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Government of India
Ministry of Water Resources,
River Development & Ganga Rejuvenation
Central Ground Water Board

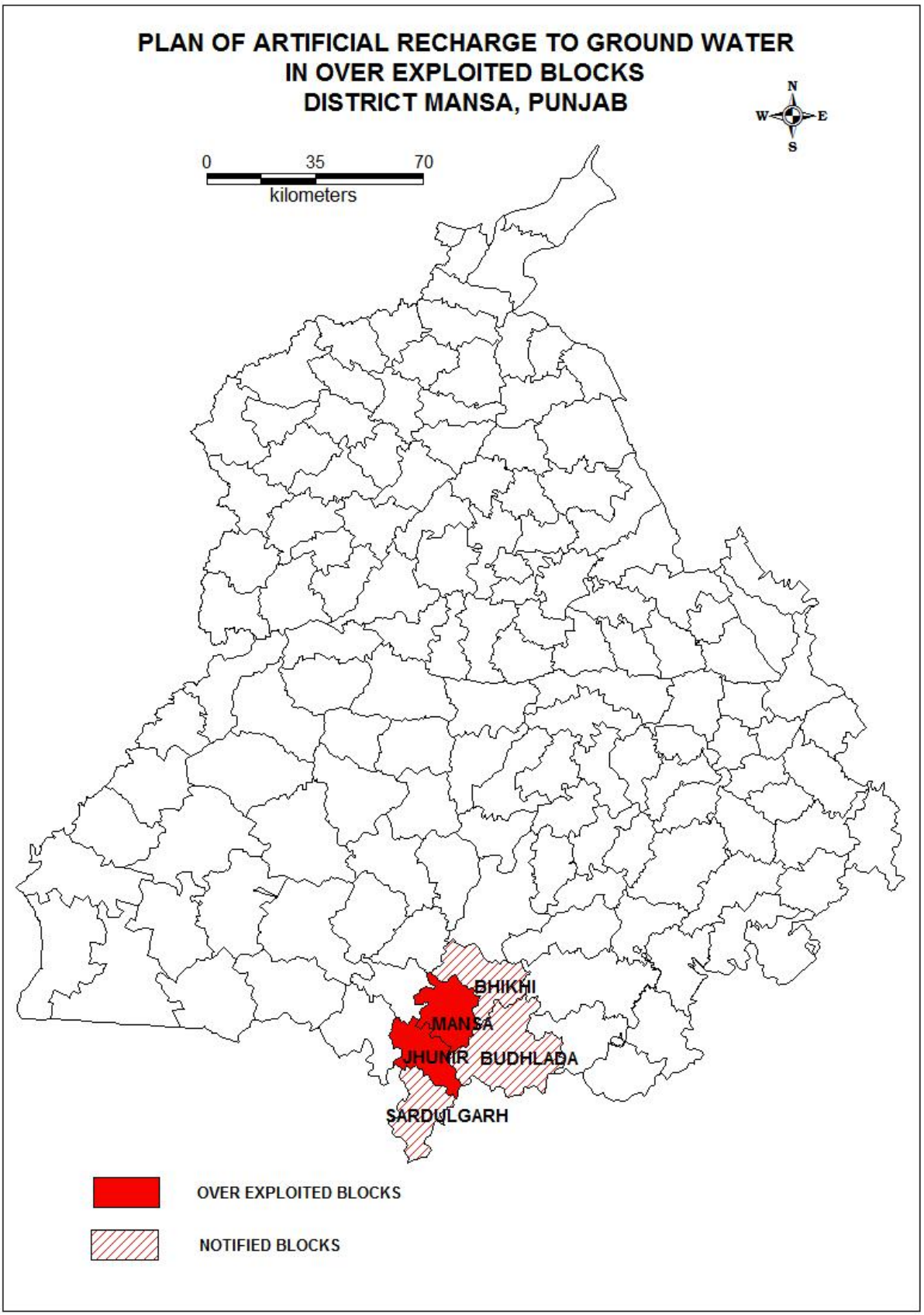
PLAN ON

ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION IN

OVEREXPLOITED BLOCKS OF MANSA DISTRICT, PUNJAB

Central Ground Water Board
North Western Region
Chandigarh

PLAN OF ARTIFICIAL RECHARGE TO GROUND WATER IN OVER EXPLOITED BLOCKS DISTRICT MANSA, PUNJAB



PLAN OF ARTFICIAL RECHARGE TO GROUND WATER IN OVER EXPLOITED BLOCKS, DISTRICT MANSA, PUNJAB

INTRODUCTION

Mansa District is located in the southern part of Punjab State and covers an area of 2,171 sq. km and lies between North latitude $29^0$32' to $30^0$12' and East longitude $75^0$10' to $75^0$46'. It is bounded by Sangrur district in the East, Bathinda Districts in the west, Barnala District in the North and Haryana State in the South. The district has total Population of 7,68,808 as per census 2011, with a population density of 350 persons/km^2 and the decennial growth of 11.2%.

RAINFALL & CLIMATE

The climate in the area is typical semi-arid type with distinct wet and dry seasons. The normal average annual rainfall of the district is 378.2 mm. The rainfall occurs due to southwest monsoon which sets in the last week of June and withdraws towards end of September. The climate of Mansa district is classified as sub-tropical steppe, semi-arid and hot which is mainly dry except in rainy months and characterized by intensely hot summer and cold winter. The normal annual rainfall of Mansa District is 378 mm in 23 days which is unevenly distributed over the district. The southwest monsoon sets in last week of June and withdraws towards end of September and contributes about 83% of annual rainfall. July and August are rainiest month. Rest 17% of the annual rainfall occurs during Non-monsoon months of the year in the district increases from southwest to northeast.

GEOMORPHOLOGY & SOILS

The district mainly represents a flat alluvial plains interrupted by sand dunes in southwestern part. There is no perennial river in the district. The area is mainly irrigated by the network of canals.

HYDROGEOLOGY:

The area falls under the Indo-Gangetic alluvial plains. The geological formations met within the district comprise Alluvium of Quaternary age. It consists of alternating beds of sand, silt and clay. In the southwestern part, the alluvium is overlain by thin layer unstratified loam.

The pre monsoon depth to water level ranges from 5.56 to 15.01 m bgl, and post monsoon value ranges from 2.18 to 10.33 m bgl .In most of the area depth to water level occurs within 10m b.g.l.
The long-term water level fluctuation over the past shows the rising trend in the northeastern part up to 5m. The rise in water table is due to less withdrawal of ground water owing to its bad quality and / or the intensive irrigation by network of canals. The decline in water level at few places may be attributed to withdrawal of ground water due to its fresh and marginal quality and/ or non-availability of canal water to meet the requirement for agricultural purposes. The water table elevation ranges from 210 m to 217 m above mean sea level. The general ground water flow is from northeast to southwest direction. The yield of the shallow tube wells varies from 870 to3000 litres per minute for 4 to 13 m drawdown. The long term trend of water level ranges in the district from -0.14 (Burj Bhalaike) to -0.82 m/yr (Rar).

GROUND WATER RESOURCES:

Groundwater resource estimation has been done as per GEC-1997 methodology as on 31.03.2011. The total utilizable ground water potential of district is 696.47 MCM and the net ground water draft is 1447.54 MCM. All the five blocks fall under over-exploited category with stage of ground water development as much as 208%.

GROUND WATER QUALITY:

The ground water quality scenario of the district is alkaline in nature and is fresh to moderately saline. The electrical conductivity (EC) values are less than 3000 ms/cm except at Rash (EC=4280) and Burj Bhalaike (EC=6990) Ms/cm at 25°c average anions bicarbonate predominates at some places, whereas other places are of the anion dominants. Among cations, by and large sodium is the dominant cat ions. Generally, it is suitable for drinking purposes as chemical parameter as well within the permissible limits of safe drinking waters set by Bureau of Indian Standards (BIS) ground water is not suitable for drinking purpose at few places due to fluoride and nitrate content. Places are Mansa (Fe= 1.581), Narinder Pura (1.551), Burj Bhalike (16.85) and Fatta Malluka (2.876) mg /l.

GROUND WATER IRRIGATION SCENARIO

As per the data available from minor irrigation census 2006-07 the detailed number of shallow, deep, tubewells, lined, unlined water distribution system, land holdings of wells are given below for reference

Distribution of Shallow Tubewells According to Owner's holding Size

No. of shallow tube wells by size class of individual owner							
Sr.no	district	Marginal (0-1 ha)	Small (1-2 ha)	Semi-Medium (2-4 ha)	Medium (4-10ha)	Big (>=10 ha)	Total
1	**Mansa**	**974**	**4221**	**14761**	**15994**	**4135**	**40085**

Distribution of Deep Tubewells According to Owner's Holding Size

No. of deep tube wells by size class of individual owner							
Sr.no	district	Marginal (0-1 ha)	Small (1-2 ha)	Semi-Medium (2-4 ha)	Medium (4-10ha)	Big (>=10 ha)	Total
1	**Mansa**	**38**	**273**	**1509**	**2386**	**389**	**4595**

Distribution of Shallow Tubewells According to Depth of tube well

No. by the depth of shallow Tube well							
Sr.no	district	(0-20 mts)	(20-40 mts)	(40-60 mts)	(60-70 mts)	(>70 mts)	Total
1	**Mansa**	**1491**	**18095**	**12923**	**7576**	**0**	**40085**

Number of Ground Water Schemes and Potential Utilized by water distribution device

Ground Water Schemes according to water Distribution System				
	Open Water Channel			
Sr.no	**District**	**Lined/pucca**	**Unlined/kutcha**	**Under-ground pipe**
1	**Mansa**	**615**	**118905**	**0**

PLAN OF THIS REPORT

In this plan 2 types of the recharge structures are proposed such as Roof Top Rain water harvesting in rural & urban areas and Recharge pits in agriculture lands of 5mt x5mt x3mt size. The pit will be surrounded by angle irons and barbed fencing. The size and depth depend on the availability of the land. The extra water available on the field will be stored in the pit and that will also be recharged to the ground water.

A summery outline of the artificial recharge plan for the entire district of each block is given at the beginning in tabular forms. This is followed by the salient features of each block along with the detailed structure-wise recharge plan and cost estimates.

Details of the block wise type of suitable recharge structures and volume of water assured for annual recharge for each block, schematic design of recharge structures are annexed at annexure I & II.

This plan is focusing on the technical aspects of the ground water recharge through various means so that various implementing agencies may get the appropriate technical guidelines. The existing/ongoing schemes of the central or state govt. like MANERGA, IWSP, PMKVY, NABARD funded schemes, Urban Development schemes, departmentally funded projects etc. may be benefitted from the recharge plan by incorporating the input in the operational guidelines/ design and for locating the specific sites.

Agriculture university, engineering Collages, Academic and Research Institution, NGO may also take up the pilot or demonstrative projects in the blocks suitable to them to plan at local level as per local conditions.

Sr.no.	Type of Structure	No. of structures	Unit cost in Lakhs	Total cost of structure in Crores	Annual Recharge (MCM)
ROOF TOP RAIN WATER HARVESTING IN RURAL AND URBEN AREAS					
1	**Artificial Recharge Plan For Urban Areas.**	3241	0.25	**8.10**	**0.213**
2	**Roof Top Rain Water Harvesting in Rural Areas**	11723	0.25	**29.30**	**1.349**
	Total	14963	**0.25**	**37.40**	**1.563**
ARTIFICIAL RECHARGE IN FARMS					
1	**Artificial Recharge Plan Through Recharge Pits.**	20836	0.35	72.92	12.677
			Total	**72.92**	**12.677**

By the implementation of the proposed recharge structures there will be a reduction of 2.21% in stage of ground water development as tabulated below.

Sr. no.	Total Draft (present) **(mcm)**	Overdraft (mcm)	Additional Recharge through proposed structures **(mcm)**	Draft Reduced due to Recharge **(mcm)**	Stage of development (present)	Stage of development after recharge	Reduction in stage of development after recharge
1	**1447.54**	**-751.07**	**14.24**	**1433.30**	**208 %**	**205.79 %**	**2.21 %**

ARTIFICIAL RCEHARGE PLAN THROUGH RECHARGE PITS IN OVER EXPLOITED BLOCKS OF MANSA DISTRICT

Block Name	Total area of the village (in hectares)	10%of village area taken for farm recharge (in hectares)	Total number of recharge pits	Annual recharge (MCM)= (Area*Runoff 15%*Rainfall)	Cost of Pit @Rs.0.35 lakh (Crores)
BHIKHI	**32992.80**	**3299**	**3299**	**1.935**	**11.54**
MANSA	**38015.50**	**3802**	**3802**	**2.338**	**13.30**
BUDHLADA	**66935.80**	**6694**	**6694**	**4.267**	**23.42**
JHUNIR	**33986.00**	**3399**	**3399**	**1.952**	**11.89**
SARDULGARH	**36416.00**	**3642**	**3642**	**2.185**	**12.74**
			20836	**12.677**	**72.89**

Number of Recharge pits are based on following factors:

Availability of Irrigation wells In the farmer land

Area of sandy strata at shallow depth identified

Type of structure will be recharge pit/ Recharge well(where top three meters is clay)

ROOF TOP RAINWATER HARVESTING IN RURAL AREAS OF MANSA DISTRICT OF PUNJAB								
Name of District	Sr.no	Name of CD Block	Total area of the village (in hectares)	Number of households (2011 census)	No of Houses taken for Artificial Recharge (10% of total households)	Total No of AR Structures (one structure for each house)	Total recharge in MCM	Cost @ 0.25 Lacs/structure (Crores)
MANSA	1	BHIKHI	32992.80	19032	1903	1903	0.089	4.75
	2	MANSA	38015.50	22203	2220	2220	0.109	5.55
	3	BUDHLADA	66935.80	40218	4022	4022	0.205	10.05
	4	JHUNIR	33986.00	18104	1810	1810	0.083	4.52
	5	SARDULGARH	36416.00	17675	1768	1768	0.863	4.42
		Total	208346.1	117232	11723	11723	1.349	29.29

ARTIFICIAL RECHARGE PLAN FOR URBAN AREAS OF DISTRICT MANSA PUNJAB

District	Block	Town Name	Total Households	Total Population of Town	HousholdS taken for Atificial Recharge (10%)	Total Roof Top Area (sqm)	Vol of water available for recharge (MCM)	Cost @Rs.0.25 lakh
MANSA	SARDULHARH	SARDULHARH (NP)	3725	19219	373	74500	0.024	0.93
	BUDHLADA	BARETA (MCL)	3409	17432	341	68180	0.023	0.85
	BUDHLADA	BUDHLADA (MCL)	5116	26172	512	102320	0.035	1.28
	BHIKHI	BHIKHI (NP)	3435	17824	344	68700	0.021	0.86
	MANSA	MANSA (MCL)	16713	82956	1671	334260	0.110	4.17
		TOTAL	32398	163603	3241	647960	0.213	

B. POTENTIAL FOR REDUCTION IN OVERDRAFT BY ENHANCING THE GROUND WATER USE EFFICIENCY OF IRRIGATION TUBE WELLS

The micro level transformation in the ground water management have vast impact potential to counter extensive ground water depletion faced by the state of Punjab, particularly in overexploited blocks. There are around 44680 tube wells operated by farmers for irrigation through unlined/Katcha (82.24%) open channel system in Mansa district where water from the tube-well is discharge to the agricultural field. In this process huge quantity of ground water is wasted in soil moisture and evaporation losses.

Dynamic ground water resources (2011) indicate that Gross ground water draft for irrigation in Mansa district is estimated at 1034.20 MCM. It is expected that around 34% of over draft can be brought down by switching over to underground/surface pipeline based distribution from the prevailing unlined open channels. Thereby gross draft will be reduced to the tune of 1078.81 MCM assuming there is no crop diversification by the farmers.

The benefit will lead to saving of precious ground water resources in overexploited blocks Mansa Districts. The measure if implemented will bring down the ground water overdraft from 138% to 104 %. The category of the blocks will also improve drastically resulting in boosting of agriculture and industrial development otherwise not sustainable in majority of the blocks in the state.

The tube wells also consume enormous electricity which is subsidized and government incurs significant revenue on this account. The measures therefore will result in saving of energy and money. Pollution impact will be reduced whenever diesel engines are used by the farmers. The environmental and ecological condition in the irrigated land will improve. Unwanted weed growth will also be controlled inside the farm land. This will also be useful in the waterlogged/ shallow water table areas as the seepage losses in these areas also aggravate the water logging.

Government should make/launch a mission mode program for installing the underground pipe lines instead of having *katcha* channel in the entire Punjab. Heavy ground water overdraft can be reduced by these efforts. This will ensure **more crops per drop**.

POTENTIAL FOR REDUCTION IN OVERDRAFT BY ENHANCING THE GROUND WATER USE EFFICIENCY IN IRRIGATION TUBEWELLS, MANSA DISTRICT

Net Annual Ground Water Availability (mcm)	Total Draft (present) (mcm)	Gross Irrigation Draft (present) (mcm)	Gross Ground Water Draft for Domestic and industrial supply (mcm)	Pecentage of unlined channel	Wastage through unlined channel, (mcm) (Col 3 X Col5 X 0.30#)	Potential of Reduced irrigation overdraft (Col3-col6) (mcm)	Gross draft after saving of water (mcm) (Col 7+Col4)	Present Stage of development (%)	Stage of development afterwards((Col 8/Col1) X100) (%)	Reduction in stage of development after constructing pucca canal (Col9-Col10) (%)
1	2	3	4	5	6	7	8	9	10	11
1034.20	1432.10	1432	0.1	82.24	353.29	1078.67	1078.81	138	104	34

 # losses from open kuchha channel are around 30%.

COST ESTIMATE OF UNDERGROUND PIPE LINE

District	Block	Irrigated area by ground water scheme (ha)	Percentage of Unlined Channel (%)	Area under unlined Channels	Total cost @Rs.0.50 lack per hector(in cr) =Total irrigated area (by ground water scheme) of the block *0.5 *Col4	Total Cost in Rs. Crores. District wise
1	**2**	**3**	**4**	**5**	**6**	**7**
MANSA	Bhikhi	8451.3	77.36	6538	**32.69**	**106.46**
	Budhlada	4090.4	77.36	3164	**15.82**	
	Jhunir	3943.2	77.36	3050	**15.25**	
	Mansa	4696.6	77.36	3633	**18.17**	
	Sardulgarh	6341	77.36	4905	**24.53**	

SALIENT FEATURES OF HYDROGEOLOGY OF DISTRICT MANSA

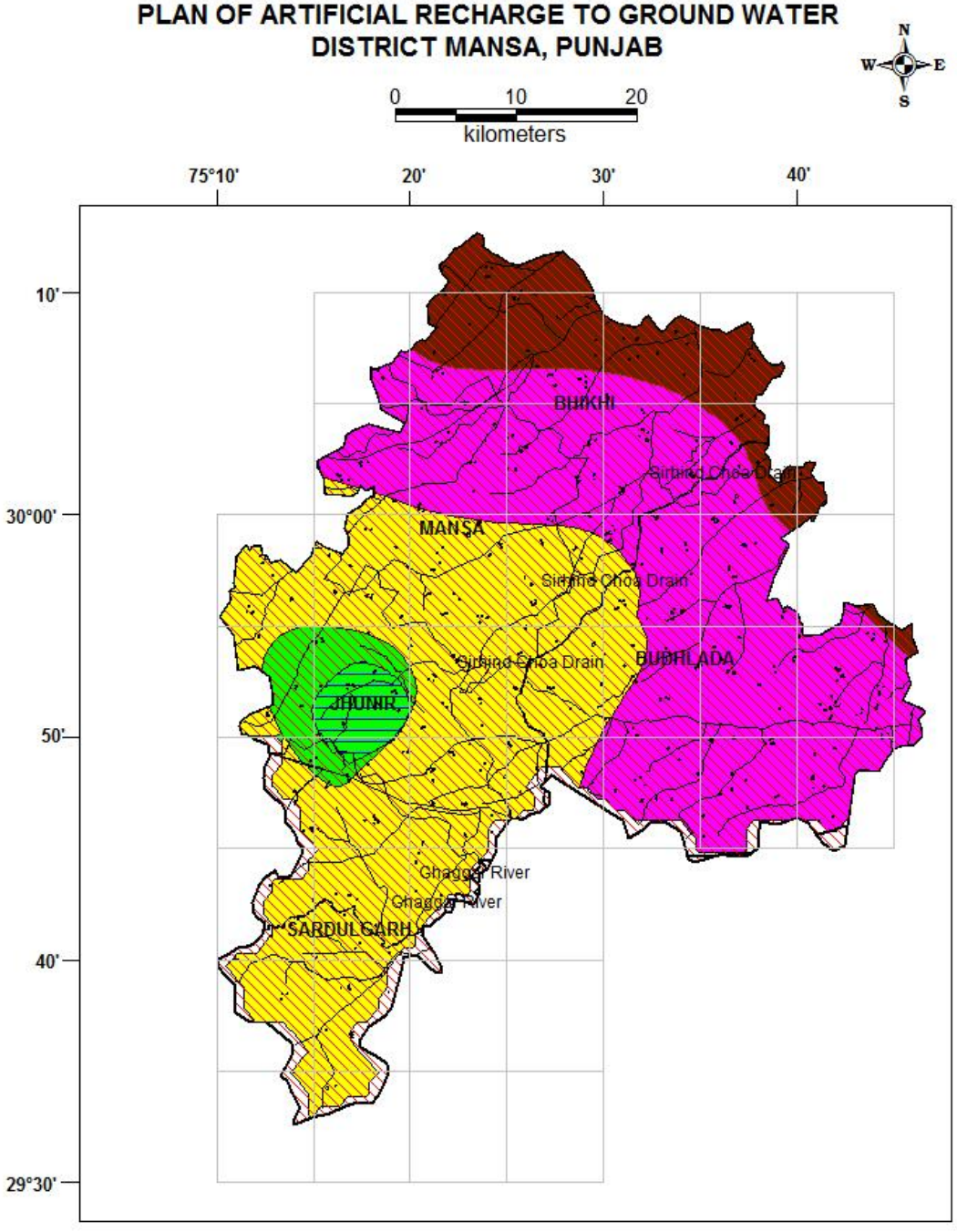
Wells Feasible	Rigs Suitable	Depth of Well (m)	Discharge (lpm)	Suitable Artificial Recharge Structures
Tube Wells	Direct and Reverse Rotary	45 - 140	1300 - 2000	Recharge Shaft And Recharge Trench
Tube Wells	Direct and Reverse Rotary	35 - 160	1000 - 1300	Recharge Shaft And Recharge Trench
Tube Wells	Direct and Reverse Rotary	20 - 80	600 - 1000	Recharge Shaft And Recharge Trench

DEPTH TO WATER LEVEL NOVEMBER 2014		
0.00 - 5.00 mbgl	National Highway	International Boundary
5.00 - 10.00 mbgl	Canals	State Boundary
10.00 - 20.00 mbgl	Water Bodies	Block Boundary
20.00 - 40.00 mbgl	Major Drainage	Block Headquarters

OTHER INFORMATION

Name of State	Punjab
Name of District	Mansa
Geographical Area	2171 sq.km
Major Geological Formation	Alluviam
Major Drainage System	Ghaggar
Population (as on 2011)	7,68,808
Total Number of Blocks	5
Existing Major/Medium Irrigation Projects	Sirhind and Bhakra Canal
Utillizable Ground Water Resources 2011	696.47 (mcm)
Net Ground Water Draft	1447.54 (mcm)
Stage of Ground Water Development	208 %
Average Annual Rainfall	378 mm
Range of Mean Daily Temperature	4° - 42° C
Over Exploted Blocks	BHIKHI MANSA BHUDHLADA JHUNIR SARDULGARH

PLAN OF ARTIFICIAL RECHARGE TO GROUND WATER
DISTRICT MANSA, PUNJAB



Legend

Refer Salient Features of Hydrogeology

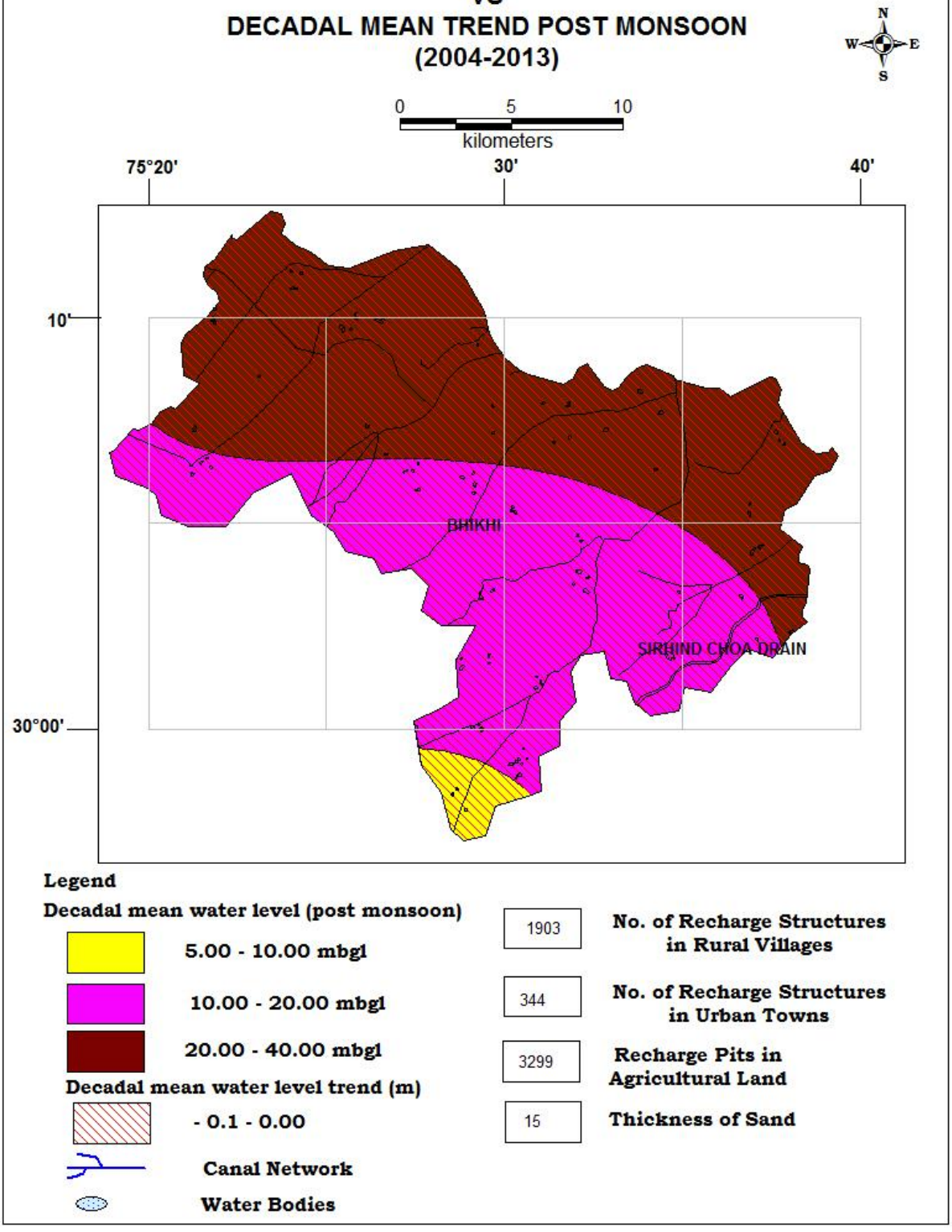
Decadal mean water level trend (m)

	0.00 -- 0.1114
	-0.20 -- -0.10
	-0.10 -- -0.00

BLOCK WISE PLAN OF DISTRICT MANSA PUNJAB

(5 OE BLOCKS)

BLOCK BHIKHI DISTRICT MANSA, PUNJAB
DEPTH TO WATER LEVEL - DECADAL MEAN POST MONSOON
VS
DECADAL MEAN TREND POST MONSOON
(2004-2013)



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Decadal mean water level (post monsoon)

- 5.00 - 10.00 mbgl
- 10.00 - 20.00 mbgl
- 20.00 - 40.00 mbgl

Decadal mean water level trend (m)

- - 0.1 - 0.00

Canal Network

Water Bodies

1903	No. of Recharge Structures in Rural Villages
344	No. of Recharge Structures in Urban Towns
3299	Recharge Pits in Agricultural Land
15	Thickness of Sand

Ground Water Scenario of Block

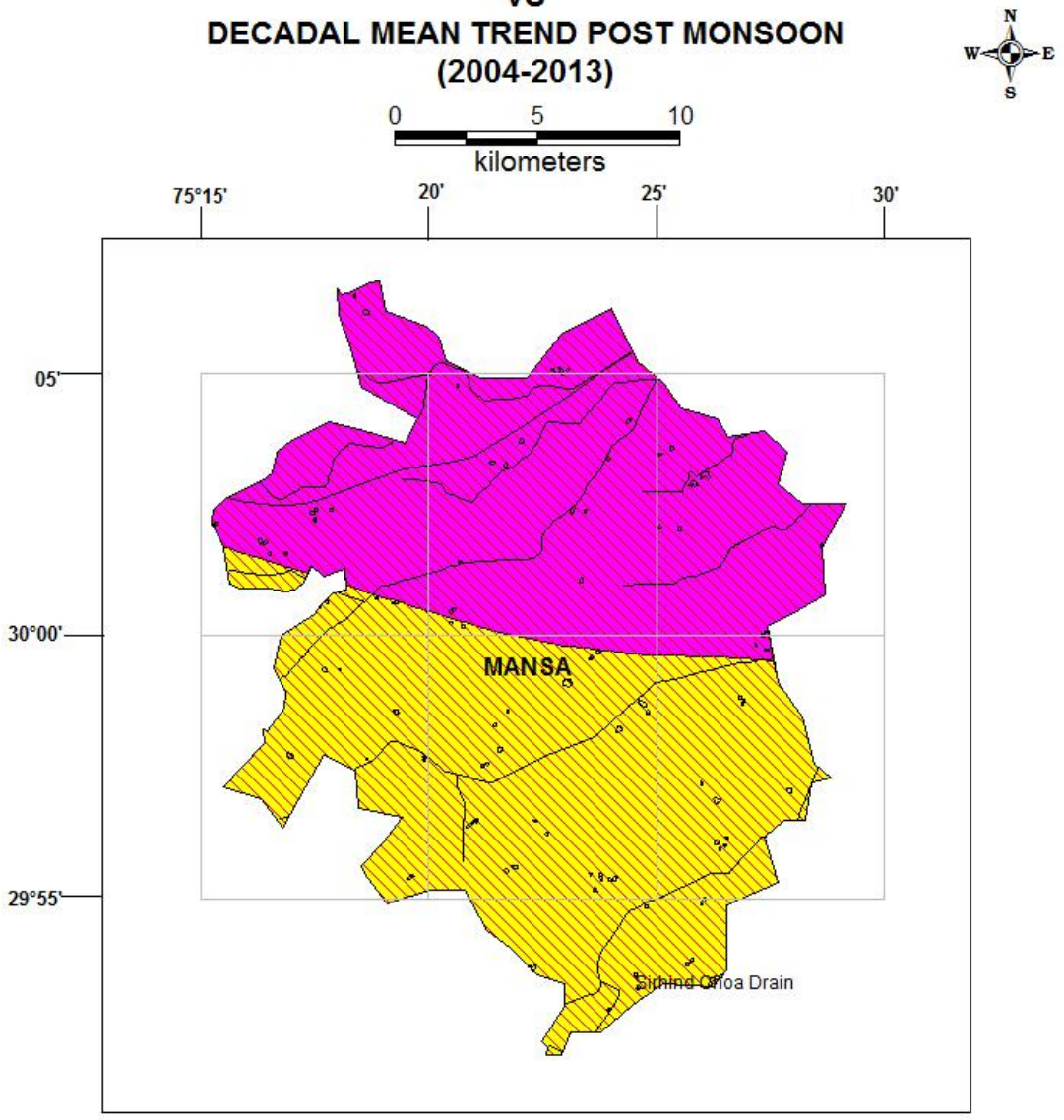
Block Name:- Bhikhi **District:- Mansa**		**State:- PUNJAB**
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	*221.2*
	• Number of Villages inhabited • Un-inhabited	*32* *0*
	ii) Average Annual Rainfall (mm)	*389*
	iii) Area feasible for Artificial Recharge	*221.2*
	iv) Village identified under scarcity of Water	*32*
	v) Village covered under water supply	*32*
	vi) Water Tank exists in the village	*16*
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	*Ghaggar 100%*
3.	LAND USE	
	• Area According to Village Papers (Sq.Km)	335.59
	• Net Area Sown (Sq.Km)	300.38
	• Area Sown More than Once (Sq.Km)	2.91
	• Total Cropped Area (Sq.Km)	303.29
	• Cropping Intensity	101
	• Area under Thur and Sem (Sq.Km)	--
4.	PREDOMINAT GEOLOGICAL FORMATIONS	*Recent alluvium*
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
	Avg. Depth to water level (decadal)	Depth to water level\ May 2015 (mbgl)

	• Pre- monsoon: (May 2015) • *10.71-24.50(mbgl)*	*10.00 – 40.00 (mbgl)*	
	• Post –monsoon: (Nov2014) • *15.48-15.48(mbgl)*		
6. *1 a*	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)		
	• No of wells drilled	*7*	
	• Depth Range (m)	*85.0-380.60*	
	• Discharge (Ipm)	*912-3000*	
	Aquifer Parameters		
	• Transmissivity (m2/day)	*43-1590*	
	• Storativity	*$13*10^{-3}$*	
	• Specified yield	*0.072*	
7.	GROUND WATER QUALITY	Min	Max
	• EC in µS/cm at 25^0c	*928*	*1585*
	• NO3 (mg/l)	*19*	*49*
	• F (mg/l)	*0.34*	*1.09*
	• As (mg/l)	0.0022	0.0035
8.	DYANMIC GROUND WATER RESOURCES in MCM	**2011**	
	• Net Ground Water Availability (Mcm)	111.92	
	• Existing Gross Ground Water Draft for Irrigation (Mcm)	271.65	
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (Mcm)	-	
	• Existing Gross Ground Water Draft for all Uses (Mcm)	271.66	
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (Mcm)	-	
	• Net Ground Water Availability for Future Irrigation Development (Mcm)	-159.74	
	• Stage of Ground Water Development / Over Draft (%)	243	
	• Category of Block	OE	
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in ground water level	*Extensive irrigation*	Extensive Irrigation
9.	Percentage of sand thickness up to 50 m depth (Average)	*Thickness (m) 15*	Percentage % 30

10	Volume of unsaturated zone available for recharge (MCM)	144.19
11.	Volume of water required for recharge (MCM)	191.83
12.	Volume of surplus water available for recharge(MCM)	4.97

RECHARGE/ CONSERVATION STRUCTURES		Total Number of Recharge Structures	Total Cost (Rs. in crores)	Total Recharge/ Water saving in MCM
13	Farm Recharge @Rs. 35000/-	3299	**11.55**	**1.935**
14	RWH Rural @ Rs. 25000/-	1903	**4.76**	**0.089**
15	RWH Urban@ Rs. 25000/-	344	**0.86**	**0.021**
16	Underground pipe line (area in hectares) @ Rs. 50000/-	6538	**32.69**	**66.31**
	TOTAL		**49.85**	**68.355**

BLOCK MANSA DISTRICT MANSA, PUNJAB
DEPTH TO WATER LEVEL - DECADAL MEAN POST MONSOON
VS
DECADAL MEAN TREND POST MONSOON
(2004-2013)



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Decadal mean water level (post monsoon)

- **5.00 - 10.00 mbgl**
- **10.00 - 20.00 mbgl**

Decadal mean water level trend (m)

- **- 0.1 - 0.00**
- **Canal Network**
- **Water Bodies**

2220	**No. of Recharge Structures in Rural Villages**
1671	**No. of Recharge Structures in Urban Towns**
3802	**Recharge Pits in Agricultural Land**
24	**Thickness of Sand**

Ground Water Scenario of Block

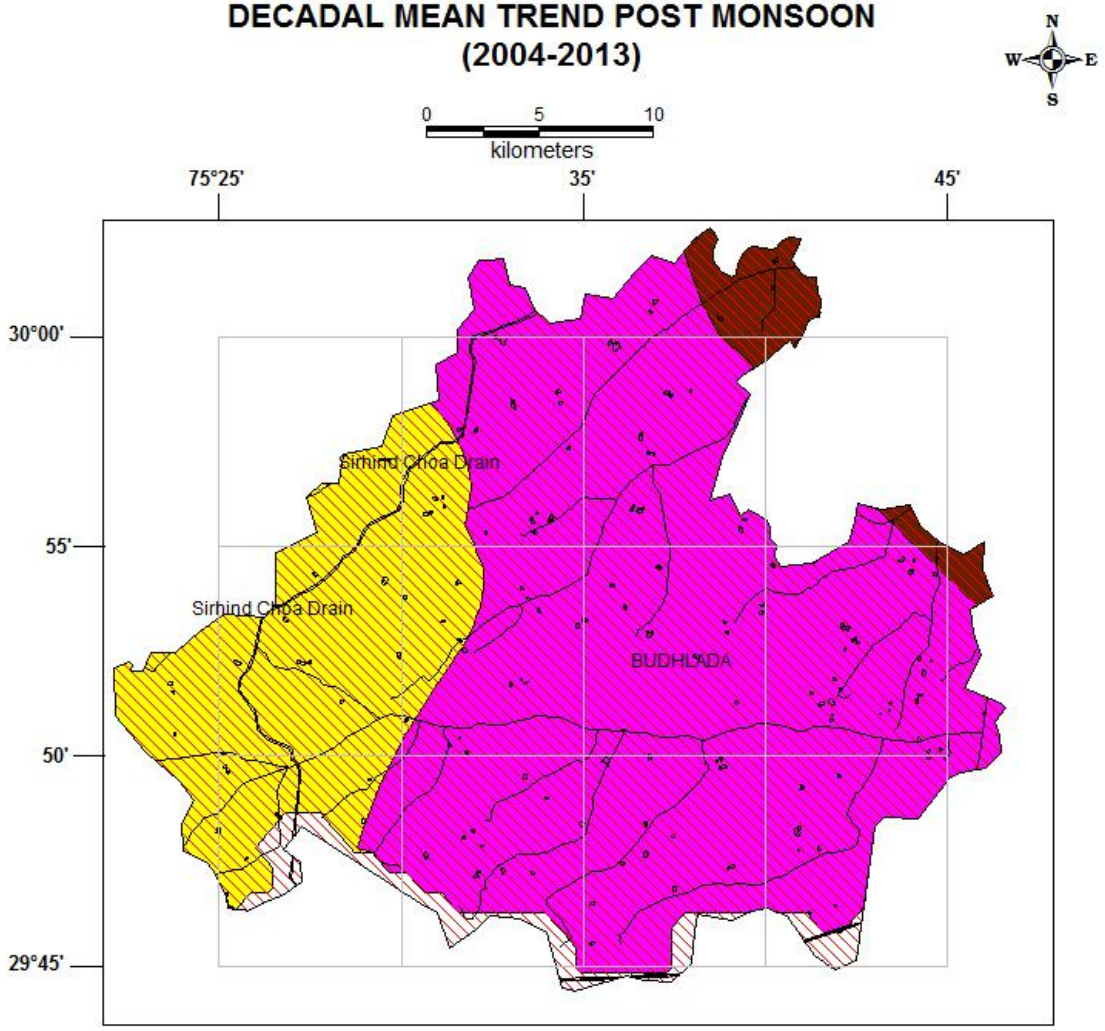
Block Name:- Mansa **District:- Mansa**		**State:- PUNJAB**
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	*358.3*
	• Number of Villages inhabited • Un-inhabited	*41* *0*
	ii) Average Annual Rainfall (mm)	*408*
	iii) Area feasible for Artificial Recharge	*358.3*
	iv) Village identified under scarcity of Water	*41*
	v)Village covered under water supply	*41*
	vi) Water Tank exists in the village	*18*
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	*Ghaggar 100%*
3.	LAND USE	
	• Area According to Village Papers (Sq.Km)	384.90
	• Net Area Sown (Sq.Km)	359.90
	• Area Sown More than Once (Sq.Km)	3.56
	• Total Cropped Area (Sq.Km)	363.46
	• Cropping Intensity	101
	• Area under Thur and Sem (Sq.Km)	--
4.	PREDOMINAT GEOLOGICAL FORMATIONS	*Recent alluvium*
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
	Avg. Depth to water level (decadal)	Depth to water level May 2015(mbgl)

	• Pre- monsoon: (May 2015) • *6.18-12.30 (mbgl)*	*5.00 – 20.00 (mbgl)*	
	• Post –monsoon: (Nov2014) • *6.82-11.10 (mbgl)*		
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)		
	• No of wells drilled	*1*	
	• Depth Range (m)	*85.0-380.60*	
	• Discharge (Ipm)	*912-3000*	
	Aquifer Parameters		
	• Transmissivity (m2/day)	*43-1590*	
	• Storativity	*$13*10^{-3}$*	
	• Specified yield	*0.072*	
7.	GROUND WATER QUALITY	Min	Max
	• EC in µS/cm at 25^0c	*825*	*825*
	• NO3 (mg/l)	*49*	*49*
	• F (mg/l)	*1.02*	*1.02*
	• As (mg/l)	0.0018	0.0066
8.	DYANMIC GROUND WATER RESOURCES in MCM	**2011**	
	• Net Ground Water Availability (Mcm)	147.98	
	• Existing Gross Ground Water Draft for Irrigation (Mcm)	298.97	
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (Mcm)	5	
	• Existing Gross Ground Water Draft for all Uses (Mcm)	299.02	
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (Mcm)	5	
	• Net Ground Water Availability for Future Irrigation Development (Mcm)	-151.04	
	• Stage of Ground Water Development / Over Draft(%)	202	
	• Category of Block	OE	
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in ground water level	*Extensive Irrigation*	Extensive Irrigation
9.	Percentage of sand thickness up to 50 m depth (Average)	*Thickness(m)* *24*	Percentage % 48

10	Volume of unsaturated zone available for recharge (MCM)	233.43
11.	Volume of water required for recharge (MCM)	310.55
12.	Volume of surplus water available for recharge(MCM)	8.05

RECHARGE/ CONSERVATION STRUCTURES		**Total Number of Recharge Structures**	**Total Cost (Rs. in crores)**	**Total Recharge/ Water saving in MCM**
13	Farm Recharge @Rs. 35000/-	3802	**13.31**	**2.338**
14	RWH Rural @ Rs. 25000/-	2220	**5.55**	**0.109**
15	RWH Urban@ Rs. 25000/-	1671	**4.18**	**0.11**
16	Underground pipe line (area in hectares) @ Rs. 50000/-	3633	**18.17**	**72.98**
	TOTAL		**41.20**	**75.537**

BLOCK BUDHLADA DISTRICT MANSA, PUNJAB
DEPTH TO WATER LEVEL - DECADAL MEAN POST MONSOON
VS
DECADAL MEAN TREND POST MONSOON
(2004-2013)



Legend

Decadal mean water level (post monsoon)

- **5.00 - 10.00 mbgl**
- **10.00 - 20.00 mbgl**
- **20.00 - 40.00 mbgl**

Decadal mean water level trend (m)

- **- 0.1 - 0.00**
- **Canal Network**
- **Water Bodies**

4022	**No. of Recharge Structures in Rural Villages**
853	**No. of Recharge Structures in Urban Towns**
6694	**Recharge Pits in Agricultural Land**
15.5	**Thickness of Sand**

Ground Water Scenario of Block

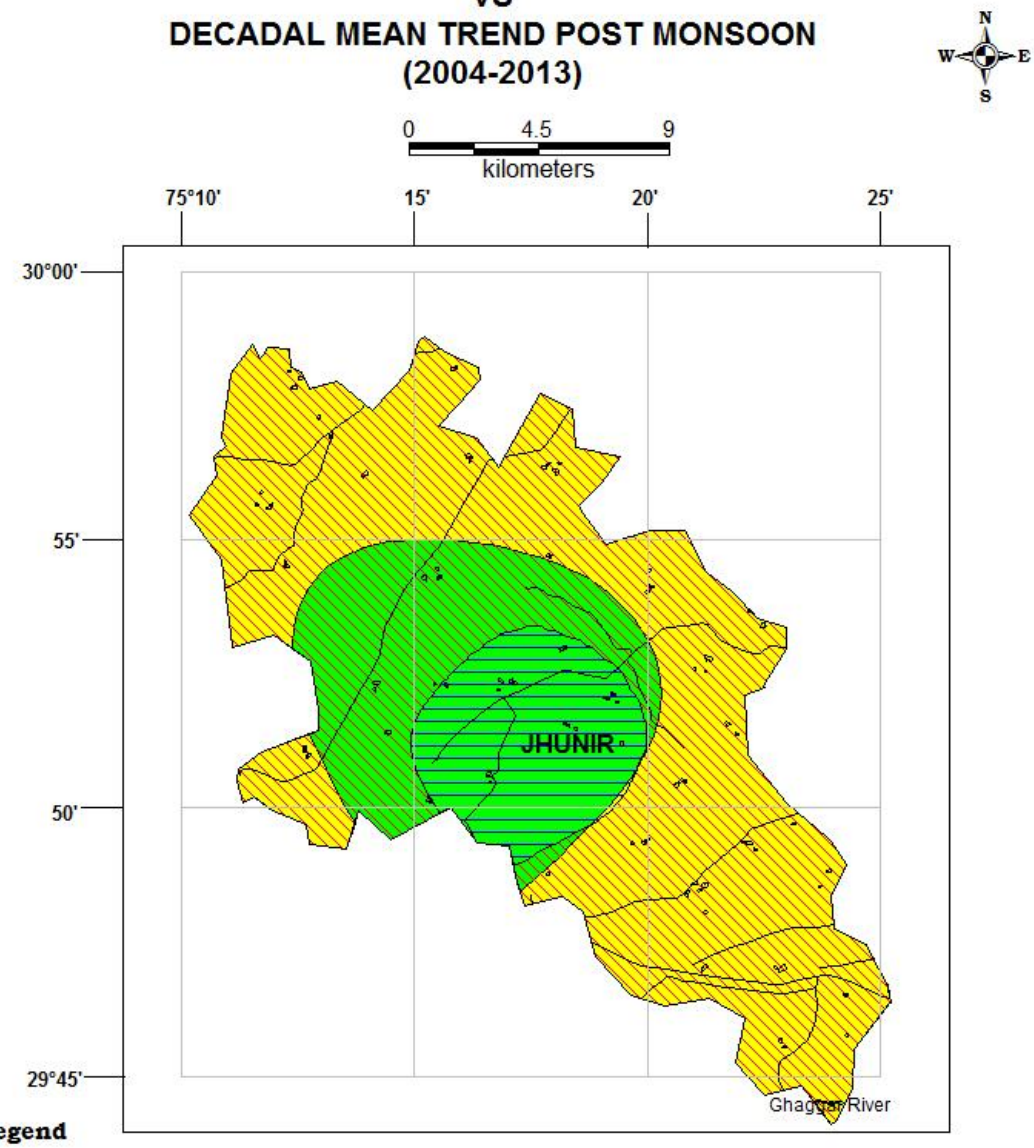
Block Name:- Budhlada **District:- Mansa**		**State:- PUNJAB**
1. `	GENERAL INFORMATION	
	i) Geographical area (sq km)	*675.4*
	• Number of Villages inhabited • Un-inhabited	*84* *2*
	ii) Average Annual Rainfall (mm)	*429*
	iii) Area feasible for Artificial Recharge	*675.4*
	iv) Village identified under scarcity of Water	*83*
	v)Village covered under water supply	*83*
	vi) Water Tank exists in the village	*33*
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	*Ghaggar 100%*
3.	LAND USE	
	• Area According to Village Papers (Sq.Km)	622.80
	• Net Area Sown (Sq.Km)	557.44
	• Area Sown More than Once (Sq.Km)	5.92
	• Total Cropped Area (Sq.Km)	563.36
	• Cropping Intensity	101
	• Area under Thur and Sem (Sq.Km)	--
4.	PREDOMINAT GEOLOGICAL FORMATIONS	*Recent alluvium*
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
	Avg. Depth to water level (decadal)	Depth to water level May 2015 (mbgl)
	• Pre- monsoon: (May 2015) • *8.20 – 14.60 mbgl)*	*5.00 – 20.00 mbgl)*
	• Post –monsoon: (Nov2014) • *7.35-13.16(mbgl)*	

6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)		
	• No of wells drilled	*2*	
	• Depth Range (m)	*85.0-380.60*	
	• Discharge (Ipm)	*912-3000*	
	Aquifer Parameters		
	• Transmissivity (m2/day)	*43-1590*	
	• Storativity	*$13*10^{-3}$*	
	• Specified yield	*0.072*	
7.	GROUND WATER QUALITY	Min	Max
	• EC in µS/cm at 25^0c	*595*	*2130*
	• NO3 (mg/l)	*10*	*33*
	• F (mg/l)	*0.67*	*3.4*
	• As (mg/l)	0.0012	0.0039
8.	DYANMIC GROUND WATER RESOURCES in MCM	**2011**	
	• Net Ground Water Availability (Mcm)	196.68	
	• Existing Gross Ground Water Draft for Irrigation (Mcm)	446.12	
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (Mcm)	5	
	• Existing Gross Ground Water Draft for all Uses (Mcm)	446.16	
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (Mcm)	5	
	• Net Ground Water Availability for Future Irrigation Development (Mcm)	-249.48	
	• Stage of Ground Water Development / Over Draft (%)	227	
	• Category of Block	OE	
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in ground water level	*Extensive Irrigation*	Extensive irrigation
9.	Percentage of sand thickness up to 50 m depth (Average)	*Thickness(m) 15.5*	Percentage % 31
10	Volume of unsaturated zone available for recharge (MCM)	440.27	
11.	Volume of water required for recharge (MCM)	585.72	

12.	Volume of surplus water available for recharge(MCM)		15.18

RECHARGE/ CONSERVATION STRUCTURES		Total Number of Recharge Structures	Total Cost (Rs. in crores)	Total Recharge/ Water saving in MCM
13	Farm Recharge @Rs. 35000/-	6694	**23.43**	**4.267**
14	RWH Rural @ Rs. 25000/-	4022	**10.06**	**0.205**
15	RWH Urban@ Rs. 25000/-	853	**2.13**	**0.058**
16	Underground pipe line (area in hectares) @ Rs. 50000/-	3164	**15.82**	**108.9**
	TOTAL		**51.44**	**113.43**

BLOCK JHUNIR DISTRICT MANSA, PUNJAB
DEPTH TO WATER LEVEL - DECADAL MEAN POST MONSOON
VS
DECADAL MEAN TREND POST MONSOON
(2004-2013)



Legend

Decadal mean water level (post monsoon)

- 0.00 - 5.00 mbgl
- 5.00 - 10.00 mbgl

Decadal mean water level trend (m)

- 0.00 - 0.1114
- - 0.1 - 0.00
- Canal Network
- Water Bodies

1810	No. of Recharge Structures in Rural Villages
-	No. of Recharge Structures in Urban Towns
3399	Recharge Pits in Agricultural Land
24.50	Thickness of Sand

Ground Water Scenario of Block

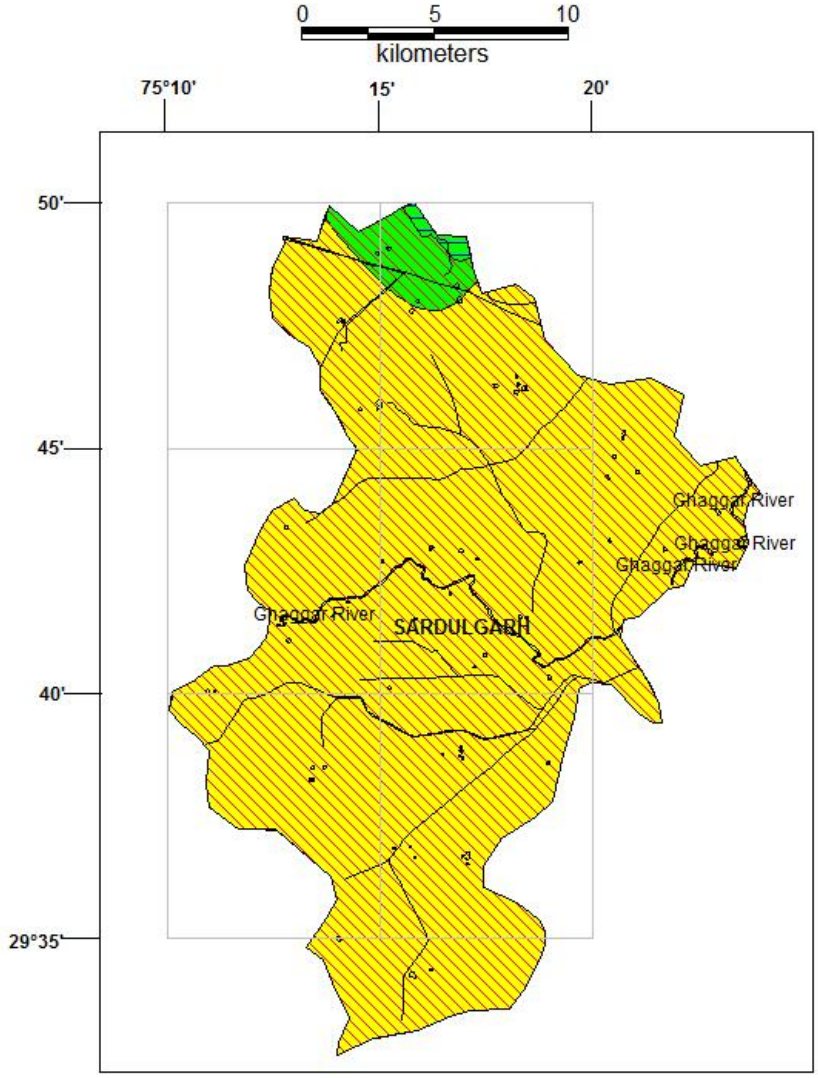
Block Name:- Jhunir **District:- Mansa**		**State:- PUNJAB**
1. `	GENERAL INFORMATION	
	i) Geographical area (sq km)	*583.3*
	• Number of Villages inhabited • Un-inhabited	*41* *0*
	ii) Average Annual Rainfall (mm)	*387*
	iii) Area feasible for Artificial Recharge	*466.64*
	iv) Village identified under scarcity of Water	*41*
	v)Village covered under water supply	*41*
	vi) Water Tank exists in the village	*26*
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	*Ghaggar 100%*
3.	LAND USE	
	• Area According to Village Papers (Sq.Km)	337.97
	• Net Area Sown (Sq.Km)	305.87
	• Area Sown More than Once (Sq.Km)	2.58
	• Total Cropped Area (Sq.Km)	308.45
	• Cropping Intensity	101
	• Area under Thur and Sem (Sq.Km)	--
4.	PREDOMINAT GEOLOGICAL FORMATIONS	*Recent alluvium*
5.	HYDROGEOLOGY	
	Major Water bearing Formation (Aquifer)	Fine to coarse Sand
	Avg. Depth to water level (decadal)	Depth to water level May 2015 (mbgl)
	• Pre- monsoon: (May 2015) • *3.92-7.35 (mbgl)*	*2.00 – 10.00mbgl)*
	• Post –monsoon: (Nov2014) • *2.17-8.29 (mbgl)*	

6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)		
	• No of wells drilled	*4*	
	• Depth Range (m)	*85.0-380.60*	
	• Discharge (Ipm)	*912-3000*	
	Aquifer Parameters		
	• Transmissivity (m2/day)	*43-1590*	
	• Storativity	*$13*10^{-3}$*	
	• Specified yield	*0.072*	
7.	GROUND WATER QUALITY	Min	Max
	• EC in µS/cm at 25^0c	*335*	*5870*
	• NO3 (mg/l)	*1.3*	*54*
	• F (mg/l)	*0.57*	*1.7*
	• As (mg/l)	--	0.0024
8.	DYANMIC GROUND WATER RESOURCES in MCM	**2011**	
	• Net Ground Water Availability (Mcm)	148.88	
	• Existing Gross Ground Water Draft for Irrigation (Mcm)	210.52	
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (Mcm)	--	
	• Existing Gross Ground Water Draft for all Uses (Mcm)	210.52	
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (Mcm)	--	
	• Net Ground Water Availability for Future Irrigation Development (Mcm)	-61.64	
	• Stage of Ground Water Development (%)	141	
	• Category of Block	OE	
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in ground water level	*Extensive Irrigation*	Extensive Irrigation
9.	Percentage of sand thickness up to 50 m depth (Average)	*Thickness(m) 24.5*	Percentage % 49
10	Volume of unsaturated zone available for recharge (MCM)	380.23	
11.	Volume of water required for recharge (MCM)	505.85	

12.	Volume of surplus water available for recharge(MCM)	13.11

RECHARGE/ CONSERVATION STRUCTURES		Total Number of Recharge Structures	Total Cost (Rs. in crores)	Total Recharge/ Water saving in MCM
13	Farm Recharge @Rs. 35000/-	3399	**11.90**	**1.952**
14	RWH Rural @ Rs. 25000/-	1810	**4.53**	**0.083**
15	RWH Urban@ Rs. 25000/-	0	**0.00**	**0**
16	Underground pipe line (area in hectares) @ Rs. 50000/-	3050	**15.25**	**49.345**
	TOTAL		**31.67**	**51.38**

BLOCK SARDULGARH DISTRICT MANSA, PUNJAB
DEPTH TO WATER LEVEL - DECADAL MEAN POST MONSOON
VS
DECADAL MEAN TREND POST MONSOON
(2004-2013)



Legend

Decadal mean water level (post monsoon)

0.00 - 5.00 mbgl

5.00 - 10.00 mbgl

Decadal mean water level trend (m)

- 0.1 - 0.00

Canal Network

Water Bodies

1768	**No. of Recharge Structures in Rural Villages**
373	**No. of Recharge Structures in Urban Towns**
3642	**Recharge Pits in Agricultural Land**
15	**Thickness of Sand**

Ground Water Scenario of Block

Block Name:- Sardulgarh **District:- Mansa**		**State:- PUNJAB**
1. `	GENERAL INFORMATION	
	i) Geographical area (sq km)	*232.9*
	• Number of Villages inhabited • Un-inhabited	*44* *0*
	ii) Average Annual Rainfall (mm)	*414*
	iii) Area feasible for Artificial Recharge	*210*
	iv) Village identified under scarcity of Water	*39*
	v)Village covered under water supply	*39*
	vi) Water Tank exists in the village	*25*
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	*Ghaggar 100%*
3.	LAND USE	
	• Area According to Village Papers (Sq.Km)	340.45
	• Net Area Sown (Sq.Km)	320.86
	• Area Sown More than Once (Sq.Km)	2.61
	• Total Cropped Area (Sq.Km)	323.47
	• Cropping Intensity	101
	• Area under Thur and Sem (Sq.Km)	--
4.	PREDOMINAT GEOLOGICAL FORMATIONS	*Recent alluvium*
5.	HYDROGEOLOGY	

	Major Water bearing Formation (Aquifer)	Fine to coarse Sand	
	Avg. Depth to water level (decadal)	Depth to water level May 2015(mbgl)	
	• Pre- monsoon: (May 2015) • *3.02-13.01mbgl)*	*2.00 -20.0 (mbgl)*	
	• Post –monsoon: (Nov2014) • *5.43-12.80(mbgl)*		
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)		
	• No of wells drilled	*1*	
	• Depth Range (m)	*85.0-380.60*	
	• Discharge (Ipm)	*912-3000*	
	Aquifer Parameters		
	• Transmissivity (m2/day)	*43-1590*	
	• Storativity	*$13*10^{-3}$*	
	• Specified yield	*0.072*	
7.	GROUND WATER QUALITY	Min	Max
	• EC in µS/cm at 25^0c	--	--
	• NO3 (mg/l)	--	--
	• F (mg/l)	--	--
	• As (mg/l)	--	--
8.	DYANMIC GROUND WATER RESOURCES in MCM	**2011**	
	• Net Ground Water Availability (Mcm)	91.01	
	• Existing Gross Ground Water Draft for Irrigation (Mcm)	220.15	
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (Mcm)	4	
	• Existing Gross Ground Water Draft for all Uses (Mcm)	220.19	
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (Mcm)	4	
	• Net Ground Water Availability for Future Irrigation Development (Mcm)	-129.18	
	• Stage of Ground Water Development / Over draft(%)	242	

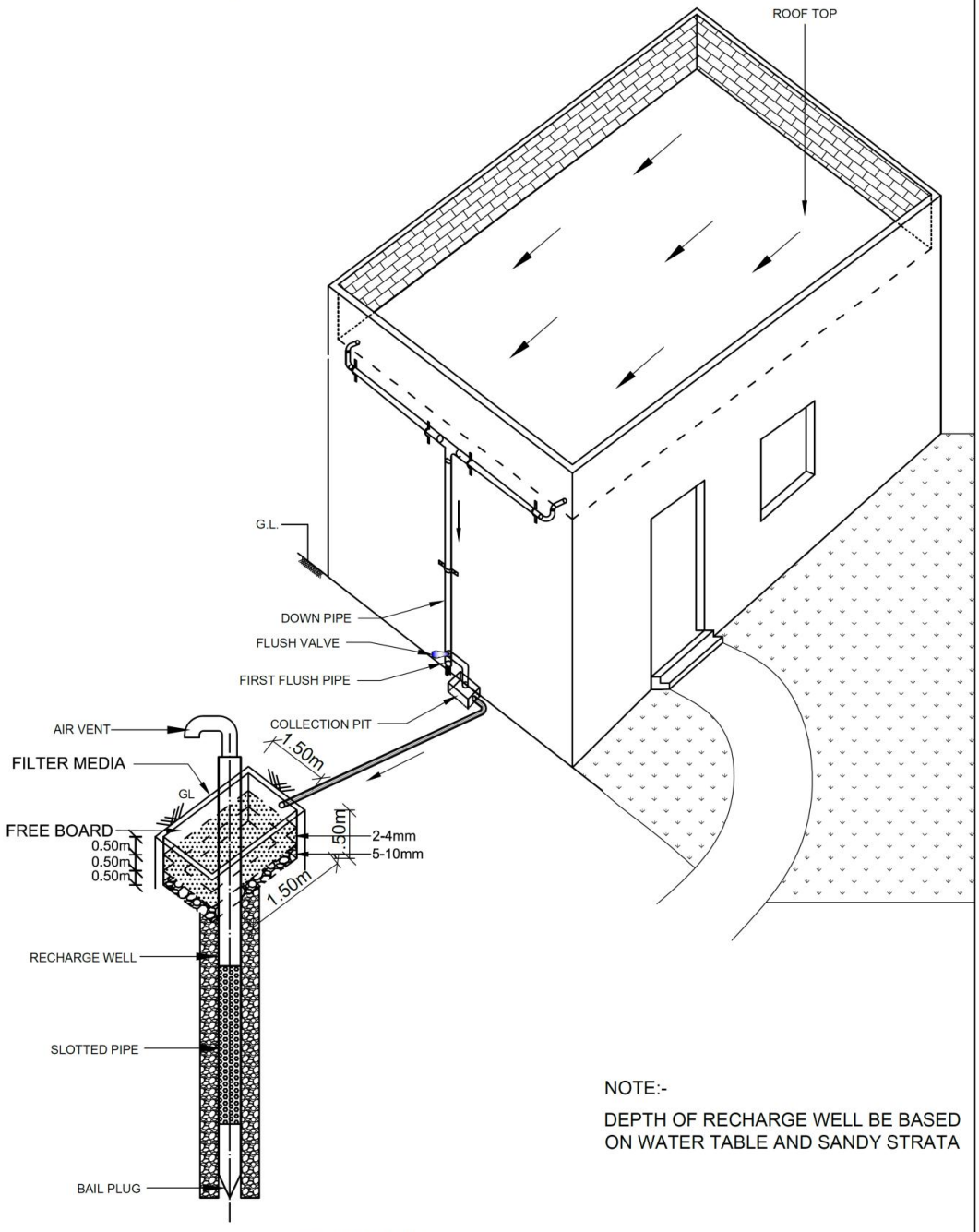
	• Category of Block	OE	
	Any specific reasons for high stress on ground water leading to Overexploitation and decline in ground water level	*Extensive irrigation*	Extensive Irrigation
9.	Percentage of sand thickness up to 50 m depth (Average)	*Thickness(m)* *15*	Percentage % 30
10	Volume of unsaturated zone available for recharge (MCM)	151.82	
11.	Volume of water required for recharge (MCM)	201.97	
12.	Volume of surplus water available for recharge(MCM)	5.24	

RECHARGE/ CONSERVATION STRUCTURES		**Total Number of Recharge Structures**	**Total Cost (Rs. in crores)**	**Total Recharge/ Water saving in MCM**
13	Farm Recharge @Rs. 35000/-	3642	**12.75**	**2.19**
14	RWH Rural @ Rs. 25000/-	1768	**4.42**	**0.86**
15	RWH Urban@ Rs. 25000/-	373	**0.93**	**0.02**
16	Underground pipe line (area in hectares) @ Rs. 50000/-	4905	**24.53**	**53.73**
	TOTAL		**42.62**	**56.80**

Annexure-I

RECHARGE FROM ROOF TOP RAIN WATER HARVESTING

(URBAN & RURAL HOUSEHOLDS)



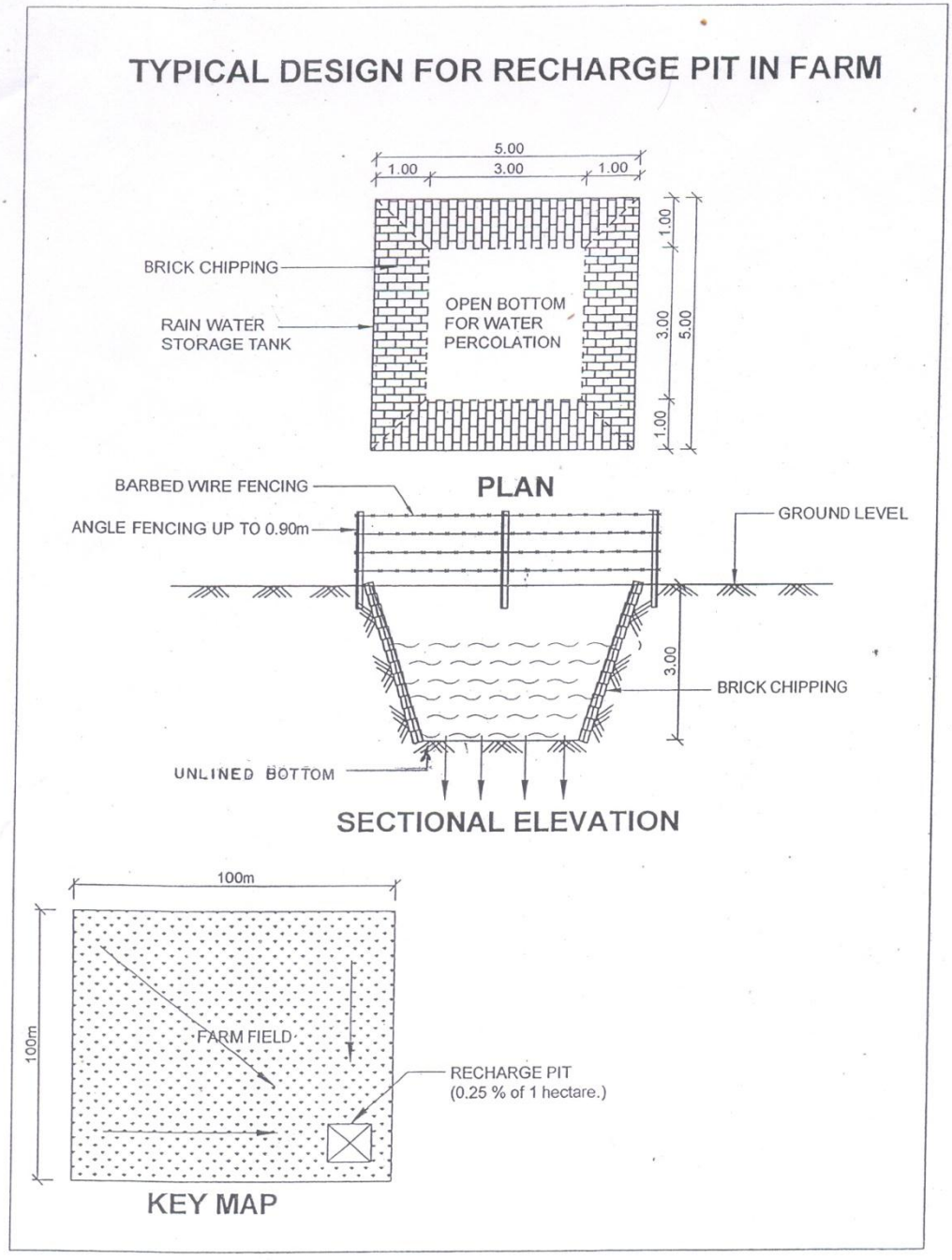
NOTE:-

DEPTH OF RECHARGE WELL BE BASED ON WATER TABLE AND SANDY STRATA

3-D VIEW

CGWB/NWR/Chandigarh

Annexure-II


TYPICAL DESIGN FOR RECHARGE PIT IN FARM
5.00
1.00
3.00
1.00
BRICK CHIPPING
RAIN WATER
STORAGE TANK
OPEN BOTTOM
FOR WATER
PERCOLATION
1.00
3.00
5.00
1.00
PLAN
BARBED WIRE FENCING
ANGLE FENCING UP TO 0.90m
GROUND LEVEL
3.00
BRICK CHIPPING
UNLINED BOTTOM
SECTIONAL ELEVATION
100m
100m
FARM FIELD
RECHARGE PIT
(0.25 % of 1 hectare.)
KEY MAP