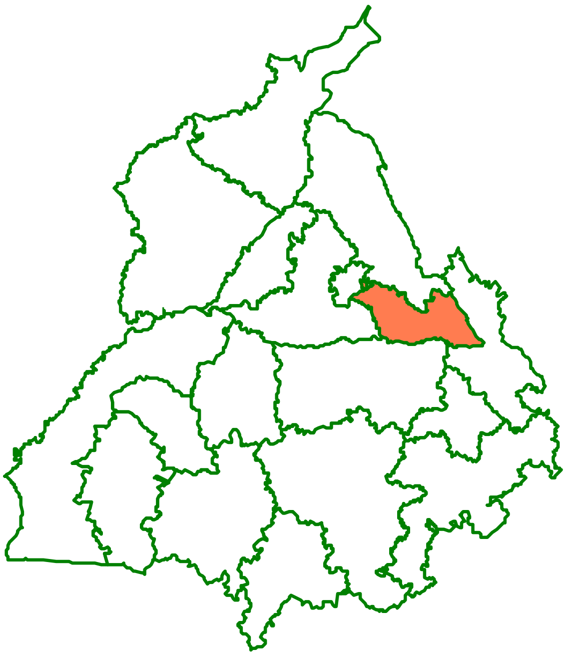
NAWANSHAHR DISTRICT PUNJAB



CENTRAL GROUND WATER BOARD
Ministry of Water Resources
Government of India
North Western Region
CHANDIGARH
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Contributors

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STA (Hg)

Prepared under supervision of

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Regional Director

GROUND WATER INFORMATION BOOKLET
NAWANSHAHR DISTRICT, PUNJAB

C O N T E N T S

NAWANSHAHR DISTRICT AT A GLANCE

Sl.NO	Items	Statistics
1.	GENERAL INFORMATION	
	i. Geographical Area (sq. km.)	1267
	ii. Administrative Divisions	
	Number of Tehsils	2
	Number of Blocks	5
	Number of Towns	9
	Number of Villages	476/ 415
	iii. Population (As per 2011Census)	6,14,362
	iv. Normal Annual Rainfall (mm)	924
2.	GEOMORPHOLOGY	
	Major physiographic Units	Alluvial Plain
	Major Drainage	Sutlej
3.	LAND USE (Sq.km.)	
	a. Forest Area:	160
	b. Net area sown:	910
	c. Cultivable area:	1750
4.	MAJOR SOIL TYPES	Reddish Chestnut, Tropical Arid Brown (Weakly Solonized)
5.	AREA UNDER PRINCIPAL CROPS (thousand hectare)	Kharif -95 Rabi -88
6.	IRRIGATION BY DIFFERENT SOURCES	(thousand hectare)
	Dugwells	-
	Tubewells/Borewells	770/21340 ((88)- 24553/
	Tanks/ponds	-
	Canals	10
	Other sources	10
	Net Irrigated area	88
	Gross irrigated area	173.6
7.	NUMBER OF GROUNDWATER MONITORING WELLS OF CGWB	
	No. of dug wells	6
	No of Piezometers	-
8.	PREDOMINANT GEOLOGICAL FORMATIONS	Alluvium
9.	HYDROGEOLOGY	
	*Major Water bearing formation *Pre-monsoon depth to water level *Post-monsoon depth to water level *Long term water level trend in 10 yrs	Sand 8.8 –29.7 8.3-23.7 Fall – 0.25 to 0.86 m/yr Rise – 0.06 m/yr

10.	GROUND WATER EXPLORATION BY CGWB	
	No. of wells drilled EW OW PZ SH	 8 - 5 -
	Depth range (m)	101-451
	Discharge (liters per minutes)	300-1833
	Storativity (S)	$1.18*10^{-3}$-$1.8*10^{-3}$
	Transmissivity (m^2/day)	645-2940
11.	GROUNDWATER QUALITY	
	Presence of Chemical constituents more than the permissible limit EC (micro mhos at 25°C) F (mg/l) As (mg/l) Fe (mg/l)	- - - - - -
	Type of water	Alkalini,Ca,Mg-NCO_3
12	DYNAMIC GROUNDWATER RESOURCES (2009) MCM	
	Net annual ground water availability	640.14
	Annual Ground Water Draft	702.77
	Projected Demand for Domestic and industrial Uses upto 2025	18.53
	Stage of Ground Water Development	112%
13	AWARENESS AND TRAINING ACTIVITY	Nil
14.	EFFORTS OF ARTIFICIAL RECHARGE& RAIN WATER HARVESTING	NIL
15.	GROUND WATER CONTROL AND REGULATION	
	Number of OE Blocks.	3- Aur, Nawanshahr & Banga
	Number of Critical Blocks	-
	Number of blocks notified	2- Aur, Banga
16.	MAJOR GROUND WATER PROBLEMS AND ISSUES.	Over-exploitation

GROUND WATER INFORMATION BOOKLET
NAWANSHAHR DISTRICT, PUNJAB

1.0 INTRODUCTION

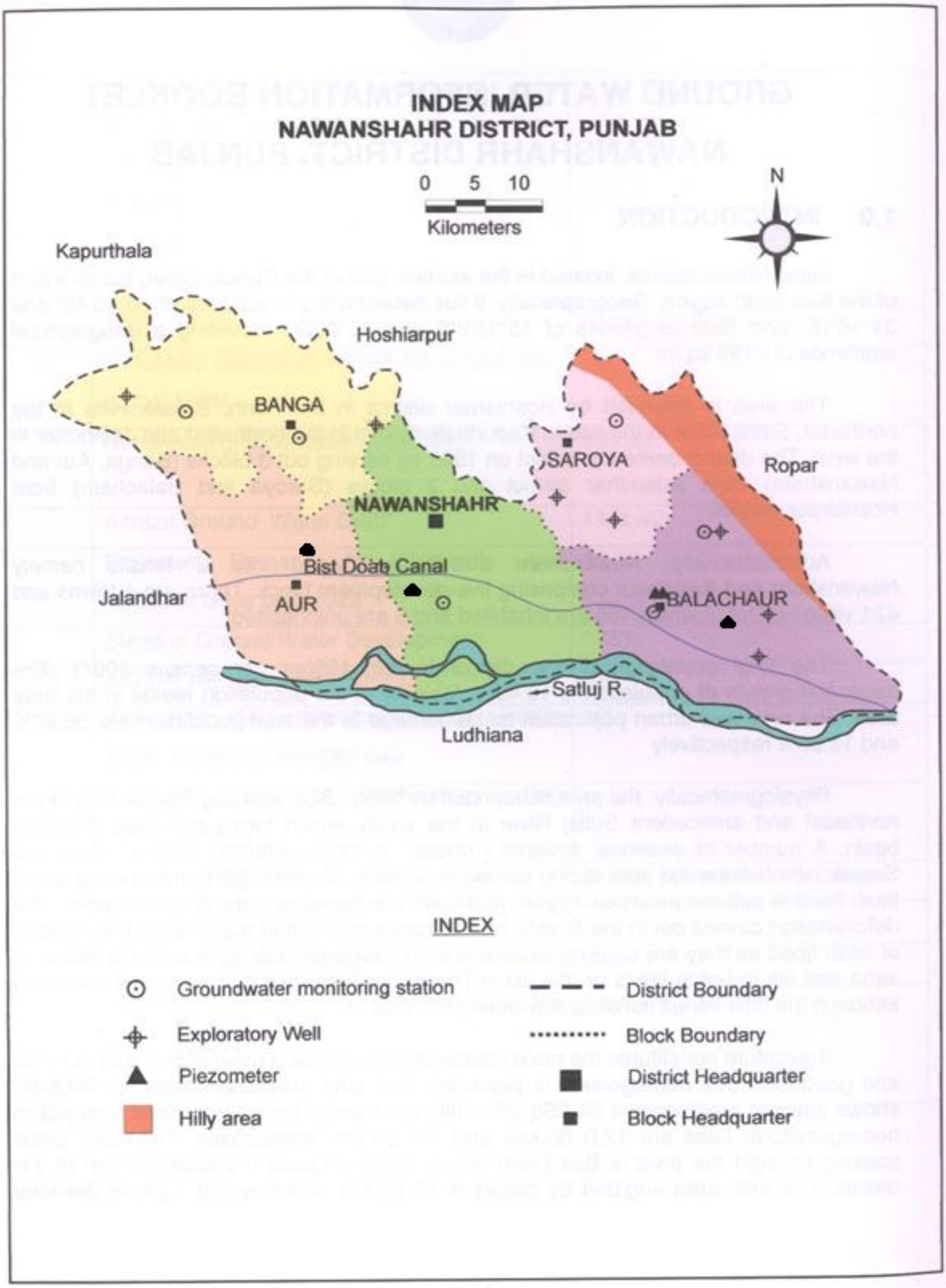
Nawanshahr district, located in the eastern part of the Punjab State, forms a part of the Bist-Doab region. Geographically, it lies between North latitudes of 30°48′45″ and 31°16′15″ and East longitudes of 75°46′00″ and 76°26′30″ covering a geographical ambience of 1190 sq.km.

The area is bounded by Hoshiarpur district in the north, Siwalik Hills in the northeast, Sutlej River in the south, Kapurthala district in the northwest and Jalandhar in the west. Nawanshahr district was carved out of Hoshiarpur and Jalandhar districts of Punjab in November 7, 1995 on the auspicious occasion of birthday of Sh. Guru Nanak Dev Ji as the sixteenth district of Punjab State. The name of the district was changed to "Shahid Bhagat Singh Nagar", to conclude the Birth Centenary celebrations of the great martyr Sardar Bhagat Singh, on 27/09/2008

Administratively, Nawanshahr district is divided into 2 tehsils namely Nawanshahr and Balachaur comprising five-development block. There are 9 towns and 476 villages.The Shahid Bhagat Singh Nagar district is one of the smaller districts of Punjab and is having an area of 125833 hectares consisting of population of 6,14,362 as per 2011 census . The land of District Shahid Bhagat Singh Nagar is fertile due to the presence of river Sutlej and irrigated through tubewells and canals except some part of the Balachaur sub-division falling in Kandi Area.

Physiographically, the area is bounded by NNW- SSE trending Siwalik Hills in the northeast and antecedent Sutlej River in the south, which forms the main drainage basin. A number of seasonal streams (‘’choes’’ in local parlance) originate from the Siwalik, which drain the area during monsoon season. At times these choes bring down flash flood in sub-mountainous region, particularly in Balachaur and Saroya blocks. The deforestation carried out in the Siwalik foothill zones has further aggravated the menace of flash flood as they are causing extensive soil erosion on one hand and deposition of sand and silt in fertile fields on the other.The Sutlej River being snow fed is perennial although the flow varies considerably during the year.

Agriculture constitutes the main source of economy and most of the area is fertile and good land use management is practiced. The land utilisation pattern of 2005-06 shows that net area sown is 94,0Sq.km. while area under forest cover and land put to non-agricultural uses are 17,0 Sq.km. and 7,0 Sq.km. respectively. The main canal passing through the area is Bist Doab canal, which irrigates the western part of the district. The total area irrigated by canals is 10 Sq.km. which is just 1.2% of the total


INDEX MAP
NAWANSHAHR DISTRICT, PUNJAB
0 5 10
Kilometers
N
Kapurthala
Hoshiarpur
BANGA
SAROYA
Ropar
NAWANSHAHR
Bist Doab Canal
Jalandhar
AUR
BALACHAUR
Satluj R.
Ludhiana
INDEX
Groundwater monitoring station
Exploratory Well
Piezometer
Hilly area
District Boundary
Block Boundary
District Headquarter
Block Headquarter

irrigated area. While area irrigated by groundwater account for about 98% shallow & deep tubewells.

Central Ground Water Board has carried out Systematic Hydrogeological Survey during 1960, 1961 and 1962. Later the same area was covered under Reappraisal Hydrogeological Survey during 1992-93 and 2003-04.

2.0 RAINFALL AND CLIMATE

Rainfall

The average annual rainfall in the district is 924 cm. The rainfall in the district in general increases from the south-west towards the north-east. About 70 % of the annual normal rainfall in the district is received during the period July to September, July being the rainiest month. Some rainfall is received mostly as thunder showers in June and in association with passing western disturbances in the cold season. On an average, there are 36 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. The heaviest rainfall in 24 hours recorded at any station in the district was 30mm.

Temperature

After February, temperature begin to rise rapidly. June is generally the hottest month with the mean daily temperature at about 41˚C and the mean daily minimum at about 27˚C. Scorching dust laden winds blow on many days in the summer season and the day temperatures on individual days may reach above 45˚C. Afternoon thundershowers which occur on some days during the summer bring welcome relief though only temporarily. With the onset of monsoon by about the end of June or early in July, the day temperature drop down appreciably. But the nights continue to be a warm during the summer. Due to increase moisture in the monsoon air, the weather is often sultry and uncomfortable, in between these rains. After about mid-September when the monsoon withdraws temperatures decrease, the drop in the night temperature being rapid. January is generally the coldest month with the mean daily maximum temperature at about 19˚Cand the mean daily minimum at about 6˚C.

Humidity

During the brief south-west monsoon months and for spells of a day or two in association with the passing western disturbances high humidity prevails in the district. In the rest of the year, the humidity is low. The driest part of the year is the summer season when in the afternoons the relative humidity is 30 %or less.

Cloudiness

The skies are heavily clouded and over cast on a few days during the south-west monsoon and for spells of a day or two in association with passing western disturbances during the cold season. During the rest of the year, the skies are mostly clear or lightly clouded.

Winds

Winds are generally light in the district. In the south-west monsoon season, winds from direction, between north-east and south-east, are common but on many days in the afternoons westerly to north-westerly winds predominate, except in the latter half of summer, when easterlies and south easterlies blow on some days.

3.0 GEOMORPHOLOGY AND SOIL TYPES

The district forms a part of Indo-Gangetic alluvial plain. Geomorphologically, the area can be grouped into 2 units-alluvial fan and alluvial plains. Alluvial fans are mainly found in the foothills deposited by hill torrents. These alluvial fans coalesced to form Kandi formation and Sirowal formation, which runs parallel to Siwaliks. This belt exhibits steep slope in the north, which become flat in the south. Majority of the district is covered by alluvial deposits comprising sand of various grades and clays with varying amount of silt and kankar.

The soils in the district can be grouped under Reddish Chestnut Soils and Tropical Arid Brown Soils (Weakly Solonized). These soils have formed from the alluvium deposited by rivers of Indus system. The soils are generally loamy sand at the surface and calcareous sandy loam in the sub-surface layers with a hard pan of gravel at 1.2mbgl. Reddish chestnut soils are found in Balachaur tehsil while tropical arid brown soils are found in the remaining parts of the district.

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology

The Nawanshahr district is covered by Quaternary alluvial deposit except in the northeastern part, where the Siwalik hills of Tertiary age are exposed. The aquifer in the alluvial tracts of Banga, Aur and Nawanshahr block comprises sand and silt with intercalation of little clay and kankar. In Kandi formation, covering large parts of Balachaur and Saroya blocks, boulders, gravel, pebbles and coarse sand with several layers of lenticular and fringing clay forms the main water bearing formation.

The Central Ground Water Board has drilled 8 exploratory wells and 5 piezometers (3 Piezometers were drilled under HP-II Programme.) to delineate the aquifer geometry and quality of formation water. The wells drilled were in the depth range of 101-451 m bgl. Exploratory drilling revealed the presence of 5-7 aquifer groups within the depth range of 300 m in western part of the district. In the northeastern part, clay is predominant over sand formations and usually thick beds of clay are associated with boulders and pebbles. The average thickness of aquifer is 100m in the eastern and northern parts while it is of order of 150 m upto the total depth of 300 m bgl in the western part.

Groundwater occurs under both unconfined as wells as confined conditions. In Kandi area and top aquifer of alluvial tract that extends to a depth range of 50 to 60m bgl groundwater occurs under unconfined condition. But towards south, groundwater occurs under semi-confined to confined condition particularly below 50 m depth that is in hydraulic continuity with the kandi area. Precipitation is the principal source of replenishment of groundwater in kandi area.

In unconfined aquifer, the depth to water level varies from 8.8 to 29.7m during pre monsoon and 8.3 to 23.7m during post monsoon season. Deeper water levels are observed in the north eastern part of the district where Tertiary Siwalik hills are exposed. Since the depth to water level is more than 5 m bgl, the whole district is not prone to water logging condition.

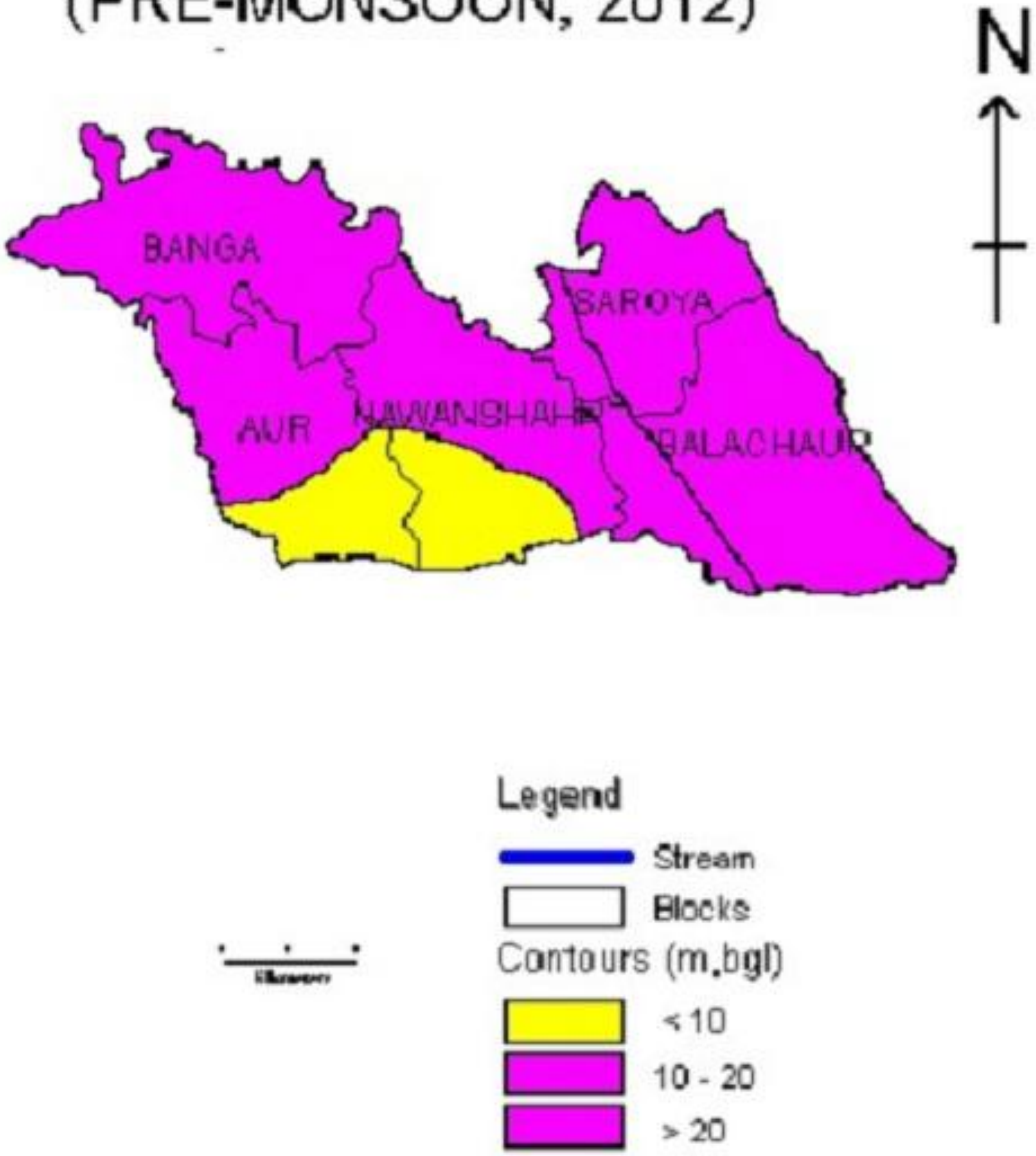
In major part of the district, the water level ranges between 10 and 30 m while the water level in the western and southern part is within the depth range of 5 to 10 m bgl. Seasonal fluctuation shows that in general there is an overall rise in the water level except in the eastern part and few isolated patches. However, the long term trend of water level of 10 years shows that there is a decline in water level in major part of the area ranging from 0.25 to 0.86 m /year except a few isolated patches where the rise is at the rate of 0.06 m/year which is insignificant.

The water table elevation is highest in the north-eastern part (Kandi area) and lowest in the south-western part, which in turn reflects the topographic gradient. In the eastern part of the district, the Sutlej River is effluent in nature while moving to the plains it becomes influent in nature. This indicates that Sutlej river also has some roles on the occurrence of groundwater in the district. The groundwater flow direction is towards south and southwest along the hilly tract but the flow direction changes to west on the central and western part of the district.

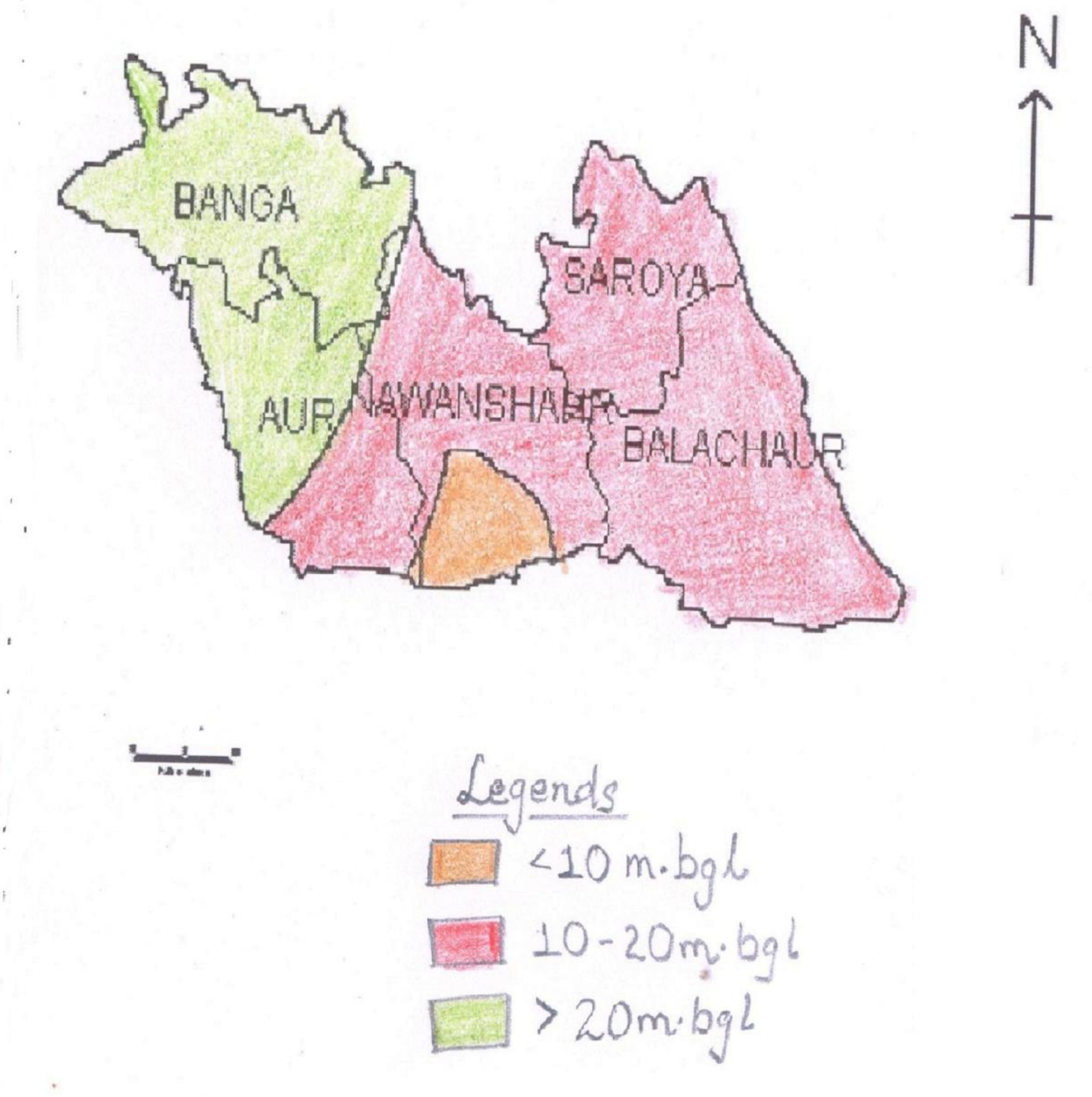
The subsurface geology shows a marked difference between the north eastern Kandi belt and alluvial plain in the western part of the district. Hence the performance of aquifer and various aquifer parameters will also show variation. The shallow tubewells tapping 40 m of alluvial aquifer in Banga, Aur and Nawanshahr block shows more yield in the range of 1500-5700 lpm for drawdown of 4.6 and 5.6 m respectively while those in Kandi belt the yield is in the range of 708-1500 lpm for drawdown of 4.69-5.9 m respectively. Similarly the aquifer parameter also show vide variation from eastern to western part of the district. In the eastern part the hydraulic conductivity is 7 m/day and transmissivity is 645 m^2/day. While in the western part the value of K & T are 53 m/day and 2940 m^2/day respectively. Similarly the storage coefficient of the aquifer in southeastern part is $1.8*10^{-3}$ while it is of the order of $1.18*10^{-3}$ in the western part. The values of various aquifer parameters clearly indicates that the aquifer in the western part of the district bear promising potential aquifer while the aquifer in the eastern part are intercalated by more clay layers.

North Western Region, CGWB has 7 ground water monitoring stations (2 dug wells and Pzs) in Nawanshahr district.

DEPTH TO WATER LEVEL MAP
(PRE-MONSOON, 2012)



DEPTH TO WATER LEVEL MAP. (POST-MONSOON, 2012)



4.2 Ground Water Resources

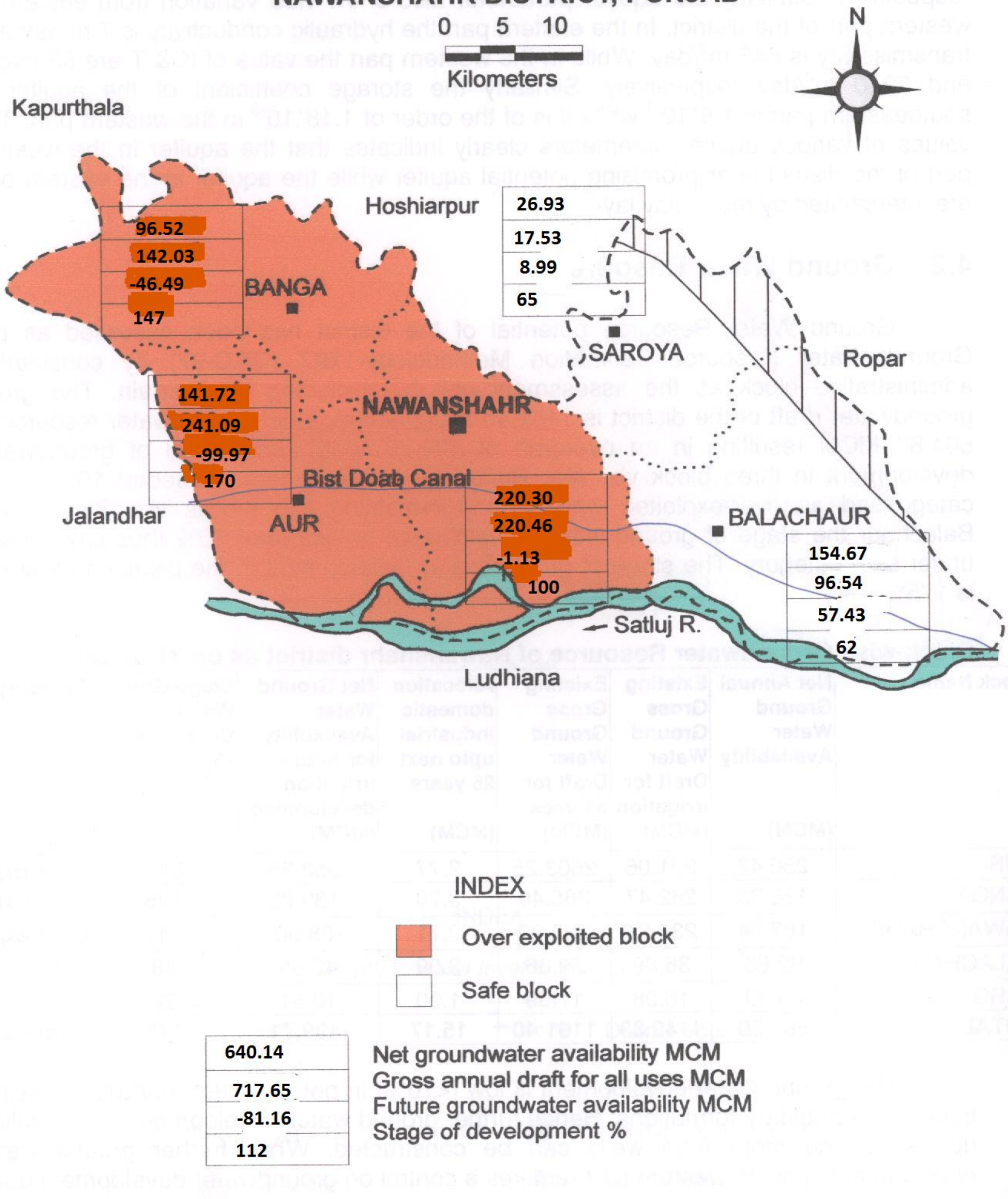
Ground Water Resource potential of the district has been assessed as per Ground Water Resource Estimation Methodology-1997 (GEC-97) by considering administrative block as the assessment unit by excluding hilly terrain. The gross groundwater draft of the district is 1161.40 MCM whereas net groundwater resource is 664.80 MCM resulting in an overdraft of 499.70 MCM. The stage of groundwater development in three block viz. Aur, Banga and Nawanshahr exceeded 100%, thus categorised as over-exploited while in the remaining two blocks viz. Saroya and Balachaur the stage of ground water development is less than 70% thus categorised under safe category. The stage of ground water development in the district as a whole is 175%.

Block-wise Groundwater Resource of Nawanshahr district as on 31.03.2009

Block Name	Net Annual Ground Water Availability (MCM)	Existing Gross Ground Water Draft for irrigation (MCM)	Existing Gross Ground Water Draft for all uses (MCM)	Allocation domestic industrial upto next 25 years (MCM)	Net Ground Water Availability for future irrigation development (MCM)	Stage Ground Water Development (%)	Category
AUR	141.72	238.84	241.09	2.85	-99.97	170	Over-Exploited
BANGA	96.52	138.31	142.03	4.70	-46.49	147	Over-Exploited
NAWANSHAHR	220.30	216.79	220.46	4.64	-1.13	100	Over-exploited
BALACHAUR	154.67	92.86	96.54	4.38	57.43	62	Safe
SAROYA	26.93	15.97	17.53	1.96	8.99	65	Safe
TOTAL	**640.14**	**702.77**	**717.65**	**18.53**	**-81.16**	**112**	**Over-exploited**

The ground water development is low (<70%) in north eastern part of the district because of bouldary formations. Hence further ground water development can be taken up safely and more tube wells can be constructed. While further ground water development in south western part requires a control on groundwater development due to over-exploitation. The total static groundwater resource of the district is 25695.28 MCM, which can be exploited for drinking purposes in times of drought.

GROUNDWATER DEVELOPMENT POTENTIAL AND CATEGORISATION OF BLOCKS NAWANSHAHR DISTRICT, PUNJAB



4.3 GROUND WATER QUALITY

The ground water in the district is alkaline in nature with low to medium salinity. The chemical quality data from the shallow and deep aquifers indicate that all major cations (Ca, Mg, Na, K) and anions (CO_3, HCO_3, Cl, SO_4) are within the permissible limits set by BIS, 1991. In the western part of the district, electrical conductivity is slightly higher than 700 microsiemens/cm. While, the maximum value of 940 microsiemens/cm is reported at village Rahon..

The ground water in the district is of Ca-Mg-HCO_3 type imparting temporary hardness. Since all the physical and chemical parameters are below the permissible limit prescribed by BIS the ground water in the area is suitable for drinking purposes. The suitability of groundwater for irrigation purpose is calculated by SAR and RSC values which are below 10 and 2.0 respectively in the entire district. As per USSL diagram, ground water of the district falls in medium to high salinity hazard and low sodium hazard and hence it is suitable for irrigation in all types of soil.

The minor constituents such as iron, nitrate and fluoride, which are essential for plant and animal growth, are found below the permissible limit. Similarly the trace element arsenic is also found below the permissible limit.

4.4 Status of Ground Water Development

The main ground water structures for domestic and irrigation purposes are hand pumps, shallow tube wells, cavity wells and deep tube wells. The shallow and deep tube wells including cavity wells are the main structures to obtain large quantities of ground water supply whereas hand pumps and dug wells are used for limited quantity of ground water.

The density of shallow tube wells is more than 20 per sq.km in over-exploited blocks and have increased tremendously during the past few years. The tube wells are in the depth range of 45 m to 190 m bgl. The discharge ranges between 300 to 1833 lpm for drawdown of 1.52 to 36.58m. The discharge of the tube wells is lower towards the Siwalik Hills in the eastern part of the district. The shallow tube wells are fitted with centrifugal pumps. In case water level is deep, submersible pumps are also being used which are either electric or diesel operated.

Groundwater is the only drinking water source to both urban and rural areas. Tube wells constructed by Punjab Health Department cater to the drinking water needs of the district. Out of the total 471 villages, as many as 169 villages have been covered under regular piped water supply.

Areas irrigated by groundwater account for about 97% of the total irrigated area. Out of the total irrigated area of 790 sq.km in Nawanshahr district, as much as 770 sq.km of land is irrigated by shallow and deep tubewells. The total number of private tubewells in the district is 21,340. The area supported by canal water irrigation is only 10 sq.km. Most of the ground water irrigation is done by private shallow tubewells. Apart from these wells, there are 129 deep tube wells drilled by state agencies.

5.0 GROUND WATER MANAGEMENT STRATEGY

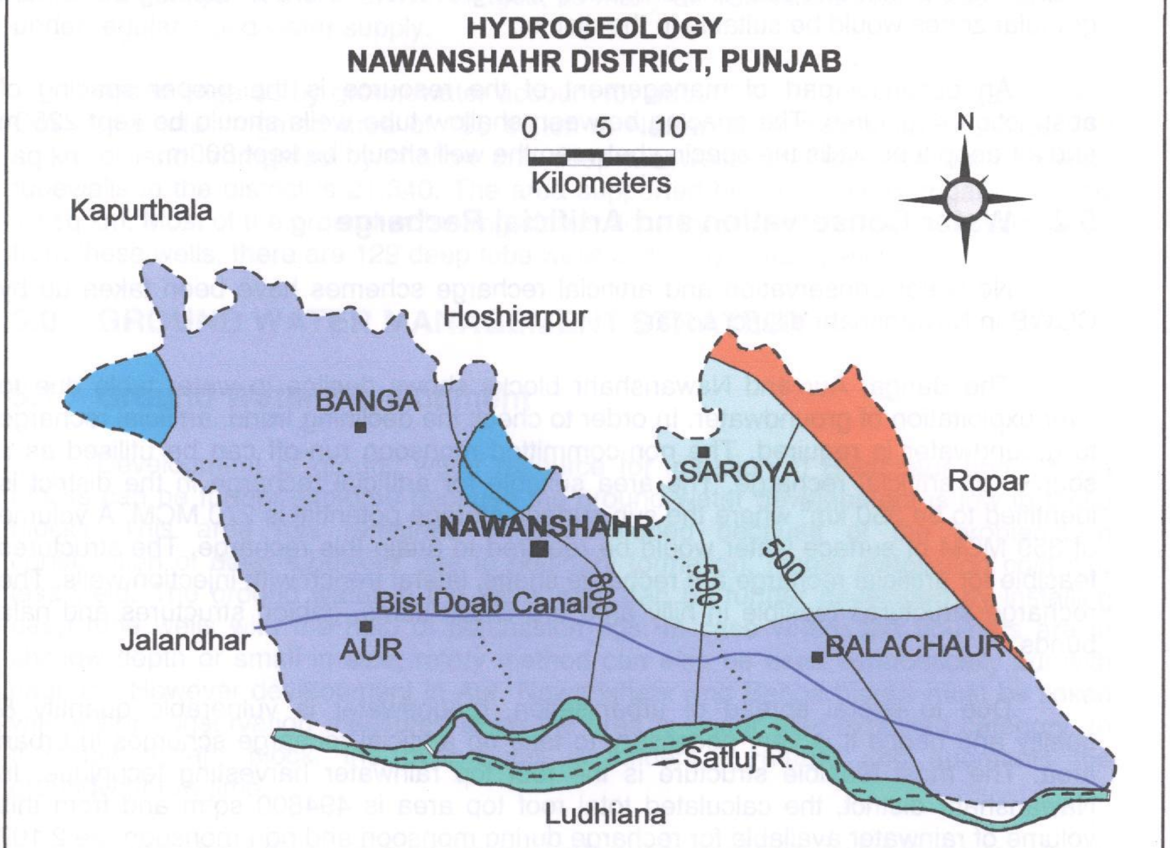
5.1 Ground Water Development

Development of ground water resource for irrigation in Balachaur and Saroya blocks can be further explored because the ground water development is low in these blocks. This area has remained under-developed because of the problems in construction of deep tubewells due to bouldary formation, higher installation cost and less yield. The ground water in the kandi area can be further developed by installing deep tube wells with the help of percussion rigs. In case where the boulders are at shallow depth or small in size, rotary method can also be used economically but with caution. However development in Aur, Nawanshahr and Banga blocks must be linked with water conservation measures since the area is under over-exploited category. In the Nawanshahr block, the river Sutlej is influent in nature and augments the groundwater regime.

Nawanshahr district can be grouped into two hydrogeological regimes (1) alluvial plains comprising sand gravel, silt and clay. (2) Kandi area comprising mainly bouldery formation. Based upon the hydrogeological regime, the well design is also different. A good design of tube well aims at efficient utilization of aquifers, long useful life of tube well, low initial cost and low operation and maintenance cost.

Direct rotary would be suitable for drilling in alluvial areas. The shallow tube wells upto 40 m depth can be constructed with a single straight assembly of 100-200 mm diameter with 10-20 m slotted pipes having 1.6mm slot size. The annular space should be shrouded with gravel of 1.5-4.7 mm. Deep tube wells of high to moderate yield are feasible down to 370m depth. A well design of 305/203 mm diameter with housing 35-70 m depending upon the water levels and expected drawdown is suitable. About 20-30 m saturated granular zones can be tapped using 1.58 mm slot size and annular space to be shrouded with 2-4 mm size gravels.

In bouldary area, deep tube wells down to 120/150 m depth can be constructed by percussion rigs. A well assembly of 305/203 mm diameter with housing length 40-60 m and 1.6-3.2 mm slot size and shrouded with gravel of 4-7.9 mm tapping 20 to 40m granular zones would be suitable in the district.



INDEX

	Wells Feasible	Rigs Suitable	Depth of Wells (m)	Discharge (lpm)	Suitable Artificial Recharge Structures
Soft Rock Aquifer	Tube wells	Direct and reverse rotary	80-175	>1280	Recharge trench with injection well
Soft Rock Aquifer	Tube wells	Direct and reverse rotary	65-150	960-1280	Recharge trench with injection well
Soft Rock Aquifer	Tube wells	Direct and reverse rotary	30-100	480-960	Recharge trench with injection well

ELECTRICAL CONDUCTIVITY (MICRO MHOS/CM AT 25° C) 500

An essential part of management of the resource is the proper spacing of abstraction structures. The spacing between shallow tube wells should be kept 225 m and for deep tube wells the spacing between the well should be kept 800m.

5.2 Water Conservation and Artificial Recharge

No water conservation and artificial recharge schemes have been taken up by CGWB in Nawanshahr district so far.

The Banga, Aur and Nawanshahr blocks shows decline in water table due to over exploitation of groundwater. In order to check the declining trend, artificial recharge to groundwater is required. The non-committed monsoon run-off can be utilised as a source for artificial recharge. The area suitable for artificial recharge in the district is identified to be 350 km^2 where the sub surface storage potential is 270 MCM. A volume of 359 MCM of surface water would be required to attain this recharge. The structures feasible for artificial recharge are recharge shafts, lateral trench with injection wells. The recharge structures feasible in hilly area are check dams, gabion structures and nala bunds.

Due to lateral spread of urbanisation, groundwater is vulnerable quantity & quality and hence it is very necessary to take up artificial recharge schemes in urban area. The most feasible structure is the roof top rainwater harvesting technique. In Nawanshahr district, the calculated total roof top area is 494800 sq.m and from this volume of rainwater available for recharge during monsoon and non-monsoon are 2.107 and 0.612 MCM respectively.

6.0 GROUNDWATER RELATED ISSUES AND PROBLEMS

Over-Exploitation

With the adoption of modern drilling techniques, construction of bore wells has become a common practice in the district to meet domestic as wells as agriculture needs. This increase in tube wells resulted in more groundwater draft from potential alluvial aquifers of Aur, Nawanshahr and Banga blocks. In addition to excess draft, these blocks also shows decline in water level during pre and post-monsoon. These scenario leads to over-exploitation in these blocks.

7.0 RECOMMENDATIONS

1. Groundwater resource in Kandi area along Siwalik Hills in Saroya and Balachaur are recommended for further development.
2. It is necessary to notify the over-exploited blocks for regulation and construction of all groundwater abstraction structures. Prior permission should be sought from Central Ground Water Authority for constructing any type of groundwater harnessing structures.
3. In order to avert the declining trend of water levels in urban areas of the district, groundwater management structures such as roof top rainwater harvesting system and recharge structures should be constructed which in turn augment the groundwater reservoir.
4. Change in irrigation practice by cultivating crops consuming less quantity of water may be grown.