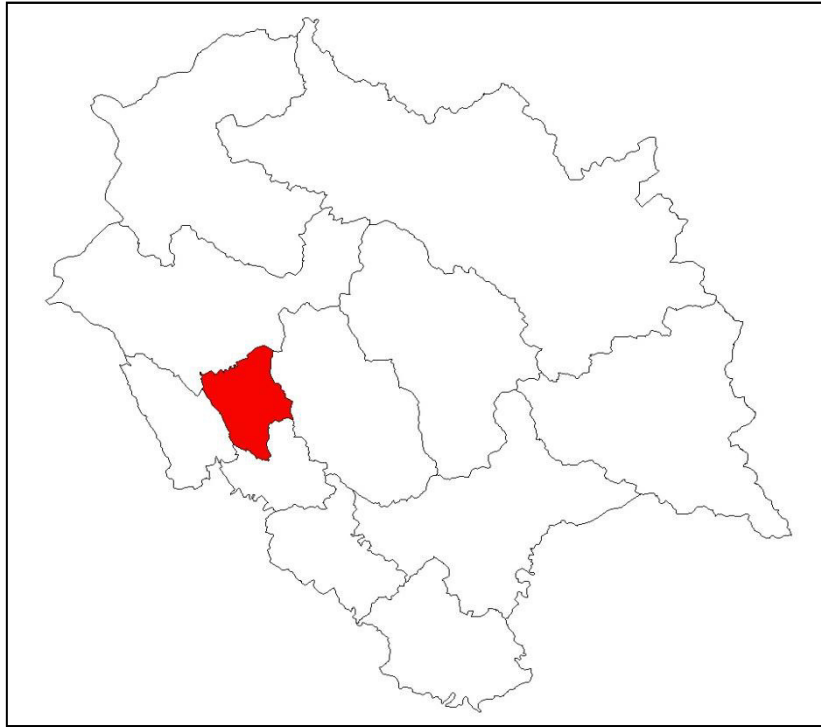




भारत सरकार
Government of India
जल संसाधन मंत्रालय
Ministry of Water Resources
केंद्रीय भूमि जल बोर्ड
CENTRAL GROUND WATER BOARD

GROUND WATER INFORMATION BOOKLET
HAMIRPUR DISTRICT, HIMACHAL PRADESH



उत्तरी हिमालय क्षेत्र
NORTHERN HIMALAYAN REGION
धर्मशाला
DHARAMSALA
सितम्बर, 2013
September, 2013

Contributors

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Prepared under the guidance of

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Our Vision
Water security through sound groundwater
management

Ground Water Information Booklet Hamirpur District, Himachal Pradesh

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HAMIRPUR DISTRICT AT A GLANCE

Sl. No	Items	Statistics
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	1,118
	ii) Administrative Divisions (2001)	
	• Number of Tehsil & sub-tehsils	5 & 1
	• Number of CD Blocks	6
	• Number of Panchayats	229
	• Number of Villages	1,672
	iii) Population (2011 Census)	
	• Total population	4,54,768
	• Population Density (pers/sq km)	407
	• Rural & Urban Population	93.1% & 6.9%
	• SC & ST Population (in percent)	24 % & 0.67%
	• Sex Ratio	1,095
	iv) Average Annual Rainfall (mm)	1,340.72
2.	GEOMORPHOLOGY	
	Major Physiographic units	<ul style="list-style-type: none"> • Structural hills & upland (elevation 600–900 m amsl) • Valley/ alluvial plain (Elevation 400-600 m amsl)
	Major Drainages	
	• Beas basin	Kunnah, Man, Sukar, Sir Khad
3.	LAND USE (2008-09) in Hectare	
	• Forest area	18,200
	• Total cropped area	68,800
4.	MAJOR SOIL TYPES	<ul style="list-style-type: none"> • Alluvial soil • Non-calcic soil
5.	AREA UNDER PRINCIPAL CROPS (2008-2009) in ha.	
	• Rice	1,995
	• Wheat	34,064
	• Maize	31,704
	• Barley	57
	• Pulses	36
6.	IRRIGATION BY DIFFERENT SOURCES (ha.)	
	• Net area irrigated (2008-09)	1,784
7.	NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (As on 31.3.2013)	
	• Number of Dug Wells	4
	• Pre-monsoon water level (May, 12)	2.73 – 8.59 m bgl
	• Post-monsoon water level (Nov, 12)	2.47 – 9.97 m bgl
	• Number of Piezometers	Nil

8.	PREDOMINANT GEOLOGICAL FORMATIONS	<ul style="list-style-type: none"> • Alluvium/valley-fill (Quaternary) • Siwalik Group (Tertiary)
9.	HYDROGEOLOGY Major Water Bearing Formations	
	1. Semi consolidated sediments (Siwalik Group)	Covers major part
	<ul style="list-style-type: none"> • Yield prospects • GW structures 	Low to moderate (1-5 lps) Springs, open wells & tube wells
	2. Unconsolidated porous sediments (Alluvium)	Along rivers and low lying areas
	<ul style="list-style-type: none"> • Yield prospects • GW structures feasible 	Low to moderate (1-5 lps) Open wells & tube wells
10	GROUND WATER EXPLORATION BY CGWB (as on 31.3.2013)	
	<ul style="list-style-type: none"> • No of wells drilled • Depth Range (m) • Discharge (lpm) • Static Water Level • Transmissivity (m²/day) 	10 (EW-10: OW-0) 40 – 100 20 – 1078 1.23 – 9.60 m bgl 7.61 – 712
11.	GROUND WATER QUALITY Presence of Chemical constituents more than permissible limits (eg. EC, F, As, Fe) Quality of Ground Water (EC Range in μ S/cm)	Nil Good (233 – 560)
12	ARTIFICIAL RECHARGE PROJECTS	
	<ul style="list-style-type: none"> • Implemented • Under implementation 	One Project Six Projects
13.	AWARENESS AND TRAINING ACTIVITY	
	<ul style="list-style-type: none"> • Mass Awareness Programmes • Place • No of participants in persons 	1 Agriculture Department, Hamirpur 200
14.	GROUND WATER CONTROL AND REGULATION	
	<ul style="list-style-type: none"> • Number of OE & Critical Blocks • No of blocks notified 	Nil Nil

DISTRICT GROUND WATER BOOKLET

HAMIRPUR DISTRICT, HIMACHAL PRADESH

1.0 INTRODUCTION

Hamirpur was a part of Kangra district when it was in the composite Punjab. Prior to that, it was a tehsil of district Kangra. Hamirpur is a sparsely populated, centrally located district of the state. The district lies between 31°23'00" and 31°53'00" north latitude and 76°20'00" and 77°45'00" east longitude. It is bounded on the east by Mandi district, on the northwest by Kangra district, on the south & southwest by Bilaspur and Una districts respectively. The district has a total area of 1,118 sq km and covers 1.97 % of the state. It has a total number of 229 Panchayats.

As per 2011 census, the district has a population of 4,54,768 persons with a population density of 407 persons per sq km. The male and female population in the district is 2,17,070 and 2,37,698 respectively, with a sex ratio of 1,095 females per 1,000 males. The schedule cast population in the district is 24 % and the schedule tribe population is 0.67%.

Hamirpur district forms a part of Changer Belt, which is an acute water scarcity area of Himachal Pradesh and experiences almost severe drought conditions. The water requirement of general public is being met from traditional water sources like springs, percolation wells, step wells and streams. *Khattris*/traditional water harvesting structures are very common in the northern part of the district in and around Sujampur-Sachui-Patlandar-Ahwa Devi areas. *Khattris* are constructed in conglomeratic terrain, in which seepage water along with rainwater is collected in the under-ground storage for domestic purpose during lean period. Traditional methods of water harvesting like roof top rainwater and collection of rain water in tanks called *Talavs* are still in practice.

Hamirpur district with its headquarter at Hamirpur comprises of three subdivisions (Hamirpur, Badsar, and Nadaun) and five tehsils (Hamirpur, Badsar, Bhoranj, Nadaun, and Sujampur-Tira). The district is also subdivided into five blocks namely; Bijri, Bhoranj, Nadaun, Hamirpur, and Sujampur-Tira.

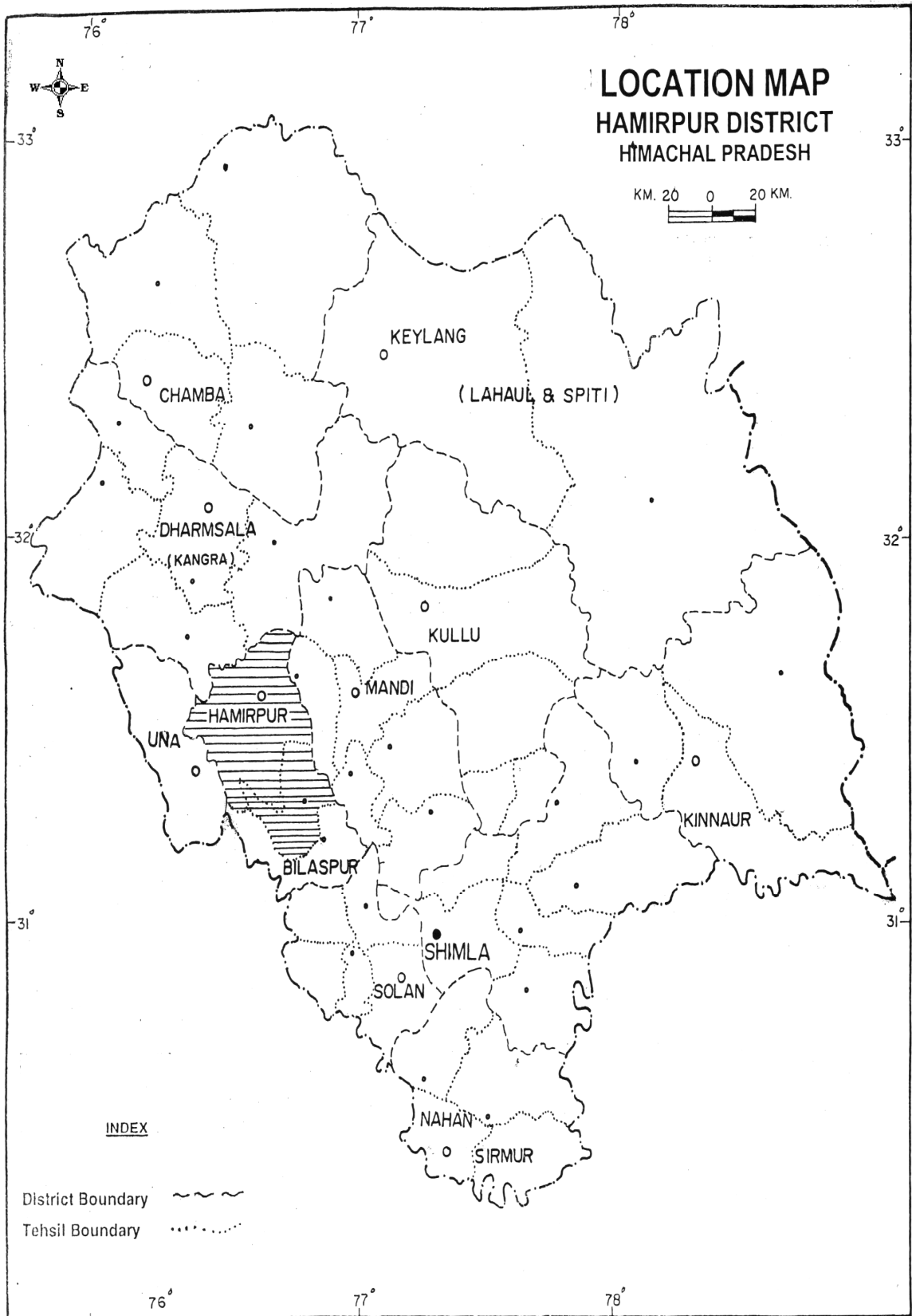
The district is approachable by all weather national and state highways, except Nadaun valley, Sachui- Sujampur valley and other valley fill deposits along the Sir, Kunah, Sukar and Man Khad, the district is mostly hilly and undulating. The cultivation is possible in small terraces and valley fill deposits along the stream/khad basins in most parts of the district. In the valleys the cultivation is spread over a vast area, except the valley area and stream/khad basins. Most of the land is either under shrub forests or grassy land with *Chir* trees up to the height of 1100 m from the mean sea level. Agriculture is the primary occupation of the people in the district.

Central Ground Water Board (CGWB) has carried out Hydro-geological Studies and Groundwater Exploration in the district. Exploratory drilling has been carried out in Hamirpur district all along the valley fills. Under ground water exploration, 10 boreholes has been drilled down to the depth ranging from 40 m at Sachuhi to maximum of 100 m at Chinjiani. The depth to static water level varies from 1.23 to 9.60 m and discharge varies from 20 lpm at Badehar to 1078 lpm at Harmandir

CGWB under its National Hydrograph Network Station monitors 4 wells for ground water regime monitoring, where water level and ground water quality is monitored.

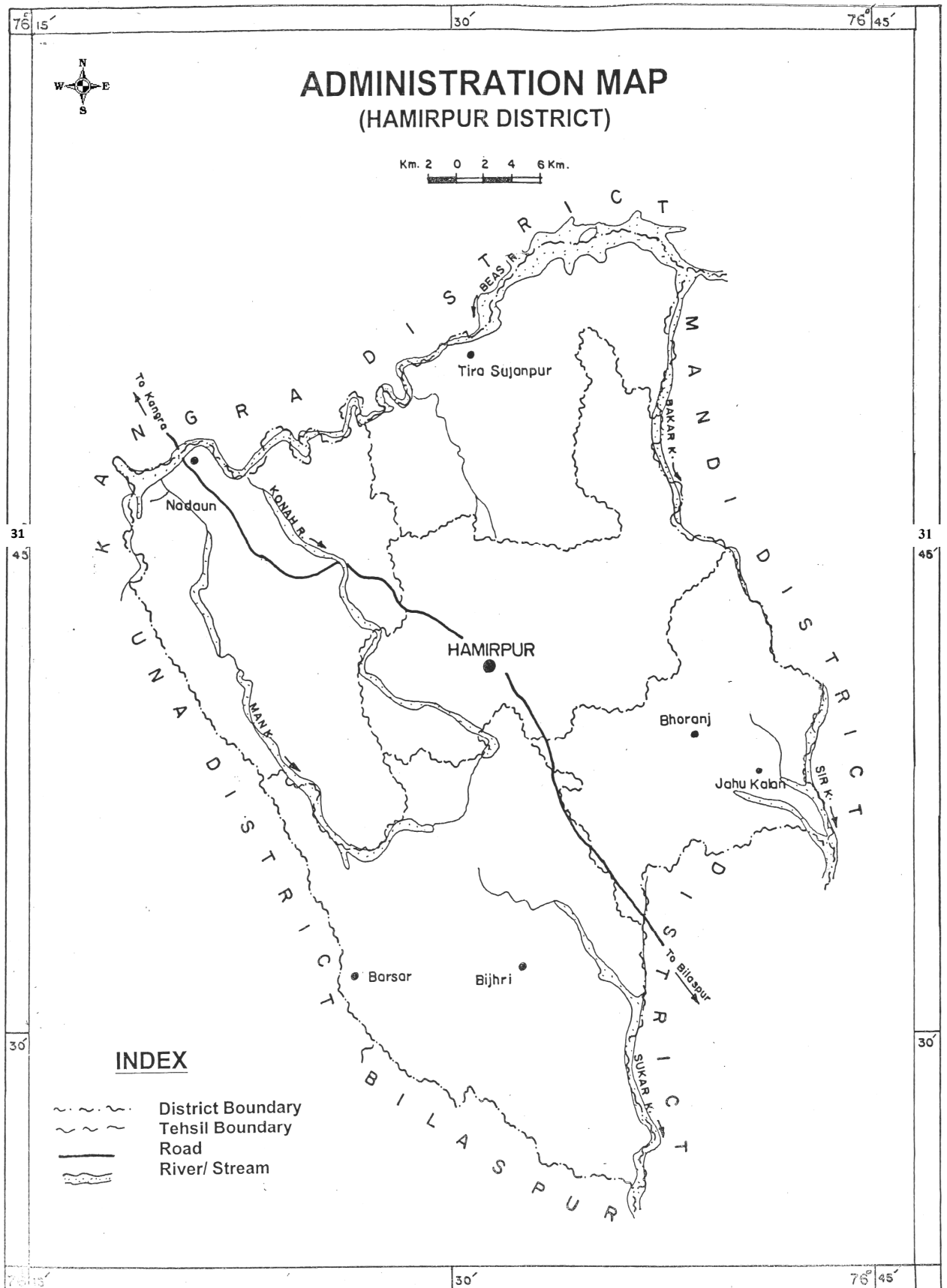
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2.0 CLIMATE & RAINFALL

Climate in various parts of the district, depend primarily much on the elevation, which varies from less than 200 meters to more than 1000 meters above mean sea level. The climate can broadly be divided into three broad seasons viz. winters from October to March, summer season from April to June and monsoon season from July to September. The district receives moderate rainfall and bulk of it is received during the months of July and August. The average annual rainfall in the district is 1,340.72 mm, out of which 82% occurs during June to Sept.

3.0 GEOMORPHOLOGY & SOILS

The terrain of the district is mostly hilly and undulating. The surface elevation ranges from 400 m to 600 m amsl along the Beas river valley and in lower reaches of Kunah Khad in the northern part of the district. The elevation is more than 900 m above msl in the eastern part of the district. The altitudinal variation in-general, ranges between 600 m to 900 m above msl. Sola Singhi hill ranges forms the western boundary of the district, with a maximum elevation of 1145 m above msl. Deep gulleys and gorges are formed in the north-eastern part of the district. The river / khad valleys are broad in the southern part of the district, mainly along the Sukar and Sir Khad in Bhorang-Jahu-Dhankar areas. In the drainage basin of Beas River, the general ground slope is towards north, while in the Sutlej River this slope is towards south.

Hamirpur district forms a part of drainage system of the Beas River in the northern and western parts, whereas in the eastern and southern parts Sutlej River system drains the areas . The drainage pattern is dendritic to sub dendritic. Drainage density is coarse to medium.

The Beas River: The entire drainage of the Beas River above Pandoh (Mandi) has been diverted to Govind Sagar (The Sutlej River).The river receives only regulated flows downstream of Pandoh and the flows contributed by the Uhl River, Neogal Khad and Binwa Khad along with the other minor seasonal rivers/Khads directly join the river Beas. Other important tributaries of Beas are Baker, Salagi, Nauli, Maili and Jangled Khads. In Hamirpur district's, Kunah and Man khads are the major streams. These along with other major khads join the Beas River.

Kunah Khad: Kunah is the most important tributary of the Beas River in the district. . Major tributaries of this khad are Sukar, Jhaniari, Gasota, Hathali and Sukrala Khads. These khads are perennial and have floods during rainy season.

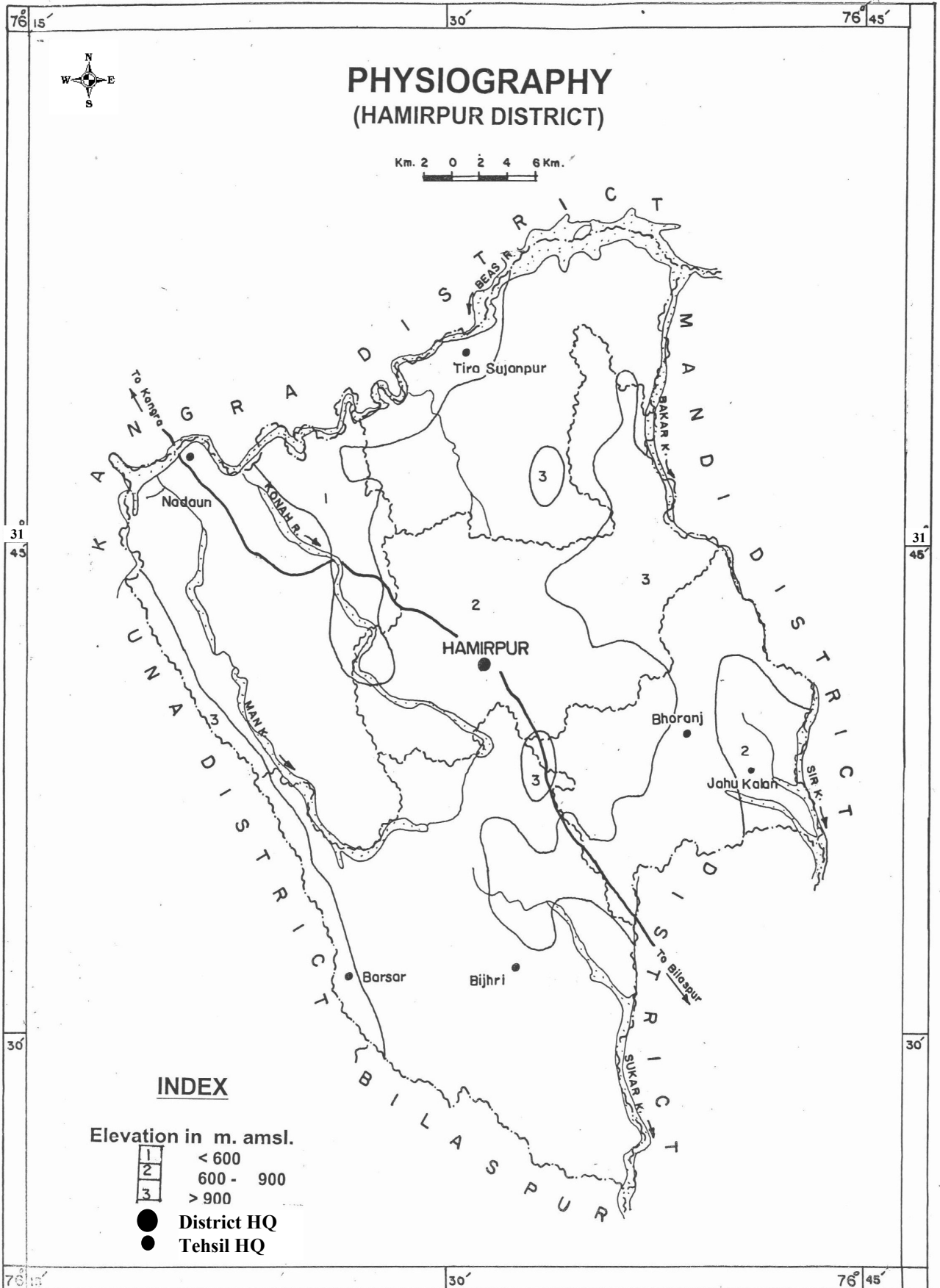
Man Khad: Man Khad is another perennial tributary of Beas River which originates near Deotsidh and flows towards NNW, to join Beas River to the west of Nadaun. Important tributaries of this khad are Haretta, Bambloo and Matwara Khads.

Sukkar Khad: Sukkar and Sir Khads are the main khads joining the Sutlej River and Govind Sagar. These occupy the southernmost part of the district and flow towards south to directly fall into the Govind Sagar. These are ephemeral in the upper parts and become perennial in the lower parts.

Sir Khad: Sir Khad is another important khad, which is draining the eastern most part and flows towards east. This khad is ephemeral in upper catchment area and becomes perennial in lower parts.

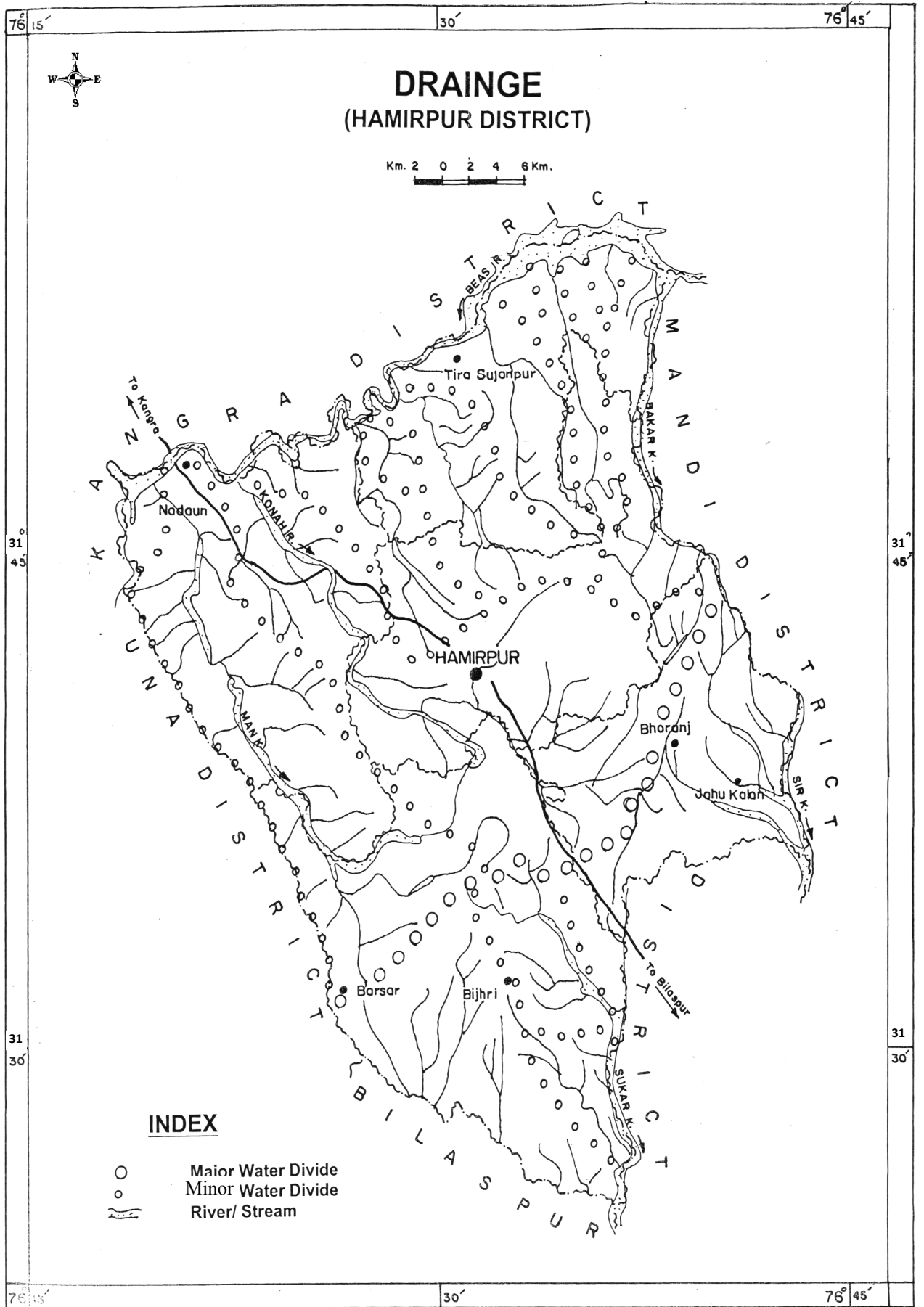
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In addition to these khads there are other numerous minor streams/khads joining the Sutlej River. There are number of minor surface water storage tanks located in the district, called *Talavs* or Tanks. Almost all the villages have a *Talav* / Tank to fulfill the domestic water requirements. There is no natural lake existing in the district.

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology

There are two main geological horizons, namely post-tertiary and tertiary formations in Hamirpur district. The sequence of geological formation is given as follows

AGE	FORMATION	LITHOLOGY
Post-Tertiary (Quaternary)	Alluvium	Sand, Gravel, Pebble & Boulders and clay
Tertiary (Siwalik)	Upper	Conglomerates, Boulders and pebbly sandstone
	Middle	Micaceous sandstone and shale
	Lower	Hard, purple sandstone & shale

TERTIARY FORMATIONS

Almost the entire district is underlain by the tertiary formations. These formations are represented by the Siwalik group of rocks (lower, middle and upper). Lower Siwaliks comprise of massive dark gray sandstone and purple shales. These are conformably overlain by micaceous sandstone and gray clay/shales of middle Siwalik. Upper Siwaliks comprise of conglomerates, coarse-grained sandstones, inter bedded with grey and pink clays/silts and sand stone or pebbles beds. Conglomerates occupy the major part of the district. Conglomerates are compact and hard in northern part, while in south-eastern parts these are weathered and fractured.

OLDER ALLUVIUM DEPOSITS

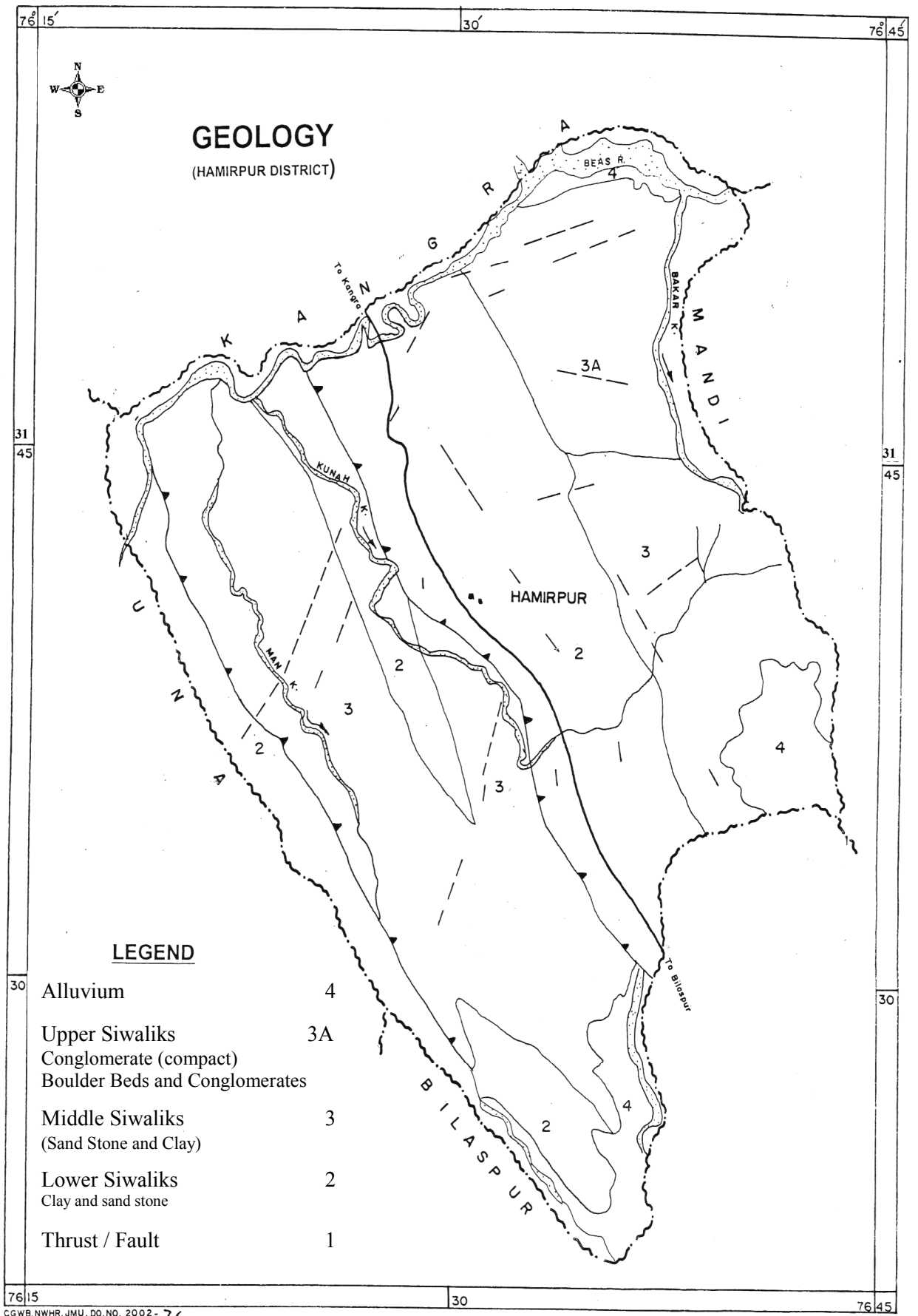
These are widely distributed in the area between Nadaun – Sandhol and Harsi Pattan along the Beas River and Jahu-Bhorang area along Sir khad. Older alluvial deposits also occur in the lower reaches of Man khad. Alluvial deposits are also formed along minor streams / tributaries. These deposits are discontinuous and are of limited aerial extent. Thickness of these deposits varies from less than 10 m to about 100 m along the Beas River valley and Sir Khad.

YOUNGER ALLUVIUM

These deposits occur either along the active channel or adjacent to it. The width of these deposits varies from few meters to about a kilometer. These are distributed along the major and minor streams/rivers. Pebbly sandstone is also occurring in the district, which is highly, weathered and fractured. Springs are formed along or near to the thrust zones traversing through the central part of the district.

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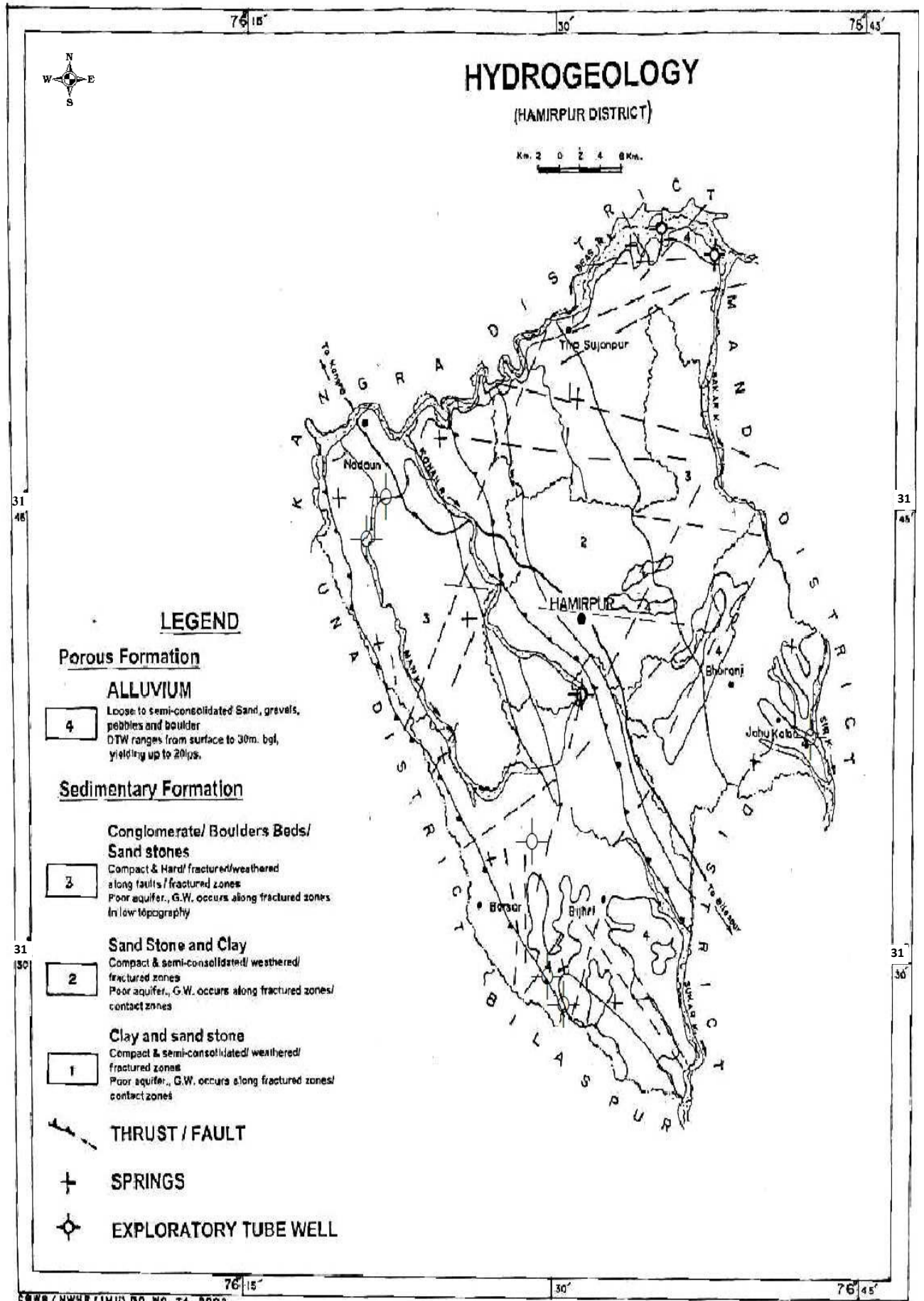
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76° 15' 30' 76° 45' 30' 31° 45' 76° 15' 30' 76° 45' 30' 31° 45'

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POST –TERTIARY FORMATIONS

Quaternary deposits forming valley fill deposits are fluvial deposits. These deposits rest uncomfotably over the Siwaliks, with more thickness in low topographical areas along the rivers/khads. These sediments are composed of sand, gravel, pebble and boulders. Mostly these are formed by the coalescence of the alluvial fan deposits by the various rivers/khads.

AQUIFER SYSTEM

1. SEDIMENTRY FORMATIONS

Sedimentary formations comprise of hard rocks belonging to Siwalik group of rocks and are represented by conglomerates, boulder beds and sandstones and clays. Conglomerates and boulder beds are compact and hard, are generally devoid of water bearing horizons and are widely distributed in the eastern part of the district. Weathered conglomeratic formations overlying the compact conglomerates, form shallow and potential aquifers mainly in topographic lows. Ground water is developed by construction of percolation wells, galleries or through springs. The discharge of wells varies from less than 1 lps to about 10 lps. Discharge generally reduces during summers. In compact conglomeratic formations ground water occurs generally either along the fractures/fault zones or along the contact zones of different lithological units. Ground water is developed only in the form of springs, formed in the low topographic areas, along the fractured zones. The discharge of the springs is meager and is utilized for domestic purposes. Most of the springs in this zone also get dried up during peak summers.

Contact and fractured zones, in sandstone formations mainly near the major faults or thrusts form the potential zones. These are widely distributed in the central and western part of the district. In these areas, ground water is mainly developed through the springs. Ground water generally occurs under unconfined conditions. Depth to water level varies from 5m to about 10 m. The yields of shallow wells are meager and are utilized only for domestic purposes.

The development of deeper ground water horizons has commenced with the introduction of borewells for installing hand pumps, ranging in depth from 40 m to 80 m spread over the entire district. Depth to water in these borewells generally ranges between 10 m to 25 m below ground level. The yield of borewells (during drilling), reportedly varies from less than one litre to about 2 litre per second (LPS). Yields are generally higher along the structurally weak zones. Ground water is mainly discharged through springs. Important springs are formed along or near to the thrust zones traversing through the central part of the district.

II. POROUS FORMATIONS:

Quaternary sediments or fluvatile deposits occur as valley fill within the older formations, distributed mainly along Beas River, Sir khad and Man khads. Fluviatile deposits are loose to semi consolidated, comprising of sand, clay, gravel, silt, pebble and boulders. The important valley fill deposits along Beas River of the district are discussed below.

VALLEY FILL ALONG BEAS RIVER

SACHUHI-SUJANPUR VALLEY FILL

This is an important valley fill formed along the southern bank of the Beas River and locally known as Ballas. This area was prone to floods with waters of Beas River during rainy season prior to the diversion of the Beas river's water to Govind Sagar, at Pandoh. This has also checked the floods and improved the marshy lands (Ox-bow), previously existing over the areas around Jangal Bary and Sachuhi.

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4.2 Ground Water Resources

Ground water resources and irrigation potential of Hamirpur district has not been computed as per the GEC-97 methodology, as the aquifers are isolated and discontinuous in nature. Ground water draft component consists of draft due to bore wells discharge through springs and effluent seepages into the rivers.

4.3 Ground Water Quality

Water samples were collected from Ground Water Monitoring Stations during May, 2012, for chemical analysis. The minimum and maximum ranges of the results are tabulated below and are within the permissible limit of safe drinking water set by Bureau of Indian Standard (BIS).

	pH	EC μS/cm at 25°C	HCO ₃	Cl	So ₄	NO ₃	F	Ca	Mg	Na	K	Total Hardness as CaCO ₃
			(in mg/l)									
Min	8.02	280	12	10	1	2	Tr	30	11	7.5	0.6	120
Max	8.17	360	153	125	85	22	0.16	48	17	14.0	5.8	165

4.4 Status of Ground Water Development

The population of the district is widely distributed and their water demands are fulfilled to larger extent, from the traditional water sources like springs, percolation well/ infiltration galleries, step-wells and streams, by piped water supplies.

Major potential areas for the ground water development are the valley fill deposits, occurring along Beas River between Sachuhi and Nadaun, lower reaches of Man khad and Sir khad and central part of Kunah khad. The aquifer thickness may vary from less than 10 m to about 100 m. The other potential areas are located along the faults/thrusts and contact zones of various formations. Majority of the springs are located along these weak zones. In most of the areas, bore wells have been constructed with yields varying from less than 1 lps to 5 lps. The bore wells with higher discharges (more than 1.5 lps) are fitted with electric motors to augment the water supplies.

So far, the valley fills or fault zones has not been explored or studied on macro level for assessing the potentialities of ground water resources in the district. However, Central Ground Water Board has taken up exploration, in Jangal-Berri-Sachuhi area and central part of Kunah Khad by constructing tube wells for studying the aquifer parameters, in order to assess the ground water resources.

Rainfall infiltration is the principal source of ground water recharge to the aquifer system in the district. Inflow seepages from khads/ rivers also contribute to the ground water resources/ reserves.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Ground Water Development

Hamirpur is partially explored and only ten exploratory wells are constructed, in which shallow aquifers are tapped. Some of the wells have been handed over to Irrigation & Public Health Department. All these wells are drilled all along the Beas River and its tributaries in the district. Lot of scope exists, for the future ground water development in the district.

In Hamirpur district, ground water occurs under water table to semi-confined conditions. Sedimentary formations comprise of hard rocks belonging to Siwalik Group and are represented by conglomerates, boulder beds, sandstones and clays. Conglomerates and boulder beds are compact and hard, generally devoid of water bearing horizons and are widely distributed in the eastern part of the district. Weathered conglomeratic formations, overlying the compact conglomerates form shallow and potential aquifers, mainly in topographic low lying areas. Fissured formations includes, Quaternary sediments or fluvial deposits and occur as valley fills, within the older formations and are distributed mainly along Beas River, Sir Khad and Man Khads. Fluvial deposits are loose to semi consolidated comprising of sand, clay, gravel, silt, pebble and boulders.

5.2 Water Conservation & Artificial Recharge

In Hamirpur district, development of ground water resources can be categorized into two distinct areas and is ultimately related to the varied topography and geological characteristics of the area. Because of hilly topography of the area, ground water structures especially traditional sources are of great value. However in valley areas, modern techniques are supplementing the old one. Such type of development is taking place in some part of the district. The various means for tapping the ground water resource is summarized below in two main physiographic units.

1. Hilly Areas
2. Valley Areas

1. Hilly Areas: -

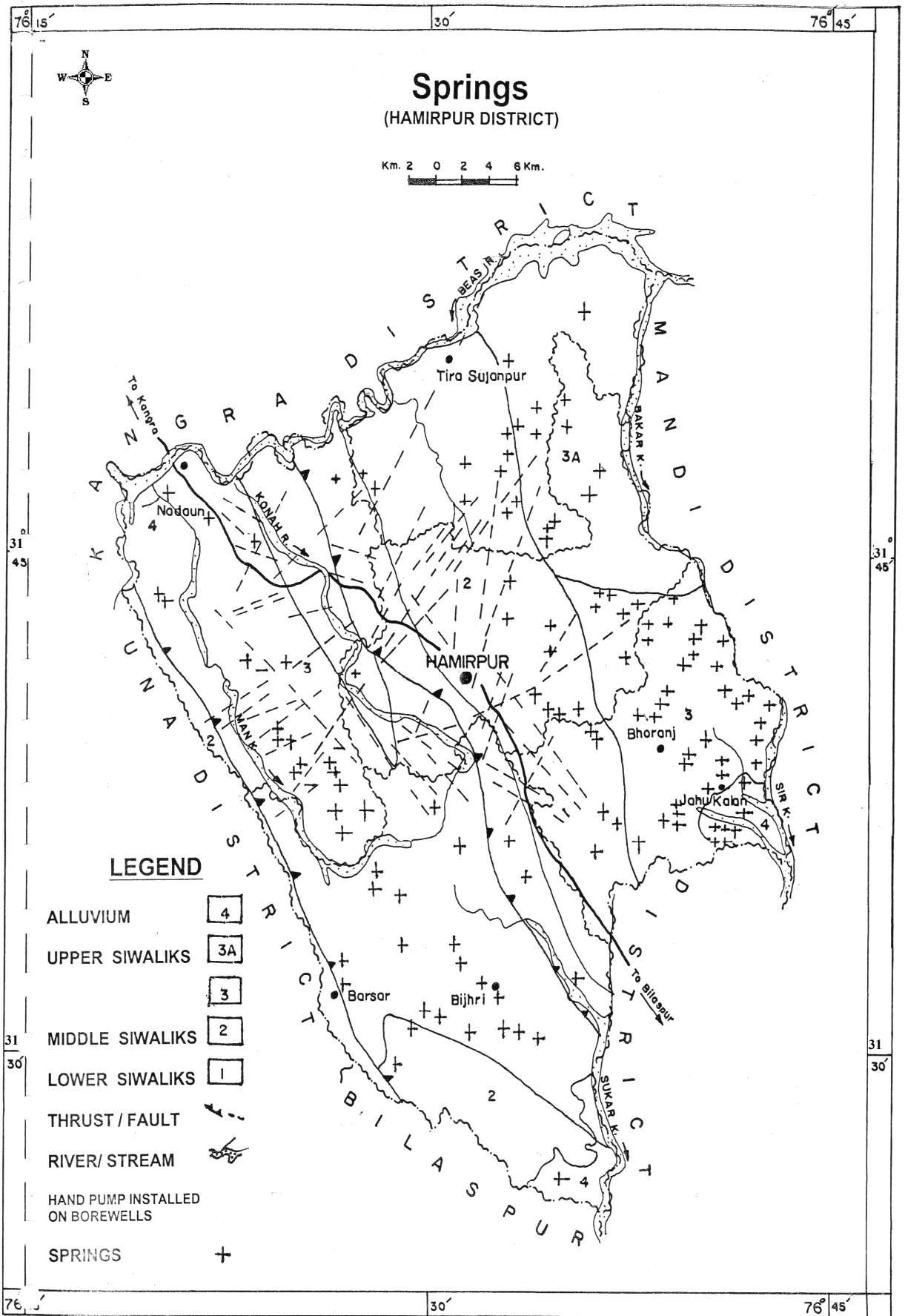
In hilly areas of Hamirpur district, springs are the main source of ground water. In local language, these are known by various names like *Bowris*, *chasmas*, *magars* etc. However the difference lies only in the way these are tapped. The spring water thus collected in artificially constructed tank structure, is ultimately used for drinking and other domestic purposes. The discharge of the spring varies from seepages to maximum of 21 lps. Few springs having sufficient discharge are being tapped by the State agencies like Irrigation & Public Health Department under various schemes. Some of the existing water supply schemes are successfully running on such sources for serving the settlements.

Hand pumps are another source of ground water, tapped for domestic use. State agencies have constructed number of hand pumps and its water is being used for drinking and other domestic purposes. Some of the hand pumps having sufficient discharge are tapped by I.P.H. department and its water is ultimately used for water supply.

Valley areas of Hamirpur district are comparatively densely populated. This reflects the demand for more water for domestic and agriculture purpose. Such areas are primarily served by various lift water supply schemes by State agencies. Most of these schemes are established on major rivers, tributaries or streams/nallas having sufficient perennial discharge.

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2. Valley Areas: -

Springs are natural ground water structures used for domestic purposes. Such spring sources are generally found to be well maintained by local community. The discharge of the spring sources varies from seepages to few lps.

Though the stage of ground water development in the district is still in *safe category*, however, declining water levels in patches suggest need for cautious and well-planned ground water development. Further, there is an urgent need to monitor development pattern by the implementing agencies.

Roof top rainwater harvesting in urban/rural areas and water harvesting in rural area need to be adopted and proper scientific intervention for spring development and revival of traditional water storage, is required in water scarce, hilly upland areas.

In the hilly areas structures like nalla bunds, gabbion structures, check dams, check dam cum ground water dams, subsurface dykes and revival of ponds are recommended, while in low hill ranges, check dam and roof top rain water harvesting structures can be adopted.

CGWB has constructed one artificial recharge project at Chalokhar nala and under XIth Plan 6 projects are taken up for augmenting the ground water resource through construction of check dams and sub-surface dykes. These structures are under implementation by I&PH Department of State Govt. at Hareta Khad, Kohi Nala, Ghasoti Khad, Gindwin Khad and Pung Nala and one project by Dr. Y.S. Parmar University of Horticulture & Forestry, Solan at Neri.

6.0 GROUND WATER RELATED ISSUES & PROBLEMS

In Hamirpur district, major water supply schemes are based on springs and surface water. The discharge in springs as well as in nallas dwindles during summers, creating shortage of water for supplies. Ground water in Hamirpur district has only been explored in the valley areas, but hard rock formations belonging to Siwalik group of rocks and represented by conglomerates, boulder beds, sandstones and clays remain unexplored. Conglomerates and boulder beds are compact and hard, generally devoid of water bearing horizons and are widely distributed in the eastern part of the district. Weathered conglomeratic formations overlying the compact conglomerates, form shallow and potential aquifers mainly in topographic lows. Ground water is developed by construction of percolation wells, galleries or through springs. Quaternary sediments or fluvial deposits occur as valley fills within the older formations and are distributed mainly along the Beas River, Sir Khad and Man Khads. Fluvial deposits are loose to semi-consolidated comprising of sand, clay, gravel, silt, pebble and boulders.

7.0 AWARENESS & TRAINING ACTIVITY

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

CGWB, under the aegis of CGWA, conducted one Mass Awareness Programme on Rainwater Harvesting and Water Management at the Directorate of Agriculture Department at Hamirpur.

About 200 farmers, including the officers and officials of Agriculture and I&PH Department, attended the programme. Lectures were delivered by CGWB and Agriculture Department

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officers, on the need for harvesting water for various uses and artificial recharge to ground water, for future use. Hon'able Minister Smt. Urmil Thakur, was the Chief Guest and she stressed the need for change in cropping pattern, optimum utilization of water to various crops and to adopt water conservation measures.

An exhibition displaying roof top rainwater harvesting models, charts, maps and other displays were arranged by CGWB, to aware the gathering on the theme.

8.0 AREAS NOTIFIED BY CGWA / SGWA

The stage of ground water development in Hamirpur district has not been calculated. Hence, no area or block has been notified from the groundwater development point of view.

9.0 RECOMMENDATIONS

- Since ground water in the district has not been fully developed, the district falls in *safe category*. There exists a scope for developing the ground water resource in the district.
- Groundwater development by constructing shallow and deep boreholes can be done in the valley areas and all along the river terraces..
- Rooftop rainwater harvesting structures are mandatory in municipal areas, but the people of rural areas are to be educated about the structures by awareness programmes.
- Traditional resources like springs, *khatri* and *bowries* need to be revived and developed/protected for use. Public participation in water resource development projects, should be encouraged.

SAVE WATER – SAVE LIFE

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

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