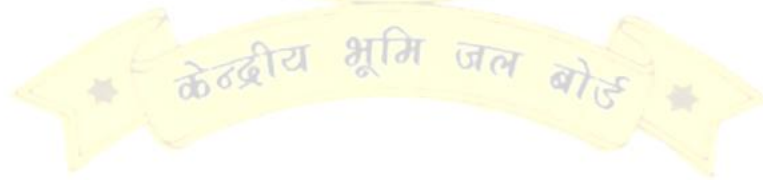




**STANDARD DESIGNS  
FOR  
ADOPTION OF ROOF TOP RAINWATER HARVESTING  
IN DELHI**



**CENTRAL GROUND WATER BOARD  
STATE UNIT OFFICE  
NEW DELHI**

## INTRODUCTION

National Capital Territory (NCT) Delhi covers an area of 1483 Sq. Km. The Ground Water available in the territory is controlled by the hydrogeological situation characterized by occurrence of alluvial formation and hard rocks such as quartzite. The hydrogeological set up and the following distinct physiographic units further influence the ground water occurrence: (1) Older Alluvial Plain on the eastern and western side of the ridge. (2) Yamuna Flood Plain deposits. (3) Isolated and nearly closed Chattarpur alluvial basin. (4) NNE-SSW trending Quartzite Ridge.

The high rate of population growth and high level of urbanization in NCT Delhi has resulted in over development of ground water resources. Thus in about 75% area of NCT Delhi ground water levels are declining at an alarming rate of 0.40 m per annum. In South and Southwest district the decline is high varying from 1 to 2 m/Yr. The annual replenishable ground water resources of the State is 0.31 bcm with a net annual ground water availability of 0.29 bcm. Ground water draft (as on 31<sup>st</sup> March 2009) is 0.40 bcm with a stage of ground water development of 138%. Out of the 27 assessment units (Tehsils) in the State, 20 have been categorized as over exploited, 05 semi critical and 02 have been categorized as safe from ground water development point of view.

In view of high state of ground water development, and depletion of ground water levels due to its over development Central Ground Water Authority (CGWA) had notified South and South-West district vide Public Notice No. 6 of 2000 dated 15.08.2000 and imposed prohibition and restriction for construction and installation of any structure for abstraction of ground water resources to avoid further depletion and deterioration of ground water quality. Subsequently the Hon'ble Lieutenant Governor had declared the whole NCT Delhi as notified on 31.03.2009 vide order No. F8 (348)/EA/Env/09/14433.

The normal annual rainfall of NCT Delhi is 611.8 mm out of which 81% of the annual rainfall is received during the monsoon months July, August and September. The rest of the annual rainfall is received as winter rain and as thunderstorm rain in the pre and post monsoon months.

In order to increase the natural ground water resource rain water harvesting and artificial recharge to ground water has become increasingly important in ground water management. The subsurface geology, post monsoon depth to water level and declining ground water level conditions of the State indicate that the area is suitable for artificial recharge. The favorable aquifer zones down to depth of ground water level which is lying unsaturated presently may be suitable recharged through rain water harvesting.

For the convenience of general public standard designs of Rainwater Harvesting have been prepared and placed on CGWB website.

**Permission to install various Artificial Recharge Structures and Recharge wells is governed by the prevailing rules and laws in the area.**

### Tehsil wise Rain Water Harvesting Structures in NCT Delhi

Sl No.	Tehsil	Recommended harvesting structures	Depth of recharge well (meter)	Remarks
	<b>District: New Delhi</b>			
1	Chanakyapuri	Trench with bore	18	
2	Connaught place	Only Trench	-	
3	Parliament Street	Trench with bore	18	
	<b>District: North West</b>			
4	Model Town	Only Trench	-	
5	Narela	Only Trench	-	
6	SaraswatiVihar	Only Trench	-	
	<b>District: West</b>			
7	Patel Nagar	Trench with bore	15	
8	Punjabi Bagh	Only Trench	-	
9	Rajouri Garden	Trench with bore	18	
	<b>District: South West</b>			
10	Delhi Cantt.	Trench with bore	25	
11	Najafgarh	Trench with bore	15	
12	VasantVihar	Trench with bore	35	
	<b>District: North East</b>			
13	Seelampur (North)	Only Trench*		
	Seelampur (South)	Only Trench	-	
14	Seemapuri	Only Trench	-	
15	Shahdara	Only Trench	-	
	<b>District: East</b>			
16	Gandhi Nagar	Only Trench*		
17	PreetVihar (East)	Trench with bore	15	
	PreetVihar (West)	Only Trench	-	
18	VivekVihar (East)	Trench with bore	15	
	VivekVihar (West)	Only Trench	-	
	<b>District: North</b>			
19	Civil Lines (North)	Only Trench*		
	Civil Lines (South)	Only Trench	-	
20	Kotwali	No Structure		
21	Sadar Bazar	No Structure		
	<b>District: Central</b>			
22	Daryaganj	Only Trench*		
23	Karolbagh (East)	Only Trench	-	
	Karolbagh (West)	Trench with bore	15	
24	Paharganj	Only Trench	-	
	<b>District: South</b>			
25	Defence Colony	Trench with bore	15-35	
26	HauzKhas	Trench with bore	50	
27	Kalkaji	Trench with bore	15-45	

\* Feasible where water level is more than 5 meter below ground level.

## Technical design of Roof Top Rain Water Harvesting and Artificial Recharge to Ground Water

### A. Trench without Recharge well

Roof Top Area (Sq. m)	Highest Rainfall intensity (mtr/ hourly)	Run-off Coefficient	Runoff/hr (cu. m)	Annual Runoff (cu. m)	Size of recharge Structure (mtr)
a	b	c	d(aXbXc)	e(aX0.54Xc)	LXBXH
100	0.025	0.8	2.0	43.20	1.2X1.2X1.4
200	0.025	0.8	4.0	86.40	1.8X1.5X1.5
300	0.025	0.8	6.0	129.6	2.4X1.8X1.4
400	0.025	0.8	8.0	172.8	2.7X2.1X1.4
500	0.025	0.8	10.0	216	3.3X2.1X1.5

Note: Normal rainfall in Delhi: 611 mm,

Normal monsoon rainfall: 540 mm

#### Points to be taken into consideration for implementation of the above structures:

1. Valid for buildings without basements (Cellar) and for areas for alluvial formation where ground water level is more than 5 meter upto 15 meter below ground level. Buildings with basements should adopt rain water harvesting through storage tank.
2. Only the rain water from the roof top area has to be diverted to recharge structure through connection of down pipe.
3. Before the onset of the monsoon all the catchment area (roof top) considered for recharge is to be cleaned. The recharge structures are to be in operation during the monsoon season only so as to avoid any contamination.
4. A mesh should be provided at the roof so that leaves or any other solid waste/debris is prevented from entering the pit. By-pass arrangement be provided before the collection chamber to reject the first showers.
5. The depth of the inlet pipe should be within 10 cm below ground level for easy overflow through outlet pipe that has to be connected to storm water drain.
6. Based on site condition length and breadth of the recharge chamber may be altered keeping its volumetric capacity the same.
7. RCC slab thickness and reinforcement shall be dependent on structural loads. Access manhole frame and covers to be provided.
8. Filter media of 1.0 meter thick will be in three layers comprising of 0.4 meter thick layer of boulders (5-20cm) at the bottom, 0.3 meter thick layer of gravels (5-10cm) in the middle and 0.3 meter thick layer of coarse sand (1.5-2.0mm) at the top so that the silt content that will come with runoff will be deposited on the top and can easily be removed.
9. A 10 cm thick layer of pea gravels will be provided over the coarse sand layer of the filter media.



10. Prior to monsoon season the top most sand layer in the pit may be scrapped and replaces with the fresh and cleaned coarse sand.

11. Recharge chambers shall be checked and cleaned at 7 days interval or more frequently during rainy season.

### **B. Trench with Recharge well**

Roof Area (m)	Top (Sq. m)	Highest Rainfall intensity (mtr/ hourly)	Run-off Coefficient	Runoff/hr (cu. m)	Annual Runoff (cu. m)	Size of recharge Structure (mtr)
a		b	c	d(aXbXc)	e(aX0.54Xc)	LXBXH
100		0.025	0.8	2.0	43.20	1.0X0.5X0.5
200		0.025	0.8	4.0	86.40	1.0X1.0X1.0
300		0.025	0.8	6.0	129.6	1.0X1.0X1.0
400		0.025	0.8	8.0	172.8	1.0X1.0X1.0
500		0.025	0.8	10.0	216	2.0X1.5X1.0

### **Points to be taken into consideration for implementation of the above structures:**

1. Valid for all buildings and for both alluvial and hard rock formation where ground water level is more than 15 meter below ground level.
2. Only the rain water from the roof top area has to be diverted to recharge structure through connection of down pipe.
3. Before the onset of the monsoon all the catchment area (roof top) considered for recharge is to be cleaned. The recharge structures are to be in operation during the monsoon season only so as to avoid any contamination.
4. A mesh should be provided at the roof so that leaves or any other solid waste/debris is prevented from entering the pit. By-pass arrangement be provided before the collection chamber to reject the first showers.
5. The depth of the inlet pipe should be within 10 cm below ground level for easy overflow through outlet pipe that has to be connected to storm water drain.
6. Based on site condition length and breadth of the recharge chamber may be altered keeping its volumetric capacity the same.
7. RCC slab thickness and reinforcement shall be dependent on structural loads. Access manhole frame and covers to be provided.
8. Filter media of 1.0 meter thick will be in three layers comprising of 0.4 meter thick layer of boulders (5-20cm) at the bottom, 0.3 meter thick layer of gravels (5-10cm) in the middle and 0.3 meter thick layer of coarse sand (1.5-2.0mm) at the top so that the silt content that will come with runoff will be deposited on the top and can easily be removed.
9. A 10 cm thick layer of pea gravels will be provided over the coarse sand layer of the filter media.

10. Prior to monsoon season the top most sand layer in the pit may be scrapped and replaces with the fresh and cleaned coarse sand.

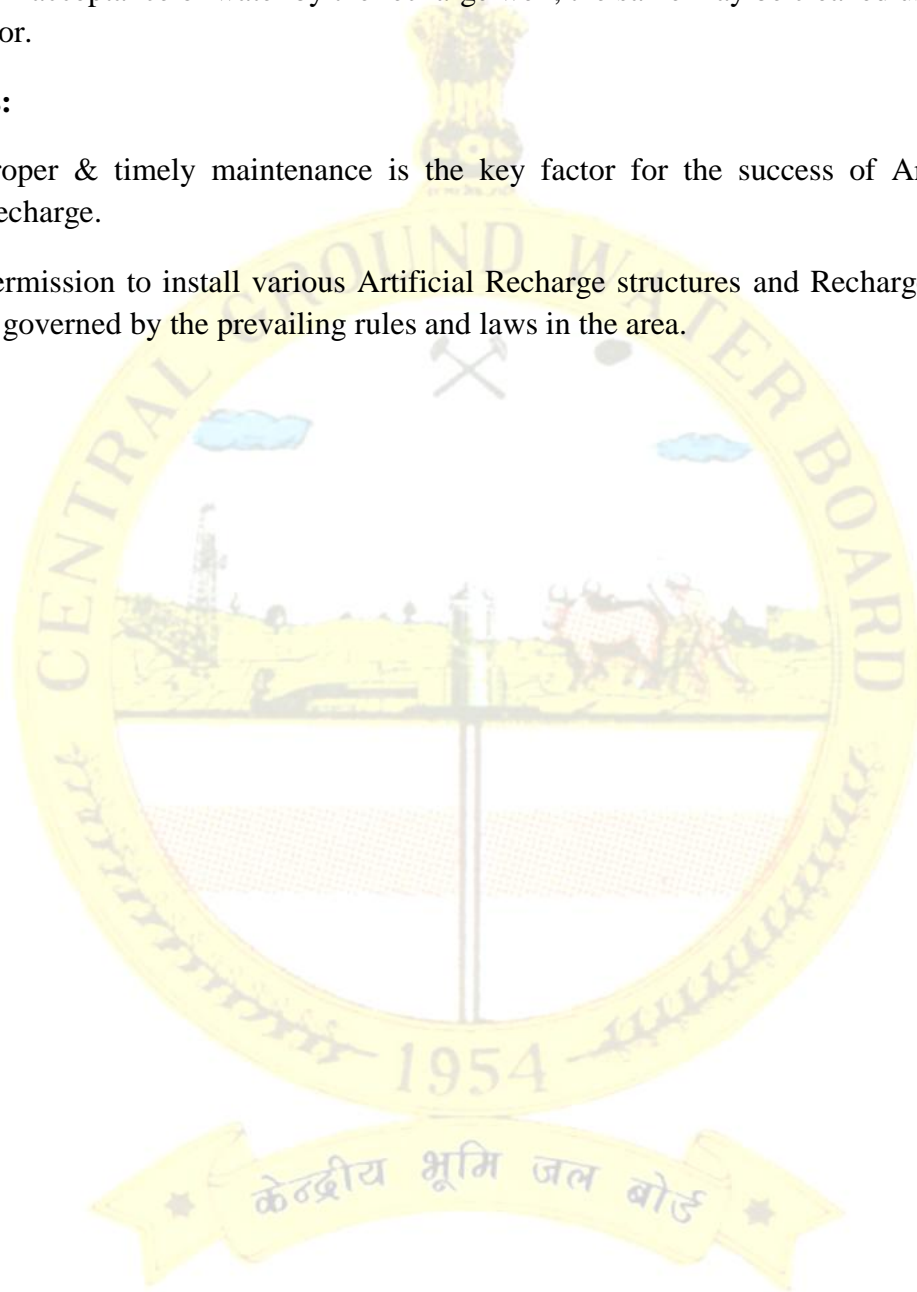
11. Recharge chambers shall be checked and cleaned at 7 days interval or more frequently during rainy season.

12. Depth of the recharge wells should be kept 2to 3 meter above post monsoon water level and the slotted pipe must be placed against the granular (Sandy of Fracture) zone.

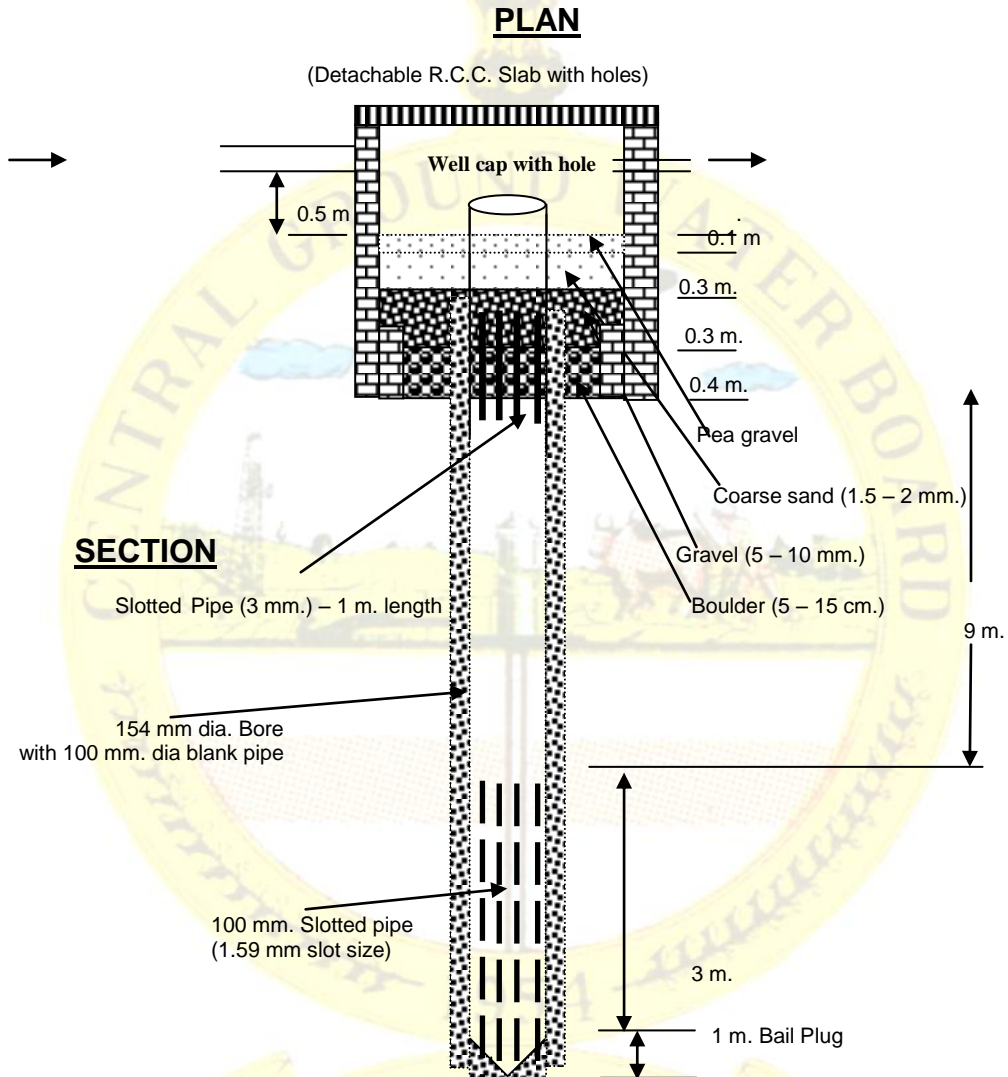
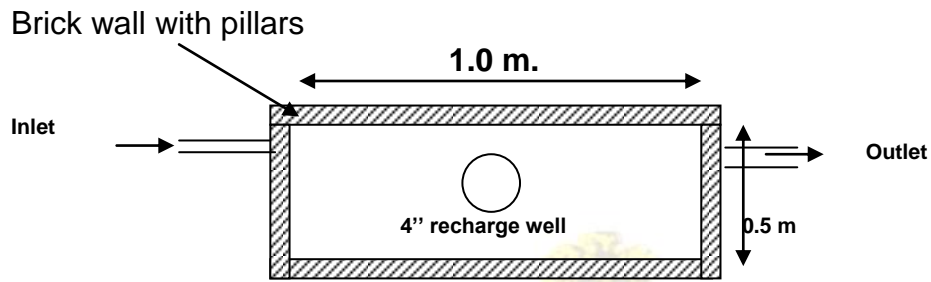
13. On non-acceptance of water by the recharge well, the same may be cleaned using air compressor.

**Remarks:**

1. Proper & timely maintenance is the key factor for the success of Artificial Recharge.
2. Permission to install various Artificial Recharge structures and Recharge wells is governed by the prevailing rules and laws in the area.



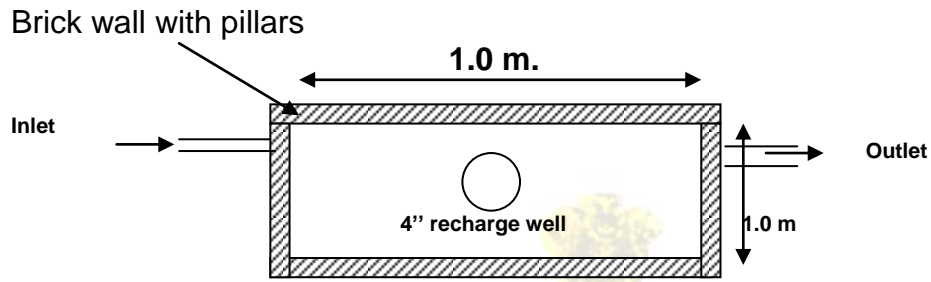
## Trench with Recharge well (Roof top area upto 100 sq. m)



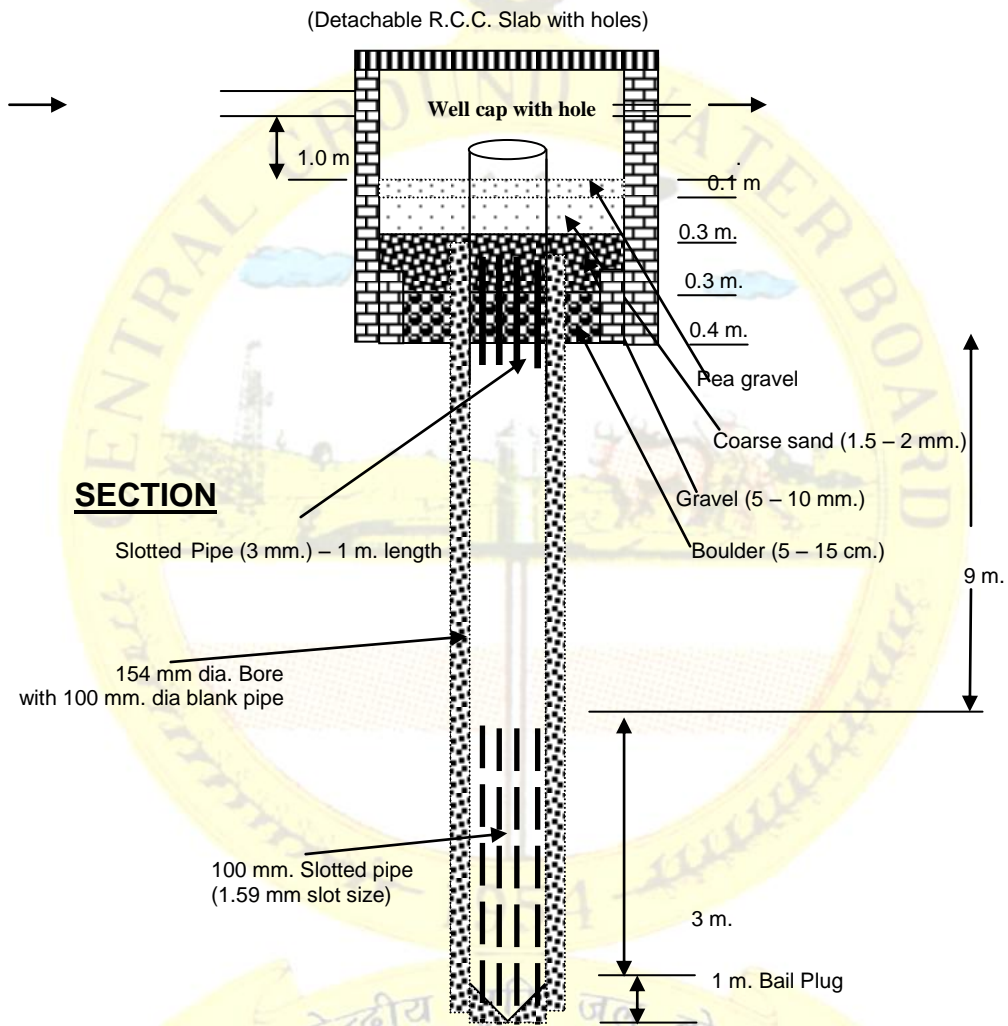
**Note:**

1. Based on post monsoon depth to water level, the recharge well depth will change and should be kept 2to 3 meter above post monsoon water level.
2. The design is indicative; the actual design depends on site condition.

## Trench with Recharge well (Roof top area 100-200 sq. m)



### PLAN

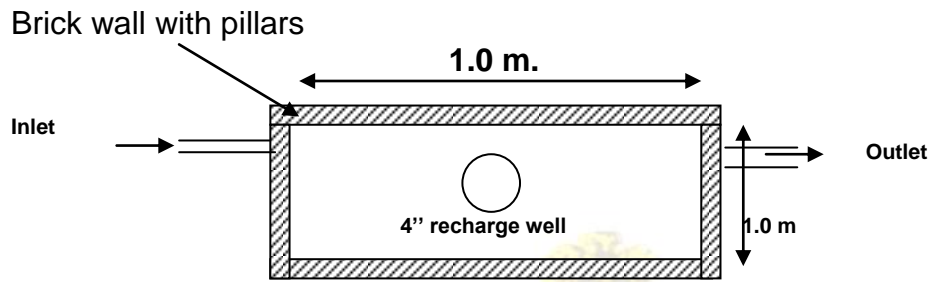


**Note:**

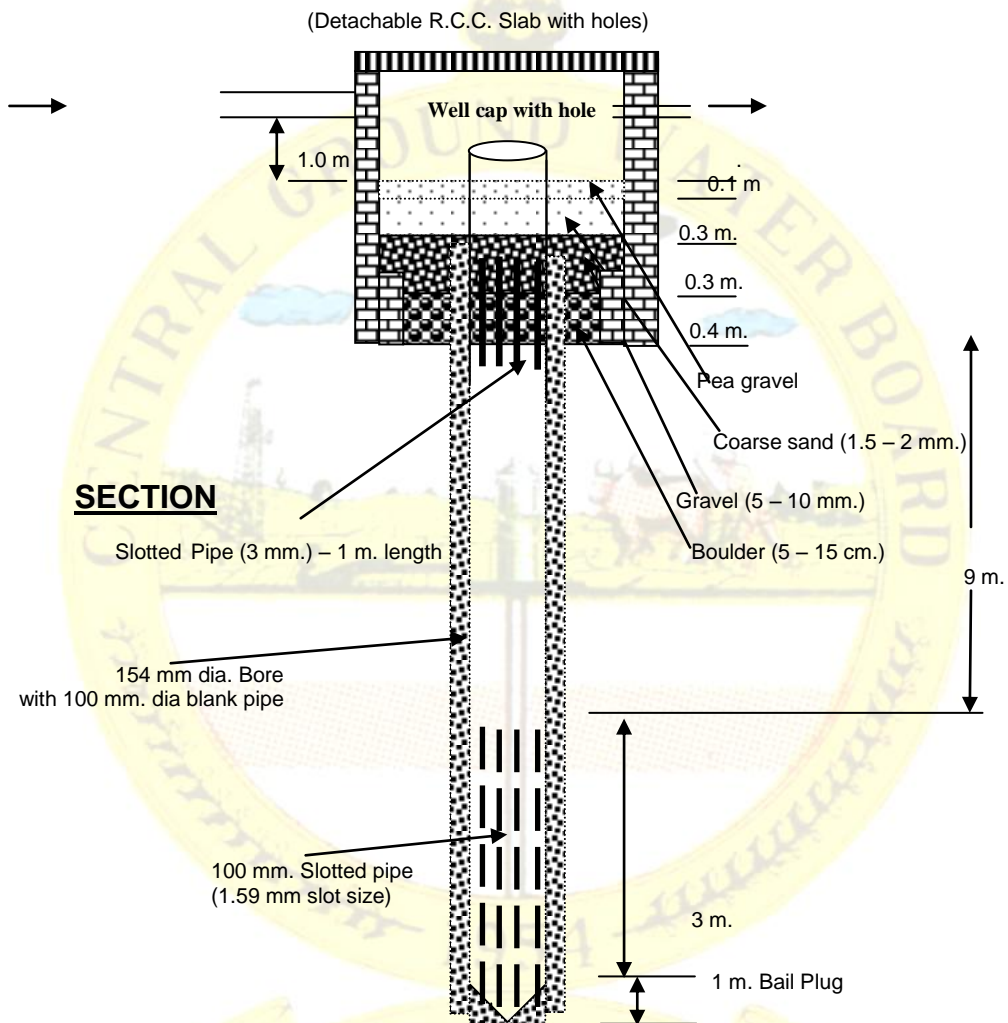
1. Based on post monsoon depth to water level, the recharge well depth will change and should be kept 2 to 3 meter above post monsoon water level.
2. The design is indicative; the actual design depends on site condition.



## Trench with Recharge well (Roof top area 200-300 sq. m)



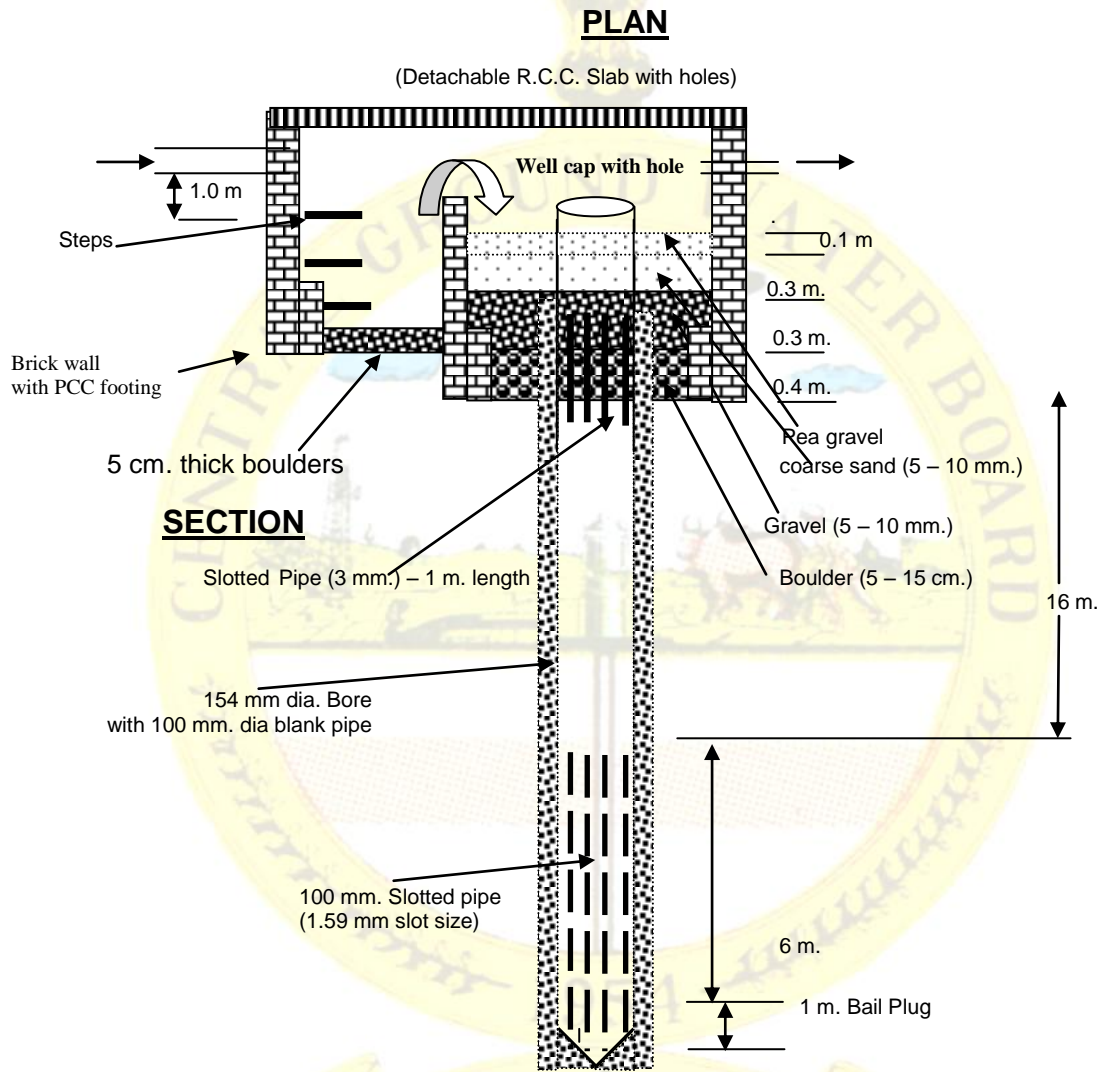
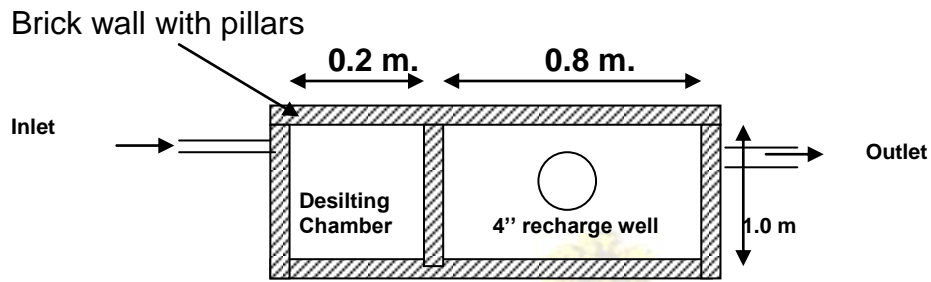
### PLAN



#### Note:

1. Based on post monsoon depth to water level, the recharge well depth will change and should be kept 2 to 3 meter above post monsoon water level.
2. The design is indicative; the actual design depends on site condition

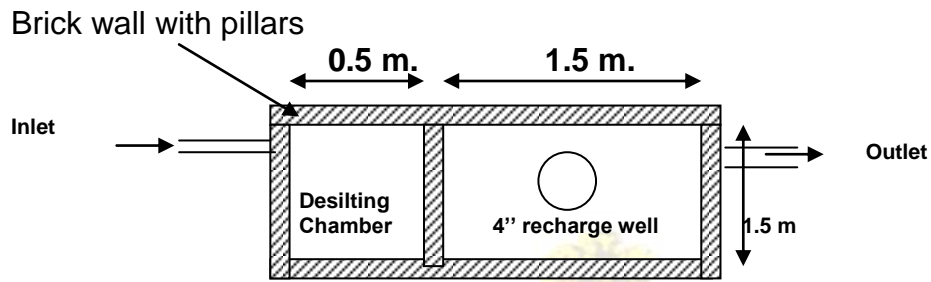
## Trench with Recharge well & De-silting Chamber (Roof top area 300-400 sq. m)



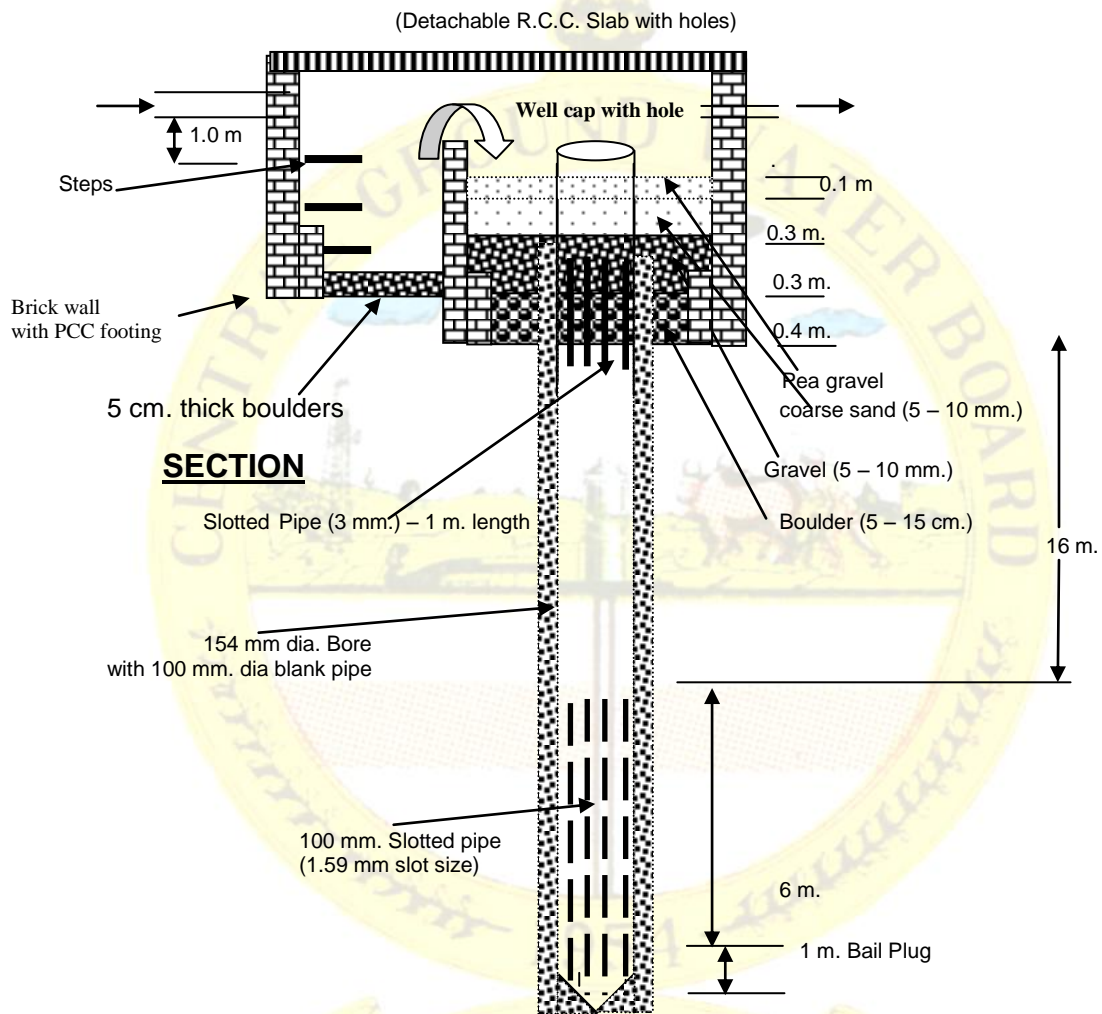
**Note:**

1. Based on post monsoon depth to water level, the recharge well depth will change and should be kept 2 to 3 meter above post monsoon water level.
2. The design is indicative; the actual design depends on site condition

## Trench with Recharge well & De-silting Chamber (Roof top area 400-500 sq. m)



### PLAN

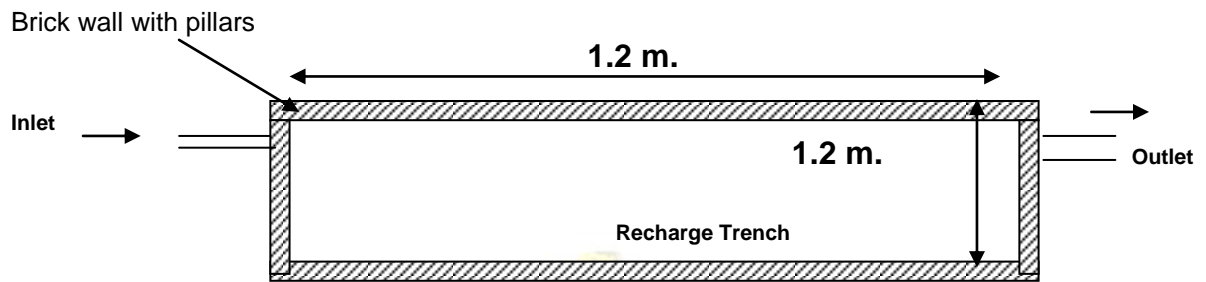


### SECTION

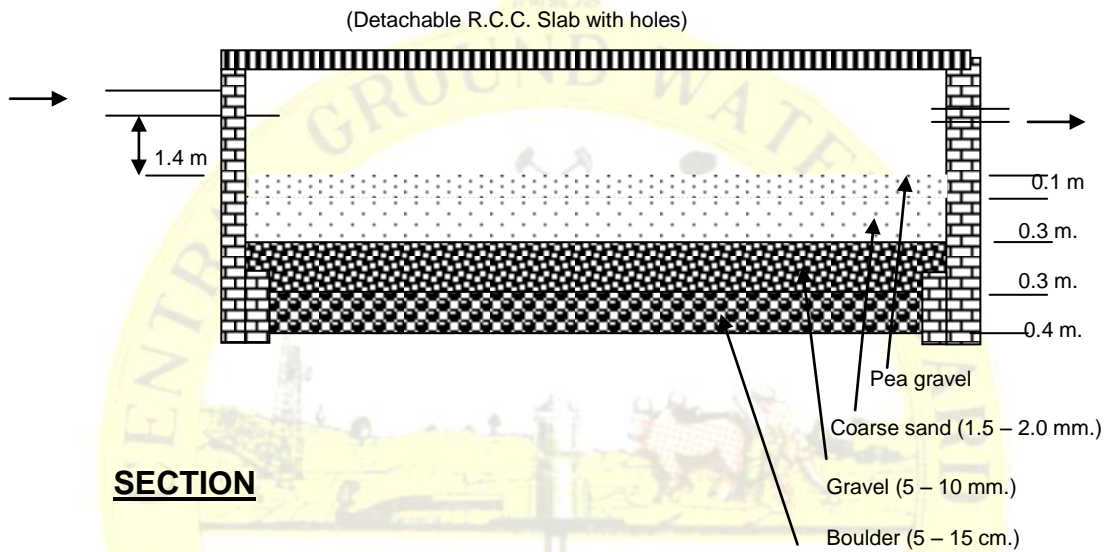
**Note:**

1. Based on post monsoon depth to water level, the recharge well depth will change and should be kept 2 to 3 meter above post monsoon water level.
2. The design is indicative; the actual design depends on site condition

## Recharge Trench (Roof Top area upto 100 sq. m.)



**PLAN**

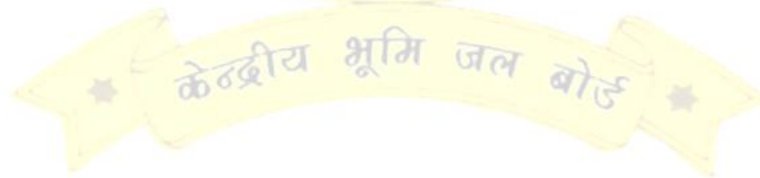


**SECTION**

**(All the dimensions are inner)**

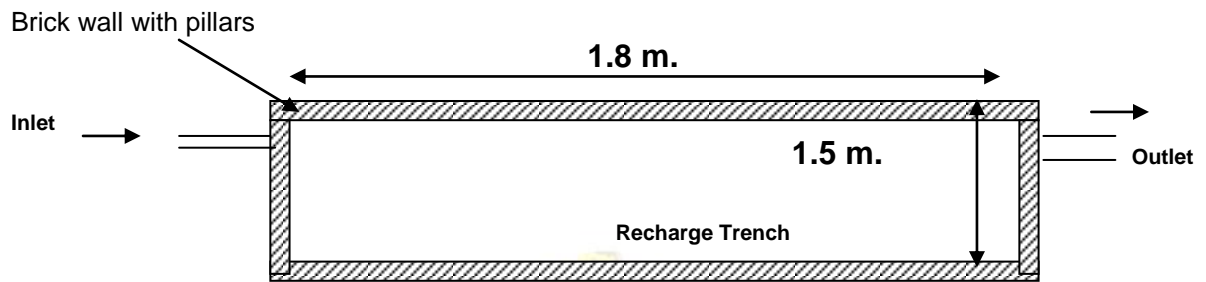
**Note:**

1. The design is indicative; the actual design depends on site condition

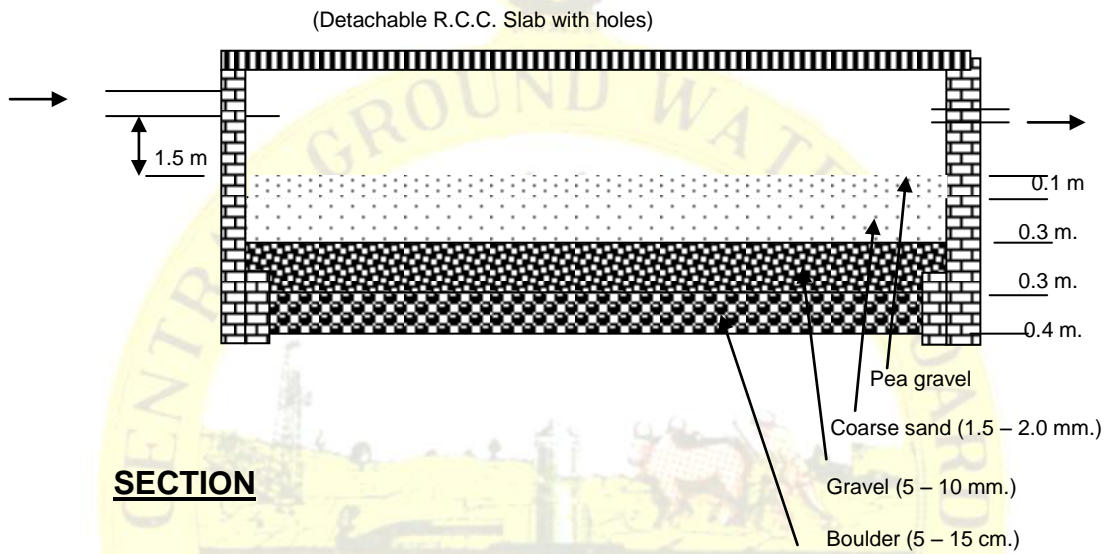




## Recharge Trench (Roof Top area 100-200 sq. m.)



**PLAN**

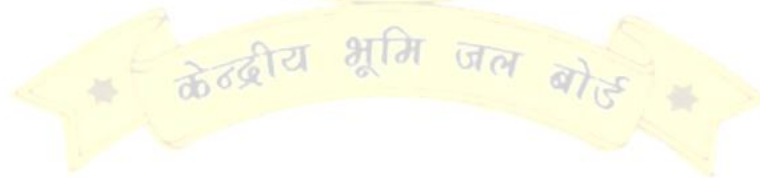


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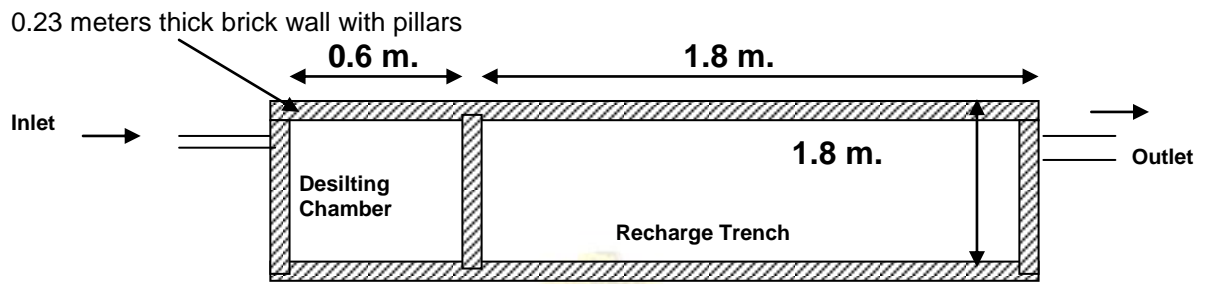
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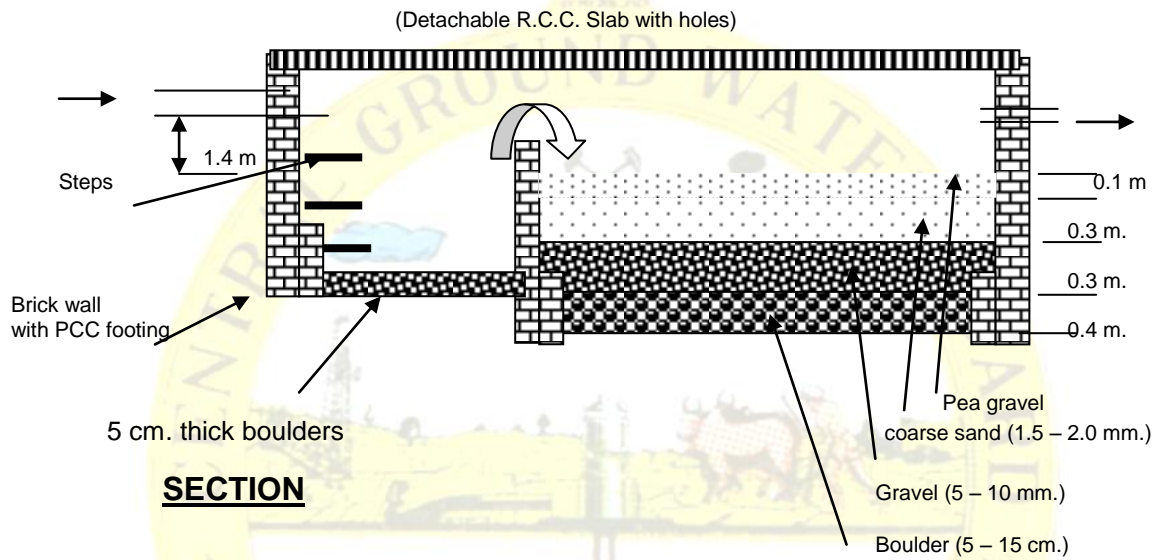
1. The design is indicative; the actual design depends on site condition



**Recharge Trench with Desilting Chamber (Roof Top area 200-300 sq. m.)**



**PLAN**

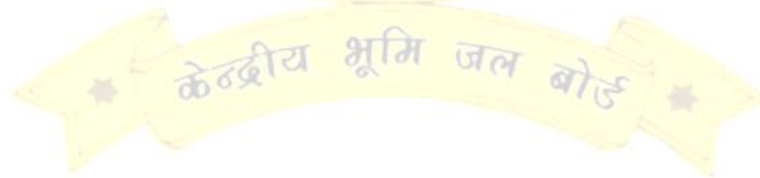


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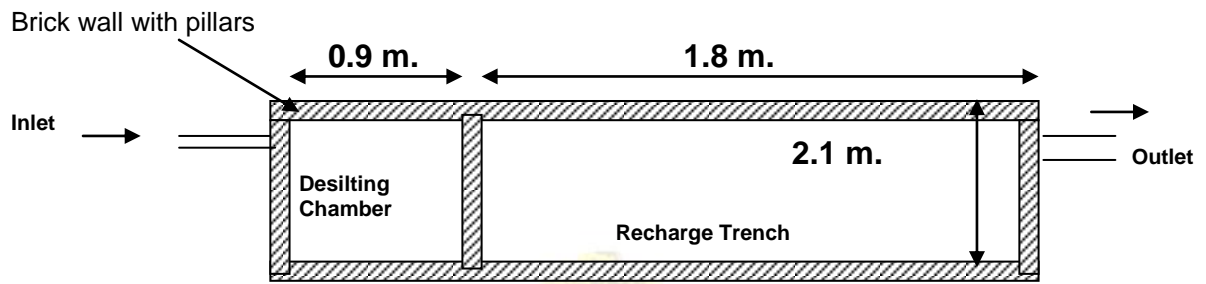
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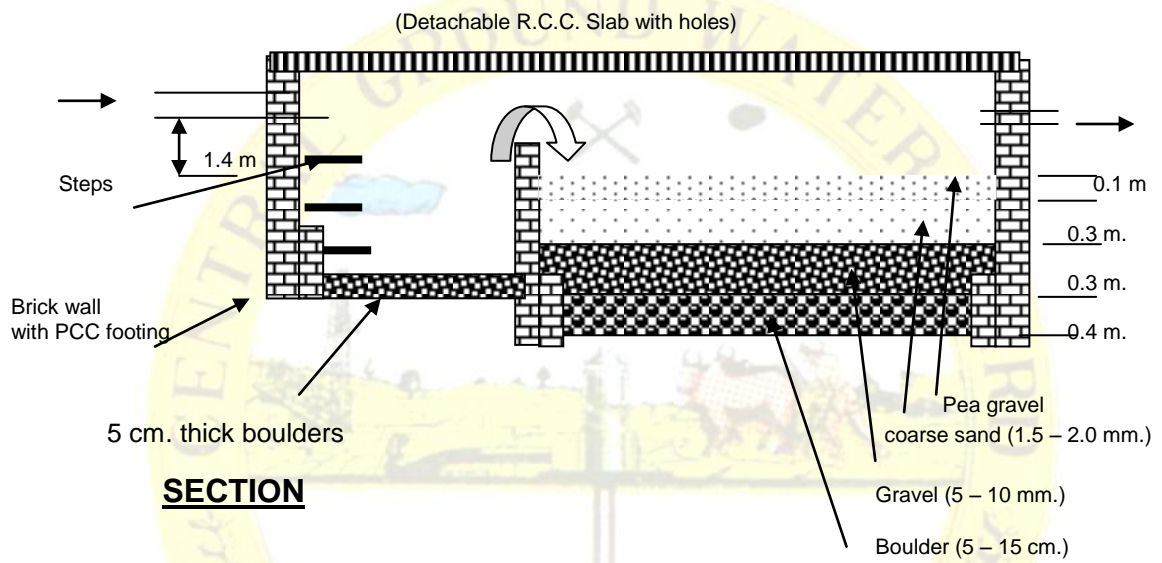
- 1. The design is indicative; the actual design depends on site condition**



## Recharge Trench with Desilting Chamber (Roof Top area 300-400 sq. m.)



**PLAN**

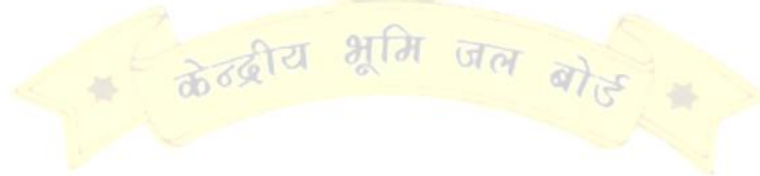


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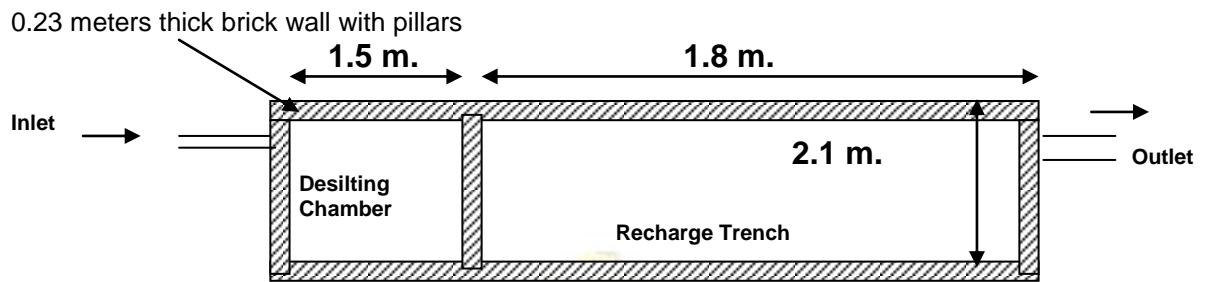
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### **Note:**

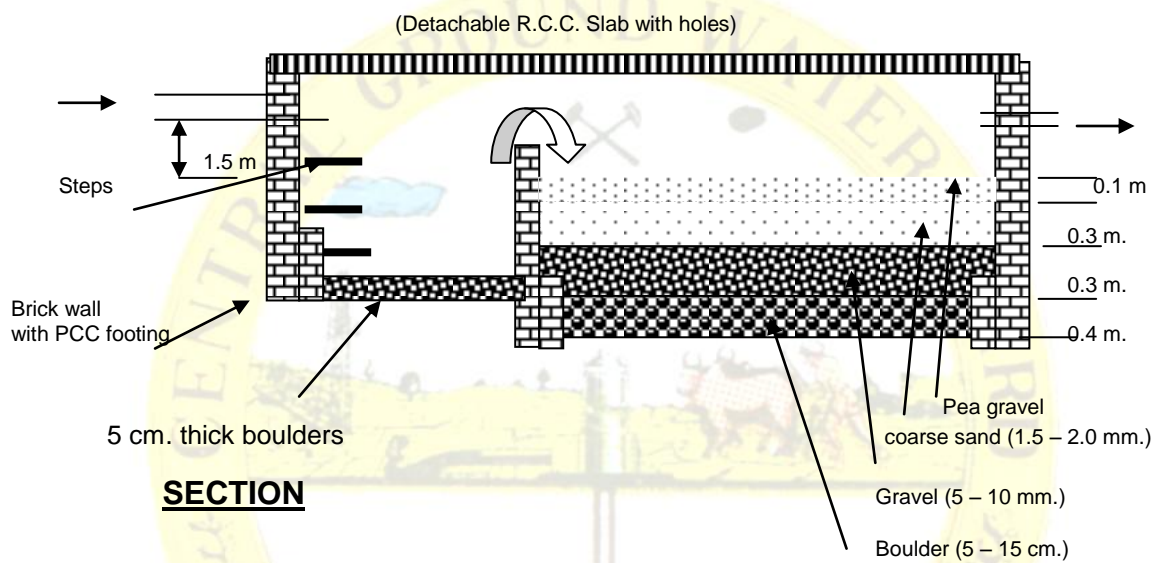
- 1. The design is indicative; the actual design depends on site condition.**



## Recharge Trench with Desilting Chamber (Roof Top area 400-500 sq. m.)



**PLAN**



**SECTION**

**(All the dimensions are inner)**

**Note:**

- 1. The design is indicative; the actual design depends on site condition.**

केन्द्रीय भूमि जल बोर्ड



# TEHSIL MAP NATIONAL CAPITAL TERRITORY, DELHI



## INDEX

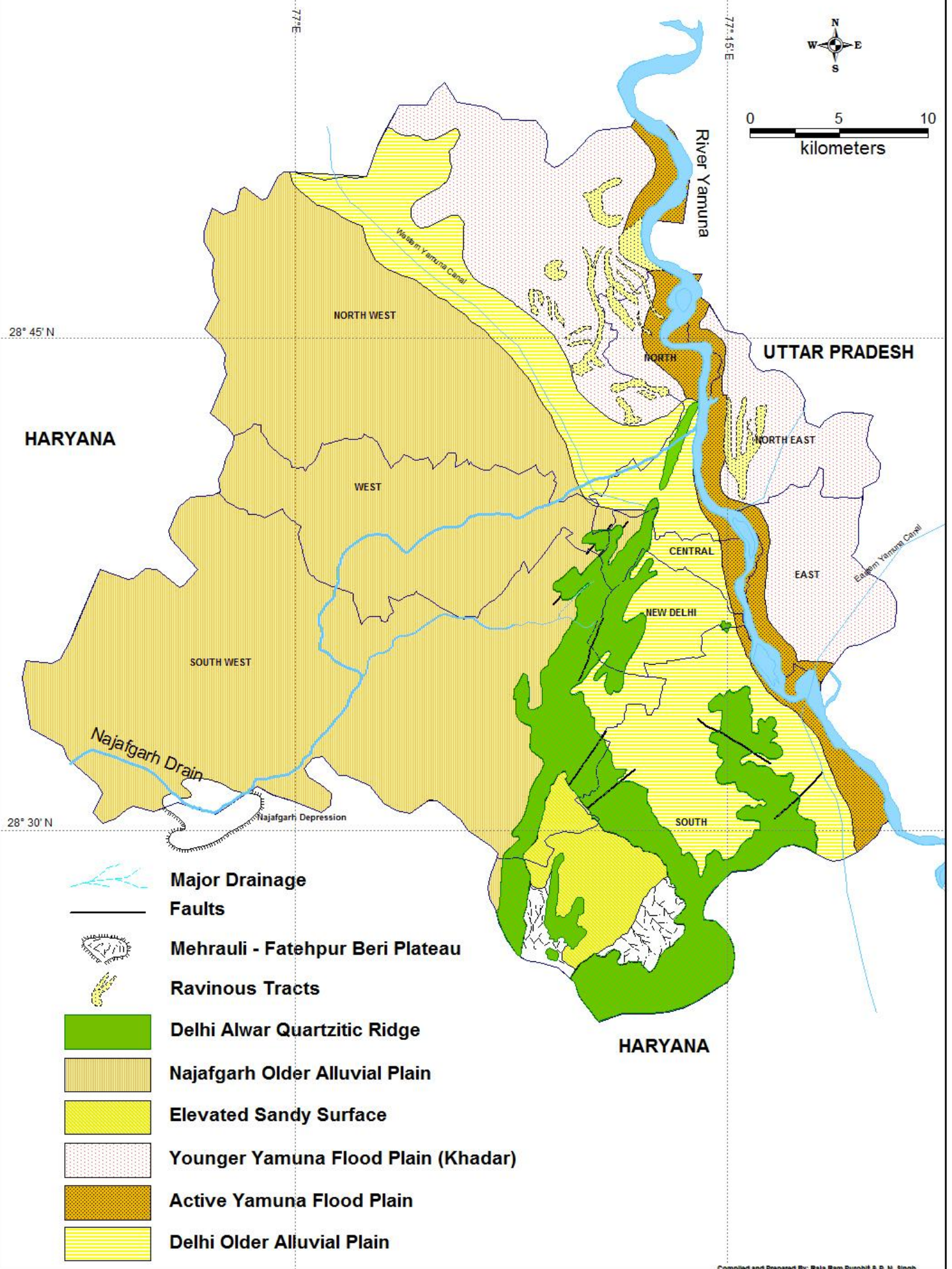


Delhi Ridge ( Alwar Quartzite)



Major Drainage and Canals

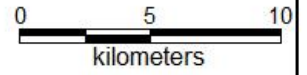
# GEOLOGY AND GEOMORPHOLOGICAL MAP OF NCT DELHI





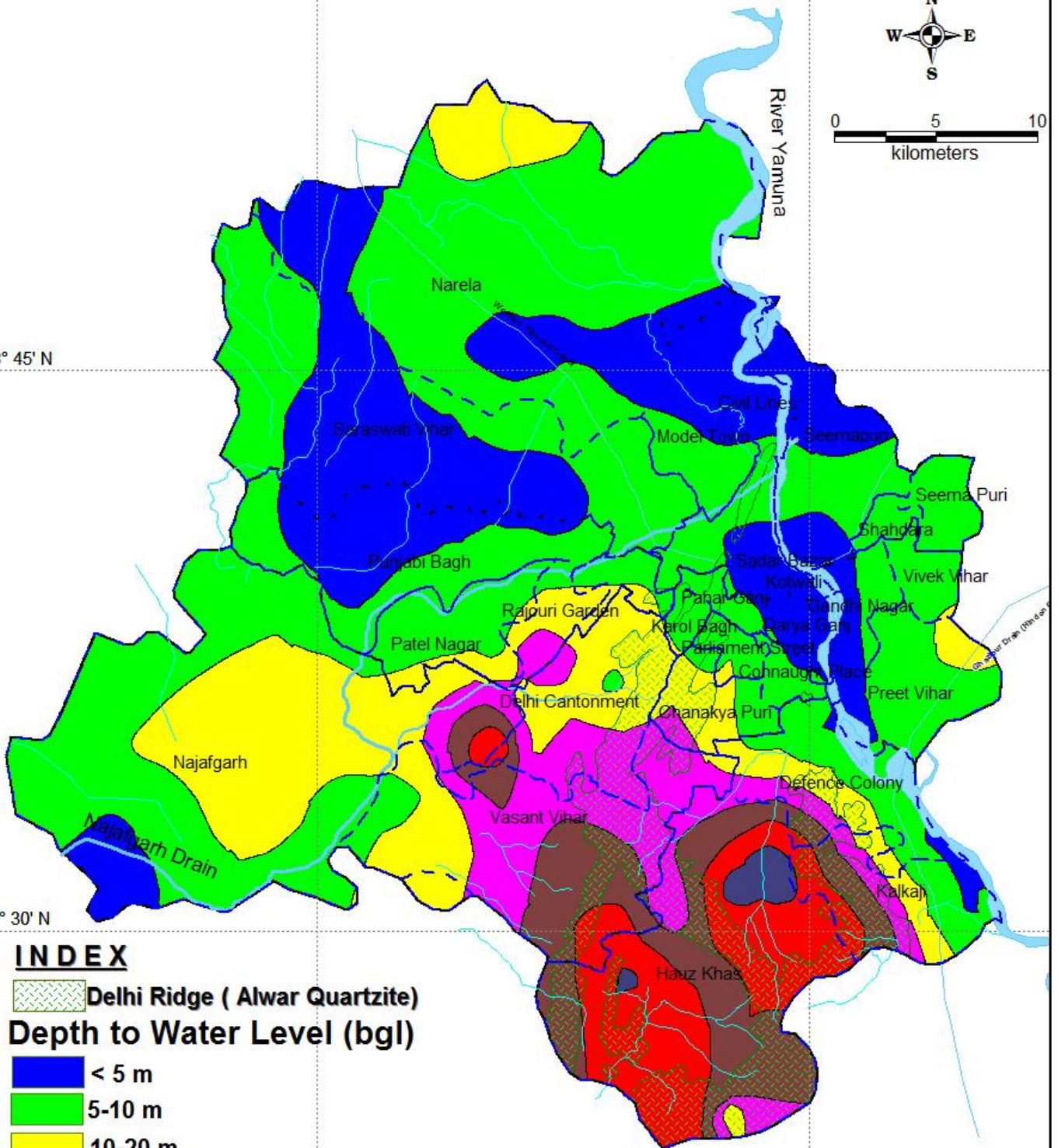
# DEPTH TO WATER LEVEL MAP FOR RAIN WATER HARVESTING STRUCTURES

## NATIONAL CAPITAL TERRITORY, DELHI



28° 45' N








28° 30' N



### INDEX

 Delhi Ridge ( Alwar Quartzite)

### Depth to Water Level (bgl)

-  < 5 m
-  5-10 m
-  10-20 m
-  20-30 m
-  30-40 m
-  40-50 m
-  > 50 m

77° E

77° 15' E