground water regime is studied through fluctuations between pre and post monsoon seasons. Similarly water level fluctuations between two consecutive seasons are studied and comparisons of water levels for the year are done with long-term mean of at least one decade. The spatial and temporal variations in chemical quality of formation water are studied through chemical analysis results of water samples collected from ground water monitoring wells during May.

The information and data presented in this report will serve as a database to the user agencies, ground water planners and managers and will be of immense use to understand the regional picture on the quantitative and qualitative aspects of ground water regime in the State of Jammu & Kashmir.

The present Ground Water Year Book 2013 - 2014 is the outcome of the efforts made by Priya Kanwar, Assistant Hydrogeologist and Kanwar P Singh, Scientist B (Geophysics). The efforts made in depicting groundwater scenario of Jammu & Kashmir State through maps and giving proper shape to this report is highly appreciable.
A.K. Murdia, Scientist-C edited and processed report for issuance. The efforts in depicting groundwater scenario of Jammu & Kashmir State through maps and giving proper shape to this report are highly appreciable.

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GROUND WATER YEAR BOOK OF THE JAMMU AND KASHMIR STATE (2013-14)

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GROUND WATER YEAR BOOK OF THE JAMMU AND KASHMIR STATE (2013-14)

1. Introduction

1.1 Location

Jammu and Kashmir is a northern most and 6th largest state of India. It lies within latitudes of 32°17' and 36° 58' N and longitudes of 73° 26' and 80° 30' E. It has a total geographical area of 2,22,236 km^2 which includes an area of 78,114 km^2 under illegal occupation of Pakistan and 5180 km^2 which has been illegally handed over by Pakistan to China. It also includes 37,555 km^2 area which is under illegal occupation of China. Total 30 Survey of India Degree Sheets cover entire J&K State. The state has international border with China and Afghanistan in the north, Tibet in east and Pakistan in the west. The states of Punjab and Himachal Pradesh lie in the south. Major parts of Jammu and Kashmir State represent high rugged mountainous terrain. The Jammu and Kashmir State is divided into two administrative divisions viz. Kashmir Division comprising Kashmir and Ladakh Regions and Jammu division comprising of Jammu Region. There are total twenty-two districts in the state of J&K.

The Board started monitoring of ground water regime through All India network of hydrograph stations from 1969 onwards. The density of observation wells was increased year after year. Earlier ground water monitoring was carried out through a network of open wells, generally dug wells for drinking purpose tapping shallow aquifers. Keeping in view the importance of future ground water development, the network was subsequently strengthened by construction of purpose built piezometers. Presently, in Jammu and Kashmir a total of 240 dug wells and 11 piezometers are being monitored for this purpose. The Central Ground Water, North Western Himalayan Region is monitoring water levels in observation wells in the State of Jammu and Kashmir four times a year viz. May (between 20th and 31st), August (between 20th and 31st), November (1st and 10th) and January (1st and 10th). Water samples from observation wells are collected once in a year during May for quality testing. The water level and chemical analysis data thus collected is analyzed and interpreted by GEMS and Map Info software and Ground Water Year Book is issued annually with interpreted data and thematic maps depicting ground water scenario.

During the period May 2013-January 2014, an effort was made to strengthen existing monitoring network. For this purpose, 47 monitoring wells were established in Jammu District and 9 monitoring wells were established in Kathua District. The total number of new monitoring wells inventoried during the period May 2013- January 2014 is 57. The total number of active ground water monitoring wells are 240 (as on January 2014) which are located in Jammu, Kathua, Rajauri, Udhampur, Srinagar, Baramulla, Anantnag, Kupwara and Pulwama Districts. Most of monitoring stations falling in valley areas of these districts.

The present report discusses regional behavior of water levels in phreatic aquifers for the period May, August, November 2013 and January 2014 which will enable user agencies to plan development strategies. The results of chemical analysis of water samples collected in May 2013 from observation wells established by Central Ground Water Board, North Western Himalayan Region are also discussed.

The main objectives of ground water regime monitoring in Jammu and Kashmir may be summarised as follows:

1. To study fluctuation of water level both spatially and temporally in response to ground water recharge and/or discharge.
2. To evaluate changes in ground water level with respect to preceding year for the same period.
3. To evaluate changes in ground water level with respect to a long term average water level such as decadal mean.
4. To study fluctuation of water level during different seasons of 2013-14.
5. To study hydro-chemical behaviour of phreatic aquifers.

1.2 Status of Hydrograph Network Stations

In Jammu & Kashmir, there are 240 Hydrograph Network Stations besides 19 numbers of piezometers. 211 NHS exist in Jammu Region and 29 stations in Kashmir Region. Efforts have been made to establishing NHS stations in Ladakh Region but till date no monitoring stations have been established. Out of 19 peizometers, eight peizometers are abandoned (as on 31.05.2013), now only 11 peizometers exists. During the period May 2013-January 2014, 47 monitoring wells were established in Jammu District and 9 monitoring wells were established in Kathua District. District-wise number of hydrograph network stations as on 31.03.2013 are given Table-1 and their locations are shown in Plate-I.

Table: 1 District-wise break up of active Ground Water Monitoring Wells in Jammu & Kashmir State (as on January 2014)

Sl. No.	Region	District	Total no of Monitoring wells	Number of Active Ground Water Monitoring Wells			
				May 2013	Aug 2013	Nov 2013	Jan 2014
1.	Jammu Region	Jammu	110	101	109	106	106
2.		Kathua	49	48	49	48	38
3.		Udhampur	22	21	21	22	22
4.		Rajauri	30	30	30	30	30
5.		Poonch	-	-	-	-	-
6.		Doda	-	-	-	-	-
7.	Kashmir Region	Anantnag	01	01	01	01	-
8.		Baramulla	10	09	10	10	-
9.		Srinagar	02	01	01	01	-
10.		Kupwara	11	10	11	11	-
11.		Pulwama	05	05	05	05	-
12.		Badgam	-	01	01	01	-
13.	Ladakh Region	Kargil	-	-	-	-	-
14.		Leh	-	-	-	-	-
Total			240	227	238	235	196

1.3 Physiography

Physiography of the Jammu & Kashmir State is very varying. There are the highest mountain ranges of the world, extensive plateau, enormous valleys, deep gorges and large canyons in Middle and Trans-Himalayan Regions. The individual ranges have characteristic steep slopes towards south and much gentle slope towards north. The northern slopes are covered with thick and dense growth of vegetation. While the southern slopes are mostly bare with thin sparse forest cover. The Zanskar range separates Ladakh Region with Kashmir Valley while Pir Panjal range divides Jammu Region and Kashmir Valley. The state can be divided into six distinct physiographic units as discussed below.

- ***Sirowal Belt***

The Sirowal belt covers an area of about 1000 km^2 and has an average topographic gradient of 1:250 to 1:300 in southwest direction. The land elevation of Sirowal belt above mean sea level is normally within 320 m. Southern parts of Jammu and Kathua Districts fall in this belt.

- ***Kandi Belt***

The elevation of Kandi belt ranges between 320 m and 400 m above mean sea level (m amsl). The average topographic gradient varies between 1:60 and 1:100. Kandi belt covers an area of about 1500 km^2 and occupies parts of Jammu and Kathua Districts imperceptibly north of Sirowal belt.

Kandi is synonymous to Bhabhar of Uttar Pradesh. Kandi belt in Jammu & Kashmir state runs in northwest - southeast direction as a narrow strip between rivers Munnawar Tawi in the west and Ravi in the east. The belt is occupied by reworked Siwalik debris, which has master slope towards south-west.

- ***Siwalik Region***

Land elevation of Siwalik region ranges between 400 m and 750 m above mean sea level. Ridges and small independent valleys are the prominent features of Siwalik region which covers parts of Kathua, Jammu, Udhampur and Rajauri Districts.

- ***Kashmir Valley***

The elevation of valley floor above mean sea level ranges between 1500 m and 2000 m. Kashmir valley covers an area of 5600 km and comprises parts of Badgam, Pulwama, Srinagar, Anantnag, Baramulla and Kupwara Districts.

- ***Hilly Mountains***

The high mountain ranges have the elevation between 2000 m and 5000 m above mean sea level and form parts of Udhampur, Anantnag, Baramulla, Srinagar and Kupwara Districts.

- ***Trans-Himalayan Zone***

The trans-Himalayan zone constitutes the inaccessible mountainous terrain of Kargil and Leh districts in Ladakh Region. The elevation of this zone varies between 5000 m and 8000 m above mean sea level. However, along the lower reaches of Indus and Shyok rivers the elevation is less than 5000 m.

1.4 Drainage

Entire state of Jammu and Kashmir falls in the rivers of Indus River System and the only exception is the small area in the extreme north-east which is part of Quraqush River Basin.

- ***Indus Basin***

The total drainage area of Indus Basin is 11,78,440 km^2 out of which an area of 453,250 km^2 falls in high Himalayan mountains and the remaining 725,190 km^2 falls in the plains of the drainage area in plains a total of 321,290 km^2 area of Indus basin falls in India whereas only 131,960 km^2 area falls in Pakistan.

The Indus River (Sanskrit-Sindhu, Greek-Sinthos, Latin-Sindhus) originates from lofty mountains near Mansarovar Lake at an elevation of 5182 m and traverses for several hundred kms through Tibet and India before reaching Suleiman mountains in Pakistan. A part of the Indus Basin is above the permanent snow line, which varies in altitude from 4268 m in the eastern parts to 5792 m on the western parts. In Ladakh Region, the snow line is at 5488 m above mean sea level, which recedes during summer.

The hydrographic system of the lndus Basin is very extensive. The river initially runs along the strike of the mountains and then suddenly makes an acute bend to the south and flows directly across the mountain. The Gilgit River joins the Indus at its great bend to the south. The Indus flows initially under the name of Singee Khabab until it is joined by Ghar River at about 257 kms from its source. After short distance downstream it enters Kashmir at an elevation of 4206 m and flows over a long flat plain in Tibet plateau. It skirts Leh at 3200 m and is joined by Zanskar River while still flowing north but more westerly. The Indus passes near Skardu and reaches Haramosh Mountain (7407 m). Here it takes a turn southwards at an acute angle and passing near Hattu Pir, enters Kohistan. After flowing through wilds of Kohistan and at about 1450 km from its source, the Indus is joined by Kabul and Swat Rivers from Afghanistan. At this point the elevation of the Indus falls to about 610 m. After leaving Attock in Pakistan the river flows southwards, parallel to the Suleiman Range. At about 805 km. from the Arabian Sea and at an elevation of 79 m. The Indus receives waters from all of its five major tributaries viz. Jhelum, Chenab, Ravi, Beas and Satluj and here, it is known as Panjnad (five rivers). The river finally joins the Arabian Sea through its mouth, which form a big delta covering 7770 km^2 and a vast coastline of about 201 kms.

Major sub-basin of Indus System in Jammu & Kashmir State is the Jhelum Sub-basin, the Chenab Sub-basin and the Ravi Sub-basin. A brief account of these three sub-basins is given as under:-

- ***Jhelum Sub-Basin***

The Jhelum is known in Kashmir as the Veth River. Most parts of Kashmir valley are drained by Jhelum River, which flows in northwesterly direction. The Jhelum River (Sanskrit-Vitasta, Greek-Hydaspes, Latin-Bipaspes) originates from Verinag Spring. The River has various tributaries in the valley several of which come from the everlasting snows of the Liddar valley. Near Srinagar it received by the Sind River, and then forms the Wular Lake. The Wular Lake in Baramulla District which, in fact, a delta of Jhelum River. Below Baramulla, the river leaves the fertile banks of the valley and rushes headlong down a deep gorge at Khadnayar and joins the Chenab River at Trimmu in Pakistan.

- ***Chenab Sub-Basin***

The Chenab River or Asikin, as it was known in Vedic times, is formed by two important tributaries, the Chandra and the Bhaga, which join near Keylong in Himachal Pradesh to form Chandra-Bhaga or the Chenab River in Himachal Pradesh.

The River then flows through the Kashmir Himalayas to emerge into the plains at Akhnoor in Jammu District, at about 250 kms from its source. Ranbir canal takes off from its left bank in Akhnoor tehsil.

- ***Ravi Sub-Basin***

Very small parts of the state, mainly the extreme south-eastern parts, fall in the Ravi Sub-basin. The Ravi River rises from the northern face of Rohtang Pass in Himachal Pradesh at an elevation of 4116 m. After passing through Dhauladhar hill ranges, the river emerges from the foothills near Madhopur where the headworks of the Upper Bari Doab Canal exist. It has the smallest catchment area among the rivers of the Indus System. An important tributary of Ravi River, the Ujh River Which originates from the Basohli hills of Kathua District joins the mainstream to its right at Lassian.

1.5 Soils

Various types of soils are formed in different regions of the state owing to marked physiographic and climatological variations.

Alluvial soils occur in parts of Jammu and Kathua Districts where the land elevation is less than 300 m above mean sea level (m amsl). These soils are homogeneous and very fertile.

Brown hilly soils are formed at laud elevations between 300 and 1500 m amsl in the areas of moderately undulating topography. Spodo soils are developed in areas with land elevation between 1500 and 3000 m amsl experiencing relatively colder winters and higher mean annual rainfall. These soils occur in Poonch and Doda districts.

Ochara-qulfs soils are yellowish brown in colour and have moderately low permeability. These are developed at an elevation of about 1600 m amsl in mid upland areas of Kashmir Valley. Hapludalfs soils are yellowish brown to dark brown in colour, very deep and well drained.

Skeletal soils are developed in parts of Leh and Kargil districts of Ladakh Region, which vary in altitude between 2400 m and 7200 m amsl and experience severely cold and dry winters.

1.6 Hydrogeology

The hydrogeological set up in the state is very complicated owing to varied geological settings and ground water conditions. All the three regions of Jammu & Kashmir state viz. Ladakh, Kashmir and Jammu represent entirely different ground water regimes. Based on geology and aquifer characteristics, the area of the state can be divided into two broad hydrogeological units. These units are Porous formations and Fissured formations.

1.6.1. Porous Formation

Porous formations are best suitable for the exploration and development. Potential zones are encountered in these formations. These formations are: -

- ***Jammu Region***

In Outer Plains of Jammu Region, extending between River Ravi in the east to Munnawar Tawi in the west, the ground water occurs in piedmont deposits belonging to upper Pleistocene to Recent age. The deposits comprise unconsolidated sediments in the form of terraces and coalescent alluvial fans developed by the streams debauching out of Siwalik Hills. The sediments consist of coarse clastics ranging in size from boulders to gravel in the loose clay matrix and occasionally alternating bands of clay of varying thickness. Kankar is also intercalated with these sediments at different intervals and in variable quantity.

These deposits are graded into finer sediments from north to south in that order. Down south it comprises alternate bands of sands of all grades and clay with subordinate peck of gravels and pebbles.

- ***Kandi Formation***

The typical Kandi formation comprises very coarse material with little clay but in the Outer Plain of Jammu & Kashmir State the typical Kandi formations are not seen. Instead, they comprise boulder, gravel, pebble and coarse sand with substantial amount of clay sometimes hard and sticky of varying thicknesss. The clay proportion increases towards southwest. Occurrence of perched water bodies is a common phenomenon in the Kandi belt of Jammu & Kashmir state. The ground water generally occurs under unconfined conditions in Kandi formation.

- ***Sirowal Formation***

The Kandi formations coalesce into Sirowal formations in the south, which are finer outwash of Siwalik debris, brought by streams. Ground water occurs under both the confined as well as unconfined conditions in Sirowal formation. A spring line demarcates the contact between Kandi and Sirowal formations because the ground water oozes out along this line causing marshy conditions. The spring line has undergone deformation due to decline of water level resulting from development of ground water in Sirowal area. However, the base flow could be seen in streams south of this line, which also in the Sirowal formation is the existence of auto-flow conditions in the deeper aquifer system.

The Dun Belt separates the Siwalik hills in the middle Himalayas and runs as a series of river terraces between Basohli (32°30', 76°49'30") in the east to Riasi (33°05', 74°50') and beyond in the west. The sediments are in the form of isolated sub-recent to recent valley fill deposits ranging in thickness between a few metres to a few tens of metres. These deposits are often dissected as a result of the present day drainage pattern. The deposits comprise of coarse clastics such as boulders, cobbles and pebbles etc. inter bedded with lenticular clays.

- ***Isolated Valley Fills in Middle Himalayas***

There exist a number of isolated valleys in middle Himalayas where ground water occurs in valley fill deposits comprising of lacustrine to fluvio-glacial sediments. A few meter thick layer of loess overlies these deposits, which is windblown.

Ground water in such valleys generally occurs under confined conditions. One of the prominent isolated valleys in middle Himalayas is Kishtwar valley (33°18' 30", 75°46') in Doda district of Jammu Region.

- ***Kashmir Region***

Kashmir valley covers an area of 5600 km and is occupied by Karewas that consist of a huge pile of alternating bands of sand, silt and clay interspersed by glacial boulder beds. The sands are mostly fine to very fine grained and it is very rare that they are medium to coarse grained. There is considerable lateral facies variation in the nature of sediments. The aggregate thickness of these sediments is of the order of 2500-3000 m. Ground water in the Karewas of Kashmir valley occurs under both the confined as well as unconfined conditions.

- ***Ladakh Region***

In Leh plain of Ladakh Region the sediments consist of moranic and fluvio-glacial boulders, cobbles underlain by lacustrine deposits consisting of clay and silt. The Leh plain covers an area of about 100 km^2 between Phayang Nala in the west to Sabu Nala in the east. Ground water generally occurs under unconfined conditions.

1.6.2. Fissured Formation

About 15000 sq. km. Area in Jammu Region is occupied by hilly terrain. It comprises rocks ranging in age from the Precambrian (Salkhala series) to Miocene or even Pliocene (Murees and upper-middle Siwaliks). The rock types range from soft or friable sandstones, Clays, Shales, Conglomerates to hard traps and metamorphic such as quartzite and crystalline limestone. In the Siwalik terrain where groundwater is tapped comes mainly either from the weathers mantle or from the joints or cracks of these rocks. Friable Siwalik sandstone does possess primary but are not very potential aquifers.

2. Depth to Water Level

The water levels in Ground Water Monitoring Wells of Jammu and Kashmir State were measured four times during the period 2013-2014 (May, August, November 2013 and January 2014). The water levels observed are shown in Annexure-XIV.

2.1 Depth to Water Level -May 2013

In **Jammu Region** the water level data in respect of 200 out of 211 National Hydrograph Network Stations for the month of May 2013 were analyzed. The depth to water levels ranges from 0.45 m bgl (Billawar in Kathua district) to 37.6 m bgl (Taryai in Jammu district).

The water level is recorded less than 2 meters below ground level (m bgl) in 27 (13.5%) wells. 103 wells (51.5% of the total wells analyzed), have shown depth to water level in the range 2 to 5 m bgl, whereas 40 wells (20%) have shown water levels in the range of 5 to 10 m bgl. 17 (8.5%) wells are showing deeper water level i.e. in the

range of 10 to 20 m bgl. 13 (6.5%) wells are showing very deep water level of more than 20 m bgl. None of the wells have shown water levels more than 40 m bgl.

All the valley areas of Rajauri and Udhampur Districts show water levels between 2 to 5 m bgl except for some places in Udhampur District and Dun Belt where water level is between 5 to 10 m bgl. In the outer plains of Jammu and Kathua districts, most of the area is having water levels between 2 to 5 m bgl. Some parts of Jammu and Kathua Districts show water levels between 5 to 10 m bgl and 10 to 20 m bgl especially in Kandi belt. In this belt the water levels are as deep as 20 m bgl which are observed at the transition boundary of Siwalik Hills and Kandi belt. (Plate II).

In Kashmir Region The water level data in respect of all the 27 National Hydrograph Network Stations for the month of May 2013 were analyzed. The depth to water levels ranges from 0.25 (in Baramulla district) to 18.75 m bgl (in Anantnag district).

The water level is recorded less than 2.0 m below ground level in 14 (51.85%) wells, 9 (33.33%) of the total wells analyzed, have shown depth to water level in the range 2-5 m bgl, whereas none of the wells have shown water levels in the range of 5-10 m bgl, 04 (1.48%) wells are showing the deeper water level i.e., 10-20 m bgl, none of the wells have shown water level more than 20.0 m bgl.

The valley of Baramulla district has maximum of its part under 0 – 2 m bgl and a very small patch of Pulwama and Anantnag districts are having water levels between 0 -2 m bgl. Rest of the parts of Kupwara, Baramulla and Badgam districts are having water levels between 2 – 5 m bgl. The water levels between 5 and 10 m bgl is observed in almost whole of valley portion of Srinagar district and parts of Pulwama and Anantnag Districts. The water level between 10 – 20 m bgl is observed in two very small patches of Srinagar and Pulwama districts. (Plate III)

2.2 Depth to Water Level -August 2013

In Jammu Region, The water level data in respect of 209 out of 211 National Hydrograph Network Stations for the month of August 2013 were analyzed. The depth to water levels ranges from -0.24 m bgl (in Rajauri district) to 33.24 m bgl (Taryai in Jammu district).

The water level is recorded less than 2 meters below ground level (m bgl) in 131 (62.67%) wells. 47 wells (22.48% of the total wells analyzed), have shown depth to water level in the range 2 to 5 m bgl, whereas 14 wells (6.69%) have shown water levels in the range of 5 to 10 m bgl. 10 (4.78%) wells are showing deeper water level i.e. in the range of 10 to 20 m bgl. 7 (3.34%) wells are showing very deep water level of more than 20 m bgl. None of the wells have shown water levels more than 40 m bgl.
All the valley areas of Rajauri District have water levels between 0 to 2 m bgl. The valley area of Udhampur District shows water levels between 0 – 2 m bgl except for its eastern part where water levels are between 2 and 5 m bgl. In Dun Belt water level is between 0 and 2 m bgl in its eastern and western parts, but in its west central part water levels up to 10 m bgl are observed. Maximum effect of monsoon is observed in the Outer Plains of Jammu and Kathua districts. In May where most of the area was having water levels between 2 to 5 m bgl has been covered up and water levels are observed between 0 and 2 mbgl followed by contour of 2 to 5 m bgl. The transition part of

Sirowal belt and Kandi belt of both Jammu and Kathua Districts shows water levels between 5 to 10 m bgl and 10 to 20 m bgl. In Kandi belt the water levels are as deep as 20 m bgl which are observed at the transition boundary of Siwalik Hills and Kandi belt (Plate IV).

In Kashmir Region The water level data in respect of all the 27 National Hydrograph Network Stations for the month of August 2013 were analyzed. The depth to water levels ranges from 0.25 (in Baramulla district) to 18.75 m bgl (in Anantnag district).

The water level is recorded less than 2.0 m below ground level in 14 (51.85%) wells, 9 (33.33%) of the total wells analyzed, have shown depth to water level in the range 2-5 m bgl, whereas none of the wells have shown water levels in the range of 5-10 m bgl, 04 (1.48%) wells are showing the deeper water level i.e., 10-20 m bgl, none of the wells have shown water level more than 20.0 m bgl.

The valley of Baramulla district has maximum of its part under 0 – 2 m bgl and a very small patch of Pulwama and Anantnag districts are having water levels between 0 -2 m bgl. Rest of the parts of Kupwara, Baramulla and Badgam districts are having water levels between 2 – 5 m bgl. The water levels between 5 – 10 m bgl is observed in almost whole of valley portion of Srinagar district and parts of Pulwama and Anantnag Districts. The water level between 10 – 20 m bgl is observed in two very small patches of Srinagar and Pulwama districts. (Plate V)

2.3 Depth to Water Level -November 2013

In **Jammu Region**, the water level data in respect of 206 out of 211 National Hydrograph Network Stations for the month of November 2013 were analyzed. The depth to water levels ranges from -0.13 m bgl (Jagti in Jammu District) to 31.54 m bgl (Taryai in Jammu district)

Majority of the wells that is 104 numbers of wells (50.48%) have recorded the water level less than 2.0 m bgl. Twenty nine wells (14.07%) of the total wells analyzed have shown depth to water level in the range 2-5 m bgl. Whereas 14 wells (6.79%) of the total wells analyzed have shown water levels in the range of 5-10 m bgl. Seven (2.91%) wells are showing the deeper water levels, i.e. 10-20 m bgl. None of the wells are showing water levels more than 20.0 m bgl.

Valley areas of Udhampur and Rajauri districts and Dun belt show water level between 0-2 and 2-5 m bgl except for two patches in Dun Belt that shows water levels between 5 and 10 m bgl. In Sirowal area of Outer Plain most of the water levels recorded between 2 and 5 m bgl except for few small patches that shows water levels from 0 to 2 m bgl. In Kandi Belt the water levels are deeper. Only a small patch in this belt near Pallanwala is having water levels near the ground surface and two patches both in the eastern part of Kandi belt in Jammu and Kathua districts show water levels between 2 and 5 m bgl otherwise rest of the Kandi belt has water levels more than 5 m bgl. In the Nilcha area of Kathua District and Taryai & Bhagwanchak area of Jammu District, the water levels are deeper than 20 m bgl. *(Plate-VI)*

In **Kashmir Valley**, the water level data in respect of all the 29 National Hydrograph Network Stations for the month of November 2013 were analyzed. The depth to water

levels ranges from 1.26 (Gandasi Bhat in Pulwama District) to 15.28 m bgl (Tral in Pulwama District).

The water level is recorded less than 2.0 m below ground level in 3 (10.34%) wells, 16 (55.17%) of the total wells analyzed, have shown depth to water level in the range 2-5 m bgl, whereas six wells (20.68%) have shown water levels in the range of 5-10 m bgl, 04 (13.73%) wells are showing the deeper water levels i.e., 10-20 m bgl, none of the wells have shown water level more than 20.0 m bgl.

Except for two very small patches in Baramulla and Pulwama Districts where water levels are within 2 m from ground, all other parts of Kashmir Valley have water levels deeper than 2 m bgl. Water levels between 5 and 10 m bgl are observed in small parts of Kupwara and Baramulla Districts and south eastern edge extending from Srinagar to Anantnag where water levels further tumble down to > 10 m bgl. (Plate VII)

2.4 Depth to Water Level -January 2014

In Jammu Region, the water level data in respect of 196 out of 211 National hydrograph Network Stations for the month of January 2014 were analyzed. The depth to water levels ranges from 0.20 in Kathua District to 32.14 m bgl in Jammu District.

About 55 (26.69%) have recorded the water level less than 2.0 m bgl. Ninty eight wells (47.57%) of the total wells analyzed, have shown depth to water level in the range 2-5 m bgl, whereas 31 wells (15.04%) of the total wells analyzed, have shown water levels in the range of 5-10 m bgl, 13 (6.31%) wells are showing the deeper water levels i.e., 10-20 m bgl, 9 (4.36%) wells are showing deepest water level that is more than 20.0 m bgl. None of the wells had shown water levels deeper than 40 m bgl.

All of the areas of valley in Udhampur and Rajauri District and also the Dun Belt show water level between 0-2 and 2-5 m bgl except for very small portion of Dun Belt falling in Udhampur District which shows water levels between 5 and 10 m bgl. In Sirowal area of Jammu District most of the water levels recorded between 0 and 2 m bgl whereas, in Kathua district water levels observed in this belt varies between 0-2 and 5-10 m bgl. In Kandi Belt of both the districts, the water levels are deeper especially in Taryai, Bhagwanchak and Marjoli areas of Jammu District and Nilcha area of Kathua district more than 20 m bgl water levels are observed. (Plate VIII)

In Kashmir Region due to heavy snowfall Monitoring of NHS stations is not being done for the month of January 2014.

3. Fluctuation of Water Level

3.1 Fluctuation of Pre-monsoon and Post- monsoon Water Levels

3.1.1. November 2013 with respect to May 2013 in Jammu Region

The seasonal water level fluctuation between November 2013 & May 2013 in respect of 198 National Hydrograph Stations are analyzed. It is observed that 188 stations (94.94%) have been shown rise in water level where as only 10 stations (5.05%) have shown fall.

Out of 188 stations showing rise in water levels, 121 wells (64.36%) have shown rise less than 2 m. 37 wells (20.21%) and 29 wells (15.42%) have shown rise in the range of 2-4 m and >4 m respectively. Eight wells (80%) have shown fall between 0-2 m and two wells (20%) has shown fall between 2-4 and >4 m.

Effect of rainfall is directly reflected in all parts of the area monitored during November 2013. Almost all the four valley areas are showing rise in the water levels except for small patches on the western and eastern parts of Rajauri valley and Kandi Belt in central part of Jammu District and eastern part of Kathua Districts shows fall of water level within 2 m bgl. In Kandi belt the rise is of more than 4 m and same is the scenario in the central part of Dun Belt. (Plate IX)

3.1.2 November 2012 with respect to May 2013 in Kashmir Valley

In Kashmir Valley, seasonal water level fluctuation between May 2013 & November 2012 in respect of National Hydrograph Stations are analyzed *(Annexure-V).* It is observed that 23 stations (85%) have been shown rise in water level where as only 4 stations (15%) have shown fall.

Out of 27 stations showing rise in water levels, 15 wells (65.2%) have shown rise less than 2 m. 4 wells (17.4%) and 4 wells (17.4%) have shown rise in the range of 2-4 m and >4 m respectively. 2 wells (50%) have shown fall between 0-2 m and one well (25%) has shown fall between 2 and 4 and >4 m.

Major parts of the valley have shown rise in water level less than 2 m followed by 2-4 and >4 m on the eastern fringes of valley in Pulwama and Kupwara District and western fringe in Baramulla District. In Anantnag District, almost whole of the valley portion is showing fall in the ranges of 0-2, 2-4 and >4 m respectively *(Plate-X).*

3.2 Annual Fluctuation

3.2.1. May 2013 with respect to May 2012

In Jammu Region, for analyzing the annual fluctuation, the water level data in respect of 138 National Hydrograph Network Stations for the month of May 2013 were analyzed and compared with their water levels monitored during May 2012. For analyzing the annual fluctuation the newly fixed and added dug wells were not considered as they were included in the monitoring network from May-2013 itself.

A total of 87 wells (64.04%) have shown rise and 47 wells (34.05%) have shown fall in water levels, in the range of 0-2 m, 2-4 m and >4 m. Rise is shown by 69 wells (79.31%) in the range of 0-2 m, 15 wells (17.24%) are showing rise from 2-4 m bgl and 03 wells (3.44%) of the wells analyzed are showing rise >4 m. Among 47 wells showing fall, 43 wells (91.48%) that have shown fall in water level are in the range of 0-2 m, 2 well (4.25%) has shown fall between 2-4 m. 2 (4.25%) wells have shown fall >4 m.

Major parts of Jammu, Kathua, Rajauri and Udhampur Districts shows rise in water levels when compared with annual fluctuation, especially in parts of Jammu, Kathua and Udhampur Districts, which have shown rise in the range of 0-2. Rise between 2 - 4

m is observed in Rajauri District and very small portion of Udhampur and Jammu Districts. Only some of places in Rajauri District, Udhampur District and Kathua District have shown the decline in water level from 0 -2 and 2-4 m. Fall is mainly observed in the eastern parts of Dun belt and valley of Udhampur District. (Plate XI)

In Kashmir Valley the water level data in respect of 22 National Hydrograph Stations for the month of May 2013 were analyzed. It was compared with those of monitored during May 2012.

Of 22 wells, a total of 8 wells (36.36%) have shown rise in the range of 0-2 m and 14 wells (63.63%) have shown fall in water level are in the range of 0-2 m.

The rise in water level is observed in only Kupwara district otherwise whole of the Kashmir valley was showing decline in water levels in the range of 0 – 2 m. (Plate XII)

3.2.2. August 2013 with respect to August 2012

In Jammu Region, For analyzing the annual fluctuation, the water level data in respect of 144 National Hydrograph Network Stations for the month of August 2013 were analyzed and compared with their water levels monitored during August 2012 *(*For analyzing the annual fluctuation the newly fixed and added dug wells were not considered as they were included in the monitoring network from May-2013 itself.

A total of 104 wells (72.22%) have shown rise and 39 wells (27.08%) have shown fall in water levels, in the range of 0-2 m, 2-4 m and >4 m. Rise is shown by 71 wells (68.26%) in the range of 0-2 m, 25 wells (24.03%) are showing rise from 2-4 m bgl and 08 wells (7.69%) of the wells analyzed are showing rise >4 m. Among 39 wells showing fall, 37 wells (94.87%) that have shown fall in water level are in the range of 0-2 m, none of the well has shown fall between 2-4 m. 2 (5.12%) wells have shown fall >4 m.

The Dun Belt is showing rise in water levels when compared to that of 2012. The Rise in water levels is observed in almost whole of the Outer Plains except for the few patches where fluctuations are showing fall in water levels. None of the part of Outer Plain of Jammu District is showing fall more than 2 m. The valley parts of Rajauri District and Udhampur District are showing decline in their eastern parts and central part in Rajauri and western in Udhampur valley. Rest parts of both the districts are showing rise. (Plate XIII)

In Kashmir Valley, the water level data in respect of 26 National Hydrograph Stations for the month of August 2013 were analyzed. It was compared with those of monitored during August 2012.

Of 26 wells, a total of 24 wells (92.30%) have shown fall in the range of 0-2 m and 02 wells (7.69%) have shown rise in water levels in the range of 0-2 m.

The rise in water level is observed only in parts of Anantnag and Pulwama District otherwise whole of the Kashmir valley was showing decline in water levels in the range of 0 – 2 m. (Plate XIV).

3.2.3. November 2013 with respect to November 2012

In **Jammu Region**, the water level data, in respect of 189 National Hydrograph Stations for the month of November 2013 was analyzed. It was compared with those of monitored during November 2012. Majority of the wells have shown rise in water levels. A total of 134 wells have shown rise and 52 wells have shown fall in water levels, in the range of 0-2 m, 2-4 m and >4 m.

Rise is shown by 115 wells (85.82%) in the range of 0-2 m. Fourteen wells (10.44%) are showing rise from 2-4 m bgl and five wells (3.73%) of the wells analyzed are showing rise >4 m. Among 52 wells showing fall, 49 wells (94.23%) that have shown fall in water level are in the range of 0-2 m. 3 wells (5.76%) have shown fall between 2-4 m and none of the wells has shown fall >4 m.

Major parts of all the four districts, i.e., Jammu, Kathua, Rajauri and Udhampur have shown rise in water level in the range of 0-2 m and some pockets have shown rise in water level >4 m. Fall is in the range of 0-2 m is observed in very small pockets in Rajauri district, Udhampur valley and northwestern part of Outer Plains of Jammu and eastern and south-eastern part of Kathua Districts. *(Plate-XV)*

In **Kashmir Valley**, the water level data in respect of 22 National Hydrograph Stations for the month of Nov 2013 were analyzed. It was compared with those of monitored during Nov 2012.

The fall in water levels in the range of 0 to 2 m is observed in Kupwara district and east-central part of Kashmir Valley except for a small patch in Baramulla District where fall is > 4 m. All other parts of Kashmir valley are showing rise in water levels in the range of 0-2 m. More than 2 m rise is observed in the south-eastern end of the valley in Anantnag District. (Plate XVI)

3.2.4. January 2014 with respect to January 2013

The water level data in respect of 197 National Hydrograph Stations for the month of January 2014 were analyzed. It was compared with those of monitored during January 2013.

Majority of the wells have shown fall in water levels. A total of 141 wells (69.11%) have shown rise and 60 wells (29.41%) have shown fall in water levels, in the range of 0-2 m, 2-4 m and >4 m. Rise is shown by 115 wells (81.56%) in the range of 0-2 m, 20 wells (14.18%) are showing rise from 2-4 m and six (4.25%) wells analyzed has shown rise >4 m. Among 60 wells showing fall, 58 wells (96.66%) that have shown fall in water level in the range of 0-2 m, 1 well (1.66%) each have shown fall between 2 to 4 m and > 4 m.

When compared to the water levels of January 2013, fall in water levels is observed in whole of Dun Belt and Udhampur District. The Outer Plains are also reflecting the same scenario of decline except for few patches in both the districts where there was rise in water levels mostly in the range of 0-2 m. In the Kandi part fall in the range of 2-4 m is observed in Jammu District but in Kathua, fall >4 m was also observed. In Rajauri valley the scenario is totally different from rest of the monitored valley portions. Rise is observed in Jhangar-Lam Valley between 0 and 2 m and the central

part of the valley and Channi Parat –Marchola areas are also showing rise. Fall is observed in the western and eastern parts valley of the Rajauri District. (Plate XVII)

3.3 Decadal Fluctuation

Fluctuation between Decadal Mean of Water Levels and Water level of Current Year

3.3.1. May 2013 with respect to mean of May 2003 – May 2012

The water level fluctuation for the month of May 2013 Vs. (Mean of May 2003 – May 2012 has been worked out in respect of 141 observation wells. It is observed that a total of 82 wells (58.15%) have shown rise and 58 wells (41.13%) have shown decline in water level (especially in Kandi areas of Outer plains).

Out of 82 (58.15%) number of wells showing rise, 74 wells (90.24%) wells are showing rise less than 2 m, 8 wells (9.75%) have shown rise from 2-4 m and no well has shown rise more than 4 m. Out of 58 wells, which are showing fall, 48 wells (82.75%) that have shown fall in water levels are in the range of 0-2 m, 7 wells (12.06%) have shown fall between 2-4 m and 3 wells (5.17%) >4 m bgl.

The water level May 2013 have been compared with the Decadal Mean water level (May 2003-12) are showing rise and fall when compared with decadal mean. All of the areas monitored have shown rise in water levels in Rajauri district and most parts of Dun belt. Rise was observed in Sirowal belt of Jammu District and fall in the Kandi Belt. In Kathua district, the water levels are mostly declining except for two small patches which show rise in water levels. (Plate XVIII)

3.3.2. August 2013 with respect to mean of August 2003 – August 2012

The water level fluctuation for the month of August 2013 Vs. (Mean of August 2003 – August 2012 has been worked out in respect of 147 observation wells. It is observed that a total of 119 wells (80.95%) have shown rise and 28 wells (19.04%) have shown decline in water level (especially in Kandi areas of Outer plains)

Out of 119 number of wells showing rise, 95 wells (79.83%) wells are showing rise less than 2 m, 21 wells (17.64%) have shown rise from 2-4 m and 3 (2.52%) wells has shown rise more than 4 m. Out of 28 wells, which are showing fall, 26 wells (92.85%) that have shown fall in water level are in the range of 0-2 m, none of the wells has shown fall between 2-4 m and 3 wells (10.71%) >4 m bgl.

The water level August 2013 have been compared with the Decadal Mean of water levels (August 2003-12) are showing rise and fall when compared with decadal mean. All of the areas monitored have shown rise in water levels in Outer Plains of both the districts of Jammu and Kathua. None of parts of Jammu District is showing fall more than 2 m. Two patches in Outer plains of Kathua district are showing fall more than 4 m. The rise is observed in Dum belt except for its western, central and northern, eastern parts. Fall is observed in the valley parts of Rajauri and Udhampur Districts. The eastern part of Udampur District and east central part of Rajauri Valley are showing fall > 2 m. The central part of Udhampur District is showing rise between 2 to 4 m. Rise in the range of 0 to 2 m is observed in the central part of Rajauri Valley. (Plate XIX).

3.3.3. November 2013 with respect to mean of November 2003 – November 2012

The water level fluctuation for the month of November 2013 w.r.t. (mean of November 2003 to November 2012) has been worked out in respect of 193 observation wells. It is observed that a total of 148 wells (76.68%) have shown rise and 43 wells (22.27%) have shown decline in water levels.

Out of 148 number of wells showing rise, 134 wells (90.54%) wells are showing rise less than 2 m. 10 wells (6.75%) has shown rise from 2-4 m and four wells (2.70%) has shown rise more than 4 m. Out of 43 wells, which are showing fall, 41 wells (95.34%) that have shown fall in water levels are in the range of 0-2 m. Two wells (4.65%) has shown fall between 2-4 m and none of the wells have shown fall >4 m.

Small patches of the Kandi and Sirowal belts of Jammu and Kathua Districts have shown fall in water levels mostly in the range of 0 to 2 m and in the extreme eastern end of Kathua District the fall is of 2 to 4 m. A very small part of Rajauri valley and central and eastern part of Udhampur valley has shown fall of 0 to 2 m bgl. Otherwise rise especially between 0 and 2 m is observed in all other parts except for west-central part of Dun belt and northern part of kandi belt both in Jammu and Kathua districts where rise of 2 – 4m is observed. *(Plate-XX)*

3.3.4 January 2014 with respect to mean of January 2004 – January 2013

The water level fluctuation for the month of January 2014 w.r.t. mean of (January 2004 to January 2013) has been worked out in respect of 131 observation wells. It is observed that a total of 11 wells (8.39%) have shown rise and 118 wells (90.07%) have shown decline in water levels.

All the 11 wells are showing rise less than 2 m. Out of 118 wells, which are showing fall, 90 wells (76.27%) that have shown fall in water level are in the range of 0-2 m. Twenty one wells (17.79%) have shown fall between 2 and 4 m and seven wells (5.93%) have shown fall in water level >4 m.

Most of the areas monitored have shown decline in water levels all the valley areas of all the four districts except for west central parts of Rajauri valley and some parts of Outer Plains in Jammu and Kathua Districts where there is rise in water levels in the range of 2 m. In the north-eastern part of Dun Belt the fall in water levels is >4 m. Fall between 0 and 2 m is observed in a small part in the centre of Udhampur valley and in small patches in Kandi belt in both the districts. (Plate XXI)

4. Hydrochemistry

The quality of shallow ground water in the state of Jammu & Kashmir has been evaluated on the basis of 228 no's of water samples collected from shallow aquifers during pre-monsoon season. All the collected samples were analyzed by adopting standard methods of analysis (APHA). Chemical analysis data of samples are summarized in Annexure XV. The summarized results of ground water samples are given in Table-1 given below.

Table: 2Ground Water Quality of Hydrograph Stations during May 2013

S.No.	Parameters	Permissible limit	Ranges	No. of Samples	Percentage %
1	Sp. Conductance µs/cm at 25°C	-	<750 751-2250 2251-3000 >3000	185 41 01 01	81.14 17.98 0.43 0.43
2	Chloride (mg/l)	250-1000	<250 251-1000 >1000	227 01 00	99.56 0.44 0.0
3	Fluoride (mg/l)	1.50 mg/l	<1.00 1.01-1.50 >1.50	225 01 02	98.68 0.44 0..88
4	Nitrate (mg/l)	45 mg/l	<45 46-100 >100	198 22 08	86.84 9.85 3.51
5	Iron (mg/l)	1.00 mg/l	<1.00 1.01-1.50 >1.50	202 09 14	89.91 3.95 6.14

pH

In Jammu Region, pH values ranging between 7.05 (Rehal) to 8.7 (Battal Ballian) and in Kashmir Region pH values ranging between 7.44 (Aripathan) to 8.03 (Regal Chowk). The pH values more than 8.30 shows presence of carbonate ions reported in these samples. Whereas rest of the samples have only bicarbonate ions. Point values for pH of all the NHNS of all Regions and Kashmir region are appended in the Appendix-XV

Specific Conductance

Majority of samples (81.14%) are found to have specific conductance less than 750 µS/cm at 25°C hence the ground water is fresh and potable. About 17.98% and 0.43% of the samples have values between 751- 2250 µS/cm and 2251-3000 µS/cm respectively. In Jammu Region, specific conductance varies between 180 and 4820 µS/cm at 25°C. More than 3000 µS/cm is observed only in one sample from Suchetgarh of Jammu District (Specific conductance 3300 µS/cm at 25°C) an abandoned well samples collected from nearby this well is potable.

In Kashmir Region specific conductance varies between 190-1210 µs/cm at 25°C. Major part of the valley areas showing EC values <1000 µs/cm except some locations i.e. Aripanthan and Kupwara.

Chloride Concentration

The concentration of Chloride in majority of the samples (99.56%) is less than 250 mg/l. Rest of 0.44% of samples Chloride concentration ranges from 251-1000 mg/l (Londi 312 mg/l from Kathua District).

In Jammu Region, the Chloride concentration less than 200 mg/l except for Londi and Bareri. In Kashmir Region all the valley areas have Chloride concentration less than 200 mg/l. The Chloride concentration in all the samples is within the maximum permissible limit of BIS for drinking water purpose.

Fluoride Concentration

Fluoride is an important parameter for evaluating ground water quality. The concentration of fluoride in majority of the samples (99.12 %) is less than 1.00 mg/l, except one place where high Fluoride is determined Sunal of Udhampur District 3.05 mg/l.

Nitrate Concentration

Nitrate is also an important parameter for evaluating ground water quality. In majority of samples 86.84%, concentration of nitrate is less than 45 mg/l, while 9.85 % (22 nos) of samples are associated with nitrate concentration more than 45 mg/l, but less than 100 mg/l. Rest of 3.51% (8 nos) of samples are reported to have nitrate concentration more than 100 mg/l. The details of samples, which are associated with Nitrate concentration more than maximum permissible limit of BIS (>45mg/L) are summarized in the table given below.

Table: 3 Samples associated Nitrate concentration more than 45 mg/l as per BIS.

S. No.	District	Location	Nitrate > 45 (mg/l)
1	Jammu	Dhanpur	115.0
2		Hamirpur Sidhar	216.0
3		Jaswan	134.0
4		Bega	115.0
5		Jourian	48.0
6		Marh	54.0
7		Arnia-I	60.0
8		Channi	48.0
9		Khairi	47.0
10		Kothey-sani	46.0
11		Miranshaib	48.0
12		Satwari	46.0
13		Supwal	51.0
14		Tirkutanagar	61.0
15		Greaterkailash	46.0
16	Kathua	Ganu Chowk	178.00
17		Jandi	106.00
18		Londi	121.00
19		Challan	74.00
20		Karol Krishna	53.00
21		Kerian Gandyal	50.00
22		Samba	94.00
23	Kupwara	Dolipura	57
24		Magam	64

25	Udhampur	Nagrota	60.0
26		Parnala	86.0
27		Sirdhara	63.0
28	Kashmir Valley	Rambarpora	70
29		Binner	54
30		Aripanthan	188

Iron Concentration

In majority of samples, 89.91% (205) have Iron concentration less than 1.00 mg/l. Iron concentrations in these samples are within the norms setup by BIS for drinking water purpose. About 3.95 % (09 nos) of samples, concentration of Iron ranges from 1.01 mg/l to 1.50 mg/l. In rest of samples 6.14 % (14 nos) Iron concentration is more than 1.50 mg/l. In Jammu Region, iron concentration ranging between 0-8.05 mg/l.

In Kashmir Region, Iron concentration is too high and this iron is basically geogenic. Iron concentration ranges between traces to 14.0 mg/l. Samples, which are associated with concentration more than maximum permissible limit 1.0 mg/l are summarised in the table given below.

Table: 4 Samples associated Iron concentration more than 1.00 mg/l of BIS

S.No	District	Location	Iron >1.00 (mg/l)
1	Jammu	Bakore	4.55
2		Bhagwanchak	1.83
3		Gajansoo	4.98
4		Senth	2.13
5		Arnia-I	8.05
6		Chamlia	1.73
7		Didyal	2.02
8		kaluchak	2.58
9		Laswara	2.04
10		Kana Chak	1.11
11		Purkhoo	1.49
12		Taryai	1.20
13		Nandpur	1.08
14		Supwal	1.09
15		Greaterkailash	1.03
16	Kathua	Chakhariya	1.21
17	Rajouri	Dharamsal	3
18		Kalal	2
19		Banpari	1
20	Udhampur	Jindhara	1.34
21	Kashmir Valley	Gandhasi Bhat	2.22
22		Pampore Silk Centre	14.00
23		Zeewan	12.00

Total Hardness

Hardness of the water is the capacity of water to neutralise soap. Hardness is mainly caused by Carbonate & Bicarbonate ions of Calcium and Magnesium.

Classification of Hardness

This classification is based on the value of total Hardness. Ground water may be classified in to four type's soft, moderate hard, hard and very hard.

Table: 5 Ground water samples summarised as per classification of Hardness

S.No	District	Nos of Samples	Soft (0-60) mg/l	Mod. Hard (61-120) mg/l	Hard (121-180) mg/l	Very Hard more than 180 mg/l
1	Jammu	93	00	09 (9.6%)	50(53.8%)	34 (36.6%)
2	Kathua	42	00	02 (4.8%)	15 (35.7%)	25 (59.5%)
3	Rajauri	32	00	00 (0.0%)	19(61.3%)	12 (38.7%)
4	Udhampur	34	00	02 (6.5%)	09 (29.0%)	20 (64.5%)
5	Kashmir Valley	27	00	02 (7.4%)	01 (3.7%)	24 (89.0%)
	Total	228*	00	15	94	115
	Percentage	100%		6.6%	41.2%	50.4%
*Four samples are not included in this analysis due to leakage.						

As per the classification, Ground water is hard and very hard. About 41.2% and 50.4% of samples belong to hard and Very hard categories respectively. None of the samples in the study area belong to Soft category.

Range of Hardness:

The ranges of Total hardness of samples are calculated district wise and summarized in the table given below.

Table: 6 District Wise Range of Hardness of NHS 2012

S.No	District	Range of Total Hardness (as $CaCO_3$) mg/l
1	Jammu	100-310
2	Kathua	80-770
3	Rajauri	125-315
4	Udhampur	105-525
5	Kashmir Valley	92-420

From the table, it is very clear that in samples collected from Jammu District, value of Total Hardness varies from 100-310 mg/l. Similarly for Kathua, Rajauri & Udhampur Districts TH values vary from 80-770mg/l, 125-315 mg/l and 105-525 mg/l respectively.

In Kashmir Region, TH value varies from 92-420 mg/l .(As per the BIS norms 300 and 600 mg/l is the limit for desirable and maximum permissible limit respectively for drinking water purposes. All samples are within the maximum permissible limit (600 mg/l) except at one location (Londi –Kathua district) where high value of Total Hardness (770mg/L) is observed.

Pollution Study

Pollution studies have been carried out at Mansar in Udhampur district and Jhelum River at Kashmir valley.

Mansar Lake

Mansar Lake is situated 62 km from Jammu, Mansar (32.6961° N, 75.1468° E) is a beautiful lake fringed by forest-covered hills, over a mile in length by half-a-mile in width. Mansar Lake is also picking up its fame among the tourists with all its flora & fauna. The lake has cemented path all around with required illumination with projected view decks to enjoy flickering of seasonal birds, tortoise and fishes of different species. There is a wild life Sanctuary housing jungle life like Spotted Deer, Neelgai etc. besides other water birds such as Cranes, Ducks etc. One can also witness the traditional and typical distinct life style of Gujjar and Backarwals wearing ethnic costume, living in open Kullhas around on the hills of Mansar Lake.

Study has been carried out in monsoon season the sample has collected by boat with 10 m matrix. pH of the sample vary from 7.95 to 8.3. Conductivity ranges from 170-280 µS/cm.

Table 7 River Water Quality of Mansar Lake 2013

S.No.	Parameters	Permissible limit	Ranges
1	Sp. Conductance µs/cm at 25^{o}C	-	170-280
2	Chloride (mg/l)	250-1000	7-11
3	Fluoride (mg/l)	1.50 mg/l	0.15-0.33
4	Nitrate (mg/l)	45 mg/l	0.6-7.6

The ranges of important parameters are appended in the table above all parameters are within the range and have no pollution problem at present.

Jhelum River

The River Jhelum rises from Verinag Spring situated at the foot of the Pir Panjal in the south-eastern part of the valley of Kashmir in India. It flows through Srinagar and the Wular Lake before entering Pakistan through a deep narrow gorge.

Table: 8 River Water Quality of Jhelum River 2013

S.No.	Parameters	Permissible limit	Ranges
1	Sp. Conductance µs/cm at 25^{o}C	-	250-320
2	Chloride (mg/l)	250-1000	4-14
3	Fluoride (mg/l)	1.50 mg/l	0-0.2
4	Nitrate (mg/l)	45 mg/l	1.81-6.49

Study has been carried out in post monsoon season the sample have been collected from Varinag 33.39 15° N, 75.1327° E to 34.12 15° N, 74.2217° E 100 km (Baramulla) along the path by boat with 10 km matrix. pH of the sample vary from 8.2 to 8.43. Conductivity ranges from 250-320 µS/cm.

The ranges of important parameters are appended in the tables given above all parameters are within the range. It is observed that concentration of all the parameters increases along the flow of the river but no pollution problem at present.

Recommendations

1. Ground water in Jammu and Kashmir state in fresh and potable in most of the areas. Water supply in this state is mainly dependant on ground water whether it is spring source, shallow ground water or deep ground water. Ground water is the main source for surface water bodies in the form of base flow in lean periods. Proper protection measures need to be taken to avoid contamination of ground water.
2. Even though salinity is not a major concern in the state, there are problems of ground water contamination like iron (Fe) (in Tertiary belt and in Kashmir valley) marshy gases (in shallow and deep aquifers of Kashmir valley), Fluoride in localized areas like in parts of Doda dist. Nitrate contamination, Bacteriological contaminations, ground water pollution is due to pesticides/ fertilizers in agriculture and horticulture. The quality surveillance needs to be increased by State Government Organisations. Ground water quality shall be monitored once in a year for all major elements, trace metals and bacteriological contaminations.
3. Most of the ground water is hard to very hard category causing gastro-intestinal problems. This type of water may be treated properly before supplying the water for drinking purposes.
4. Deeper aquifers in both Jammu region and Kashmir valley can be developed for mitigating the water supply requirements. Micro-level planning is required to develop these aquifers based on the available data of aquifer geometry, parameters and water resources.

Groundwater from deeper aquifers in Kashmir valley consists of iron and marshy gasses which need to be treated properly before supplying the water. It is better to identify the iron free aquifers through scientific ground water exploration techniques couples with modern techniques of geophysics so that iron problem can be mitigated. Tube wells shall be constructed by tapping only iron free aquifers and avoiding iron rich aquifers through cement sealing and putting gravel pack only around the iron free aquifers.

5. The reality of climate change is the most significant long term threat to water resources. In hilly region water supply is still based on springs, where discharges of springs are drastically being reduced. Systematic enumeration/inventory of springs including its quality, snow water harvesting techniques and other available techniques is required to develop ground water resources on sustainable basis need to be adopted.
6. Fast developing urban & industrial areas need special attention/quality surveillance by the State government authorities. Proper monitoring for trace elements in industrial areas like Bari-Brahmana, Gangyal and other industrial areas located in Kashmir valley shall be taken up. Monitoring network stations shall be established all along the nalas and drains carrying industrial effluents.
7. As the water supplies in Jammu city and parts of areas in Srinagar city are ground water based, proper well head protection measures need to be taken to avoid bacteriological contamination like coliform bacteria and E-coli.
8. There is lack of proper sewage and sanitation in all over the state resulting into ground water and surface water contaminations. This issue need to be addressed immediately by the authorities. Village sewages shall be disposed off properly after proper treatment. In water logging areas, where ground water is being contaminated by polluted surface water, proper drainage shall be created for avoiding the water logging conditions.
9. Ground water contamination by improper disposal of domestic and industrial solid wastes is of another concern. Special efforts shall be made to address this problem.
10. There is an urgent need to take-up comprehensive studies on ground water quality of both shallow and deep ground waters analyzing major elements, heavy metals, pesticides, microbial contamination is the need of the hour. Areas identified in this report where higher concentrations of heavy metals, nitrates and fluorides need to be given special attentions.
12. The existing data base on quality with different organizations like CGWB, PHED, State pollution control board, academic institutions like Jammu university and Kashmir university need to integrated and a comprehensive data base need to be established.
13. Scientific research projects on ground water contamination especially geo-genic contamination like Iron, gasses and fluoride need to be taken up immediately

14. Proper management strategies need to be drawn up to combat the problems of geo-genic contamination. Cost effective community level treatment plants need to be established. The treatment plants as recommended in this report shall be constructed with trained manpower as in charges so that these treatment plants may work efficiently for longer periods.
15. As the ground water is hard to very hard type and consists of iron, proper treatment shall be followed before using this water for irrigation through modern irrigation methods like sprinkler irrigations and drip irrigations. This type of water may choke the sprinklers and drips.

Annexure-I

CATEGORIZATION OF DEPTH TO WATER LEVEL- MAY 2013

State	Jammu and Kashmir														
District	No. of Wells Analysed	Depth to Water Level (mbgl)		Number of Wells Showing Depth to Water Level (mbgl) in the Range of						Percentage of Wells Showing Depth to Water Level					
		Min	Max	0.0-2.0	2.0-5.0	5.0-10.0	10.0-20.0	20.0-40.0	>40.0	0.0-2.0	2.0-5.0	5.0-10.0	10.0-20.0	20.0-40.0	>40.0
ANANTNAG	1	18.75	18.75	0	0	0	1	0	0	0	0	0	100	0	0
BADGAM	1	2.52	2.52	0	1	0	0	0	0	0	100	0	0	0	0
BARAMULLA	9	0.25	3.57	8	1	0	0	0	0	88.89	11.11	0	0	0	0
JAMMU	101	0.57	37.60	6	53	24	9	9	0	5.94	52.48	23.76	8.91	8.91	0
KATHUA	48	0.45	35.00	7	20	10	8	3	0	14.58	41.67	20.83	16.67	6.25	0
KUPWARA	10	0.73	12.63	5	4	0	1	0	0	50.00	40	0	10	0	0
PULWAMA	5	1.02	14.97	1	3	0	1	0	0	20	60	0	20	0	0
RAJAURI	30	0.79	10.00	9	18	3	0	0	0	30	60	10	0	0	0
SRINAGAR	1	10.30	10.30	0	0	0	1	0	0	0	0	0	100.00	0	0
UDHAMPUR	21	1.05	25.13	5	12	3	0	1	0	23.81	57.14	14.29	0	4.76	0
Total	227	0.25	37.60	41	112	40	21	13	0						

Annexure-II

CATEGORIZATION OF DEPTH TO WATER LEVEL- AUGUST 2013

District	No. of Wells Analyzed	Depth to Water Level (mbgl)		No. of Wells Showing Depth to Water Level (mbgl) in the Range of						Percentage of Wells Showing Depth to Water Level					
		Min	Max	0.0-2.0	2.0-5.0	5.0-10.0	10.0-20.0	20.0-40.0	>40.0	0.0-2.0	2.0-5.0	5.0-10.0	10.0-20.0	20.0-40.0	>40.0
ANANTNAG	1	12.84	12.84	0	0	0	1	0	0	0	0	0	100.00	0	0
BADGAM	1	4.17	4.17	0	1	0	0	0	0	0	100.00	0	0	0	0
BARAMULA	10	0.63	3.56	5	5	0	0	0	0	50.00	50.00	0	0	0	0
JAMMU	109	-0.67	33.24	59	28	11	6	5	0	54.13	25.69	10.09	5.50	4.59	0
KATHUA	49	0.25	21.40	29	12	3	4	1	0	59.18	24.49	6.12	8.16	2.04	0
KUPWARA	11	1.46	13.42	1	8	1	1	0	0	9.09	72.73	9.09	0	0	0
PULWAMA	5	0.70	13.94	1	2	1	1	0	0	20.00	40.00	20.00	20.00	0	0
RAJAURI	30	-0.24	3.70	26	4	0	0	0	0	86.67	13.33	0	0	0	0
SRINAGAR	1	10.42	10.42	0	0	0	1	0	0	0.00	0.00	0	100.00	0	0
UDHAMPUR	21	-0.70	24.80	17	3	0	0	1	0	80.95	14.29	0	0	4.76	0
Total	238	-0.70	33.24	138	63	16	14	7	0						

Annexure-III

CATEGORIZATION OF DEPTH TO WATER LEVEL- NOVEMBER 2013

District	No. of Wells Analyzed	Depth to Water Level (mbgl)		No. of Wells Showing Depth to Water Level (mbgl) in the Range of						Percentage of Wells Showing Depth to Water Level					
		Min	Max	0.0- .0	2.0-.0	5.0-0.0	10.0-20.0	20.0-40.0	>40.0	0.0-.0	2.0-.0	5.0-0.0	10.0-20.0	20.0-40.0	>40.0
ANANTNAG	1	15.02	15.02	0	0	0	1	1	0	0.00	0.00	0	100.00	0	0
BADGAM	1	5.38	5.38	0	0	1	0	0	0	0.00	0.00	100.00	0	0	0
BARAMULA	10	1.21	8.24	1	8	1	0	0	0	10.00	80.00	10.00	0	0	0
JAMMU	106	-0.13	31.54	30	49	14	8	5	0	28.30	46.23	13.21	7.55	0	0
KATHUA	48	0.14	21.25	15	22	8	2	1	0	31.25	45.83	16.67	4.17	4.72	0
KUPWARA	11	1.68	13.49	1	6	3	1	0	0	9.09	54.55	27.27	9.09	2.08	0
PULWAMA	5	1.26	15.28	1	2	1	1	0	0	20.00	40.00	20.00	20.00	0	0
RAJAURI	30	0.40	4.71	19	11	0	0	0	0	63.33	36.67	0	0	0	0
SRINAGAR	1	10.14	10.14	0	0	0	1	0	0	0.00	0.00	0	100.00	0	0
UDHAMPUR	22	0.75	24.90	14	6	1	0	1	0	63.64	27.27	4.55	0	4.55	0
Total	235	-0.13	31.54	81	104	29	14	7	0						

Annexure-IV

CATEGORIZATION OF DEPTH TO WATER LEVEL- JANUARY 2014

District	No. of Wells Analysed	Depth to Water Level (mbgl)		Number of Wells Showing Depth to Water Level(mbgl) in the Range of						Percentage of Wells Showing Depth to Water Level (mbgl) in the Range of					
		Min	Max	0.0-2.0	2.0-5.0	5.0-10.0	10.0-20.0	20.0-40.0	>40.0	0.0-2.0	2.0-5.0	5.0-10.0	10.0-20.0	20.0-40.0	>40.0
JAMMU	106	-0.22	32.14	19	55	17	9	6	0	17.92	51.89	16.04	8.49	5.66	0
KATHUA	38	0.20	28	14	14	12	4	2	0	29,17	33.33	25.00	8.33	4.17	0
RAJAURI	30	0.62	7.35	13	13	1	0	0	0	43.33	53.33	3.33	0	0	0
UDHAMPUR	22	0.25	26.14	9	11	1	0	1	0	40.91	50.00	4.55	0	4.55	0
Total	206	-0.22	32.14	55	98	31	13	9	0						

Annexure-V

CATEGORIZATION OF CHANGES IN WATER LEVEL BETWEEN MAY 2013 AND NOV 2013, JAMMU DIVISION

District Name	No. of Wells	Range of Fluctuation (m)				No. of Wells Showing Fluctuation						Percentage of wells Showing Fluctuation						Total No. of Wells	
		Rise		Fall		Rise			Fall			Rise			Fall			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
ANANTNAG	1	3.73	3.73	-	-	0	1	0	0	0	0	0	100.00	0	0	0	0	1	0
BADGAM	1	-	-	2.86	2.86	0	0	0	0	1	0	0	0	0	0	100.00	0	0	1
BARAMULA	9	-	-	0.72	7.79	0	0	0	6	2	1	0	0	0	66.67	22.22	11.11	0	9
JAMMU	100	0.08	13.39	0.01	2.30	55	23	16	3	2	0	55.00	23.00	16.00	3.00	2.00	0	94	5
KATHUA	47	0.10	13.75	0.14	0.30	28	7	10	2	0	0	59.57	14.89	21.28	4.26	0	0	45	2
KUPWARA	10	-	-	0.04	6.91	0	0	0	6	3	1	0	0	0	60.00	30.00	10.00	0	10
PULWAMA	5	-	-	0.15	2.72	0	0	0	4	1	0	0	0	0	80.00	20.00	0	0	5
RAJAURI	30	0.11	6.75	0.23	0.23	25	2	2	1	0	0	83.33	6.67	6.67	3.33	0	0	29	1
SRINAGAR	1	0.16	0.16	-	-	1	0	0	0	0	0	100.00	0	0	0	0	0	1	0
UDHAMPUR	21	0.10	5.23	0.01	0.26	13	5	1	2	0	0	61.90	23.81	4.76	9.52	0	0	19	2
Total	225	(3.73)	(0.16)	0.00	7.79	122	38	29	24	9	2							189	35

Annexure VI

CATEGORIZATION OF CHANGES IN WATER LEVEL BETWEEN MAY 2013 AND NOV 2012, KASHMIR DIVISION

District Name	No. of Wells	Range of Fluctuation (m)				Number of Wells Showing Fluctuation						Percentage wells Showing Fluctuation						Total No. of Wells	
		Rise		Fall		Rise			Fall			Rise			Fall				
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	Rise	Fall
ANANTNAG	01	-	-	5.55	5.55	0	0	0	1	0	0	0	0	0	100.00	0		0	0
BADGAM	01	0.63	0.63			1	0	0	1	0	0	100.00	0	0	0	0		1	1
BARAMULLA	09	0.69	5.87	-	-	7	1	1	0	0	0	77.77	11.11	11.11	0	0		9	0
KUPWARA	08	0.53	6.40	-	-	5	2	1	0	0	0	62.5	25.00	12.5	0	0		8	0
PULWAMA	04	0.17	2.53	-	-	3	1	0	0	0	0	75.00	25.00	0	0	0		4	0
SRINAGAR	01	0.02	0.02	-	-	1	0	0	0	0	0	100.00	0	0	0	0		1	0
Total	24					17	04	02	02	0	0							23	01

Annexure-VII

CATEGORIZATION OF CHANGES IN WATER LEVEL BETWEEN MAY 2012 and MAY 2013

District Name	No. of Wells	Range of Fluctuation (m)				Number of Wells Showing Fluctuation						Percentage wells Showing Fluctuation						Total No. of Wells	
		Rise		Fall		Rise			Fall			Rise			Fall				
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	Rise	Fall
JAMMU	52	0.05	4.06	0.10	1.72	24	2	1	23	0	0	46.15	3.85	1.92	44.23			27	23
KATHUA	38	0.04	3.45	0.05	7.00	19	3	0	11	2	2	50.00	7.89	0	28.95	5.26	5.26	22	15
RAJAURI	28	0.03	5.08	0.19	1.43	15	8	1	3	0	0	53.57	28.57	3.57	10.71	0	0	24	3
UDHAMPUR	20	0.01	4.29	0.04	1.62	11	2	1	6	0	0	55.00	10.00	5.00	30.00	0	0	14	6
ANANTNAG	01	0.95	0.95	-	-	1	0	0	0	0	0	100.00	0	0	0	0	0	1	0
BADGAM	01	-	-	0.42	0.42	0	0	0	1	0	0	0	0	0	100.00	0	0	0	1
BARAMULLA	09	-	-	0.04	0.85	0	0	0	9	0	0	0	0	0	100.00	0	0	0	9
KUPWARA	06	0.06	0.79	0.61	0.61	5	0	0	1	0	0	83.33	0	0	16.66	0	0	5	1
PULWAMA	04	0	0.02	0.53	1.17	2	0	0	2	0	0	50.00	0	0	50.00	0	0	2	2
SRINAGAR	01	-	-	-0.21	-0.21	0	0	0	1	0	0	0	0	0	100.00	0	0	0	1
Total	160	(0.05)	(3.45)	0.04	7.00	77	15	3	57	2	2							95	61

Annexure -VIII

CATEGORIZATION OF CHANGES IN WATER LEVEL BETWEEN AUGUST 2012 and AUGUST 2013

District Name	No. of Wells	Range of Fluctuation (m)				No. of Wells Showing Fluctuation						Percentage Showing Fluctuation						Total No. of Wells	
		Rise		Fall		Rise			Fall			Rise			Fall			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
JAMMU	57	0.07	4.70	0.04	0.97	31	13	3	9	0	0	54.39	22.81	5.26	15.79	0	0	47	9
KATHUA	38	0.02	11.24	0.02	10.06	17	7	3	9	0	2	44.74	18.42	7.89	23.68	0	5.26	27	11
RAJAURI	29	0.03	4.45	0.07	0.61	14	4	2	9	0	0	48.28	13.79	6.90	31.03	0	0	20	9
UDHAMPUR	20	0.03	2.99	0.05	1.03	9	1	0	10	0	0	45.00	5.00	0	50.00	0	0	10	10
ANANTNAG	01	1.52	1.52	-	-	1	0	0	0	0	0	100	0	0	0	0	0	1	0
BADGAM	01	-	-	1.37	1.37	0	0	0	1	0	0	0	0	0	100	0	0	0	1
BARAMULLA	09	0.31	0.31	0.16	1.69	1	0	0	8	0	0	11.11	0	0	88.88	0	0	1	8
KUPWARA	10	-	-	0.11	1.74	-	-	-	10	0	0	0	0	0	100	0	0	0	10
PULWAMA	05	-	-	0.10	1.38	0	0	0	5	0	0	0	0	0	100	0	0	0	5
SRINAGAR	00	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	170	(0.07)	(2.99)	0.02	10.06	71	25	8	37	0	2							106	53

Annexure-IX

CATEGORIZATION OF CHANGES IN WATER LEVEL BETWEEN NOVEMBER 2012 and NOVEMBER 2013

District Name	No. of Wells	Range of Fluctuation (m)				Number of Wells Showing Fluctuation						Percentage wells Showing Fluctuation						Total No. of Wells	
		Rise		Fall		Rise			Fall			Rise			Fall				
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	Rise	Fall
JAMMU	101	0.02	11.09	0.03	1.64	58	8	5	28	0	0	57.43	7.92	4.95	27.72			71	28
KATHUA	38	0.10	4.00	0.04	2.67	23	4	0	8	2	0	60.53	10.53		21.05	5.26		27	10
RAJAURI	29	0.06	2.21	0.02	1.43	18	2	0	9	0	0	62.07	6.90		31.03			20	9
UDHAMPUR	21	0.02	0.97	0.04	2.29	16	0	0	4	1	0	76.19			19.05	4.76		16	5
Total	189	(0.10)	(0.97)	0.02	2.67	115	14	5	49	3	0							134	52

Annexure-X

CATEGORIZATION OF CHANGES IN WATER LEVEL BETWEEN JANUARY 2013 and JANUARY 2014

District Name	No. of Wells	Range of Fluctuation (m)				No. of Wells Showing Fluctuation in the range of						Percentage Showing Fluctuation in the range of						Total No. of Wells	
		Rise		Fall		Rise			Fall			Rise			Fall			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
JAMMU	104	0.02	11.82	0.01	1.48	59	13	2	28	0	0	56.73	12.50	1.92	26.92	0	0	74	28
KATHUA	48	0.02	7.66	0.32	6.51	33	5	4	4	0	1	68.75	10.42	8.33	8.33	0	2.08	42	5
RAJAURI	30	0.07	2.28	0.04	2.29	6	1	0	22	1	0	20.00	3.33	0	73.33	3.33	0	7	23
UDHAMPUR	22	0.07	3.61	0.24	1.08	17	1	0	4	0	0	77.27	4.55	0	18.18	0	0	18	4
Total	204	(0.07)	(2.28)	0.01	6.51	115	20	6	58	1	1							141	60

Annexure-XI

CATEGORISATION OF CHANGES IN WATER LEVEL BETWEEN MAY 2013 TO DECADAL MEAN (MAY 2003-MAY 2012)

District Name	No. of Wells	Range of Fluctuation (m)				No. of Wells Showing Fluctuation						Percentage Showing Fluctuation						Total No. of Wells	
		Rise		Fall		Rise			Fall			Rise			Fall				
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	Rise	Fall
JAMMU	53	0.03	2.60	0.04	2.68	27	1	0	21	3	0	50.94	1.89	0	39.62	5.66		28	24
KATHUA	38	0.04	3.07	0.01	6.91	16	1	0	16	2	3	42.11	2.63	0	42.11	5.26	7.89	17	21
RAJAURI	29	0.03	3.22	0.53	3.67	21	2	0	5	1	0	72.41	6.90	0	17.24	3.45	0	23	6
UDHAMPUR	21	0.03	3.03	0.12	3.48	10	4	0	6	1	0	47.62	19.05	0	28.57	4.76	0	14	7
Total	**141**	**2.60**	**0.04**	**0.01**	**6.91**	**74**	**8**	**0**	**48**	**7**	**3**							**82**	**58**

Annexure-XII

CATEGORISATION OF CHANGES IN WATER LEVEL BETWEEN AUGUST 2013 TO DECADAL MEAN (AUGUST 2003-AUGUST 2012)

District Name	No. of Wells	Range of Fluctuation (m)				No. of Wells Showing Fluctuation						Percentage wells Showing Fluctuation						Total No. of Wells	
		Rise		Fall		Rise			Fall			Rise			Fall			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
JAMMU	59	0	4.59	0.07	1.72	43	9	1	6	0	0	72.88	15.25	1.69	10.17			53	6
KATHUA	38	0.02	7.93	0.07	12.19	19	7	2	8	0	2	50	18.42	5.26	21.05		5.26	28	10
RAJAURI	29	0.01	2.83	0.07	0.33	22	3	0	4	0	0	75.86	10.34		13.79			25	4
UDHAMPUR	21	0.07	2.49	0.02	0.66	11	2	0	8	0	0	52.38	9.52		38.1			13	8
Total	147	2.49	0.07	0.02	12.19	95	21	3	26	0	2							119	28

Annexure-XIII

CATEGORISATION OF CHANGES IN WATER LEVEL BETWEEN NOVEMBER 2013 TO DECADAL MEAN (NOVEMBER 2003- NOVEMBER 2012)

District Name	No. of Wells	Range of Fluctuation (m)				No. of Wells Showing Fluctuation						Percentage Showing Fluctuation						Total No. of Wells	
		Rise		Fall		Rise			Fall			Rise			Fall			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
JAMMU	103	0.02	10.74	0.01	1.53	63	7	3	28	0	0	61.17	6.80	2.91	27.18	0	0	73	28
KATHUA	38	0.04	4.34	0.14	2.81	31	1	1	3	2	0	81.58	2.63	2.63	7.89	5.26	0	33	5
RAJAURI	30	0.05	2.08	0.20	1.05	26	1	0	3	0	0	86.67	0	0	10.00	0	0	27	3
UDHAMPUR	22	0.02	2.42	0.01	0.75	14	1	0	7	0	0	63.64	0	0	31.82	0	0	15	7
Total	**193**	**2.08**	**0.05**	**0.01**	**2.81**	**134**	**10**	**4**	**41**	**2**	**0**							**148**	**43**

Annexure-XIV

CATEGORISATION OF CHANGES IN WATER LEVEL BETWEEN JANUARY 2014 TO DECADAL MEAN (JANUARY 2004- JANUARY 2013)

District Name	No. of Wells	Range of Fluctuation				No. of Wells Showing Fluctuation in the range of						No. of Wells/Percentage Showing Fluctuation						Total No. of Wells	
		Rise (m)		Fall (m)		Rise (m)			Fall (m)			Rise (m)			Fall (m)			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
JAMMU	105	0.02	11.76	0.03	1.48	58	10	2	34	0	0	55.24	9.52	1.90	32.38	0	0	70	34
KATHUA	48	0.02	8.26	0.11	6.03	37	2	3	5	0	1	77.08	4.17	6.25	10.42	0	2.08	42	6
RAJAURI	30	0.05	2.58	0.05	1.72	16	1	0	13	0	0	53.33	3.33	0	43.33	0	0	17	13
UDHAMPUR	22	0.04	3.26	0.03	1.08	16	1	0	5	0	0	72.73	4.55	0	22.73	0	0	17	5
Total	**205**	**2.58**	**0.05**	**0.03**	**6.03**	**127**	**14**	**5**	**57**	**0**	**1**							**146**	**58**

Annexure-XV

Depth to Water Level Data for all the four Seasons

S.No	Location	Latitude	Longitude	May 13	Aug-13	Nov-13	Jan-14
1	Rambarpora	33.74	75.22	18.75	12.84	15.02	0
2	Regal Chowk	34.04	74.82	2.52	4.17	5.38	0
3	Aripathan	34.06	74.58	1.52	2.02	2.24	0
4	Badran	34.08	74.58	3.57	2.49	4.63	0
5	Binner	34.23	74.36	0.52	3.29	3.74	0
6	Bomai	34.36	74.42	0.54	1.62	2.59	0
7	Mirgund	34.14	74.65	1.50	1.80	2.33	0
8	Ranji	34.22	74.50	0.00	3.56	4.15	0
9	Sangrama	34.24	74.45	0.95	1.65	2.43	0
10	Sopore Model Town	34.31	74.44	0.25	0.63	1.21	0
11	Waripora	34.09	74.56	0.45	1.76	8.24	0
12	Zambodzpora	34.22	74.36	1.63	3.20	3.28	0
13	Agre Chak	32.62	74.72	3.19	1.12	1.94	2.69
14	Akhnoor	32.86	74.75	0.00	11.77	0.00	14.29
15	Allah	32.52	74.84	4.24	1.68	2.75	2.69
16	Arnia II	32.52	74.80	5.62	2.32	7.88	8.55
17	Bakore	32.81	74.56	5.27	2.57	4.70	4.58
18	Baradow	32.91	74.42	6.29	2.96	5.19	5.81
19	Bassi Kalan	32.64	74.90	4.58	2.98	3.06	3.33
20	Batera	32.85	74.75	11.42	6.25	6.96	8.81
21	Bega	32.61	74.67	2.97	1.56	2.16	2.52
22	Bengular	32.49	75.06	7.63	6.01	5.59	5.81
23	Bera	32.62	74.68	2.79	1.04	1.63	2.49
24	Bhagwanchak	32.86	74.58	29.79	25.42	24.15	24.49
25	Birpur	32.66	74.95	23.40	7.80	10.01	11.46
26	Bishnah	32.61	74.86	3.34	0.89	2.02	1.92
27	Chamlial	32.49	74.88	1.84	1.00	0.00	0.00
28	Channi	32.63	74.92	7.94	2.89	5.74	7.38
29	Chatta	32.69	74.93	0.00	3.25	1.96	3.85
30	Chowkichora	33.03	74.65	0.00	-0.28	1.20	2.53
31	Daboh	32.59	75.11	4.34	2.61	2.81	3.76
32	Devipura	32.86	74.66	8.69	3.79	7.37	7.02
33	Dhanpur	32.81	74.54	3.95	2.20	3.39	4.32
34	Dharam Khu	32.86	74.76	25.49	20.67	20.43	23.05
35	Didyal	32.47	74.96	2.53	0.15	1.65	1.83
36	Gajansoo	32.76	74.71	3.19	1.24	2.85	2.95
37	Garhi (Jammu)	32.79	74.77	8.26	6.04	7.95	7.54
38	Gho Manhasan	32.72	74.74	2.11	0.74	2.03	1.92
39	Gho Rakawalan	32.55	74.95	4.36	1.70	1.88	2.64
40	Ghobrahmna	33.56	74.95	6.85	4.17	4.63	5.13
41	Gigrial	32.80	74.48	3.30	2.34	2.22	3.16
42	Greater Kailash	32.69	74.93	10.77	4.65	4.56	4.71
43	Gudwal	32.55	75.01	4.38	1.23	1.48	1.86

S.No	Location	Latitude	Longitude	May 13	Aug-13	Nov-13	Jan-14
44	Gura	32.88	74.71	14.28	9.52	11.00	12.08
45	Hamirpur Kohna	32.77	74.55	3.49	1.06	3.00	3.78
46	Hamirpur Sidhar	32.78	74.53	3.48	1.60	2.12	2.75
47	Hazuribag	32.76	74.82	12.00	4.69	6.34	7.53
48	Jagati	32.81	74.90	0.57	-0.33	-0.13	-0.22
49	Jaswan	32.79	74.73	4.65	3.66	4.45	4.58
50	Jhiri	32.83	74.74	6.00	2.38	3.88	5.56
51	Jindrah	32.81	75.09	13.43	7.38	1.68	1.58
52	Jogwan	32.93	74.44	3.43	2.74	1.45	4.73
53	Jourian	32.83	74.58	5.01	1.27	2.39	3.28
54	Kachrial	32.87	74.47	2.52	-0.67	0.05	0.97
55	Kainthpur	32.59	74.98	4.98	1.79	3.36	3.52
56	Kalah	32.91	74.48	2.07	1.52	1.78	2.33
57	Kaluchak	32.66	74.89	5.73	1.23	3.83	4.50
58	Kana Chak	32.82	74.72	4.40	1.80	3.31	3.65
59	Kangar	32.84	74.85	12.26	3.26	4.68	7.76
60	Karnaile Chak	32.71	74.82	7.95	6.03	7.16	8.00
61	Katcha-Pind	32.65	75.44	2.35	1.92	2.35	2.45
62	Khairi (Bishnah)	32.59	74.91	4.08	1.94	2.81	1.96
63	Khairi (Raipur)	32.81	74.86	7.20	1.06	1.78	3.61
64	Khour	32.83	74.51	2.82	1.42	2.44	2.99
65	Kothey Saini	32.58	74.88	4.35	2.70	3.12	3.68
66	Kotli Charkan	32.62	74.83	3.42	1.66	2.35	2.67
67	Kunihala	32.84	75.03	1.87	1.17	0.97	1.07
68	Lalyal	32.66	74.77	3.75	1.89	3.03	3.29
69	Lam	32.83	74.48	2.30	0.85	1.61	1.90
70	Laswara	32.59	74.84	3.56	0.91	1.50	1.53
71	Leherian	32.87	74.69	10.00	7.24	8.43	7.13
72	Lower Barnai	32.76	74.79	0.00	2.62	4.14	4.78
73	Mahal Kalandrian	32.51	74.94	5.08	1.61	3.02	2.88
74	Maheen Charkan	32.65	74.99	9.56	4.80	7.60	8.37
75	Majua Laxmi	32.56	74.92	3.70	0.72	1.55	2.03
76	Makwal	32.69	74.72	3.97	2.01	2.41	3.62
77	Marh	32.78	74.75	1.52	1.45	2.25	2.20
78	Marjholi	32.85	74.77	30.00	26.30	25.37	26.87
79	Miran Sahib	32.65	74.79	7.36	6.56	6.39	6.56
80	Muthi	32.75	74.80	2.22	0.60	1.56	1.70
81	Nagbani	32.76	74.78	3.10	1.35	2.55	3.53
82	Nagrota	32.80	74.92	3.25	2.00	2.80	3.12
83	Nandini	32.72	74.82	4.21	3.07	4.59	0.00
84	Nandpur	32.52	74.89	0.00	0.66	2.89	2.40
85	Nikowal	32.51	74.71	5.09	1.50	4.12	4.33
86	Nud	32.61	75.15	4.27	1.14	2.90	2.30
87	Palanwala	32.85	74.45	1.99	0.50	0.70	1.42
88	Palatan	32.84	74.45	2.45	1.00	1.95	1.93

S.No	Location	Latitude	Longitude	May 13	Aug-13	Nov-13	Jan-14
89	Palli	32.63	74.89	4.24	1.09	1.76	1.82
90	Pangli Colony	32.79	74.52	2.98	0.75	1.83	2.45
91	Pata Khu	32.84	74.77	23.70	18.56	18.76	20.06
92	Patli	32.61	74.95	7.87	3.32	5.84	6.24
93	Patyale Chak	32.76	74.78	3.76	2.08	3.60	3.90
94	Peer Kho	32.73	74.88	9.96	9.46	12.26	12.36
95	Poal II	32.51	74.82	3.39	1.11	2.29	2.19
96	Purkhoo	32.80	74.78	19.73	16.34	16.36	17.08
97	Quadar Pur	32.55	74.78	0.00	0.39	0.00	0.00
98	Raiyan	32.51	75.13	23.84	22.10	17.94	18.54
99	Rangoora	32.75	74.90	2.53	0.46	0.46	0.56
100	Rehal	32.56	74.88	6.03	2.85	3.02	4.03
101	Sajwal	32.79	74.59	3.60	0.62	3.61	2.71
102	Salehar II	32.56	74.82	3.70	1.40	2.50	2.96
103	Samba	32.56	75.12	18.37	14.87	14.20	14.75
104	Sandhwan	32.71	74.71	3.37	1.94	3.10	3.14
105	Satwari	32.69	74.85	11.38	7.45	9.25	10.25
106	Sei Khurd	32.51	74.72	4.15	0.97	1.80	3.75
107	Senth	32.77	74.51	2.56	1.24	1.60	2.07
108	Shama Chak	32.83	74.74	6.81	2.97	4.33	5.11
109	Sidhra	32.76	74.89	4.97	1.38	1.55	1.40
110	Sobka	32.88	74.75	23.90	19.44	20.40	21.50
111	Sohanjana	32.70	74.74	3.89	2.14	2.91	3.24
112	Suchet Gadh	32.58	74.67	2.89	0.47	1.68	1.66
113	Suchetgarh II	32.57	74.68	0.00	0.36	1.58	2.25
114	Sugetar	32.88	74.96	1.90	0.80	1.10	1.47
115	Sumah	32.96	74.67	10.00	2.54	2.75	2.74
116	Supwal	32.56	75.07	7.22	0.66	2.60	4.36
117	Swankha	32.57	75.01	21.19	15.89	17.49	17.76
118	Tanda Sheeda	32.98	74.70	0.00	0.71	1.87	3.83
119	Taryai	32.87	74.61	37.60	33.24	31.54	32.14
120	Trikuta Nagar	32.70	74.89	4.09	1.12	2.20	2.38
121	Upralakanhal	32.63	74.88	3.44	0.87	2.48	2.95
122	Barni	32.42	75.59	6.63	3.16	4.80	5.39
123	Bhagwal	32.45	75.37	23.26	17.92	12.54	11.45
124	Billawar	32.61	75.61	0.45	0.30	0.25	0.20
125	Chakhariya	32.39	75.37	3.20	1.57	1.76	2.07
126	Chan Khatrian	32.49	75.25	16.40	12.55	2.76	5.51
127	Chanranga	32.48	75.33	16.20	0.89	8.69	10.47
128	Chapki Kalan	32.45	75.31	19.18	6.74	6.88	11.03
129	Dulme Chak	32.43	75.18	4.47	2.15	2.80	3.18
130	Feruchak	32.38	75.28	8.74	1.44	4.87	3.07
131	Gadyal	32.42	75.31	2.88	0.51	0.48	0.86
132	Ganguchak	32.40	75.26	3.29	1.77	2.10	1.99
133	Gond	32.33	75.50	5.80	4.59	4.81	5.80
134	Jandi	32.46	75.25	6.05	1.68	3.71	4.41
135	Jasath	32.50	75.20	15.15	12.25	5.28	7.00

S.No	Location	Latitude	Longitude	May 13	Aug-13	Nov-13	Jan-14
136	Karol Krishna	32.40	75.24	8.85	6.70	6.92	7.45
137	Kathua	32.36	75.53	1.99	0.60	0.62	0.94
138	Kerian Gandyal II	32.30	75.52	3.60	1.65	2.55	2.75
139	Kerian Ramnagar	32.28	75.51	3.50	1.69	2.71	2.43
140	Khanpur	32.43	75.36	2.16	1.37	1.46	1.57
141	Khukhial	32.35	75.47	1.69	1.14	1.20	1.26
142	Konthal	32.42	75.26	0.00	4.35	4.15	6.21
143	Kootah	32.51	75.24	35.00	21.40	21.25	23.37
144	Kotepanu	32.35	75.38	2.28	1.43	1.90	1.66
145	Kothian	32.37	75.51	2.73	1.00	0.14	0.80
146	Lakhanpur	32.38	75.59	3.29	0.91	3.59	2.52
147	Lakri	32.66	75.42	3.29	2.39	2.49	2.65
148	Lale Chak	32.45	75.20	1.52	1.08	1.66	1.77
149	Lokli	32.54	75.27	7.40	1.35	2.81	3.56
150	Londi	32.43	75.21	6.10	2.80	4.15	4.90
151	Madun	32.48	75.16	2.65	0.25	1.93	1.80
152	Mahi Chak	32.42	75.42	28.00	12.85	16.25	28.00
153	Mandli	32.64	75.51	3.08	1.15	1.95	2.03
154	Mukandpur	32.37	75.37	4.13	4.00	3.97	3.89
155	Nagri	32.35	75.43	3.26	0.67	2.39	2.16
156	Nagrota-gujroo	32.65	75.39	10.95	1.98	5.38	6.55
157	Naran	32.50	75.15	11.70	2.97	4.69	5.40
158	Nauni	32.56	75.30	2.57	0.53	1.78	1.60
159	Nilcha	32.56	75.25	12.17	4.57	8.95	10.74
160	Pallan	32.56	75.57	1.95	0.40	1.09	0.95
161	Pangdour	32.51	75.07	4.85	2.64	3.11	2.95
162	Pansar	32.37	75.31	6.48	3.01	5.95	5.88
163	Patiari	32.40	75.44	4.71	1.72	3.63	2.21
164	Patyari II	32.55	75.27	4.71	2.76	0.00	0.00
165	Phalora	32.48	75.13	3.08	1.27	2.05	1.92
166	Phinter	32.58	75.54	6.84	2.00	4.50	5.77
167	Raghuchak	32.49	75.20	1.66	0.76	1.50	2.28
168	Ramkot	32.64	75.34	6.58	0.55	4.90	5.27
169	Sadoh	32.47	75.13	10.97	8.32	7.34	7.61
170	Sanoora	32.49	75.18	0.90	0.75	0.80	0.80
171	Chowgal	34.41	74.32	0.73	1.46	2.43	0.00
172	Dolipura	34.52	74.18	1.71	3.71	4.28	0.00
173	Drugmulla	34.49	74.29	2.92	5.42	6.06	0.00
174	Gulgam	34.54	74.22	3.70	4.42	3.96	0.00
175	Guse	34.54	74.28	12.63	13.42	13.49	0.00
176	Khanpora	34.44	74.27	1.86	2.41	2.56	0.00
177	Kupwara Main Chowk	34.53	74.26	3.04	3.19	3.08	0.00
178	Langate	34.38	74.31	1.22	4.22	8.13	0.00
179	Magam	34.46	74.23	1.91	2.78	3.70	0.00
180	Trehgam	34.52	74.18	3.14	4.70	6.34	0.00

S.No	Location	Latitude	Longitude	May 13	Aug-13	Nov-13	Jan-14
181	Gandhasi Bhat	33.86	75.05	1.02	0.70	1.26	0.00
182	Pampore	33.99	74.92	4.05	4.20	4.99	0.00
183	Sambura-Kokapura	33.96	74.93	3.52	5.04	6.24	0.00
184	Tral	33.91	75.03	14.97	13.94	15.28	0.00
185	Zeewan	34.04	74.92	4.30	4.40	4.45	0.00
186	Bagnoti	33.14	74.30	4.80	2.35	3.30	4.00
187	Bakhar	33.09	74.43	1.45	0.53	0.91	1.43
188	Banpari	33.03	74.46	3.23	0.76	1.30	1.80
189	Bareri	33.10	74.19	3.09	0.89	2.14	4.70
190	Bhatta Morh	33.20	74.20	1.96	1.30	1.44	1.77
191	Channi Parat	33.09	74.46	6.46	0.23	2.96	7.35
192	Chittiar	33.29	74.28	2.30	0.63	0.77	3.10
193	Chowki Handa	33.17	74.19	2.30	0.54	1.45	2.20
194	Darhal Quilla	33.22	74.15	4.00	2.06	2.35	3.20
195	Dharamsal	33.13	74.41	3.54	0.25	2.79	3.80
196	Dhok Baniar	33.03	74.42	2.53	1.34	1.50	2.32
197	Dyala	33.24	74.37	3.47	2.12	2.32	2.63
198	Gagrote	32.81	75.22	10.00	0.03	3.25	1.87
199	Jhangar	33.24	74.05	4.82	3.70	4.71	4.90
200	Kalal	33.08	74.23	3.69	0.15	3.29	3.55
201	Kalsian	33.19	74.14	1.15	-0.24	0.90	1.25
202	Kangri (grid Station)	33.06	74.40	2.92	0.50	1.16	2.78
203	Laroka	33.24	74.10	2.13	0.63	0.84	1.34
204	Lower Kharak	33.17	74.42	0.79	0.18	0.40	0.73
205	Marchola	33.09	74.48	1.74	0.76	1.02	3.59
206	Naunihal	33.18	74.21	5.10	0.18	0.51	2.25
207	Panja	33.18	74.42	1.72	1.15	1.18	1.50
208	Phukarni	33.27	74.11	1.51	0.64	0.89	1.24
209	Potha	33.28	74.32	2.88	1.12	1.40	1.40
210	Rumli Dara	33.14	74.22	2.85	0.50	1.50	1.67
211	Seri	33.08	74.29	2.72	1.06	2.25	2.68
212	Sial	33.07	74.32	1.92	0.32	0.51	0.62
213	Siot	33.12	74.38	2.50	1.30	1.53	1.40
214	Solki	33.16	74.43	3.90	0.28	1.80	2.36
215	Thangrot	33.14	74.59	1.82	0.52	2.05	3.01
216	Rainawari	34.10	74.82	10.30	10.42	10.14	0.00
217	Aliyah	33.17	74.55	1.82	0.53	1.54	1.82
218	Badola	32.94	75.03	4.50	1.55	2.00	1.71
219	Battal Ballian	32.88	75.13	9.76	2.08	4.53	4.76
220	Bhamla	33.05	74.58	1.65	0.30	1.91	3.05
221	Chhani Mansar	32.70	75.16	2.86	0.79	1.19	1.39
222	Dadua	33.07	74.64	2.13	1.63	1.94	2.02
223	Dehari	32.78	75.27	1.05	-0.70	0.95	0.25
224	Eastern Mand	32.90	75.03	2.94	1.15	0.75	1.97
225	Garhi (Udh)	32.91	75.08	1.15	0.45	0.85	0.46

S.No	Location	Latitude	Longitude	May 13	Aug-13	Nov-13	Jan-14
226	Katra	32.99	74.93	3.98	1.40	1.80	2.60
227	Kuperlah	32.85	75.18	3.85	0.00	2.09	2.66
228	Manwall	32.76	75.15	8.81	3.65	6.10	6.78
229	Nagrota Panjgrain	32.84	75.27	0.00	1.40	2.30	2.10
230	Nanora	33.13	74.63	2.15	1.83	2.16	2.42
231	Phangyal	32.90	75.14	3.23	1.25	1.85	2.32
232	Ramnagar	32.81	75.31	4.98	2.85	4.55	3.92
233	Riasi	33.08	74.84	25.13	24.80	24.90	26.14
234	Salabra	32.72	75.18	2.40	0.85	1.20	1.44
235	Seen Thakaran	32.91	75.04	2.23	1.08	1.88	1.85
236	Sunal	32.68	75.24	3.10	0.80	0.90	3.48
237	Talpad	32.86	75.20	1.58	0.70	1.05	0.78
238	Talwara	33.09	74.80	5.02	1.95	4.00	4.75

Result of Chemical Analysis of water samples of National Hydrograph Stations collected during May 2013 Appendix XVI

Jammu Region

S. No.	District	Location	Type of Source	Date of collection	Temp °C	pH	Sp Cond ms/cm 25°C	CO_3	HCO_3	Alkalinity	Cl	SO_4	NO_3	F	Ca	Mg	Na	K	TH	TDS	Fe
1	Jammu	Akhnoor	T/W	24/5/13	21	7.93	530	0	293	240	18.0	24	14.0	0.13	64	29	**5.7**	**6.5**	280	281	0.30
2	Jammu	Bakore	H.P	24/5/13	20	7.72	610	0	214	175	46.0	53	43.0	0.11	50	34	28.0	3.7	265	323	4.55
3	Jammu	Baradow	D.W	24/5/13	19	7.83	360	0	189	155	14.0	2	17.0	0.06	46	15	6.8	0.43	175	191	0.14
4	Jammu	Barera	D.W	24/5/13	21	7.96	470	0	235	193	25.0	2	7.1	0.09	56	21	3.7	1.2	225	249	0.31
5	Jammu	Bhagwanchak	D.W	24/5/13	21	8.28	420	0	171	140	14.0	45	40.0	0.10	30	16	45.0	1.3	140	223	1.83
6	Jammu	Devipur	D.W	24/5/13	20	7.91	360	0	189	155	18.0	3	9.7	0.08	52	13	1.9	1.3	185	191	0.06
7	Jammu	Dhanpur	H.P	24/5/13	22	7.63	630	0	232	190	28.0	2	115.0	0.03	80	21	18.0	1	285	334	0.14
8	Jammu	Dharam Khoo	D.W	24/5/13	21	8.24	280	0	134	110	18.0	20	9.5	0.13	28	20	5.1	2.3	150	148	0.05
9	Jammu	Gajansoo	H.P	24/5/13	19	8.01	580	0	220	180	64.0	43	0.9	0.14	38	28	45.0	5.9	210	307	4.98
10	Jammu	Garhi	D.W	24/5/13	20	8.66	470	18	134	140	35.0	56	13.0	0.16	14	34	33.0	9.3	175	249	0.21
11	Jammu	Gho Manhas	D.W	24/5/13	21	8.01	680	0	323	265	32.0	16	5.8	0.26	20	54	27.0	2	270	360	0.23
12	Jammu	Gigrial	D.W	24/5/13	20	8.27	320	0	183	150	18.0	2	5.4	0.19	34	15	16.0	1.6	145	170	0.01
13	Jammu	Gura	D.W	24/5/13	20	8.35	420	12	159	150	25.0	35	34.0	0.16	24	37	17.0	1.3	210	223	1.00
14	Jammu	Hazuribag	H.P	24/5/13	21	8.07	280	0.00	73	60	14.0	75	4.5	0.13	34	10	4.1	22.1	125	148	0.43
15	Jammu	Hamirpur Kona	D.W	24/5/13	21	8.49	270	6	128	115	7.0	18	2.0	0.11	34	13	2.5	0.72	140	143	0.13
16	Jammu	Hamirpur Sidhar	D.W	24/5/13	21	7.67	1190	0	152	125	113.0	145	216.0	0.25	50	34	116.0	73	265	631	0.13
17	Jammu	Jaswan	D.W	24/5/13	22	7.8	450	0	82	67	50.0	0	134.0	0.16	18	26	16.0	48	150	239	0.20
18	Jammu	Jhri	D.W	24/5/13	19	8.45	310	12	104	105	14.0	32	11.0	0.10	24	22	5.9	3.4	150	164	0.04
19	Jammu	Jourian	D.W	24/5/13	19	8.26	580	0	177	145	53.0	47	48.0	0.08	48	17	46.0	14	190	307	0.26
20	Jammu	Jogwan	D.W	24/5/13	19	8.05	420	0	189	155	25.0	2	40.0	0.16	58	12	13.0	1.34	195	223	0.01

21	Jammu	Kachrial	D.W	24/5/13	21	7.78	690	0	232	190	25.0	57	16.0	0.11	70	18	10.0	20	250	366	0.20
22	Jammu	Kalah	D.W	30/5/13	19	7.95	510	0	213	175	28.0	3	38.0	0.10	80	0	14.0	14.2	200	270	0.02
23	Jammu	Kana Chak	D.W	30/5/13	21	7.89	480	0	183	150	25.0	23	13.0	0.05	40	22	9.0	8.2	190	254	1.11
24	Jammu	Kangar	D.W	30/5/13	19	8.24	260	0	128	105	18.0	3	9.7	0.14	24	16	6.4	1.7	125	138	0.23
25	Jammu	Khairi	D.W	30/5/13	20	8.27	220	0	98	80	14.0	0	18.0	0.11	30	6	6.2	1.6	100	117	0.09
26	Jammu	Khour	H.P	30/5/13	19	7.71	490	0	177	145	18.0	25	16.0	0.10	46	15	15.0	1.43	175	260	0.13
27	Jammu	Lam	D.W	30/5/13	19	8.13	520	0	214	175	21.0	2	4.1	0.00	54	9	11.0	13	170	276	0.13
28	Jammu	Lehherian	D.W	30/5/13	19	8.44	330	12	134	130	18.0	27	12.0	0.14	22	24	16.0	2.4	155	175	0.40
29	Jammu	Marh	H.P	30/5/13	19	8.07	640	0	207	170	36.0	73	54.0	0.19	38	46	24.0	1.8	285	339	0.37
30	Jammu	Marjholi	D.W	30/5/13	21	8.15	350	0	159	130	14.0	9	6.3	0.05	18	17	5.3	2.5	150	186	0.00
31	Jammu	Muthi	D.W	30/5/13	21	8.25	500	0	195	160	36.0	64	4.0	0.26	32	34	26.0	3.00	220	265	0.09
32	Jammu	Nagbani	D.W	30/5/13	19	8.19	380	0	189	155	11.0	25	0.0	0.38	26	23	16.0	1.30	160	201	0.40
33	Jammu	Nandni	D.W	30/5/13	18	8.37	310	6	146	130	18.0	2	0.0	0.02	30	15	8.9	2.6	135	164	0.10
34	Jammu	Pallanwala	D.W	30/5/13	21	8.28	300	0	128	105	14.0	16	7.0	0.10	20	18	10.0	0.70	125	159	0.97
35	Jammu	Paltan	D.W	30/5/13	19	8.31	320	6	98	90	28.0	33	14.0	0.08	28	18	14.0	0.90	145	170	0.08
36	Jammu	Pangli Colony	D.W	30/5/13	18	8.11	340	0	128	105	18.0	47	7.4	0.11	30	18	14.0	3.90	150	180	0.04
37	Jammu	Pata Khu	D.W	30/5/13	20	7.91	360	0	189	155	11.0	5	7.0	0.05	34	20	6.0	2.50	165	191	0.01
38	Jammu	Patyale Chak	D.W	30/5/13	19	8.1	380	0	177	145	14.0	49	4.2	0.20	22	28	22.0	1.50	170	201	0.01
39	Jammu	Purkhoo	H.P	30/5/13	19	8.42	370	6	159	140	25.0	26	29.0	0.10	20	30	22.0	2.06	175	196	1.49
40	Jammu	Sandhwan	H.P	31/5/13	20	8.07	620	0	232	190	43.0	88	14.0	0.13	24	46	41.0	11.00	250	329	0.33
41	Jammu	Sajwal	D.W	31/5/13	19	8.01	390	0	165	135	14.0	11	6.2	0.07	38	16	4.0	2.40	160	207	0.25
42	Jammu	Senth	D.W	31/5/13	19	7.99	560	0	275	225	18.0	21	17.0	0.26	58	22	18.0	9.00	235	297	2.13
43	Jammu	Taryai	D.W	31/5/13	21	8.15	300	0	122	100	14.0	20	5.0	0.13	34	12	3.0	2.60	135	159	1.20
44	Jammu	ShameChak	D.W	31/5/13	20	8.38	380	12	137	132	18.0	37	22.0	0.08	46	12	17.0	1.20	165	201	0.05
45	Jammu	Barnai	H.P	31/5/13	19	8.17	450	0	189	155	21.0	19	14.0	0.03	32	24	12.0	8.00	180	239	0.94
46	Jammu	Kaloo Chak	H.P	31/5/13	20	8.06	570	0	305	250	21.0	4	0.0	0.06	60	22	14.0	11.00	240	302	0.08

47	Jammu	Arnia-I	DW	24-5-13	19	8.07	720	0	220	180	46.0	45	60.0	0.14	20	22	**65**	**46**	140	382	8.05
48	Jammu	Arnia-II	DW	24-5-13	21	7.6	1180	0	494	405	78.0	9	42.0	1.00	56	40	63.0	91	305	625	0.57
49	Jammu	Alla	DW	25-5-13	20	8.2	250	0	79	65	11.0	1	5.8	0.36	26	13	3.6	0.6	120	133	0.57
50	Jammu	Arge Chak	DW	25-5-13	21	7.94	490	0	183	150	14.0	0	11.0	0.27	45	21	8.7	0.7	160	260	0.23
51	Jammu	Bera	DW	25-5-13	19	7.95	500	0	238	195	14.0	3	2.6	0.32	20	26	29.0	2.01	155	265	0.06
52	Jammu	Bega	DW	25-5-13	21	8.2	1510	0	519	425	113.0	124	115.0	0.56	8	61	65.0	310	270	800	0.16
53	Jammu	Bishna	DW	28-5-13	18	8.28	630	0	287	235	50.0	11	6.6	0.10	18	30	52.0	30	170	334	0.20
54	Jammu	Bassi Kalan	DW	28-5-13	19	8.36	380	6	159	140	21.0	5	18.0	0.23	20	24	15.0	1.6	150	201	0.08
55	Jammu	Birpur	TW	28-5-13	19	8.28	220	0	98	80	14.0	4	17.0	0.05	30	18	7.6	1.03	100	117	0.07
56	Jammu	Channi	DW	28-5-13	20	7.9	640	0	171	140	36.0	5	48.0	0.01	40	20	24.0	1.4	180	339	0.00
57	Jammu	Chamlia	DW	29-5-13	21	7.99	590	0	293	240	36.0	15	2.9	0.28	12	22	85.0	2.9	120	313	1.73
58	Jammu	Didyal	DW	29-5-13	20	7.91	460	0	226	185	21.0	2	20.0	0.11	24	24	32.0	3.3	160	244	2.02
59	Jammu	Gho-Brahmana	DW	29-5-13	20	7.87	580	0	219	180	43.0	3	27.0	0.03	26	21	52.0	1.9	150	307	0.59
60	Jammu	Gudwal	DW	29-5-13	19	8.15	230	0.00	110	90	28.0	5	12.0	0.06	34	11	8.4	1.2	125	122	0.02
61	Jammu	Gho-Rakhwala	DW	29-5-13	20	8.02	740	0	311	255	71.0	2	17.0	0.17	26	39	67.0	0.5	225	392	0.08
62	Jammu	Kainthpur	DW	30-5-13	21	8.07	270	0	128	105	21.0	0	6.2	0.19	20	17	8.8	1.4	120	143	0.46
63	Jammu	kaluchak	DW	30-5-13	21	8.16	400	0	153	125	29.0	39	10.0	0.01	18	29	21.0	3	165	212	2.58
64	Jammu	Khairi	DW	30-5-13	19	8.33	670	36	171	200	60.0	57	47.0	0.17	16	46	63.0	12	230	355	0.47
65	Jammu	kothey-sani	DW	30-5-13	20	8.28	530	0	171	140	29.0	28	46.0	0.25	32	23	32.0	1.2	175	281	0.15
66	Jammu	kotli-charkan	DW	31-5-13	18	8.31	350	12	153	145	11.0	19	15.0	0.53	36	20	7.7	0.62	170	186	0.00
67	Jammu	karnaile chak	DW	31-5-13	19	8.17	350	0	159	130	18.0	4	18.0	0.00	36	16	7.5	2.6	155	186	0.01
68	Jammu	Lalyal	DW	31-5-13	19	8.09	320	0	177	145	21.0	1	2.3	1.00	30	14	19.0	5.1	130	170	0.43
69	Jammu	Laswara	DW	31-5-13	19	7.88	740	0	140	115	71.0	68	36.0	0.30	58	27	27.0	0.8	255	392	2.04
70	Jammu	Makwal	DW	31-5-13	20	8.21	260	0	134	110	14.0	3	0.3	0.02	24	14	7.2	2	115	138	0.07
71	Jammu	Majuha Laxmi	DW	31-5-13	21	8.35	380	12	183	170	21.0	3	16.0	0.18	16	27	29.0	2.3	150	201	0.16
72	Jammu	Mahal Kalandarian	DW	1/6/2013	19	7.85	540	0	293	240	21.0	24	12.0	0.82	18	23	75.0	1.1	140	286	0.27

73	Jammu	Meen-Charkan	DW	1/6/2013	19	8.38	480	18	226	215	18.0	2	39.0	0.21	56	21	15.0	1.08	225	254	0.05
74	Jammu	Miranshaib	DW	31-5-13	21	7.44	700	0	171	140	96.0	120	48.0	0.14	14	39	75.0	0.6	245	371	0.07
75	Jammu	Nndpur	HP	31-5-13	20	8.23	450	0	183	150	53.0	2	1.7	0.37	18	16	34.0	35	110	239	1.08
76	Jammu	Nikowal	DW	29-5-13	19	8.25	510	0	330	270	18.0	13	0.0	0.57	20	38	46.0	2.5	205	270	0.37
77	Jammu	Patli	DW	29-5-13	21	8.47	510	6	214	185	43.0	33	11.0	0.88	20	35	42.0	1.90	195	270	0.26
78	Jammu	Palli	DW	29-5-13	20	8.05	750	0	360	295	43.0	24	12.0	0.98	18	32	98.0	1.80	175	398	0.14
79	Jammu	Poal	DW	29-5-13	20	8.18	480	0	207	170	25.0	18	13.0	0.31	40	26	13.0	0.7	205	254	0.07
80	Jammu	Qudarpur	HP	31-5-13	21	7.91	860	0	177	145	60.0	158	22.0	0.21	44	37	69.0	1.60	260	456	0.03
81	Jammu	Rehal	DW	31-5-13	19	8.7	530	0	262	215	36.0	4	1.7	0.25	14	32	45.0	1.60	170	281	0.22
82	Jammu	Saleahar	DW	31-5-13	19	8.22	1580	0	720	590	71.0	133	4.5	0.31	42	50	90.0	255.00	310	837	0.36
83	Jammu	Satwari	DW	28-5-132	18	8.6	430	12	116	115	36.0	27	46.0	0.01	20	30	27.0	1.80	175	228	0.03
84	Jammu	Sei Khurd	DW	28-5-132	18	8.52	480	6	262	225	11.0	23	0.1	0.28	18	27	49.0	2.10	155	254	0.83
85	Jammu	Sohanjan	DW	28-5-132	19	8.44	720	12	195	180	53.0	104	23.0	0.38	20	38	43.0	61.00	205	382	0.07
86	Jammu	Suchetgarh	DW	31-5-13	21	8.61	4820	6	232	200	18.0	36	0.2	0.07	16	33	39.0	2.50	175	2555	0.98
87	Jammu	Supwal	DW	31-5-13	20	8.17	510	0	153	125	50.0	4	51.0	0.33	30	26	28.0	0.20	180	270	1.09
88	Jammu	Swankha	DW	31-5-13	19	7.94	460	0	189	155	25.0	3	45.0	0.12	32	11	47.0	1.17	125	244	0.95
89	Jammu	Upralakanha	DW	31-5-13	19	8.69	570	6	275	235	1.9	2	7.9	0.21	12	27	91.0	0.70	140	302	0.22
90	Jammu	Tirkutanagar	DW	31-5-13	18	8.35	460	6	159	140	39.0	4	61.0	0.18	56	9	26.0	1.30	225	244	0.07
91	Jammu	Chata	HP	31-5-13	20	8.27	400	0	183	150	18.0	16	15.0	0.03	44	17	10.0	1.60	180	212	0.61
92	Jammu	Greaterkailash	DW	31-5-13	19	8.25	390	0	146	120	28.0	40	46.0	0.21	30	27	24.0	1.20	185	207	1.03
93	Jammu	RS Pura	DW	31-5-13	18	8.39	400	6	140	125	11.0	21	8.7	42.00	42	11	8.7	0.50	150	212	0.24

S. No.	District	Location	Type of Source	Date of collection	Temp °C	pH	Sp Cond mS/cm 25°C	CO_3	HCO_3	Alkalinity	Cl	SO_4	NO_3	F	Ca	Mg	Na	K	TH	TDS	Fe
1	Kathua	BANGLAR	DW	28.5.13	27.5	7.3	1680	BD	353.8	290	170	228	**4.2**	**0.45**	72	18	202.5	59.0	255	874	0.16
2	Kathua	BARNI	DW	30.5.13	24.5	7.92	320	BD	183	150	14	4	23.50	0.48	46	13	10.0	0.8	170	166	0.40
3	Kathua	BHAGWAL	DW	30.5.13	24	7.95	390	BD	201.3	165	18	12	17.00	0.33	52	13	13.4	2.0	185	203	0.43
4	Kathua	CHAK HARIYA	DW	30.5.13	26	7.65	530	BD	311.1	255	11	30	5.30	0.33	70	17	22.1	9.5	245	276	1.21
5	Kathua	Challan	DW	30.5.13	24	8.1	790	BD	158.6	130	92	95	74.00	0.39	48	33	69.7	9.7	255	411	0.67
6	Kathua	CHANRANGA	DW	30.5.13	26	8.3	340	BD	128.1	105	14	49	15.00	0.33	36	13	15.5	7.0	145	177	ND
7	Kathua	CHAPKI KALAN	DW	30.5.13	24	8.02	350	BD	195.2	160	11	16	9.60	0.33	44	15	12.1	2.5	170	182	0.16
8	Kathua	DABOH	DW	29.5.13	22	7.95	410	BD	170.8	140	32	47	7.70	0.39	40	15	34.6	3.9	160	213	0.12
9	Kathua	DULME CHAK	DW	30.5.13	23	8.1	1200	BD	500.2	410	78	155	40.00	0.39	44	43	100.0	165.0	285	624	0.15
10	Kathua	FERUCHAK	DW	30.5.13	26	7.99	360	BD	189.1	155	11	31	11.00	0.36	32	21	20.5	1.0	165	187	0.36
11	Kathua	GANGU CHAK	DW	30.5.13	26	7.92	1030	BD	170.8	140	107	165	178.00	0.23	74	40	87.4	51.4	350	536	0.23
12	Kathua	JANDI	DW	30.5.13	26	7.96	1220	BD	549	450	78	164	106.00	0.68	88	71	74.8	112.0	510	634	0.34
13	Kathua	JASATH	DW	30.5.13	23.5	8.02	570	BD	280.6	230	28	31	15.00	0.54	54	26	32.5	3.3	240	296	0.21
14	Kathua	KAROL KRISHNA	DW	28.5.13	24	8.36	920	6.00	353.8	300	71	129	53.00	0.48	32	53	114.0	24.6	298	478	ND
15	Kathua	KATHUA	DW	30.5.13	26.5	8.05	870	BD	183	150	128	138	22.00	0.45	74	28	80.0	13.6	300	452	0.16
16	Kathua	KERIAN GANDYAL	DW	30.5.13	24	7.31	690	BD	237.9	195	107	-1	50.00	0.07	84	26	22.6	15.4	315	359	0.07
17	Kathua	KERIAN RAMNAGAR	DW	30.5.13	24	7.69	520	BD	268.4	220	7	61	3.90	0.48	76	19	9.1	5.0	270	270	0.27
18	Kathua	KHANPUR	DW	30.5.13	27	8.1	350	BD	207.4	170	7	19	6.90	0.39	70	0	13.1	1.3	175	182	
19	Kathua	KHUKHIAL	DW	30.5.13	24	8.04	870	BD	323.3	265	46	38	2.20	0.39	46	12	54.8	68.3	165	452	
20	Kathua	KONTHAL	DW	28.5.13	23.5	8.13	460	BD	262.3	215	18	27	10.00	0.48	66	9	32.4	4.3	200	239	

21	Kathua	KOTE PANU	DW	30.5.13	24	7.97	420	BD	237.9	195	11	35	1.80	0.39	52	12	26.0	8.5	180	218	
22	Kathua	KOTHIAN	DW	30.5.13	26	7.96	340	BD	183	150	18	5	9.40	0.39	32	16	17.5	3.5	145	177	
23	Kathua	LAKHANPUR	DW	30.5.13	25	8.15	180	BD	91.5	75	7	9	5.60	0.33	32	0	7.7	1.5	80	94	
24	Kathua	Lalechak	DW	28.5.13	27.5	8.1	650	BD	250.1	205	53	102	7.10	0.48	52	24	60.7	23.3	230	338	
25	Kathua	LOKLI	DW	29.5.13	21.5	8.2	270	BD	146.4	120	7	4	9.90	0.33	44	5	4.4	1.8	130	140	
26	Kathua	LONDI	DW	28.5.13	25	7.98	2400	BD	536.8	440	312	542	121.00	1.25	100	126	335.0	34.0	770	1248	
27	Kathua	Madun	DW	28.5.13	25	8.24	7.2	BD	420.9	345	28	35	18.00	0.39	96	27	36.3	5.8	350	4	
28	Kathua	MUKANDPUR	DW	30.5.13	24	7.87	690	BD	353.8	290	28	54	5.40	0.39	82	23	27.3	24.1	300	359	
29	Kathua	NAGRI	DW	30.5.13	25	8.2	360	BD	183	150	14	32	0.90	0.57	22	23	22.5	4.0	150	187	
30	Kathua	NARAN	DW	30.5.13	22	8.23	820	BD	384.3	315	46	2	2.90	0.39	32	12	107.0	16.9	130	426	
31	Kathua	NILCHA	DW	29.5.13	24	7.34	270	BD	170.8	140	4	23	4.00	0.29	42	12	6.7	1.8	155	140	
32	Kathua	NOUNI	DW	29.5.13	23.2	7.41	400	BD	207.4	170	21	19	5.80	0.33	42	21	14.8	2.0	190	208	
33	Kathua	NUD	DW	29.5.13	23	7.54	600	BD	213.5	175	46	84	23.00	0.39	74	18	35.5	7.0	260	312	
34	Kathua	PANGDOUR	DW	29.5.13	35	8.1	490	BD	250.1	205	14	13	36.00	0.58	76	13	9.8	1.3	245	255	
35	Kathua	PANSAR	DW	30.5.13	23	8.12	570	BD	384.3	315	7	43	1.00	0.12	28	38	64.9	3.5	225	296	
36	Kathua	PATIARI	DW	29.5.13	21.5	Leak															
37	Kathua	PHALORA	DW	30.5.13	23	8.21	940	BD	225.7	185	36	324	25.00	0.39	22	18	211.5	2.5	130	489	
38	Kathua	RAGHU CHAK	DW	30.5.13	24	7.91	390	BD	219.6	180	11	15	0.50	0.22	52	11	15.1	2.4	175	203	
39	Kathua	RAIYAN	DW	28.5.13	24.5	7.95	560	BD	317.2	260	21	27	4.30	0.07	86	10	29.5	1.9	255	291	
40	Kathua	SADOH	DW	28.5.13	24.5	7.98	710	BD	427	350	18	8	30.00	0.35	134	0	32.6	1.4	335	369	
41	Kathua	SAMBA	DW	28.5.13	22	8	810	BD	201.3	165	71	66	94.00	0.12	66	13	81.9	9.4	220	421	
42	Kathua	SNOORA	DW	29.5.13	22	8.36	230	12	103.7	105	3.55	11.8	2.10	0.07	26	9.7	8.2	0.9	105	120	

S. No.	District	Location	Type of Source	Date of collection	Temp °C	pH	Sp Cond ms/cm 25°C	CO_3	HCO_3	Alkalinity	Cl	SO_4	NO_3	F	Ca	Mg	Na	K	TH	TDS	Fe
1	Udhampur	Battal Ballian	DW	1/6/2013	24	7.05	940	0	153		152.0	97.0	28.0	0.21	48	50	**63**	**1.9**	325	508	0.51
2	Udhampur	Billawar	DW	1/6/2013	24	7.45	890	0	402		57.0	1.0	12.0	0.19	56	29	64.0	17	260	481	0.15
3	Udhampur	Channi Manesar	DW	1/6/2013	23	7.87	340	0	189		21.0	22.0	3.7	0.18	32	21	21.0	0.7	165	184	0
4	Udhampur	Dehari	DW	1/6/2013	24	7.87	980	0	183	0	188.0	36.0	1.1	0.30	78	29	85.0	3.5	315	529	0.1
5	Udhampur	Dhansi	DW	1/6/2013	24	7.66	610	0	244	0	57.0	29.0	15.0	0.12	52	26	39.0	2.4	235	329	0.03
6	Udhampur	Garhi	DW	1/6/2013	21	7.7	520	0	207		36.0	29.0	21.0	0.17	52	16	33.0	1	195	281	0.01
7	Udhampur	Jindhara	DW	1/6/2013	23	7.72	600	0	287	0	39.0	33.0	11.0	0.15	50	23	37.0	26	220	324	1.34
8	Udhampur	Katra	DW	1/6/2013	25	7.82	590	0	323	0	25.0	0.0	3.5	0.03	50	38	10.0	1.5	280	319	0.56
9	Udhampur	Kail	DW	1/6/2013	25	7.79	380	0	195	0	18.0	25.0	3.2	0.15	40	23	6.5	0.5	195	205	0
10	Udhampur	Sunal	DW	1/6/2013	25	7.98	300	0	159	0	18.0	18.0	18.0	3.05	44	9	14.0	0.5	145	162	0
11	Udhampur	Lakri	DW	1/6/2013	22	8.02	490	0	256	0	36.0	1.4	1	0.07	48	17	31.0	4	190	265	0
12	Udhampur	Mandli	DW	1/6/2013	24	7.85	650	0	336	0	36.0	1	1.7	0.15	42	23	54.0	8.2	200	351	0.14
13	Udhampur	Manwal	DW	1/6/2013	23	8.06	500	0	159	0	43.0	1.4	22.0	0.17	48	11	20.0	0.8	165	270	0.23
14	Udhampur	Nagrota	DW	1/6/2013	23	8.13	920	0.00	293	0	85.0	0	60.0	0.17	48	45	74.0	30	305	497	0.09
15	Udhampur	Parnala	DW	1/6/2013	25	7.06	960	0	208	0	131.0	9	86.0	0.12	60	24	81.0	5.9	250	518	0.11
16	Udhampur	Pallan	DW	1/6/2013	24	7.3	330	0	146	0	32.0	1	1.6	0.17	40	7	17.0	1	130	178	0.22
17	Udhampur	Phangyal	DW	1/6/2013	21	7.57	260	0	120	0	28.0	20	11.0	0.03	28	9	28.0	1.5	105	140	0
18	Udhampur	Phinter	DW	1/6/2013	20	7.68	400	0	177	0	36.0	21	12.0	0.11	46	13	22.0	7	170	216	0.24
19	Udhampur	Ramcot	DW	1/6/2013	23	7.61	570	0	305	0	36.0	22	5.2	0.15	52	29	31.0	8	250	308	0.26
20	Udhampur	Ramnagar	DW	1/6/2013	Data not avilable																0.15
21	Udhampur	Riasi	DW	1/6/2013	22	8.16	1080	0	610	0	71.0	1	2.4	0.00	84	76	23.0	22	525	583	0.66
22	Udhampur	Salabara	DW	1/6/2013	25	8.44	320	6	128	0	21.0	0	44.0	0.07	34	24	11.0	0.31	155	173	0.01
23	Udhampur	Suygetar	DW	1/6/2013	23	8.04	860	0	403	0	74.0	1	2.3	0.25	42	30	93.0	4.6	230	464	0.01

24	Udhampur	Talwara	DW	1/6/2013	24	8.02	560	0	298	0	25.0	5	8.8	0.11	62	29	6.5	1.7	275	302	0.04
25	Udhampur	Jagti	DW	1/6/2013	24	8.22	350	0	177	0	21.0	1	20.0	0.07	44	16	6.7	1.8	175	189	0.06
26	Udhampur	Badola	DW	1/6/2013	Data not avilable																0.13
27	Udhampur	Seen Thakran	DW	1/6/2013	20	7.97	490	0	226	0	39.0	2	3.1	0.31	48	17	25.0	0.5	190	265	0.1
28	Udhampur	Nagorat Panjgra	DW	1/6/2013	22	8.37	290	6	140	0	21.0	9	7.9	0.17	28	15	18.0	1.5	130	157	0.13
29	Udhampur	Kuperlah	DW	1/6/2013	Data not avilable																0.09
30	Udhampur	EaSTREN Mand	DW	1/6/2013	23	8.25	480	0	256	0	25.0	2	18.0	0.09	44	29	13.0	3	230	259	0.1
31	Udhampur	Talpad	DW	1/6/2013	25	8.45	260	6	134	0	21.0	0	1.2	0.15	28	12	13.0	1.20	120	140	0.16
32	Udhampur	Phikroo	DW	1/6/2013	23	8.47	310	6	159	0	18.0	13	4.1	0.04	36	11	21.0	1.60	135	167	0.07
33	Udhampur	Sirdhara	DW	1/6/2013	24	8.21	610	0	201	0	32.0	5	63.0	0.21	34	39	8.2	2.1	245	329	0
34	Udhampur	Rangura	DW	1/6/2013	22	8.09	1180	0	194	0	43.0	0	28.0	0.09	28	38	7.2	1.05	225	637	0

S. No.	District	Location	Type of Source	Date of collection	Temp °C	pH	Sp Cond ms/cm 25°C	CO_3	HCO_3	Alkalinity	Cl	SO_4	NO_3	F	Ca	Mg	Na	K	TH	TDS	Fe
1	Rajouri	Aliah	DW	25.5.13	18	7.27	570	0	220	180	28	6	8	0.25	44	12	33.0	0.7	160	353	ND
2	Rajouri	Bagnoti	DW	21.5.13	19	7.53	480	0	140	115	57	20	10	0.25	32	17	33.0	1.7	150	298	0
3	Rajouri	Banpari	DW	24.5.13	17	7.15	650	0	208	170	57	32	11	0.23	44	23	39.0	2.2	205	403	1
4	Rajouri	Bareri	DW	22.5.13	18	7.31	1150	0	244	200	227	37	6	0.35	44	43	125.0	5.4	285	713	0
5	Rajouri	Bhamla	DW	21.5.13	21	7.65	450	0	220	180	18	14	3	0.14	24	22	32.0	1.9	150	279	1
6	Rajouri	Bhatta Morh	DW	22.5.13	17	7.65	510	0	191	157	21	0	5	0.24	24	17	26.0	2.9	130	316	0
7	Rajouri	Channi Parat	DW	28.5.13	18	7.53	510	0	189	155	18	21	10	0.39	24	22	26.0	2.8	150	316	ND
8	Rajouri	Chittiar	DW	22.5.13	19	7.60	380	0	189	155	11	12	2	0.12	32	13	22.0	1.5	135	236	0
9	Rajouri	Chowki Handa	DW	22.5.13	18	7.29	540	0	232	190	38	14	3	0.35	24	21	46.0	1.3	145	335	0
10	Rajouri	Dadua	DW	28.5.13	18	7.20	560	0	232	190	21	7	5	0.23	16	24	42.0	0.6	140	347	0
11	Rajouri	Dharal Quilla	DW	22.5.13	19	7.65	370	0	143	117	14	0	8	0.10	20	18	7.6	1.3	125	229	0
12	Rajouri	Dharamsal	DW	28.5.13	20	7.69	810	0	395	324	46	0	10	0.22	24	51	55.0	5.9	270	502	3
13	Rajouri	Dhok Baniar	DW	23.5.13	18	8.01	410	0	165	135	25	4	8	0.12	18	20	25.0	0.5	125	254	0
14	Rajouri	Jhangar	DW	22.5.13	21	8.27	810	0	177	145	85	76	25	0.39	26	46	49.0	2	255	502	0
15	Rajouri	Kalal	DW	23.5.13	18	7.81	560	0	232	190	25	6	12	0.24	30	27	24.0	3	185	347	2
16	Rajouri	Kalsian	DW	22.5.13	18	8.28	330	0	183	150	11	11	3	0.22	50	8.5	5.8	4.8	160	205	1
17	Rajouri	kangri	DW	24.5.13	20	8.21	440	0	165	135	18	18	12	0.34	34	12	24.0	0.4	135	273	1
18	Rajouri	Laroka	DW	22.5.13	19	7.74	720	0	287	235	43	17	3.0	0.00	50	22	45.0	1.9	215	446	0
19	Rajouri	Marchola	DW	23.5.13	18	7.62	620	0	250	205	21	17	5	0.30	40	21	32.0	1.7	185	384	0
20	Rajouri	Nanora	DW	28.5.13	18	8.26	390	0	256	210	11	1	5	0.08	48	24	4.4	0.5	220	242	0
21	Rajouri	Rumli Dhara	DW	23.5.13	21	8.14	350	0	195	160	11	1	5.0	0.08	42	8.5	19.0	0.5	140	217	0
22	Rajouri	Seri	DW	23.5.13	20	7.86	910	0	159	130	131	90	32	0.10	64	38	54.0	1.6	315	564	0
23	Rajouri	Sial	DW	23.5.13	19	8.06	410	0	179	147	21	0	10.0	0.10	48	2.4	25.0	1	130	254	0

24	Rajouri	Siot	DW	21.5.13	18	8.04	420	0	171	140	21	7	11	0.24	52	4	18.0	3	145	260	0
25	Rajouri	Solki	DW	29.5.13	20	7.3	440	0	188	154	14	1	10.0	0.10	48	9.7	9.8	1.6	160	273	ND
26	Rajouri	Thangrot	DW	23.5.13	18	7.88	760	0	330	270	21	15	15.0	0.10	48	30	36.0	3.8	245	471	0
27	Rajouri	Potha	DW	23.5.13	21	7.2	430	0	195	160	25	2	6.0	0.24	46	9.7	19.1	4	155	267	0
28	Rajouri	Panja	DW	29.5.13	19	7.31	720	0	305	250	32	10	22.0	0.14	78	7.3	44.0	1.3	225	446	0
29	Rajouri	Phukarni	DW	22.5.13	19	7.24	400	0	194	159	18	1	5.0	0.00	48	8.5	15.0	1.1	155	248	0
30	Rajouri	Lower kharak	DW	29.5.13	19	7.35	460	0	233	191	14	1	10	0.14	50	16	13.0	1.5	190	285	ND
31	Rajouri	Barkhar	DW	24.5.13	18	7.31	330	0	183	150	14	4	5.0	0.24	52	7.3	6.3	3.8	160	205	ND

Kashmir Region

S. No.	District	Location	Type of Source	Date of collection	Temp °C	pH	Sp Cond ms/cm 25°C	CO_3	HCO_3	Alkalinity	Cl	SO_4	NO_3	F	Ca	Mg	Na	K	TH	TDS	Fe
1	Budgam	Aripanthan	dugwell	**27-5-13**	16.8	7.44	1210	0	305	250	99	96	188	0.38	116	32	80.0	37.0	420	629	0.38
2	Budgam	Bardan	dugwell	**27-5-13**	17.1	7.74	280	0	109.8	90	11	14	9.6	0	30	9	6.4	2.6	110	146	0.00
3	Baramulla	Binner	dugwell	**28-5-13**	19.4	7.56	460	0	195.2	160	14	17	54	0.23	72	9	9.3	4.6	215	239	0.23
4	Baramulla	Bomai	dugwell	**29-5-13**	19.2	7.67	860	0	390.4	320	64	64	22	0.23	104	27	55.0	4.0	370	447	0.26
5	Kupwara	Chowgal	dugwell	**29-5-13**	20.2	7.94	460	0	231.8	190	7	38	14	0.23	64	12	18.0	1.7	210	239	0.05
6	Kupwara	Dolipura	dugwell	**28-5-13**	17.8	7.94	530	0	134.2	110	57	13	57	0.33	56	19	12.5	1.7	220	276	0.04
7	Kupwara	Drugmullah	dugwell	**29-5-13**	18.8	7.82	370	0	189.1	155	11	9	6.5	0.19	50	9	10.1	2.3	160	192	
8	Pulwama	Gandhasi Bhat	dugwell	**27-5-13**	20.5	7.88	500	0	305	250	7	6	17	0.3	82	15	5.5	2.0	265	260	2.22
9	Kupwara	Gulgam	dugwell	**28-5-13**	16.1	7.71	790	0	317.2	260	64	65	33	0.23	82	26	56.5	9.0	310	411	0.23
10	Kupwara	Guse	dugwell	**28-5-13**	19.4	7.96	410	0	219.6	180	18	33	27	0.23	52	23	15.0	2.5	225	213	0.00
11	Kupwara	Khanpoora	dugwell	**28-5-13**	18.7	7.53	490	0	237.9	195	25	39	13	0.29	68	15	17.5	9.9	230	255	0.05
12	Kupwara	Kupwara	dugwell	**28-5-13**	14.9	7.67	1160	0	378.2	310	149	93	29	0.23	114	24	110.0	13.0	385	603	0.20
13	Kupwara	Langate	dugwell	**28-5-13**	19.2	7.82	460	0	189.1	155	21	30	15	0.29	62	10	14.6	1.1	195	239	0.03
14	Kupwara	Magam	dugwell	**28-5-13**	18.1	7.51	850	0	305	250	71	32	64	0.23	114	22	27.5	0.0	375	442	0.00
15	Baramulla	Mirgund Silk Centre	dugwell	**28-5-13**	16.2	7.73	780	0	445.3	365	25	56	4.6	0.39	56	21	102.5	11.0	225	406	0.02
16	Pulwama	Pampore Silk Centre	dugwell	**27-5-13**	19	7.83	870	0	542.9	445	25	84	18	0.63	76	50	65.0	36.0	395	452	14.00
17	Srinagar	Rainawari	dugwell	**24-5-13**	19	7.83	780	0	347.7	285	32	71	23	0.33	92	24	36.0	11.5	330	406	0.06
18	Anantnag	Rambarpora	dugwell	**27-5-13**	18	7.88	820	0	366	300	36	84	70	0.12	104	27	40.0	29.0	370	426	0.14
19	Srinagar	Regal Chowk	dugwell	**24-5-13**	20	8.03	950	0	524.6	430	50	112	4.3	0.29	92	46	65.0	46.0	420	494	0.00
20	Pulwama	Sambura	dugwell	**31-5-13**	18.5	7.94	410	0	213.5	175	14	10	4.9	0.23	72	4	6.7	0.0	195	213	0.00

21	Baramulla	Sangrama	dugwell	**28-5-13**	17.3	7.73	570	0	286.7	235	21	33	22	0.33	88	12	17.5	6.7	270	296	0.17
22	Baramulla	Sopore Model Town	dugwell	**29-5-13**	16.2	7.74	510	0	219.6	180	36	37	14	0.33	64	11	30.0	7.3	205	265	0.30
23	Pulwama	Tral	dugwell	**27-5-13**	20	7.65	640	0	353.8	290	18	24	21	0.23	102	19	8.7	2.4	335	333	0.12
24	Kupwara	Trehgam	dugwell	**28-5-13**	16.4	7.95	870	0	335.5	275	71	50	26	0.29	110	22	35.0	5.5	365	452	0.06
25	Baramulla	Waripora	dugwell	**27-5-13**	19.9	7.69	190	0	103.7	85	7	1	8.3	0.23	26	6	5.4	1.1	90	99	0.25
26	Baramulla	Zanbadpura (Hadipora)	dugwell	**28-5-13**	18	7.56	800	0	396.5	325	43	51	5.5	0.45	102	24	39.5	1.3	355	416	0.15
27	Pulwama	Zeewan	dugwell	**27-5-13**	17	7.5	730	0	347.7	285	46	0	43	0.33	126	7	16.2	3.6	345	380	12.00