LUDHIANA DISTRICT PUNJAB

CENTRAL GROUND WATER BOARD
Ministry of Water Resources
Government of India
North Western Region
CHANDIGARH
2013

Contributors

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Our Vision

"Water Security through Ground water Management"

GROUND WATER INFORMATION BOOKLET
LUDHIANA DISTRICT, PUNJAB

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LUDHIANA DISTRICT AT A GLANCE

Sl No.	ITEMS	Statistics
1.	General Information	
	i) Geographical area (Sqkm)	3860
	ii) Administrative divisions (As on 2011)	
	Number of tehsils	1. Ludhiana 2. Khanna 3. Samrala 4. Jagraon
	Block	1. Delhon I 2. Doraha 3. Jagraon 4. Khanna 5. Ludhiana 6. Machhiwara 7. Mangat 8. Pakhowal 9. Samralat 10. Sidhwan Bet 11. Sudhar
	Number of Punchayat's	-
	Villages-	91
	iii) Population (As on 2011 census)	3487882
	iv) Average annual Rainfall (mm)	681 mm
2.	Geomorphology/	
	Major physiographic units	Plain
	Major drainages	Satluj and its tributary, and Budha nalah
3.	Land use (sqkm)	
	a) Forest area:	100 sq.km
	b) Net area shown	3250 sq.km
	c) Cultivable area	6080sq.km
4.	MAJOR SOIL TYPES	Sandy, clayey loam, alkaline in nature.
5.	AREA UNDER PRINCIPAL; CROPS	Wheat-2468 Paddy-2297 Maize-30 Cotton-4 Sugercane-51
6.	IRRIGATION BY DIFFERENT SOURCES	

	(Area and Number of Structures)	
	Dug wells	-
	Bore wells/Tubewells	2970 sq.km
	Tanks/ Ponds	-
	Canals	90 sq.km
	Other sources	-
	Net Irrigated area	3060 sq. km
	Gross irrigated area	6050 sq. km
7.	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-3-2011)	
	No. of Dug Wells	3
	No of Piezometers	19
8.	PREDOMINENT GEOLOGICAL FORMATIONS	Quaternary alluvium
9.	HYDROGEOLOGY	
10.	• Major water bearing formations	Sand, Gravel
	• (Pre-monsoon Depth to water level during 2012)	4.32-31.22 m bgl
	• (Post-monsoon Depth to water level during 2012)	2.89-27.30 m bgl
	• Long term water level trend in 10 yrs (2002-2012)	Fall only (0.11m/y-1.34 m/y
11.	GROUND WATER EXOLORATION BY CGWB (As on 31-3-2011)	
	No of Wells drilled (EW,OW,PZ,SH,Total)	25
	Depth range (m)	25m (PAU)- 408m (Bhaini raian)
	Discharge (Liters per second)	3-52.4 lps
	Storativity (S)	$4.3x10^{-4}$ $6.98x10^{-4}$
	Transmissivity (m^2/day)	628-1120
12.	GROUND WATER QUALITY	
	Presence of Chemical constituents more than permissible limit (e.g. Ec, F, As, Fe)	NO_{3-} 45 mg/l
	Type of Water	Calcium bi carbonate
13.	DIANAMIC GROUND WATER RESOURCES (March-2011) - in MCM	
	Net Annual Ground Water Availability	2034.48
	Net annual Ground Water Draft For All Uses	3455.04
	Projected demand for Domestic and Industrial Uses up to 2025	158.90
	Stage of Ground Water development	170
14.	AWARENESS AND TRAINNING ACTIVITY	
	Mass awareness Programs organized Date	nil

	Place	
	No of Participants	
	Water Management Training Program's Organized	nil
	Date	
	Place	
	No of participants	
15.	EFFORTS OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING	-
	Projects completed by CGWB (no & amount spent)	-
	Projects under technical guidance of CGWB (numbers)	-
16.	GROUND WATER CONTROL AND REGULATION	
	Number of OE blocks	12
	Number of Critical blocks	
	NB of blocks notified	Ludhiana city
17.	MAJOR GROUND WATER PROBLEMS AND ISSUES	Declining trend, increasing quality problem

GROUND WATER INFORMATION BOOKLET
LUDHIANA DISTRICT, PUNJAB

1.0 INTRODUCTION

Ludhiana district falls in central part of Punjab. The district is bounded between North latitude 30^0 $33^/$ and 31^0 $01^/$ and East longitude 75^0 $25^/$ and 76^0 $27^/$. The Satluj forms the border of the district in the North with Jalandhar and Hoshiarpur districts. Ropar and Fatehgarhsahib districts marks the eastern and south eastern boundaries. The western border is adjoining Moga and Ferozpur districts. The geographical area of the district is 3790 sq.kms.

Administratively Ludhiana district falls under Patiala division. The district has four sub-divisions viz-Ludhiana, Khanna, Samrala and Jagraon and eleven development blocks viz.- Ludhiana, Mangat, Doraha, Khanna, Dehlon, Pokhwal , Samrala , Machiwara, Jagraon, Sidhwanbet and Sudhar.

2.0 RAINFALL & CLIMATE

The climate of Ludhiana district can be classified as tropical steppe, hot and semi-arid which is mainly dry with very hot summer and cold winter except during monsoon season when moist air of oceanic origin penetrate into the district. There are four seasons in a year. The hot weather season starts from mid March to last week of the June followed by the south west monsoon which lasts upto September. The transition period from September to November forms the post-monsoon season. The winter season starts late in November and remains up to first week of March.

Rainfall: The normal annual rainfall of the district is 680 mm which is unevenly distributed over the area in 34 days. The south west monsoon , sets in from last week of June and withdraws in end of September, contributed about 78% of annual rainfall. July and August are the wettest months. Rest 22% rainfall is received during non-monsoon period in the wake of western disturbances and thunder storms. Generally rainfall in the district increases from southwest to northeast.

Normal Annual Rainfall	: 680mm
Normal monsoon Rainfall	: 528 mm

Temperature

Mean Maximum	: 1.2°C(May&June)
Mean Minimum	: 5.8°C(January)
Normal Rain days	: 34

3.0 GEOMORPHOLOGY & SOIL TYPE

The district area is occupied by Indo-Gangetic alluvium. And there are no surface features worth to mention except that area is plain and major drains are Satluj and its tributaries and Budha nala.

Soil is the end product of the parent material resulting from the consistent influence of climate, topography and the natural vegetation over a long period of time. In the district soil characteristics are influenced to a very limited extent by the topography, vegetation and parent rock. The variations in soil profile characteristics are much more pronounced because of the regional climatic differences. The soil of this zone has developed under semi-arid condition. The soil is sandy loam to clayey with normal reaction (pH from 7.8 to 8.5).

4.0 GROUND WATER SCENARIO

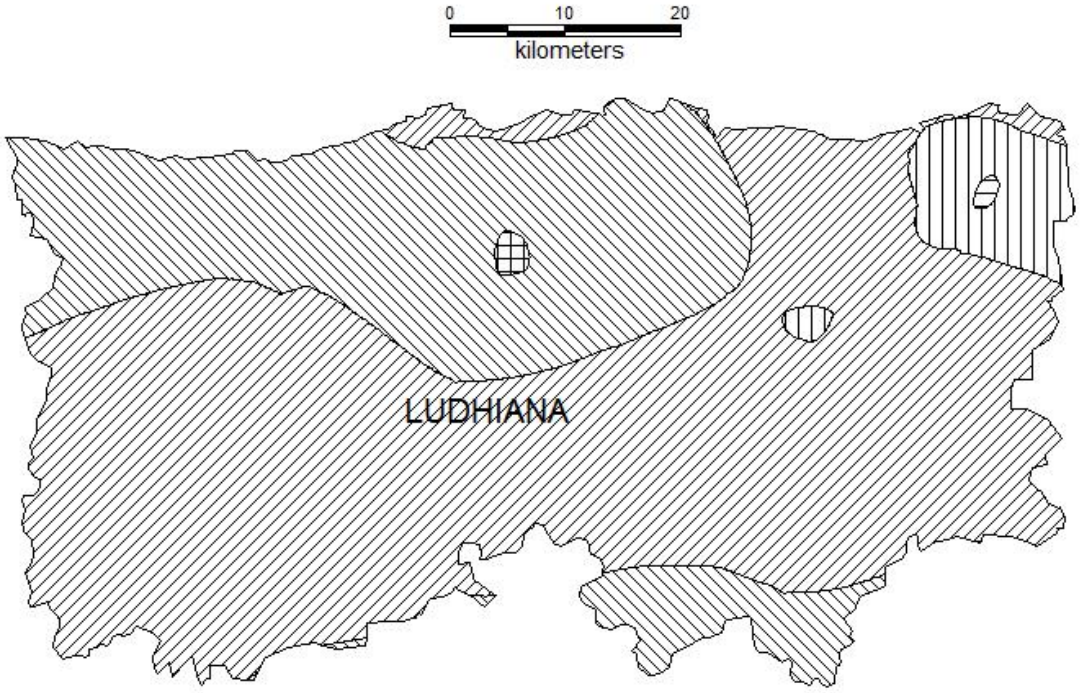
4.1 Hydrogeology

The district area is occupied by Indo-Gangatic alluvium of Quaternary age. The subsurface geological formations of the area comprise of sand, silt, clay and kankar in various proportions. In general the Ground water of the district is fresh except in and around Ludhiana city where the ground water is polluted due to industrial effluents. The aquifer disposition of the area is revealed by drilling data carried out down to 408 m by Central Ground Water Board and state govt. The lithological data of these boreholes indicate the presence of many sand beds forming the principal aquifers separated by clay beds at various depths.

The data indicates presence of about 5 prominent sand horizons down to 400 m depth separated by thick clay horizons. The first aquifer generally occurs between 10 and 30m. The second is between 50 and 120m. Third between 150-175m. For the forth between 200-250m and the fifth between 300-400m. The aquifers are giving discharge from 3-52 lps with $4.3X10^{-4}$ - $6.98X10^{-4}$storativity and transvity is ranges between 628-1120 m^2/day. The sand content in the aquifer in the district varies from 50 to 80%. Clay beds though thick at places occur mostly as lens and pinches out laterally. The granular material becomes coarser with depth. The aquifer at deeper levels acts as semi-confined to con fined.

The depth to water level in the area ranges between 9-26 m bgl. In the north easternpart' Machhiwara' block area it ranges between 5-10 m bgl and 10-20 m in north central part of the district in Ludhiana city aqnd Bhaini raian . In rest of the area of the district it ranges between 20-30 meters. During the pre monsoon period depth to water level varies between 4.32 to 31.22 m bgl and in post monsoon it ranges between 2.89-27.30 m bgl. The long term water trend indicates that the water level showing decline ranges from 0.11 m /y -1.34 m/year.

DEPTH TO WATER LEVEL MAP
LUDHIANA
MAY 2011



LEGEND
RANGE (MBGL)

- 2.0 - 5.0
- 5.0 - 10.0
- 10.0 - 20.0
- 20.0 - 30.0
- >30.0

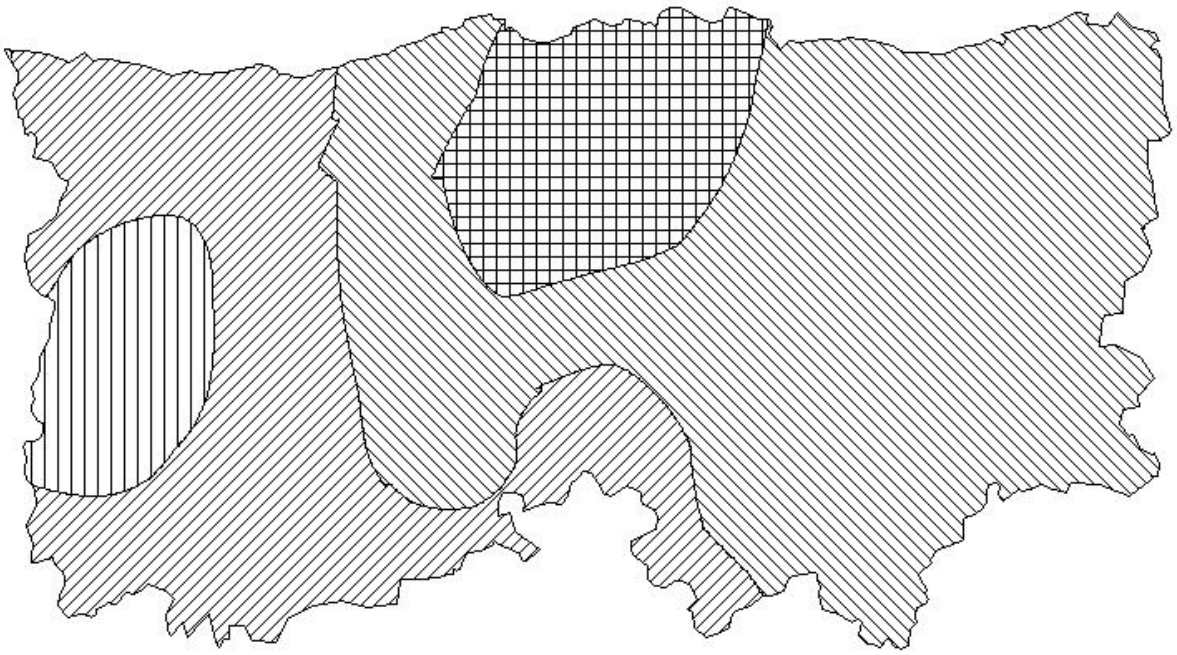
DEPTH TO WATER LEVEL MAP
LUDHIANA
NOVEMBER 2011

Depth to water level (m bgl)

	2.0 - 5.0		10.0 - 20.0
	5.0 - 10.0		20.0 - 30.0

SEASONAL WATER LEVEL FLUCTUATION MAP
LUDHIANA
MAY 2011 & NOVEMBER 2011

0 10 20
kilometers



LEGEND
FLUCTUATION RANGE (MBGL)

FALL		RISE
	>4.0	
	4.0 - 2.0	
	2.0 - 0.0	

4.2 Ground Water Resources

The Ground Water resources of the district were done for each individual block as per GEC 1997 norms. Perusal of the estimates reveals overall stage of ground water development in the district is of the order of 144 %.The ground water development in all the blocks of the district have been categorized as over exploited. Khanna ,Pakhowal and Ludhiana blocks are showing 290 % , 229 % and 255 % respectively. Net ground water availability of the district is 203448 ham.

The blocks wise resource potential in the district has been assessed are given below.

GROUND WATER RESOURCE AND DEVELOPMENT POTENTIAL OF HOSHIARPUR DISTRICT, PUNJAB AS ON 31ST MARCH, 2011 in ha m

Block	Net annual ground water availability (ham)	Existing gross ground water draft for irrigation (ham)	Existing gross ground water draft for all uses (ham)	Provision for domestic & industrial requirement supply to 2025 (ham)	Net annual ground water availability for future irrigation development (ham)	Stage of ground water development (%)	catagory
DEHLON	15888	33001	33553	749	-17862	211	OVER-EXPLOITED
DORAHA	27203	29639	30145	715	-3151	111	OVER-EXPLOITED
JAGRAON	23199	30305	31139	1168	-8274	134	OVER-EXPLOITED
KHANNA	11728	33132	33964	1152	-22556	290	OVER-EXPLOITED
LUDHIANA	12167	26571	31045	7001	-21405	255	OVER-EXPLOITED
MACHHIWARA	23607	27395	27839	612	-4400	118	OVER-EXPLOITED
MANGAT	27182	34680	35622	1213	-8711	131	OVER-EXPLOITED
PAKHOWAL	10726	24135	24541	610	-14019	229	OVER-EXPLOITED
RAIKOT	11655	26571	26901	535	-15451	231	OVER-EXPLOITED
SAMRALA	7598	19960	20502	711	-13072	270	OVER-EXPLOITED
SIDHWAN BET	22382	35195	35826	820	-13633	160	OVER-EXPLOITED
SUDHAR	10114	14032	14429	604	-4523	143	OVER-EXPLOITED
TOTAL	**203448**	**334616**	**345504**	**15890**	**-147057**	**170**	OVER-EXPLOITED

4.3 Ground Water Quality

Present data of chemical analysis of water samples collected from shallow aquifers (NHS-2006) indicates that ground water is slightly alkaline in nature (pH varies between 7.25-7.90). also ground water is fresh to moderate saline (Ec varies between 550-1320micromomhos/cm at 25^0C. All the chemical parameters are well with in the permissible limits for safe drinking water set by BIS 1991 revised in 2007 exfcept for NO_3 at Bhalolpur (52 mg/l), Muskabad (8 mg/l), Kohara (104 mg/l), Begowal (56mg/l) , and Serian (57 mg/l).

Bicarbonate is the dominant anion while calcium or calcium along with magnesium is the dominant cation in he waters. By and large , quality ground water is suitable for drinking except at few places mentioned above due to high value of NO_3 exceeding 45 mg/l.

The suitability of ground water for Irrigation is generally assessed by the factors of salinity (EC), Sodium absorption ratio (SAR) & Residual Sodium carbonate (RSC). These parameters range between 550-1320 microsiemens /cm at 25^0 C, 0.29-3.64 and (-) 1.68 to 4.08 respectively. Based upon the plot of EC Vs SAR on the USSL diagram for rating Irrigation Waters, C_{25} & C_3S_1, classes of waters have been observed, Such waters will cause problems of neither salinity nor sodium hazard when used for customary Irrigation.

The shallow ground water is getting polluting by heavy metals like copper, lead, manganese and iron. However, in deeper aquifer the concentration of these heavy metals is low as compare to shallow aquifer. The overall review of trace elements analysis indicates that the presence of heavy metals in the ground water at shallow and deeper aquifers, which is due to industrial pollution.

Presence of chemical constituents more than the permissible limits:-

A.

Chemical constituents	Total wells	B15 limit of 1991 revised in 2007	Above limits	Location with value in mg/l
No_3	8	45mg/l	5	Bhalolpur (52) Muskabad (58) Kohara (104) Begowal (56) Sherian (57)
Fe	5	1.0 mg/l	Nil	
As	5	0.01 mg/l	nil	

B. Type of water: - calcium bicarbonate

4.4 Status of Ground Water Development

Ground water development in the district has taken place through private and public agencies for both irrigation and drinking purposes and can be summarized as below: -

The water supply to the district is mainly based on ground water through tube wells. The water supply to the villagers is met out with the installation of hand pumps as spot & convenient source of water. The canal irrigation covers a very sound area of 90 sq. km out of 3060 sq. km area of total irrigated area. The remaining area is irrigated by ground water. The shallow tube wells in the district ranges from 25-90 m deep. Tapping the aquifer from 10-90m, With a discharge of 200 to 1500 lpm. Most of the shallow tubewells are either run by diesel engines or electric moters. 117352 no. of moters are working in district. The ground water discharge is between 600 1000 lpm in south east and is between 1300-300 lpm in the northern part of the district.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Ground Water Development

The hydrogeological data generated through exploratory test drilling has provided vital information regarding identification of aquifer systems, demarcation of their vertical and lateral extent, delineation of potential aquifer characteristics. These studies also provide information on well design and drilling techniques. A well assembly of 305/203 mm dia combination, using about 80m 90 m housing length having slot size of 1.19 mm would be ideal for the district area. The 'V' wires galvanized Johnson screen-having 1.00mm slot width may also be used against granular zones, as it has more open space for entrance of water. The shallow tube wells up to 40 m depth should have 203 mm single dia pipe assembly with a suitable screen length. Direct or reverse rotary rig can carry out the drilling with a suitable length.

5.2 Water Conservation And Artificial Recharge

The North western and south western part of the district where water level decline exits, Artificial recharge structures may help in arresting this water level decline. Generally Recharge Trench with injection well structure is suitable for artificial recharge. Water conservation methods like change in cropping pattern, change in Irrigation policy, timely plantation of paddy, promotion of sprinkler and drip irrigation etc. may be adopted to overcome the ground water decline in the area.

6.0 GROUND WATER RELATED ISSUES & PROBLEMS

GROUND WATER DEPLETION

Significant water table decline has been observed in Northwestern and south western parts of Ludhiana district. The main cause of ground water depletion is its over-exploitation to meet the increasing demand of various sectors including Agriculture, Industry and Domestic. This declining water table trend, if not checked, would assume an alarming situation in the near future affecting agricultural production and thus economy. Ground Water Recharge and Ground Water Conservation may be done in these areas to overcome the Water level decline.

7.0 RECOMMENDATIONS

1. In order to arrest the declining trend of water levels in North western and south western part of the district, the rooftop rainwater harvesting technology should be adopted and recharge structures may also be constructed.
2. Planned use of surface and ground water (conjunctive use) has to be done to over come both over exploitation and Ground water quality problems.
4. The construction of roof top rainwater harvesting structures should be made mandatory in building bye-laws, which will help in checking the falling water level trend in the towns of water level depleting areas.
5. The abandoned dug wells may be cleaned and should be used for recharging the ground water by utilizing the surface monsoon runoff.
7. The crops consuming less quantity of water may be grown in place of crops requiring more water in the over exploited blocks.