# GROUND WATER INFORMATION BOOKLET, FEROZEPUR DISTRICT, PUNJAB

## C O N T E N T S

## FEROZEPUR DISTRICT AT A GLANCE

| S. No.. | Items | Statistics |
|---|---|---|
| 1. | GENERAL INFORMATION | |
| | i. Geographical Area (sq. km.) | 5850 |
| | ii. Administrative Divisions | |
| | Number of Tehsils | 05 |
| | Number of Blocks | 10 |
| | Number of Panchayats | - |
| | Number of Villages | 1008 |
| | iii. Population (as per 2011 Census) | 2026831 |
| | iv. Average Annual Rainfall (mm) | 389 |
| 2. | GEOMORPHOLOGY | |
| | Major Physiographic Units | Upland plain, sand dunes tract, Younger flood plain, Active flood plain. |
| | Major Drainage | River Satluj |
| 3. | LAND USE (Sq. Km.) | |
| | a. Forest Area: | 120 |
| | b. Net area sown: | 4730 |
| | c. Cultivable area: | 8880 |
| 4. | MAJOR SOIL TYPES | Sierozem soil, Desert soil |
| 5. | AREA UNDER PRINCIPAL CROPS | Kharif Crop,<br>Rabi Crop |
| 6. | IRRIGATION BY DIFFERENT SOURCES<br>(Areas and Number Of Structures) | |
| | Dug wells | - |
| | Tube wells/Bore wells | 308 |
| | Tanks/ponds | - |
| | Canals | 162 |
| | Other sources | - |
| | Net Irrigated area | 470 |
| | Gross irrigated area | 884.6 |
| 7. | NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB. | |
| | No. of dug wells | 13 |
| | No of Piezometers | 9 |
| 8. | PREDOMINANT GEOLOGICAL FORMATIONS | Quaternary Alluvium |
| 9. | HYDROGEOLOGY | |
| | *Major Water bearing formation<br>*(Pre-monsoon depth to water level)<br>*(Post-monsoon depth to water level)<br>*Long term water level trend in 10 yrs in m /yr | Sand & Gravel<br>0.73-11.35 m bgl<br>0.49-9.60 m bgl<br>0.43 0 m( Fall) |

| | | |
|---|---|---|
| 10. | GROUND WATER EXPLORATION BY CGWB | |
| | EW<br>OW<br>PZ<br>SH | 12<br>-<br>03<br>- |
| | Depth range (m) | 454 |
| | Discharge (liters per minute) | 120-3000 |
| | Storativity (S) | $0.638*10^{-3}$ -$27*10^{-3}$ |
| | Transmissivity ($m^2$/day) | 327-2600 |
| 11. | GROUND WATER QUALITY | |
| | Presence of Chemical constituents more than the permissible limit<br>EC, in micromhos at $25^0$C<br>F, in mg/l<br>As (mg/l)<br>Fe, in mg/l | <br><br>787-8680<br>0.15-9.15<br>nd-3.21<br>nd-0.0086 |
| | Type of water | $NaHCO_3$ & Mixed Type |
| 12 | DYNAMIC GROUND WATER RESOURCES (2009) | |
| | Annual Replenish able Ground water Resources | 196553 ham |
| | Net Annual Ground water Draft | 273766 ham |
| | Projected Demand for Domestic and Industrial uses up to 2025 | 4824 ham |
| | Stage of Groundwater Development | 141 % |
| 13 | AWARENESS AND TRAINING ACTIVITY | Ni |
| 14. | EFFORTS OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING | Nil |
| 15. | GROUND WATER CONTROL AND REGULATION | |
| | Number of Over Exploited Blocks. | 08 |
| | Number of Semi Critical Blocks | Nil |
| | Number of blocks notified | Nil |
| 16 | .MAJOR GROUND WATER PROBLEMS AND ISSUES. | Ground water salinity & water logging |

# GROUND WATER INFORMATION BOOKLET
# FEROZEPUR DISTRICT, PUNJAB

## 1.0 INTRODUCTION

Ferozpur, the south western most district of Punjab State with a total geographical area of 5850 sq km. is located between 29o 56' 47" and 31o 0' 7" north latitudes and 72o 52' 4" and 75o 01' 11" east longitudes. The district area falls in Survey of India degree heet os. 44 J, 44F, 44I. Administratively, the district is under control of Ferozpur division and is divided into 10 development blocks namely Ferozpur, Fazilka, Abohar, Zira, Jalalabad, Ghall Khurd, Guru Har Sahai, Khuyian Servar, Makhu and Mamdot.

The Ferozpur district forms a part of Sutlej sub basin of main Indus basin and is interrupted by clusters of sand dunes. The district area is almost a flat terrain with a gentle slope towards south west direction.

Physiographically, it is characterized by four distinct features i.e. the upland plain, sand dune tracts, younger flood plain and active flood plain. The river Sutlej that is of perrineal nature mainly drains the area. River Sutlej shows both influent and effluent nature in the area. The area is traversed by a dense network of canals. In irrigation practices, contribution of tubewells are larger as compared to canal system i.e 137 % area irrigated by canal is being irrigated by tubewells.

## 2.0 RAINFALL & CLIMATE

The climate of the district can be classified as tropical desert, arid and hot. The area receives about 389 mm annual normal rainfalls which is unevenly distributed over the area in 23 days, out of which about 79% occurs during south west monsoon. Rain fall in the district decreases from north east to south west.

Normal Annual Rainfall : 389 mm

Rainy Days : 23 Days

Drought Frequency ( 1970- 2002)

Moderate - 5 Probability - 0.15

Severe- 1 Probability - 0.03

Normal monsoon Rainfall: 79% of the Total

Probability of Excess Rainfall : 42%

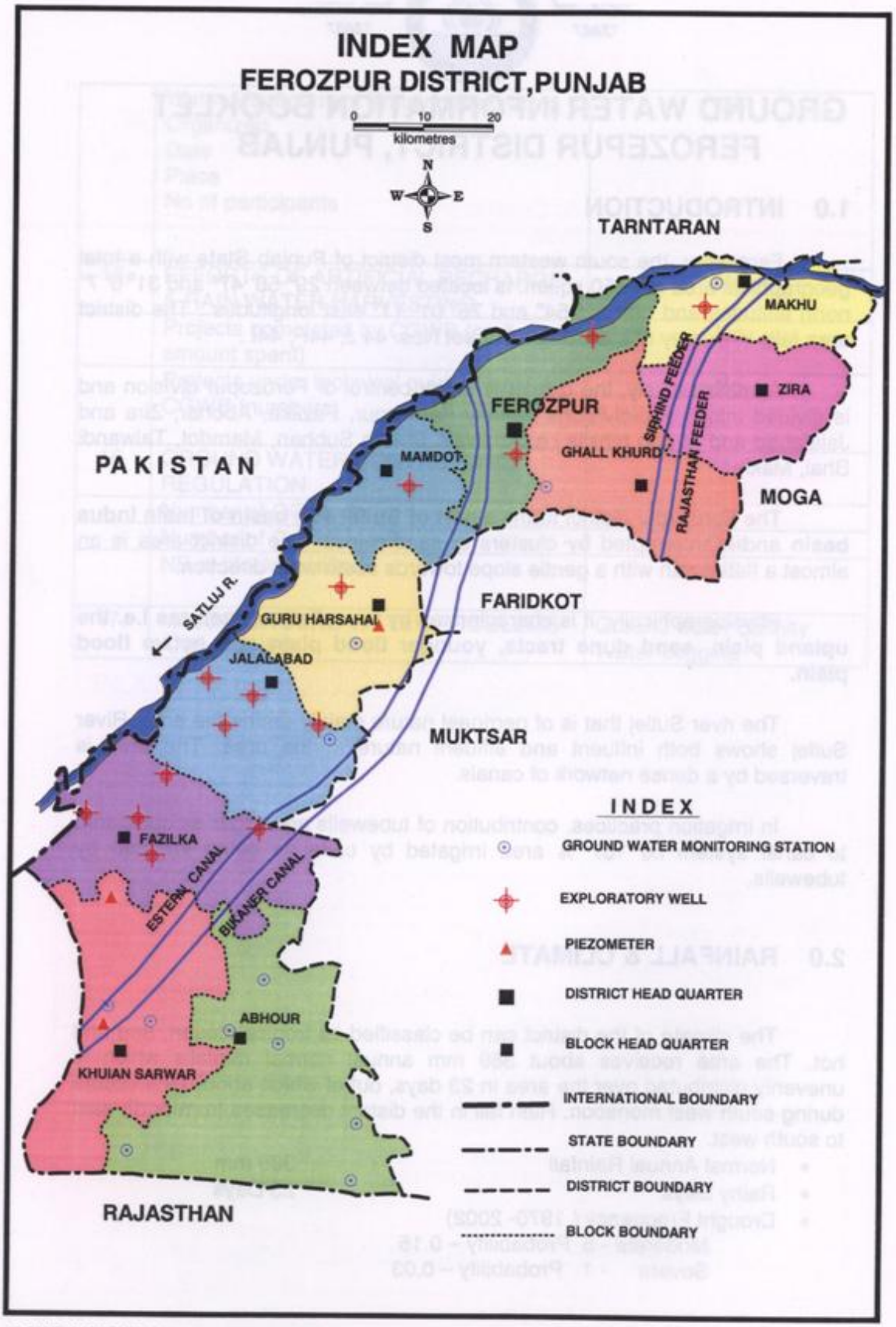
Probability of Normal Rainfall : 30%

Probability Of Deficient Rainfall : 27.

## 3.0 GEOMORPHOLOGY & SOIL

The district area forms a part of Indo-Gangetic plain and Sutlej Sub basin of main Indus basin. The area as a whole is almost flat with a gentle slope towards the south westerly direction. The physiographic of the district is broadly classified from north to south into four distinct features i.e. Upland plain, Sand dune tract, younger flood pain and active flood plain of Sutlej.

The soil of the district is of two types i.e. sierozem (in northern parts) and desert soils (in southern parts)

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# 4.0 GROUND WATER SCENARIO

## 4.1 Hydrogeology

The geological formations met within the district comprised of unconsolidated alluvial deposits of Quaternary age. The alluvial deposit comprises of sand, silt, clay and often associated with kankar. Fine to medium grained sand horizon form the potential aquifer in the area.

The major source of recharge to ground water in the area is inflow of ground water from north eastern and northern parts, rainfall, seepage from canals, return seepage through irrigation and percolation from surface water bodies. The water level in the district is ranging from 0.73 to 11.35 m bgl in premonsoon and 0.49 to 9.60 m bgl after post monsoon.

The ground water in unconfined condition is abstracted through hand pumps (up to 30 m) and through shallow and medium depth tubewells up to the depth of 175 meters in northern part of district and 125 m in central part of the district. Aquifer up to the depth of 175 m is leaky aquifer. Water from aquifer below the depth of 200 m is saline to highly saline in the southern part of district. These aquifers are confined aquifer.

### Aquifer System

The geometry and nature of aquifer provide the basic parameters for determining occurrence and movement of ground water and are significant for resource evaluation

### Water level behaviour

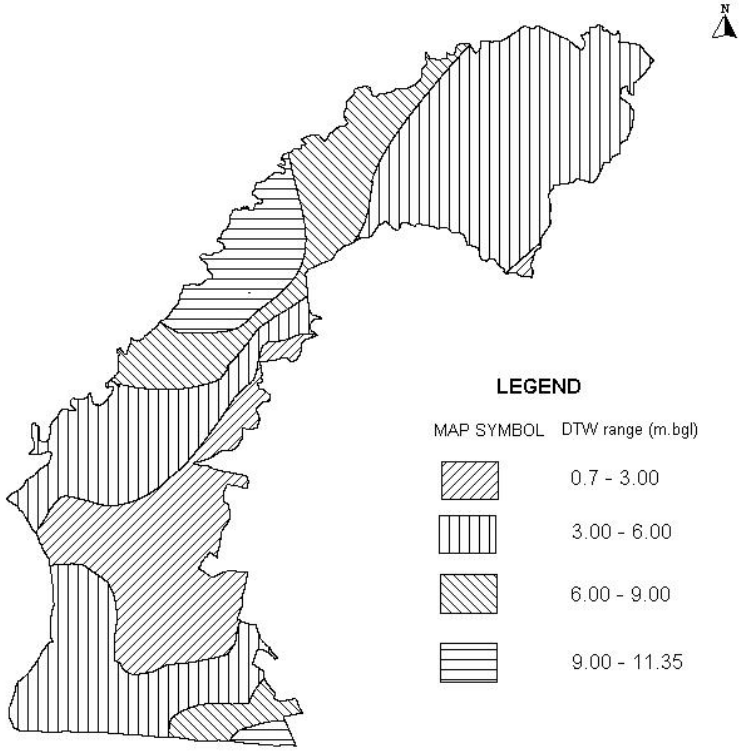
The alluvial complex in the area constitutes a vast regional aquifer. Aquifer geometry is chiefly irregularly shaped tabular bodies of highly permeable sand interspersed with lenticular layer of semi pervious to impervious silty clay or clay layers. The area has both unconfined/ semi unconfined and confined/ leaky confined aquifers.

The alluvium forms the principal ground water reservoir and the principal aquifer material comprises fine to medium sand and sand often mixed with kankar. This aquifer is either in the form of isolated lenses of sand embedded in clay beds or well connected granular zones that have a pinching and swelling disposition.

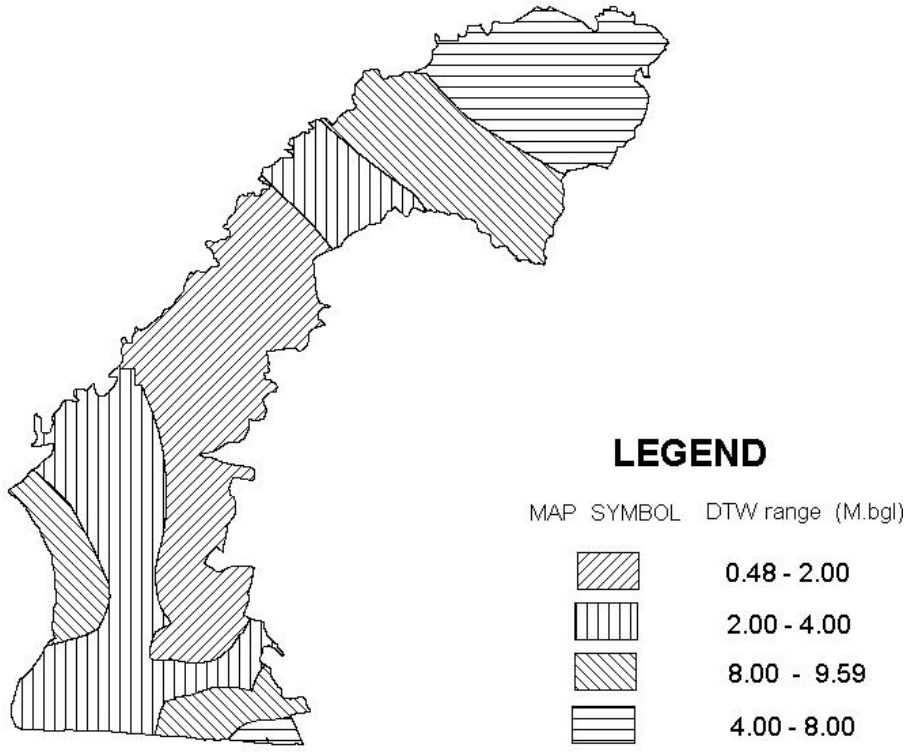
The occurrence of clay beds is rather irregular and on a regional scale their extensions are limited. Thus while locally the presence of such beds can give rise to leaky confined or confined conditions.

The thickness of the alluvium varies from 200 to 300 m. in tubewells drilled upto the depth of 454 m. The thickness of alluvial formation increases towards north

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




## POST MONSOON DEPTH TO WATER LEVEL
## (NOVEMBER - 2011)



## 4.2 Ground Water Resources

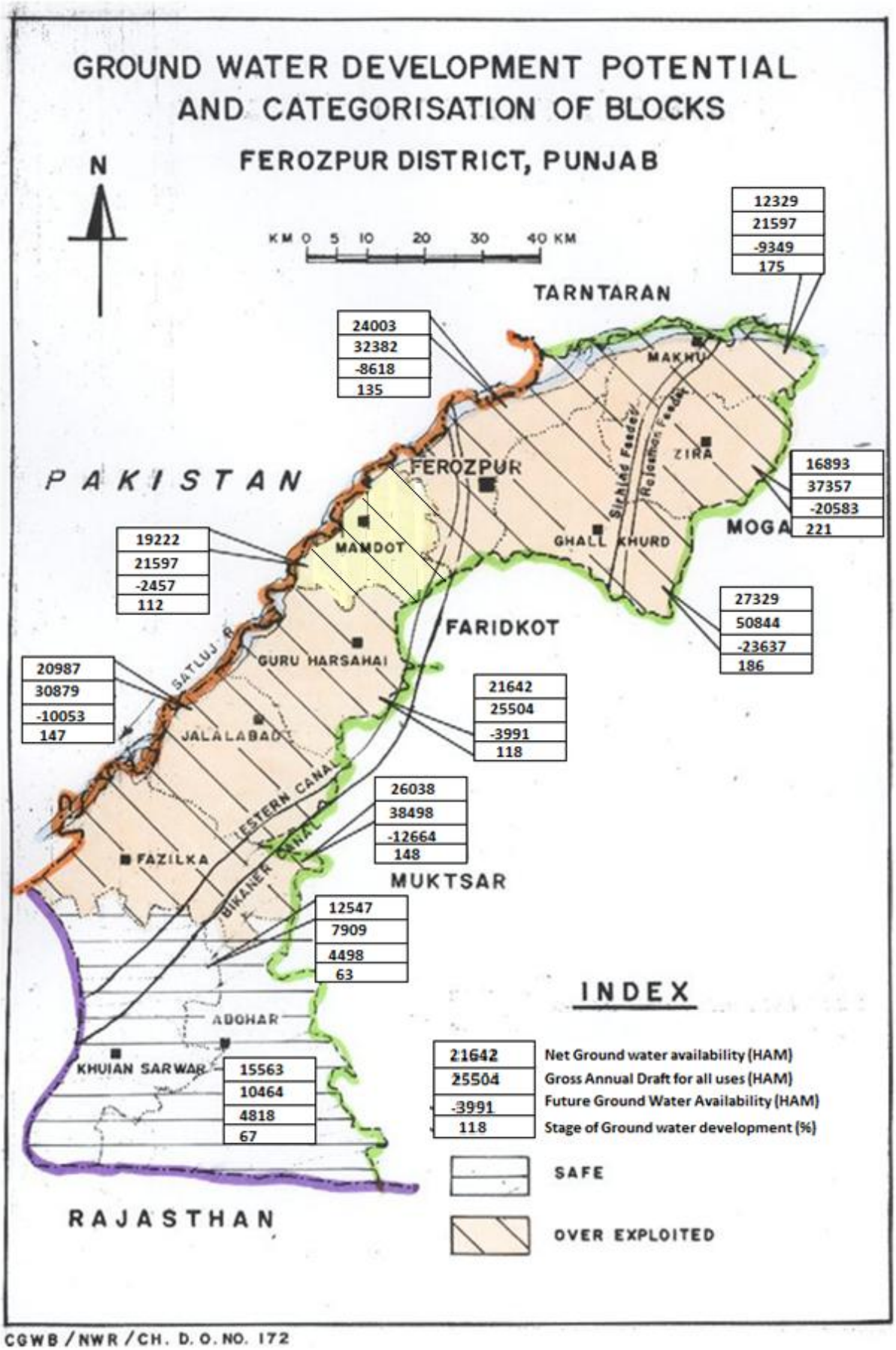
The block wise ground water resource potential of the district has been assessed as per GEC-97. Net Replenishable ground water availability in the district has been assessed as 196553 ham. Gross ground water draft for all uses in the district is 273766 ham, leaving a shortfall (over draft) of 82037 ham. Ground water development in 8 blocks has exceeded available recharge; hence these blocks have been categorized as over exploited. The stage of ground water development ranges from 63 % (block Khuyian Sarwar) to 221 % (block Zira). The stage of ground water development in Ferozepur district has been assessed as 141 %.

**Ground Water Resources and Development Potential, Ferozepur District, Punjab (as on 31-03-2009)**

| Block | Net Ground Water Availability (Ham) | Existing Gross Ground Water Draft for Irrigation (Ham) | Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (Ham) | Existing Gross Ground Water Draft for all Uses (Ham) | Allocation for Domestic and Industrial Requirement Supply up to next 25 years (Ham) | Net Ground Water Availability for Future Irrigation Development (Ham) | Stage of Ground Water Development (%) | Category of Block |
|---|---|---|---|---|---|---|---|---|
| Abohar | 15563 | 9901 | 563 | 10464 | 844 | 4818 | 67 | Safe |
| Fazilka | 26038 | 38020 | 477 | 38498 | 682 | -12664 | 148 | Over-exploited |
| Ferozpur | 24003 | 31915 | 468 | 32382 | 707 | -8618 | 135 | Over-exploited |
| Ghall Khurd | 27329 | 50570 | 275 | 50844 | 396 | -23637 | 186 | Over-exploited |
| Guru Har Sahai | 21642 | 25234 | 270 | 25504 | 399 | -3991 | 118 | Over-exploited |
| Jalalabad | 20987 | 30534 | 345 | 30879 | 507 | -10053 | 147 | Over-exploited |
| Makhu | 12329 | 21438 | 159 | 21597 | 240 | -9349 | 175 | Over-exploited |
| Mamdot | 19222 | 21438 | 159 | 21597 | 240 | -2457 | 112 | Over-exploited |
| Khuyian Sarwar | 12547 | 7628 | 280 | 7909 | 420 | 4498 | 63 | Safe |
| Zira | 16893 | 37088 | 270 | 37357 | 389 | -20583 | 221 | Over-exploited |
| **Total** | 196553 | 273766 | 3266 | 277032 | 4824 | -82037 | 141 | |

## 4.3 Ground Water Quality at a Glance

Chemical quality data obtained the analysis of groundwater samples representing shallow aquifers reveals that ground water is alkaline in nature and the EC of water samples ranges from moderately to highly saline. The development of high productive agricultural practices, industries and changing life style of people have taken place which has affected the quality of ground water and which has become more prone to deterioration. 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.

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**Type of Water**

The shallow ground water is of Na-HCO3 type and in some places mixed waters are present. Among the anions bicarbonate is dominant in some water where as none of the anions dominates in rest. Among cations sodium is the dominant cation.

**Suitability of Water**

Domestic

The ground water quality of Ferozepur district shows that water in more than half of the district area is unsuitable for drinking as well as for domestic purposes. Only 31% of the samples have concentration of EC, Chloride, Nitrate and Fluoride within the permissible limit 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 $C_2S_1$, $C_3S_1$, $C_3S_3$, $C_4S_2$, $C_4S_3$ and $C_4S_4$ classes of irrigation rating. Continuous use of waters in $C_2S_1$, $C_3S_1$ classes may lead to low to vary high salinity hazards, while these may not cause sodium hazards because of low SAR. Use of water falling in $C_3S_3$, $C_4S_3$ and $C_4S_4$ classes, for irrigation under normal practices, may lead to salinity as well as sodium hazards. However, these waters can be used for irrigating salt tolerant crops grown on soils with adequate permeability.

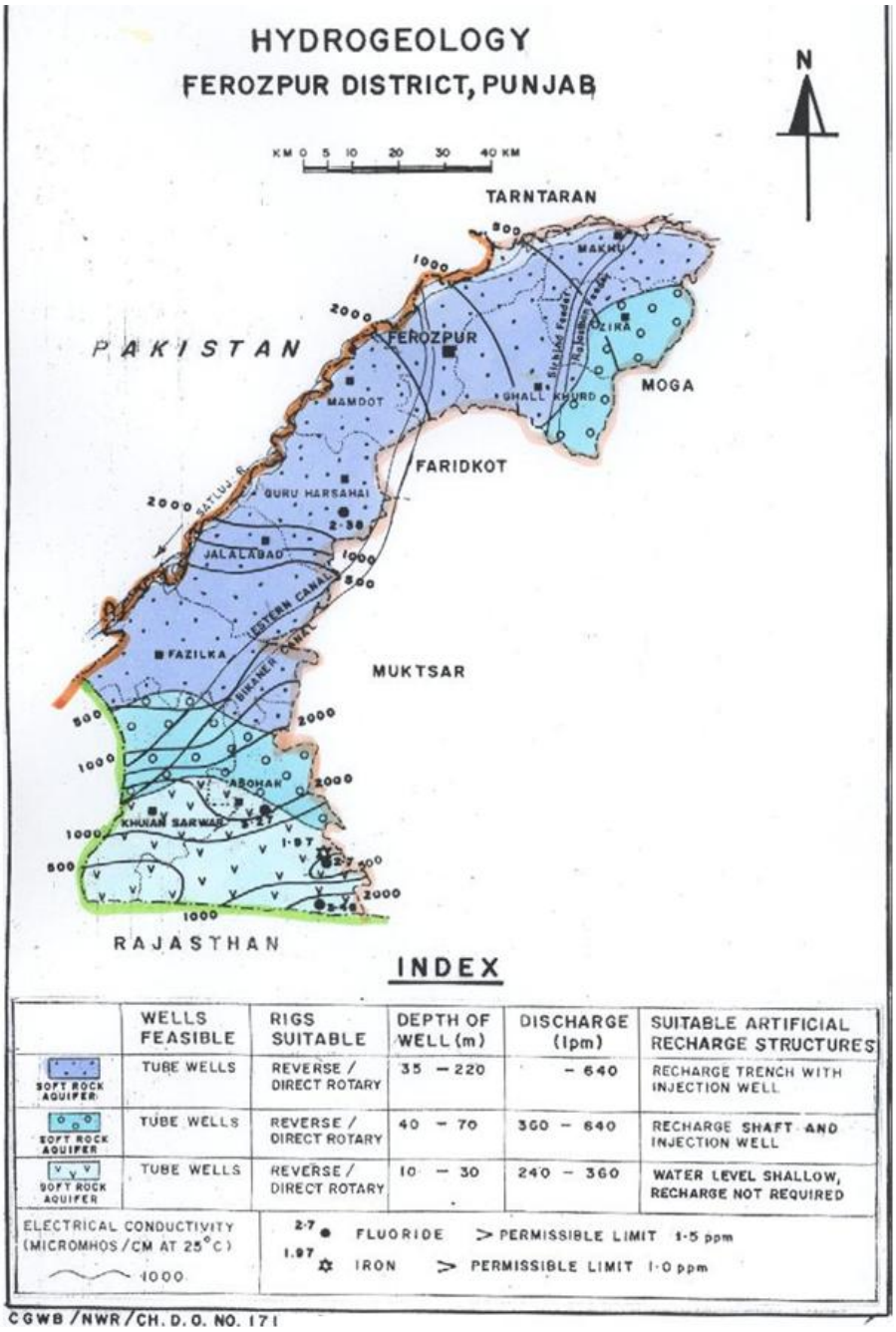
## 4.4 Geophysical studies

The findings of surface geophysical studies shows ground water to be saline at all levels in major parts of Abohar and few parts of Fazilka block, selected portion of the area is available with fresh water within 80-200 m depth in Fazilka and Jalalabad blocks. As an overall conclusion of the present study in south west Ferozepur, it is evident that no fresh water occurs below 200 m depth

Areas where possibility of fresh water within 20-50 m depth is expected are Dangra-khrea, Rajpura, Dodewala, Juradkhera, Narainpur, Bajidpur, Rukanpura,in the south, Hasta kalan, Nakerian, Salem-shah and Chak-saidake in the north. Area where possibility of fresh water in the depth interval of 80-200 m depth is expected are Bahak-khas, Jhugge-gulabsinghwala, Bhamba-battu, Jamal-ke, Sohana-sander, Chak-Bandiwala, Gumaniwala, Chak-singhwala, Rana, Dhondji-quadim, Gubhaya,Mauzzam and the-qu-alander lying in Jalalabad and Fazilka blocks. Based on geophysical survey, depth wise variation in ground water quality in southern part is given in figure no. 1.

## 5.0 GROUND WATER MANAGEMENT STRATEGY

The hydrogeological data generated through exploratory test drilling has provided vital information regarding identification of aquifer systems, demarcation of their vertical and lateral extent, and 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' wire galvanized Johnson sdreen 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



## 6.0 GROUND WATER RELATED ISSUES & PROBLEMS

Ground water is saline in semi-unconfined aquifer up to 30-55 m depth in isolated patches in central and northern part of the district. The ground water quality is fresh in aquifer between 30-150 m depth in southern part and 55-175 m in northern part of the district. This is the main source of tube well based water supply schemes. Aquifer systems below 200 meter depth have been reported to have saline water throughout the southern part of the district. Salinity is the main quality problem and second one is the high Fluoride concentration in Guru harsahai and Jalalabad blocks. However, in northern part there are some successful tube wells taping this water.

The water level in the district area ranges from 1.6 m to 11.07 m bgl and the ground water flow is towards south west direction. The rise has been observed in northern part whereas decline has been observed in southern part Water logging conditions have changed alarmingly in pre and post monsoon period. Only potential area for water logging shows increase of 300% from pre monsoon period. there is only spatial variation in water logged and critical area in the district and hardly quantitative change. In long term water logged area has increased more than 300%, in 1993 it was only 51.1 Sq.km which was 297 Sq. km in year 2009.

## 7.0 AWARENESS & TRAINING ACTIVITY

Nil

## 8.0 AREAS NOTIFIED BY CGWA/SGWA

Nil

## 9.0 RECOMMENDATIONS

1. The tubewells down to 110 m depths can be constructed at places in the northern part of the district whereas in southern part up to 30 m or where ever ground water is fresh in the form of thin lens.
2. In blocks namely Makhu, Ferozpur and Ghal Khurd, restrictions may be imposed for further development of ground water and people need to be educated for practices of water conservation.
3. As the area does not receives adequate amount of rainfall and surface being sandy generate little run-off, these together rules out the question of artificial recharge on large scale. However Rooftop rain water harvesting can be of local importance.
4. There is an urgent need to address the problem of Salinity management else area deprived of natural resource of fresh water will soon may face the problem of land degradation or soil salinity. To avoid situation of soil salinity in the area method of leaching and blending under the proper guidance, as discussed should be adopted.
5. In Northern part of Ferozepur district, there is less number of observation wells to monitor the water levels as most of the structures have gone dry. Hence shallow piezometers of 50 m depths should be installed in northern part of the District.