



MUKTSAR 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 MUKTSAR DISTRICT, PUNJAB

MUKTSAR DISTRICT AT A GLANCE

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MUKTSAR DISTRICT AT A GLANCE

Sl.No	Contents	Statistics
1.	GENERAL INFORMATION	
	i. Geographical Area (Sq.Km)	2630
	ii. Administrative Divisions (As per 2011) Number of Tehsils	3
	Number of Blocks	4
	Number of Villages	234
	iii. Population (As per Census 2011)	9,02,702
	iv. Normal Annual Rainfall (mm)	430.7mm
2.	GEOMORPHOLOGY	
	i. Major Physiographic Units	Alluvial Plains and sand dunes
	ii. Major Drainage	South, south western direction
3.	LANDUSE (Sq.Km)	
	i. Forest Area	38
	ii. Net area sown	2260
	iii. Cultivable Area	2210
4.	MAJOR SOIL TYPES	Two, Sierozem soil and desert soil
5.	AREA UNDER PRINCIPAL CROPS	416000ha
	(Wheat- 206000ha, Rice- 113000 ha, Cotton – 97000 ha)	
6.	IRRIGATION BY DIFFERENT SOURCES (Area and Number of Structures)	
	i. Dugwells	25000ha
	ii. Tubewells/ Borewells	59145 No. Tubewells
	iii. Tanks/Ponds	--
	iv. Canals	200000 ha
	v. Other sources	--
	vi. Net Irrigated Area	225000 ha
	vii. Gross Irrigated Area	434300 ha
	viii. Gross Cropped Area	436000 ha
7.	NUMBERS OF GROUNDWATER MONITORING STRUCTURES / WELLS OF CGWB	
	i. Number of Dugwells	8

	ii. Number of Piezometers	3
8.	PREDOMINANT GEOLOGICAL FORMATIONS	Alluvial
9.	HYDROGEOLOGY	
	i. Major Water Bearing Formation	Sand
	ii. Pre-monsoon depth to water level	0.67 mbgl to 7.43 mbgl
	iii. Post-monsoon depth to water level	0.06 mbgl to 7.78 mbgl
	iv. Long-term water level trend in 10 yrs in m/yr (2002 – 2011)	Rise: 0.008 to 0.322 m/yr Fall : 0.031 to 0.209 m/yr
10.	GROUNDWATER EXPLORATION BY CGWB	
	i. Number of wells drilled	
	Exploratory Well	2
	Observation Well	--
	Piezometer	3
	Slim Holes	--
	ii. Depth Range (m)	332-422 m
	iii. Discharge (liters per minute)	3.5 lpm
	iv. Storativity (S)	0.00157
	v. Transmissivity (m ² /day)	3.13 x 10 ⁻²
11.	GROUNDWATER QUALITY	
	i. Presence of chemical constituents more than the permissible limit	
	EC, in micromhos	336-5980
	F, in mg/l	0.08-6.11
	As, in mg/l	nd-0.0035
	Fe, in mg/l	nd-0.973
	ii. Type of water	Ca- Mg- HCO ₃ & Na mixed anions
12.	DYNAMIC GROUNDWATER RESOURCES (MCM)	As on 31. 03. 2011
	i. Annual Replenishable Groundwater Resources	779.14 MCM
	ii. Net Annual Groundwater Draft	540.85 MCM
	iii. Projected Demand for Domestic and Industrial uses upto 2025	24.60 MCM
	iv. Stage of Groundwater Development	69
13.	AWARENESS AND TRAINING ACTIVITY	Nil
14.	EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING	Nil
15.	GROUNDWATER CONTROL AND REGULATION	
	i. Number of Over Exploited blocks	Nil

	ii. Number of Critical blocks	Nil
	iii. Number of Semi Critical blocks	Nil
	iv. Number of blocks notified	Nil
16.	MAJOR GROUNDWATER PROBLEMS AND ISSUES	Salinity and water logging

GROUND WATER INFORMATION BOOKLET

MUKTSAR DISTRICT, PUNJAB

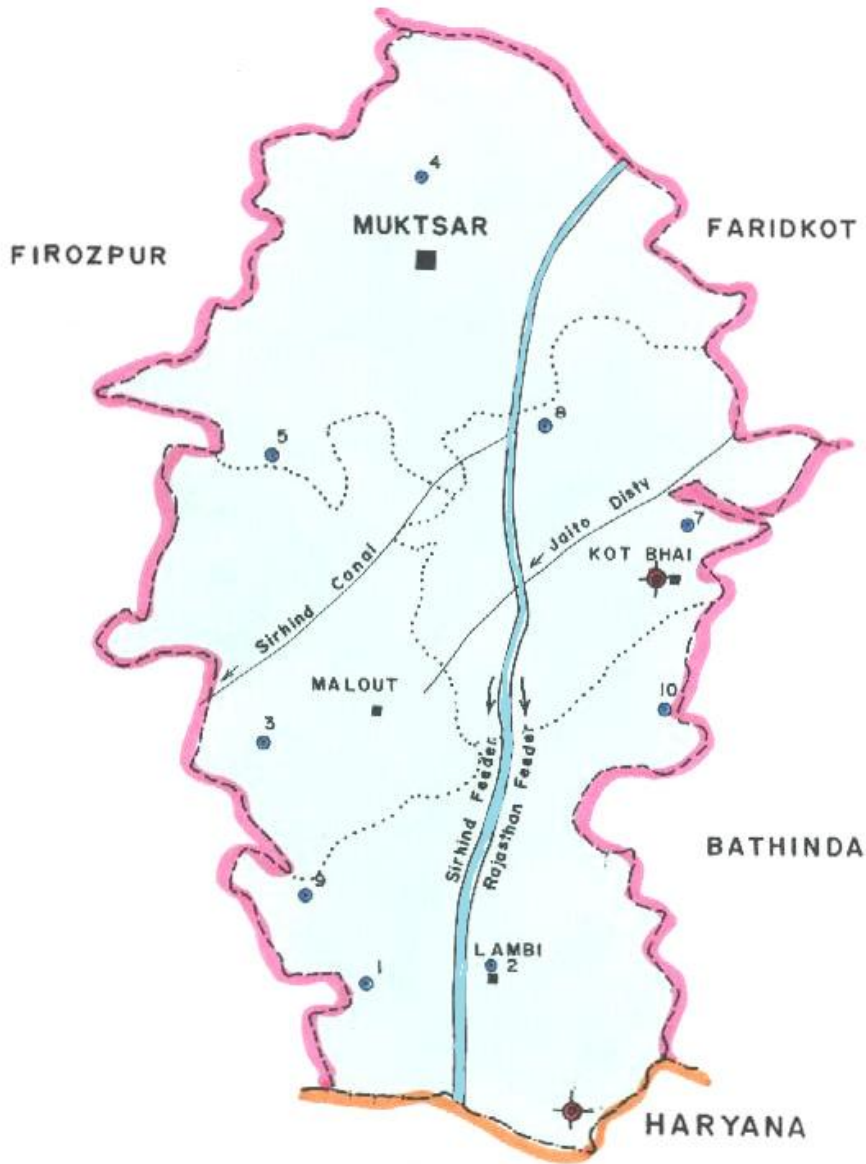
1.0 INTRODUCTION

Muktsar district lies in the south western part of the state and lies between North Latitude $29^{\circ} 54' 20''$ & $30^{\circ} 40' 20''$ and East Longitude $74^{\circ} 15'$, $74^{\circ} 19'$ and falls in Survey of India Toposheet No. 44J & 44K and covers an geographical area of 2630km². The district has a population of 9,02,702 as per 2001 census with the population density of 295 person per sq.km. The district falls in the Ferozpur division and is divided into three tehsil subdivision two sub tehsils and four development blocks namely Kotbhai, Lambi, Malout and Muktsar for the purpose of administrative control. The district shares its boundary with Faridkot district in north and north east, in North West and eastern side with Ferozpur district. On the east, it is bounded by Bathinda district of Punjab. On the south by Hanumangarh district of Rajasthan and Sirsa district of Haryana state.

Physiographically the area has no river and is covered extensively by the canal net work of Sirhind feeder canal to meet the irrigation and drinking water needs of the people. The area is flat and plain and slopes from NE to SW. The climate of the district is dry sub humid with grass land type of vegetation. The district receives an annual rainfall of 430.7 mm in 22 rainy days .79% of the annual rainfall occurs during monsoon period and 21% occurs during non monsoon period. The district forms a part of Satluj sub basin and main Indus basin. The district has mostly sierozem type of soil and partly desert soil in the south western part. Index map is shown below.

INDEX MAP

MUKTSAR DISTRICT, PUNJAB



I N D E X

- | | |
|------------------------------------|-------------------------|
| ■ DISTRICT HEAD QUARTER | — STATE BOUNDARY |
| ■ BLOCK HEAD QUARTER | - - - DISTRICT BOUNDARY |
| ✦ EXPLORATORY WELL | BLOCK BOUNDARY |
| ● GROUND WATER MONITORING STATIONS | |

2.0 RAINFALL AND CLIMATE

The normal annual rainfall of the area is 430.7mm in 22 days which is unevenly distributed over the district. The south western monsoon sets in the last week of June and withdraws towards the end of September and contributes about 79% of the rainfall. July and August are the rainiest months, rest 21% occurring during the non monsoon period in the form of thunder storm and western disturbances.

The climate of the district is sub- tropical steppe, semi arid and hot which is mainly dry except in rainy months and characterized by intensely hot summer and cold winter.

3.0 GEOMORPHOLOGY AND SOILS

The area forms a part of Satelej sub basin and main Indus basin alluvial plains. The topography of the district is almost flat. It has an average elevation of 200m amsl, and slopes gently towards south and south-west. The district is dotted with a number of isolated sand dunes of varying dimensions. The sand dunes are of longitudinal type and do not show any preferred alignment. There is no river flowing through the district. A number of artificial drains criss cross the district which carries the excess run off during rains.

The soils in the district have largely developed on alluvium the material laid by rivers under the dominant influence of climate over space and time. It has two types of soil viz the sierozem soils and desert soil.

Sierozem soils : The soils are light yellowish brown to pale brown in colour. Soils are calcareous and usually have kankars at a depth of 0.75m to 1.25m. These are deficient in nitrogen phosphorous and potash. Salinity and alkalinity are the serious problems particularly in the irrigated area. Wind erosion is also the common feature in the tract. These soils are found in whole of Muktsar blocks, Kotbhai block, in northern and eastern part of Malout blocks and eastern, central and southern part of Lambi block.

Desert soil: These soils are light brown to yellowish brown and are deficient in nitrogen phosphorous and potash. Wind erosion is a serious problem here. These soils are found in southern and western part of Malout and Lambi blocks of the district. Gram, wheat, barley, bajra , jawar , cotton and mustard are the principal crops in whole of the area.

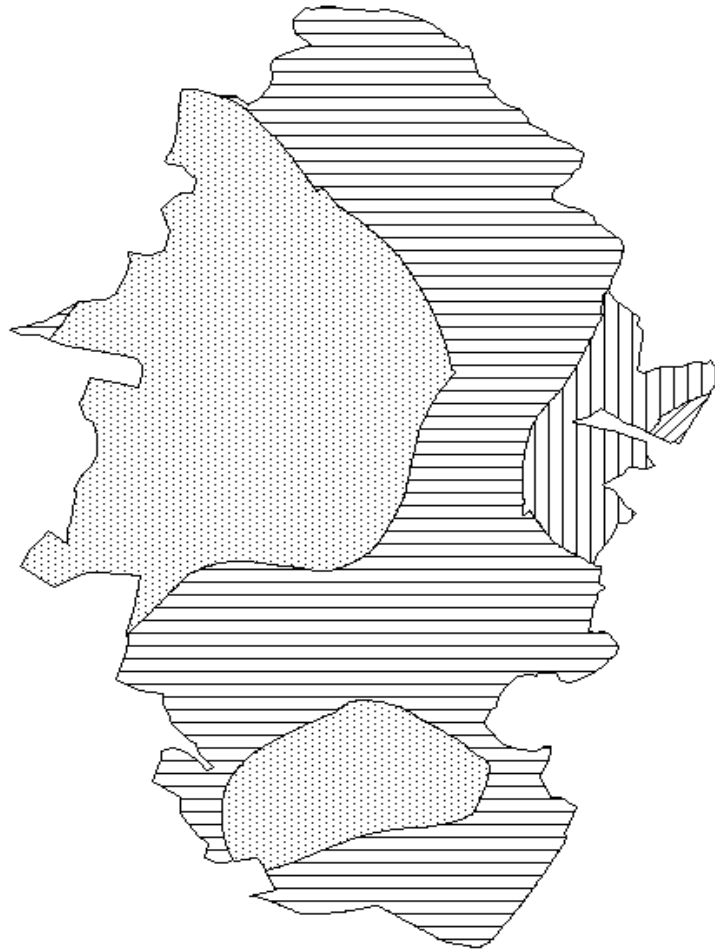
4.0 GROUND WATER SCENARIO

4.1 Hydrogeology





On the basis of two exploratory boreholes drilled by CGWB (1 Kumharwala, Lambi Block) during 1974-78) and Kotbhai Block HQ during 1999, the aquifer system belongs to huge aquifer system of Indus plains. It cannot primarily of quaternary alluvial sediments. The area has both unconfined and confined aquifer. In general unconfined condition exists only upto 30m depth. The proportion of permeable beds at deeper depth is generally low. At Kumharwala drilling down to the depth of 422m was done. At the depth of 416m Nagaur clay stone has been encountered indicating that the alluvium thickness is 416m and beyond this depth Nagaur clay stone occurs. Transmissivity 3.13×10^{-2} and hydraulic conductivity was computed to be 34.78m/day. At Kotbhai, drilling was done upto 331m. At both the places, well was constructed down to the depth of 54.0 and 53.0 m respectively because of poor quality beyond this depth. At Kumharwala even the EC of constructed well is 4557 which is not fit for drinking purposes.

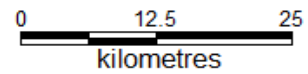
The area is underlain by unconsolidated formation comprising sand, silt and clays etc. Extensive moderately thick unconfined to confined aquifer exists down to the drilled depth of about 30m bgl . In the district the ground water is generally saline at all levels except at local patches. There is wide lateral variation in the chemical quality depending upon the proximity of the area to the surface irrigation channels.

**DEPTH TO WATER LEVEL
PRE MONSOON
(MAY - 2011)**

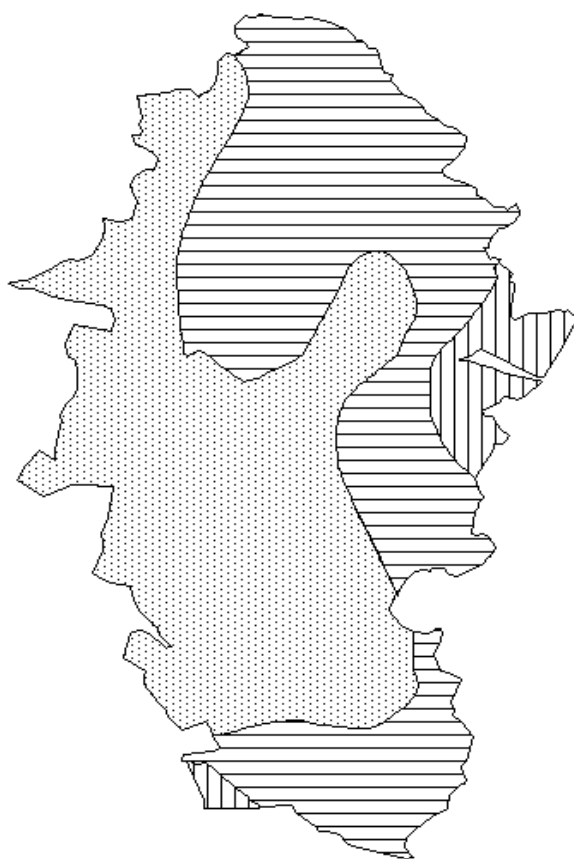


LEGEND




MAP SYMBOL	DTW Range (m.bgl)
	< 2.00
	2.00 - 5.00
	5.00 - 10.00
	> 10.00

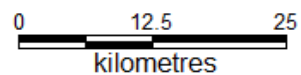


DEPTH TO WATER LEVEL POST MONSOON (NOVEMBER - 2011)



LEGEND

MAP SYMBOL	DTW Range (m. bgl)
	< 2.00
	2.00 - 5.00
	> 5.00



4.2 Ground Water Resources

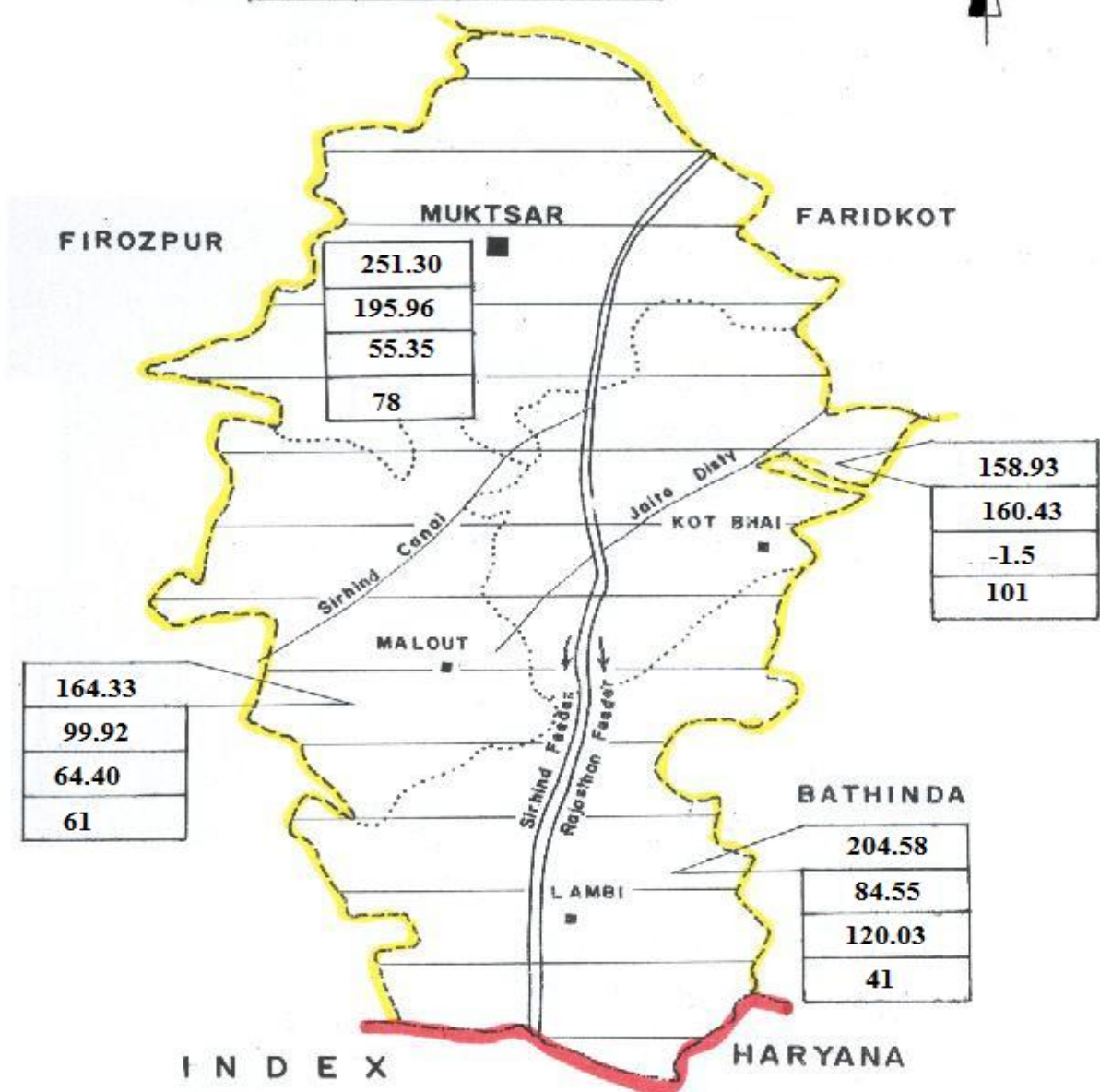
Ground water resources estimation of the district was done in 2011 for each individual block. Perusal of the estimates reveals that overall stage of development in the district is of 69%. The ground water developments of three blocks are below 100% and have been categorized as safe for ground water development. The ground water development of each block is as follows Kotbhai (Gidder Baha)- 101%, Lambi-41%, Malout-61%, Muktsar-78%. The block wise ground water resources potential in the district has been assessed as per GEC 97 as on 31.3.2011 .

Ground Water Resources of Muktsar district, Punjab as on 31.3.2011

Block Name	Net Annual Ground Water Availability (Ham)	Existing Gross Ground Water Draft for irrigation (Ham)	Existing Gross Ground Water Draft for all uses (Ham)	Allocation domestic industrial up to next 25 years (Ham)	Net Ground Water Availability for future irrigation development (Ham)	Stage of Ground Water Development (%)	Category of Block
GIDDER BAHA	15893	15578	16043	464	-150	101	SAFE
LAMBI	20458	8241	8455	213	12003	41	SAFE
MALOUT	16433	9415	9992	578	6440	61	SAFE
MUKTSAR	25130	18391	19596	1205	5535	78	SAFE
Total	77924	51625	54085	2460	23829	69	SAFE

GROUND WATER DEVELOPMENT POTENTIAL AND CATEGORIZATION OF BLOCKS MUKTSAR DISTRICT , PUNJAB

Km. 5 0 5 15 Km.



251.30
195.96
55.35
78

158.93
160.43
-1.5
101

164.33
99.92
64.40
61

204.58
84.55
120.03
41

I N D E X

779.14
540.85
238.29
69

- GROUND WATER RESOURCES (MCM)
- GROSS GROUND WATER DRAFT (MCM)
- FUTURE GROUND WATER AVAILABILITY (MCM)
- STAGE OF GROUND WATER DEVELOPMENT %
- SAFE BLOCK

4.3 Ground Water Quality

The shallow ground water of the district is alkaline in nature and is moderate to highly saline (EC 336 to 5980 us/cm). The distribution of various constituents varies greatly in the district. In some cases higher limits of certain important parameters exceed the maximum permissible limit making water unpotable.

Type of Water

Among ions, bicarbonate followed by chloride is the predominant anion dominates, whereas, among cations, sodium + potassium predominate in 50% of the samples followed by calcium+ magnesium in the remaining samples.

Suitability of Water

Domestic:

The three-fourth ground water of the district area is unsuitable for drinking as well as for domestic purposes. Only 25% of the samples have concentration of EC, Chloride , Nitrate and Fluoride within the permissible limit (BIS) for drinking water.

Irrigation :

Salinity (EC) Sodium Adsorption ration (SAR) and Residual Sodium Carbonate (RSC) are the basic parameters considered for ascertaining the irrigation suitability of ground water. It is observed that most of waters fall under classes C3S1, C3S3, C3S4, C4S1, C4S2 and C4S4. Waters falling under class under class C3S1 and C4S1 may cause salinity hazards and those falling C3S3 are likely to cause both sodium and salinity hazards. It would be better if such waters are used for irrigating salt tolerant crops along with appropriate amount of gypsum on well drained soils. Waters falling in C3S4 and C4S4 may lead to high salinity and extremely high sodic hazards and should be avoided in irrigational practices

4.4 Status of Ground Water Development

In whole of the district, irrigation is based on both canal and tubewell supplies. The main stress is on canal water because the whole of the district has an intense network of canal system. The two major canals Sirhind feeder and Sirhind canal are the main source of water supply which are further divided into various distributaries and minors. From the data available from Agriculture Deptt. , Punjab, about 96% of the district is being irrigated by canal water and only 4% of the area is irrigated by tube wells. Tube wells are of shallow depth ranging from 25-55 m.bgl. There are 12184 electric operated tube wells and 17136 are diesel operated tube wells in the district. From the water level monitoring data available in CGWB, only two wells are showing decline i.e. Muktsar and Bhamial . The decline at Muktsar (2002 to 2011) is 0.031 m/yr whereas at Bhaliana, decline is 0.21 m/year (2002 to 2011) which is a nominal decline in 10 years (2002 to 2011) whereas all the other wells are showing rise in water levels ranging from 0.008 m/yr (Labianwali) to 0.322 m/yr (Kuthian wali).

The water level of district ranges between 2-5 m whereas only a small portion i.e. east of Kotbahai is more than 5m. Northern and western part of Muktsar block and southern and central part of Lambi block fall in less than 2m category whereas rest of district falls in 2-5m category in post monsoon 2011. Whereas based on pre monsoon water level 2011, majority of the district comes under 2-5m category except two patches near Lambi and NW of Kotbahai . All the blocks fall in the safe category ranging from 41 to 101% of development.

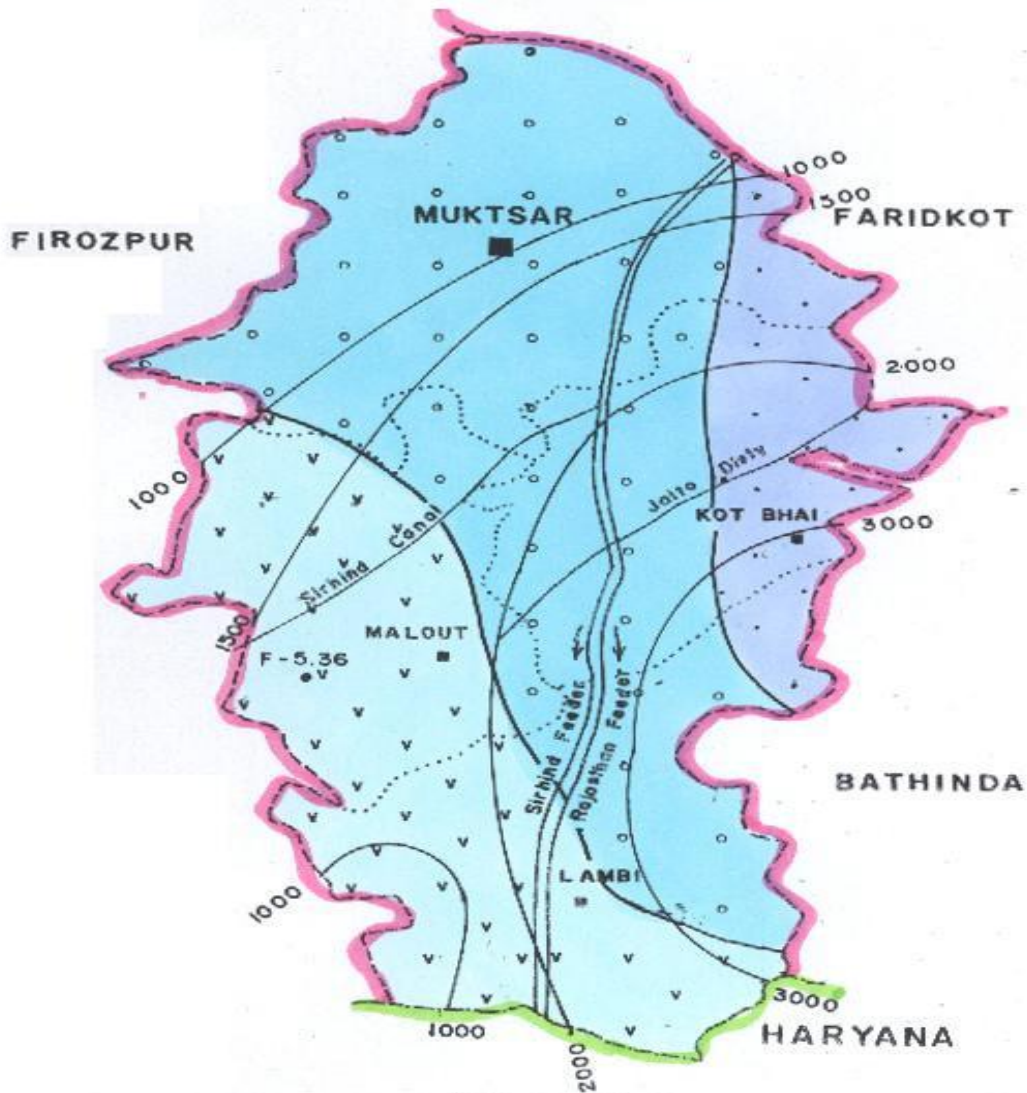
5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Ground Water Development

All the blocks fall in safe category and EC ranges 3150-3500 $\mu\text{s/cm}$; the ground

water can be utilized with proper blending with the canal water. More and more shallow tubewells may be constructed .The electrical connection for shallow tubewells may be liberalized so that the water from the phreatic aquifer may be withdrawn. The tubewells upto 30m depth may be constructed with the slot opening of 1.0mm may be used. These tube wells give discharge of about 1000 lpm . The ground water may be used after blending with the canal water so that the withdrawal from the ground water may increase.

HYDROGEOLOGY MUKTSAR DISTRICT, PUNJAB



I N D E X

	WELLS FEASIBLE	RIGS SUITABLE	DEPTH OF WELL (m)	DISCHARGE (lpm)	REMARKS
SOFT ROCK AQUIFER	TUBE WELLS	REVERSE / DIRECT ROTARY	25 - 55	1000 - 2000	DEEPER ZONES ARE SALINE
SOFT ROCK AQUIFER	TUBE WELLS	REVERSE / DIRECT ROTARY	20 - 50	250 - 1000	
SOFT ROCK AQUIFER	TUBE WELLS	REVERSE / DIRECT ROTARY	15 - 45	100 - 250	
ELECTRICAL CONDUCTIVITY (MICROMHOS/Cm AT 25°C)		5.36 ●	FLUORIDE > PERMISSIBLE LIMIT (1.5 ppm)		
1000					

6.0 GROUND WATER RELATED ISSUES & PROBLEMS

Almost whole of the district is facing the problem of water logging Southern and North western parts are severely affected with the water logging problem. Out of 2630km² area of the district 2240km² is fed by the canals and there being the quality problem the ground water exploration is low. As a result all the four blocks of the district are safe. The water logging problems is least severe in the pre monsoon period and more severe in the post monsoon period. Pre monsoon decline in last ten years is observed at only two places whereas all the other eight places (NH Stations) have shown rise in water level which has caused water logging. The breach in the canal system gives rise to recharge of the phreatic aquifer system. The quality the water is marginal to saline which can be used with proper blending with the canal water.

7.0 RECOMMENDATIONS

1. The area is water logged and showing rise in the water levels to range of 0.67 mbgl to 7.43 mbgl in pre monsoon 2011 and 0.06 mbgl to 7.78 mbgl in post-monsoon period in Nov.2011. The phreatic aquifer system may be exploited and in conjunctive use of water may be adopted for irrigation purpose.
2. The electrical connection may be liberalized so that the phreatic aquifer system may be exploited.
3. Cropping pattern may be changed.
4. Drip irrigation system may be embodied which will reduce the recharge (reverse seepage) to ground water.
5. The canal system may be monitored and breaching of canal may be repaired

to decrease the ground water recharge from the canal.

