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

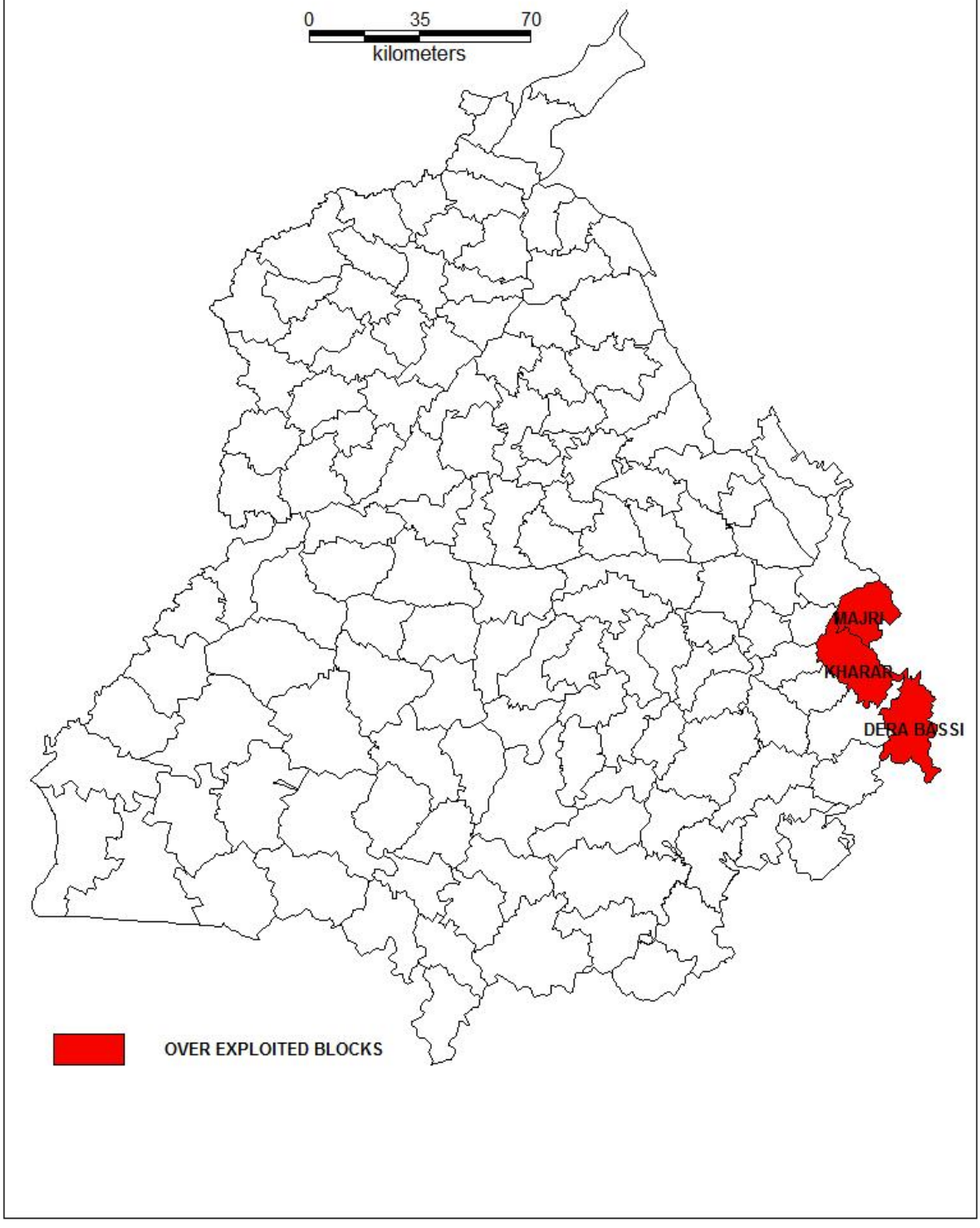
PLAN ON

ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION IN

OVEREXPLOITED BLOCKS OF S.A.S NAGAR DISTRICT, PUNJAB

Central Ground Water Board
North Western Region
Chandigarh

PLAN OF ARTIFICIAL RECHARGE TO GROUND WATER IN OVER EXPLOITED BLOCKS DISTRICT S.A.S NAGAR, PUNJAB



PLAN OF ARTFICIAL RECHARGE TO GROUND WATER IN OVER EXPLOITED BLOCKS, DISTRICT S.A.S NAGAR PUNJAB

INTRODUCTION

S.A.S Nagar district is located in the eastern part of the Punjab state and lies between North latitudes of 30°21'00" and 30°56'00" and East longitudes of 76°30'00" and 76°55'00" covering a geographic ambience of 1189 sq.km. The district is bounded by Patiala and Fatehgrah Sahib district in the south-west, Ropar district in the northwest, Chandigarh and Panchkula in the east and Ambala district of Haryana state in the south.

The district was created by carving out 2 blocks (Sialba Majra and Kharar) from Ropar district and one block (Derabassi) from Patiala district. Administratively, the district is divided into 3 tehsil viz.,Derabassi, Mohali & Kharar comprising of 3 development blocks. The total population of the district is 9,86,147. The decennial growth rate (2001-2011) of population in the district is 30.02%. The literacy rate is 84.9 % and the population density is 830 persons/sq.km.

The Ghaggar River and its tributaries form the natural drainage system on Derabassi block of the district. While north-eastern part is drained by Siswan Nadi, Jainti Devi Ki Rao and Patiali Rao, which emerge from the Siwalik Hills. The Siswan Nadi drains the northern part of the district and finally converges with Sutlej River in the Ropar district. While Jainti Devi Ki Rao and Patiali Rao drains in NE-SW direction and joins the Ghaggar River.

CLIMATE & RAINFALL

The climate of S.A.S district can be classified as subtropical monsoon. The normal annual rainfall of the district is 1061 mm which is unevenly distributed over the area in 49 days. The south west monsoon contributes about 80% of annual rainfall.

GEOMORPHOLOGY AND SOIL TYPES

The area can be broadly grouped into two depending upon its geomorphic features as alluvial fan and alluvial plains. Alluvial fans are deposited by hill torrents with a wavy plain rather than a steep slope. Adjacent to the alluvial fan are the alluvial plains which forms a part of large Indo-Gangetic Quaternary basin comprises of thick sand and silty sand layers interbedded with silt and clay beds. The alluvial plains are of vital economic value as it supports the dense population of the district. The soils are mainly developed on alluvium under the dominant influence of climate followed by topography and time. The major soil type of the district is weakly solonized tropical arid brown soils.

HYDROGEOLOGY

The CGWB has drilled 11 exploratory wells, 2 slim holes and 1 piezometer in the district in the depth range of 295-590 m bgl to determine the various aquifer systems and its extent. All the exploratory wels drilled in the Derabassi block were abandoned due to insufficient thickness of aquifer zones and low yield. Exploratory drilling has revealed 4-13 saturated granular zones comprising of fine to coarse sand, silt and kankar up to the total drilled depth of 460 m in Kharra and Sialba Majra blocks. The discharge ranges from 870-2407 lpm for 21.65 and 11.36 m drawdown respectively. The transmissivity and hydraulic conductivity varies between 55 to 862 m2/day and 7.4 - 48m/day respectively. The storativity value ranges between 7.3*10-4- 2.4*10-3, which clearly indicates a leaky confined condition.

The S.A.S Nagar district is occupied by Quaternary Alluvial deposits belonging to the vast Indo-Gangetic alluvial plains, which forms the main aquifer system. Groundwater occurs under phreatic conditions in the shallow aquifers while leaky confined to confine conditions occur along the deeper aquifers of Quaternary alluvial deposits.

The principal aquifer system of the district is Alluvium and major aquifer system is Depth to water level maps of pre monsoon (May 2011), post monsoon (Nov. 2011) and seasonal fluctuation (May 2011 to Nov. 2011) are given in plate III,IV & V respectively. In major part of the district, the water level ranges between 5 and 10 m while the water level in the north western and eastern part is between 10 to 20 meters, in the extreme western part of the district water levels are around 30 meters. In the southern part of the district water level ranges from 2 to 5 meters. Seasonal fluctuation shows that, in general, there is an overall decline in the water level except few isolated patches.

Depth to water level ranges from 2.14 to 32.24 m bgl during pre-monsoon and 2.61 to 33.37 m bgl during post monsoon period. Seasonal fluctuations (pre & post 2011) in the district ranges from -1.03 to 3.67 meters. The long-term trend of water level (2002 to 2011) also shows that there is decline in water level on major part of the area ranging from 0.16 to 0.35 m/yr except a few isolated patches where there is rise at the rate 0.02 to 0.06 m/yr which is insignificant.

GROUND WATER RESOURCES

Groundwater resource potential of the district has been assessed as per Groundwater Resource Estimation Methodology (GEC-97) as on 31.03.11 by considering administrative block as the assessment unit. Net ground water development of the district is 27484 ham and exiting ground water draft for all users is 28194 ham. Net ground water availability for future irrigation development is -1626 ham. The stage of groundwater development in the district as a whole is 103%. It falls under Over Exploited category.

The stage of groundwater development in Dera Bassi ,& Kharar blocks is 134 % & 101% respectively and falls under Over Exploited category, whereas stage of ground water development of Sialba Majri Block is 46 % and falls in safe category.

HYDROCHEMISTRY

The ground water in the district is slightly alkaline in nature with medium to high salinity. The pH values ranges from 7.38 to 8.08. Chloride, nitrate & fluoride are the important parameters that are normally considered for evaluating the suitability of ground water for drinking uses and it is found that the ground water in the district is suitable for domestic use as all cations and anions are within the permissible limits as per BIS 10,500-1991 standard. Iron which is an essential plant and animal nutrient is found to be within permissible limit except in some parts of the district. Arsenic is below permissible limits in whole of the district.

Salinity (Ec), sodium absorption ration (SAR) and Residual Sodium Carbonate (RSC) are the basic parameters considered for ascertaining the suitability of ground water. The chemical data indicates that most of water fall in C_2S_1 category in USSL plot and is suitable for irrigation purposes.

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	**S.A.S NAGAR**	**601**	**1850**	**3577**	**2484**	**538**	**9050**

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	**S.A.S NAGAR**	**50**	**325**	**877**	**1067**	**267**	**2586**

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	**S.A.S NAGAR**	**0**	**2570**	**2891**	**3589**	**0**	**9050**

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	**S.A.S NAGAR**	**1821**	**9815**	**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.**	**10407**	0.25	**26.02**	**1.291**
2	**Roof Top Rain Water Harvesting in Rural Areas**	**6042**	0.25	**15.11**	**0.562**
	Total	**16449**	**0.25**	**41.12**	**1.853**
ARTIFICIAL RECHARGE IN FARMS					
1	**Artificial Recharge Plan Through Recharge Pits.**	6959	0.35	**24.35**	8.094
			Total	**24.35**	**8.094**

By the implementation of the proposed recharge structures there will be a reduction of 4.04 % 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	**281.94**	**-162.6**	**9.947**	**271.993**	**103%**	**98.96%**	**4.04 %**

ARTIFICIAL RECEHARGE PLAN THROUGH RECHARGE PITS IN OVER EXPLOITED BLOCKS S.A.S NAGAR 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)
KHARAR	**35502.80**	**3553**	**3553**	**4.125**	**12.44**
DERA BASSI	**34055.90**	**3406**	**3406**	**3.969**	**11.92**
			6959	**8.094**	**24.36**

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 S.A.S. NAGAR 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**	**Total No of AR Structures**	**Total recharge in MCM**	**Cost @ 0.25Lacs/structure (Crores)**
S.A.S NAGAR	1	KHARAR	**35502.80**	**32773**	**3277**	**3277**	**0.304**	**8.19**
	2	DERA BASSI	**34055.90**	**27646**	**2765**	**2765**	**0.258**	**6.91**
		Total	**218780**	**60419**	**6042**	**6042**	**0.562**	**15.11**

ARTIFICIAL RECHARGE PLAN FOR URBAN AREAS OF DISTRICT S.A.S NAGAR PUNJAB

District	Block	Town Name	Total Households	Total Population of Town	Households taken for Artificial Recharge (10%)	Total Roof Top Area (sqm)	Vol of water available for recharge (MCM)	Cost @Rs.0.25 lakh
S.A.S NAGAR	KHARAR	KURALI (MCL)	6388	31060	639	127760	0.079	1.60
	KHARAR	KHARAR (MCL)	15930	74460	2000	400000	0.248	5.00
	KHARAR	NAYA GAON (NP)	11332	50869	2833	566600	0.351	7.08
	DERA BASSI	ZIRAKPUR (MCL)	20587	95553	1000	200000	0.124	2.50
	DERA BASSI	DERA BASSI (MCL)	5871	26295	1468	293550	0.182	3.67
	DERA BASSI	BHANKHARPUR (CT)	2176	10768	544	108800	0.068	1.36
	DERA BASSI	MIRPUR (CT)	1191	5967	298	59550	0.037	0.75
	DERA BASSI	MUBARAKPUR (CT)	1098	5217	275	54900	0.034	0.69
	DERA BASSI	DAPPER (CT)	1309	5963	327	65450	0.041	0.82
	DERA BASSI	LALRU (CT)	4093	21394	1023	204650	0.127	2.56
	TOTAL		69975	327546	10407	2081260	1.291	26.02

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 11636 tubewells operated by farmers for irrigation through unlined/Katcha (84.35%) open channel system in SAS Nagar 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 SAS Nagar district is estimated at 233.20 MCM. It is expected that around 20% 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 224.72 MCM assuming there is no crop diversification by the farmers.

The benefit will lead to saving of precious ground water resources in overexploited blocks of SAS Nagar Districts. The measure if implemented will bring down the ground water overdraft from 98% to 78 %. 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 tubewells 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 crop per drop**.

POTENTIAL FOR REDUCTION IN OVERDRAFT BY ENHANCING THE GROUND WATER USE EFFICIENCY IN IRRIGATION TUBEWELLS, SAS NAGAR 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
289.60	283.70	233.20	50.5	84.35	59.02	174.21	224.72	98	78	20

 # 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**
SAS NAGAR	Majri	**11464.4**	**84.35**	**9670**	**48.35**	**212.96**
	Kharar	**21873.1**	**84.35**	**18450**	**92.25**	
	Dera Bassi	**17156.6**	**84.35**	**14472**	**72.36**	

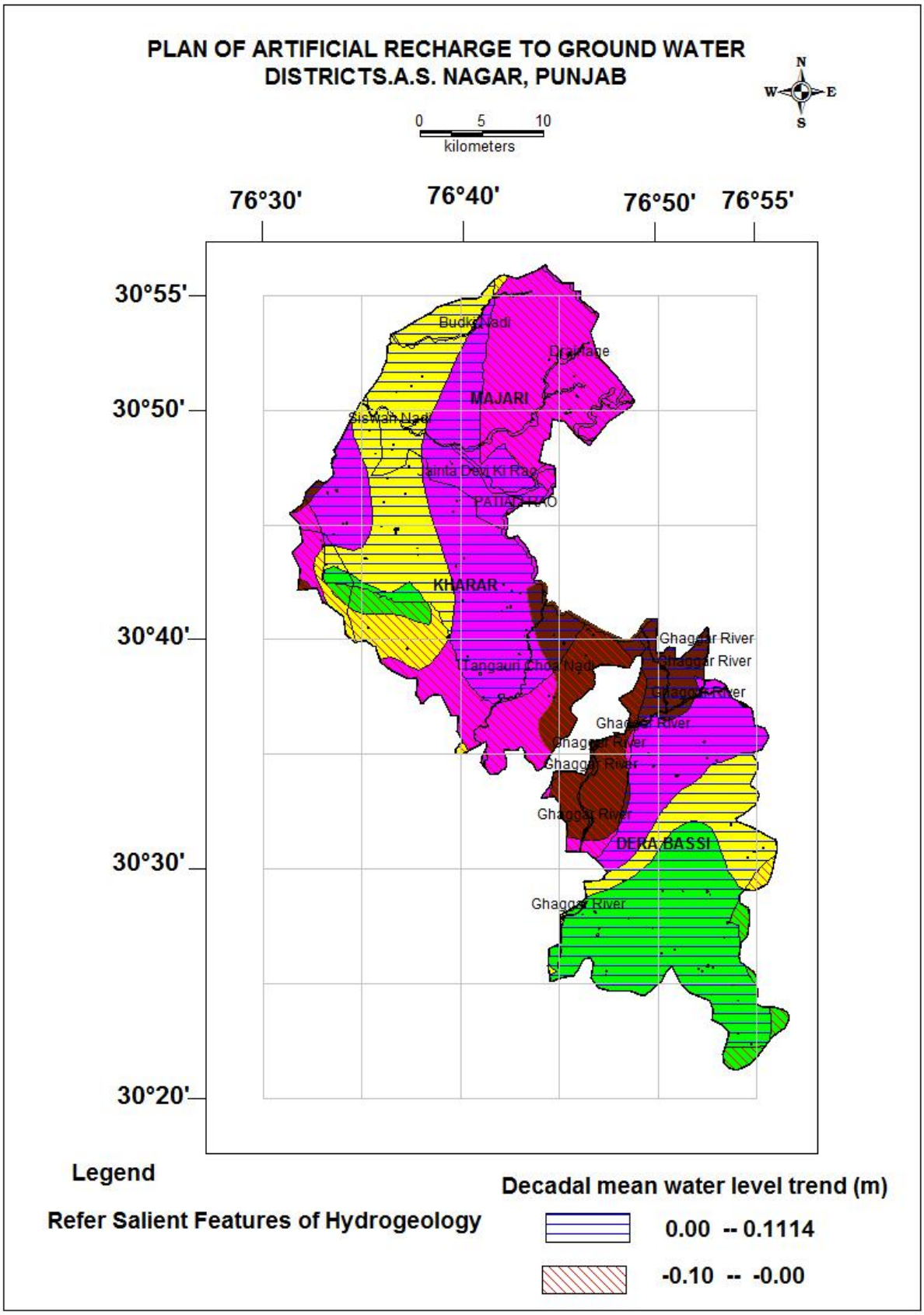
SALIENT FEATURES OF HYDROGEOLOGY OF DISTRICT S.A.S. NAGAR

Wells Feasible	Rigs Suitable	Depth of Well (m)	Discharge (lpm)	Suitable Artificial Recharge Structures
Tube Wells	Direct and Reverse Rotary	35 - 185	1300 - 2500	Recharge Shaft And Recharge Trench
Tube Wells	Direct and Reverse Rotary	50 - 220	1000 - 1300	Recharge Shaft And Recharge Trench
Tube Wells	Direct and Reverse Rotary	25 - 180	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	S.A.S. NAGAR
Geographical Area	1189 sq.km
Major Geological Formation	Alluviam and Shivaliks
Major Drainage System	Sutlej and Ghaggar
Population (as on 2011)	9,86,147
Total Number of Blocks	3
Existing Major/Medium Irrigation Projects	Nil
Utillizable Ground Water Resources 2011	274.84 (mcm)
Net Ground Water Draft	281.94 (mcm)
Stage of Ground Water Development	103 %
Average Annual Rainfall	1061 mm
Range of Mean Daily Temperature	7° - 40° C
Over Exploted Blocks	DERA BASSI KHARAR MAJRI


PLAN OF ARTIFICIAL RECHARGE TO GROUND WATER
DISTRICTS.A.S. NAGAR, PUNJAB
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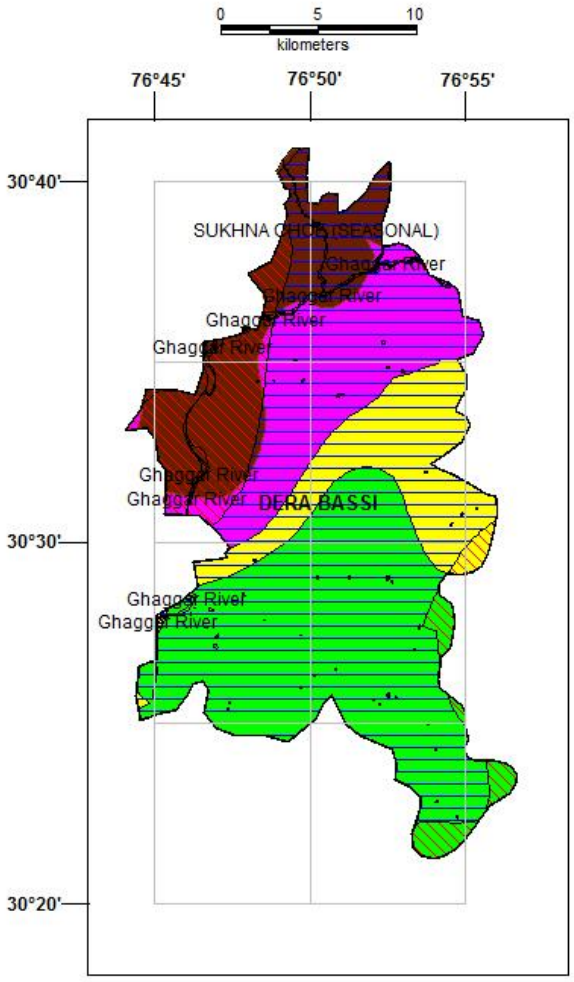
0 5 10
kilometers
76°30'
76°40'
76°50'
76°55'
30°55'
30°50'
30°40'
30°30'
30°20'
MAJARI
KHARAR
DERA BASSI
Legend
Refer Salient Features of Hydrogeology
Decadal mean water level trend (m)
0.00 -- 0.1114
-0.10 -- -0.00

BLOCK WISE PLAN OF DISTRICT S.A.S NAGAR PUNJAB

(2 OE BLOCKS)

BLOCK DERA BASSI DISTRICT S.A.S.NAGAR, 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
- 10.00 - 20.00 mbgl
- 20.00 - 40.00 mbgl

Decadal mean water level trend (m)

- 0.00 - 0.1114
- - 0.1 - 0.00

2765	No. of Recharge Structures in Rural Villages
4935	No. of Recharge Structures in Urban Towns
3406	Recharge Pits in Agricultural Land
12	Thickness of Sand
	Canal Network
	Water Bodies

Ground Water Scenario of Block

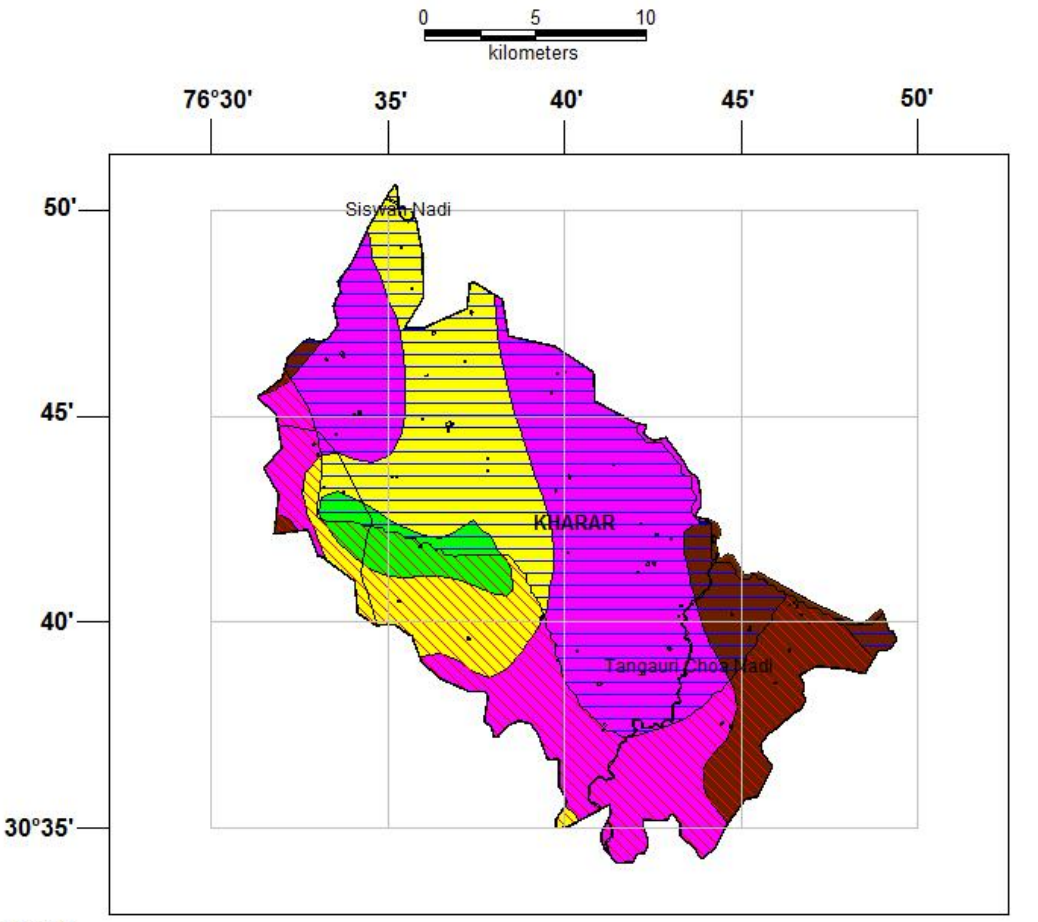
Block Name:-Dera Bassi **District:- Mohali**		**State:- PUNJAB**
1.	GENERAL INFORMATION	
	i) Geographical area (sq km)	*479.9*
	• Number of Villages inhabited • Un-inhabited	*122* *7*
	ii) Average Annual Rainfall (mm)	*782*
	iii) Area feasible for Artificial Recharge	*408*
	iv) Village identified under scarcity of Water	*135*
	v) Village covered under water supply	*112*
	vi) Water Tank exists in the village	*58*
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	 *Ghaggar100%*
3.	LAND USE	
	• Area According to Village Papers (Sq.Km)	312.23
	• Net Area Sown (Sq.Km)	199.64
	• Area Sown More than Once (Sq.Km)	162.21
	• Total Cropped Area (Sq.Km)	361.85
	• Cropping Intensity	181
	• Area under Thur and Sem (Sq.Km)	89
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) • *3.25-29.60(mbgl)*	*2.00 -40.00(mbgl)*	
	• Post –monsoon: (Nov2014) • *0.88-25.30(mbgl)*		
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)		
	• No of wells drilled	*5*	
	• Depth Range (m)	*75.80-562.97*	
	• Discharge (Ipm)	*870-1984*	
	Aquifer Parameters		
	• Transmissivity (m2/day)	*55-862*	
	• Stortivity	*$1.2*10^{-3}$ to $7.3*10^{-4}$*	
	• Specified yield	*0.072*	
7.	GROUND WATER QUALITY	Min	Max
	• EC in µS/cm at 25^0c	*658*	*954*
	• NO3 (mg/l)	*1.3*	*76*
	• F (mg/l)	*0.35*	*0.69*
	• As (mg/l)	*0.0014*	*0.0023*
8.	DYANMIC GROUND WATER RESOURCES in MCM	**2011**	
	• Net Ground Water Availability (MCM)	119.00	
	• Existing Gross Ground Water Draft for Irrigation (MCM)	139.59	
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM)	19.65	
	• Existing Gross Ground Water Draft for all Uses (MCM)	159.23	
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM)	22.55	

	• Net Ground Water Availability for Future Irrigation Development (MCM)	-43.14	
	• Stage of Ground Water Development/ Over Draft (%)	134	
	• 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)* *12*	Percentage % 24
10	Volume of unsaturated zone available for recharge (MCM)	371.09	
11.	Volume of water required for recharge (MCM)	493.70	
12.	Volume of surplus water available for recharge(MCM)	11.63	

	RECHARGE/ CONSERVATION STRUCTURES	**Total Number of Recharge Structures**	**Total Cost (Rs. in crores)**	**Total Recharge/ Water saving in MCM**
13	Farm Recharge @Rs. 35000/-	3406	**11.92**	**3.969**
14	RWH Rural @ Rs. 25000/-	2765	**6.91**	**0.258**
15	RWH Urban@ Rs. 25000/-	4935	**12.34**	**0.613**
16	Underground pipe line (area in hectares) @ Rs. 50000/-	14472	**72.36**	**34.94**
TOTAL			**103.53**	**39.78**

BLOCK KHARAR DISTRICT S.A.S.NAGAR, 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
- 10.00 - 20.00 mbgl
- 20.00 - 40.00 mbgl

Decadal mean water level trend (m)

- 0.00 - 0.1114
- - 0.1 - 0.00

3277	No. of Recharge Structures in Rural Villages
5472	No. of Recharge Structures in Urban Towns
3553	Recharge Pits in Agricultural Land
24	Thickness of Sand
	Canal Network
	Water Bodies

Ground Water Scenario of Block

Block Name:-Kharar **District:- Mohali**		**State:- PUNJAB**
1.	GENERAL INFORMATION	
	vii) Geographical area (sq km)	*416.2*
	• Number of Villages inhabited • Un-inhabited	*148* *4*
	viii) Average Annual Rainfall (mm)	*780*
	ix) Area feasible for Artificial Recharge	*416.2*
	x) Village identified under scarcity of Water	*142*
	xi) Village covered under water supply	*123*
	xii) Water Tank exists in the village	*58*
2.	GEOMORPHOLOGY	
	Major Physiographic	Alluvium Plain
	Major drainages Basin Sub-Basin	 *Ghaggar 97%* Satluj 3%
3.	LAND USE	
	• Area According to Village Papers (Sq.Km)	327.13
	• Net Area Sown (Sq.Km)	229.69
	• Area Sown More than Once (Sq.Km)	185.66
	• Total Cropped Area (Sq.Km)	415.35
	• Cropping Intensity	181
	• Area under Thur and Sem (Sq.Km)	0
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)	*5.00 – 20.00 (mbgl)*

	• 6.58-18.65(mbgl)		
	• Post –monsoon: (Nov2014) • 4.53-17.35 (mbgl)		
6.	GROUND WATER EXPLORATION BY CGWB (As on 31.03.2015)		
	• No of wells drilled	*5*	
	• Depth Range (m)	*75.80-562.97*	
	• Discharge (Ipm)	*870-1984*	
	Aquifer Parameters		
	• Transmissivity (m2/day)	*55-862*	
	• Stortivity	*$1.2*10^{-3}$ to $7.3*10^{-4}$*	
	• Specified yield	*0.072*	
7.	GROUND WATER QUALITY	Min	Max
	• EC in µS/cm at 25^0c	*678*	*1000*
	• NO3 (mg/l)	*1.9*	*14*
	• F (mg/l)	*0.24*	*2.15*
	• As (mg/l)	*0.0005*	*0.0023*
8.	DYANMIC GROUND WATER RESOURCES in MCM	**2011**	
	• Net Ground Water Availability (MCM)	92.21	
	• Existing Gross Ground Water Draft for Irrigation (MCM)	69.46	
	• Existing Gross Ground Water Draft for Domestic and Industrial Water Supply (MCM)	23.88	
	• Existing Gross Ground Water Draft for all Uses (MCM)	93.34	
	• Allocation for Domestic and Industrial Requirement Supply up to next 25 years (MCM)	28.71	
	• Net Ground Water Availability for Future Irrigation Development (MCM)	-5.96	
	• Stage of Ground Water Development / Over Draft(%)	101	
	• 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

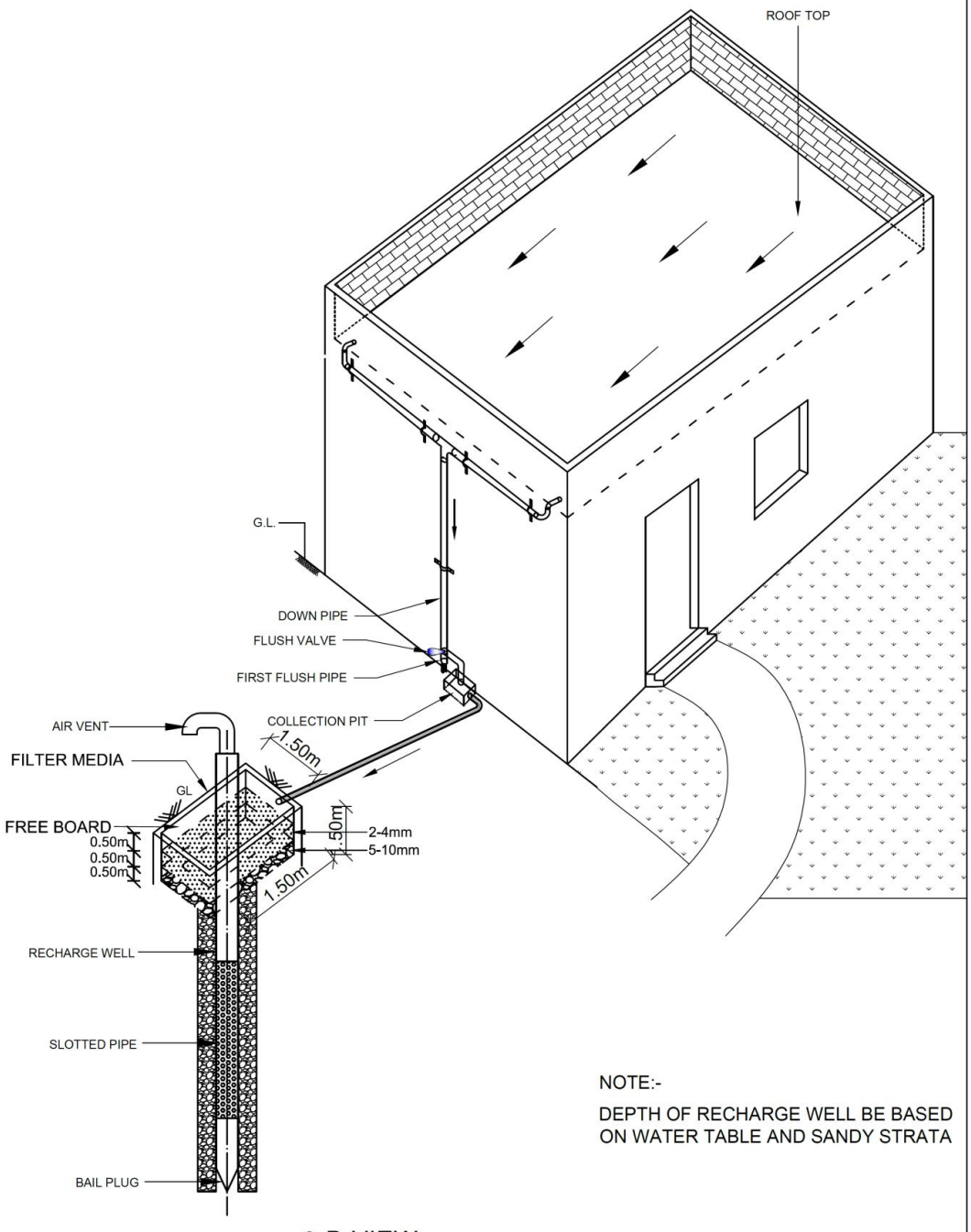
9.	Percentage of sand thickness up to 50 m depth (Average)	*Thickness(m) 24*	Percentage % 48
10	Volume of unsaturated zone available for recharge (MCM)	---	
11.	Volume of water required for recharge (MCM)	---	
12.	Volume of surplus water available for recharge(MCM)	----	

	RECHARGE/ CONSERVATION STRUCTURES	**Total Number of Recharge Structures**	**Total Cost (Rs. in crores)**	**Total Recharge/ Water saving in MCM**
13	Farm Recharge @Rs. 35000/-	3553	**12.44**	**4.125**
14	RWH Rural @ Rs. 25000/-	3277	**8.19**	**0.304**
15	RWH Urban@ Rs. 25000/-	5472	**13.68**	**0.678**
16	Underground pipe line (area in hectares) @ Rs. 50000/-	18450	**92.25**	**17.39**
TOTAL			**126.56**	**22.497**

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

TYPICAL DESIGN FOR RECHARGE PIT IN FARM