Project Proposal Report

Rooftop Rainwater Harvesting schemes for Ground Water Recharge at roof tops of various Government Buildings across Punjab

Rooftop Rainwater Harvesting schemes for Ground Water Recharge at roof tops of various Government Buildings across Punjab

Report

Introduction

The state of Punjab has sub tropical climate and is located in NW part of India between 29-32" N and 32-31'N Latitude and between 73-52'E and 76'55' Longitude. The average annual rainfall in the Punjab state is approximately 500 mm (Average from 2009-2010). Though three rivers namely Ravi, Beas and Satluj flow through the State and the state has a well developed canal network. The Canal/Surface water accounts for 29% of Irrigation requirements of the State and the 71 % requirement is fulfilled by the Ground Water/ tubewell irrigation.

Ground Water Scenario of Punjab

According to Dynamic Ground Water Estimation Report 2020, there is overexploitation of Ground Water to meet the agriculture requirement of the state as surface water is limited and due to more draft of ground water the overall stage of ground water extraction of the state is 164 % as estimated. About 78% area of the state is over-exploited. Out of 150 blocks, 117 blocks are "over-exploited" 06 blocks are "critical" 10 blocks are "semi-critical" and 17 blocks are in "safe" category.

Ground water levels in Punjab State vary from almost near surface to about 60 m bgl. The deep water levels are recorded in Kandi belt. Water logging conditions exist in some parts of southwestern districts. In the remaining part of Punjab the water table varies from 3 to 40 m bgl approximately.
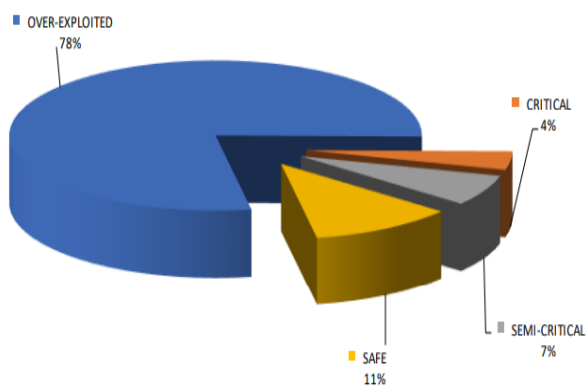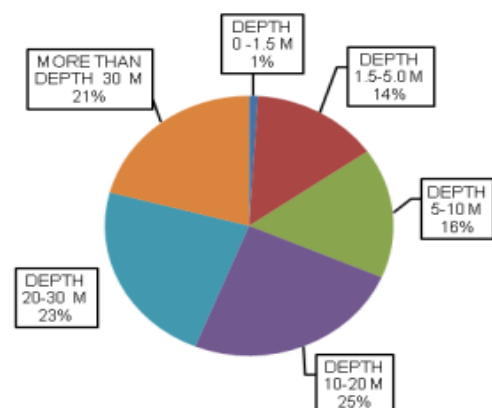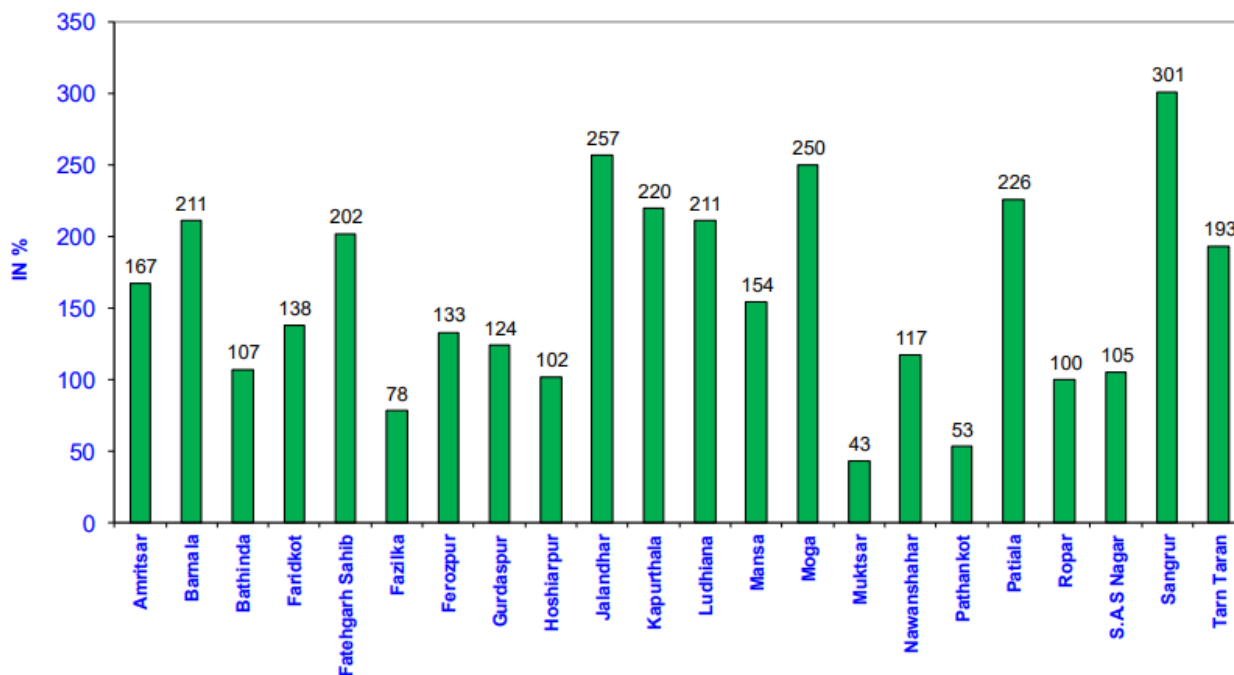
FIG.11 DISTRICT-WISE STAGE OF GROUND WATER DEVELOPMENT, PUNJAB

Rainfall Distribution

There are two periods of rainfall in the state. The southwest monsoon season, the principal source of ground water sets in last week of June and withdraws towards end of September and constitutes about 80% of annual average rainfall. Another period of rainfall is winter rain from December to March is about 20% of total rainfall which is mostly absorbed into the soil. The rainfall distribution in Punjab State is erratic both in time and space. The annual rainfall in the state varies from about 1000 mm in the northeast to less than 300 mm in the southwest. The areas to the north of Gurdaspur and near the Shivalik hills receive maximum amount of rainfall while the areas situated in the southwestern side of Punjab (Fazilka) receive minimum amount of rainfall. In the central part of the state, average long term rainfall varies from 400 mm to 600 mm. The highest and the lowest annual average rainfall in the state for the year 2019 are recorded in Gurdaspur and Ferozepur districts which are 1201 mm and 245 mm respectively.

Year	Average Annual rainfall in mm
2009	385
2010	472
2011	480
2012	366
2013	620
2014	385
2015	547
2016	427
2017	493
2018	598
2019	579

Necessity

The Ground Water resource of Punjab are depleting at a fast rate with overall stage of ground water extraction of the state at 164 % as estimated. About 78% area of the state is over-exploited. Out of 150 blocks, 117 blocks are "over-exploited" 06 blocks are "critical" 10 blocks are "semi-critical" and 17 blocks are in "safe" category. About 80% of the rainfall state receives is concentrated in the months of June- September. The uneven spells of rainfall can cause some times flooding of area which further leads to erosion of soil, deterioration of roads etc. To arrest these problems and harvest rainwater to maximum potential in order to augment the Ground Water Level, the project is proposed to install roof top rain water harvesting and Ground Water recharge Schemes at the buildings of Government Offices

Proposal

The components of the scheme are as below

1. Catchment: Rooftop or paved area

2. Transportation: PVC Pipes for carrying Rain   water

3. Filtration: Sedimentation and Filtration Chambers

4. Recharge: Injection Well

A typical structure consists of PVC pipes which will be wall mounted/ laid under ground by making trenches. The water falling on the roof top will be collected by a number of these pipes in the collection chambers (Haudis). These Haudis are connected to Filtration cum sedimentation Chamber. (3m x 1m x 2m) The silt from the water settles in the sedimentation tank and the water will reach the filtration chamber over the baffle wall. The Filtration chamber is provided with an inverted filter consisting of bottom & middle layer of varying sizes of gravel, and top layer of coarse sand. A 40 meter deep injection well of 150 mm diameter PVC pipe is proposed and consists of 2 filters of 1meter and 10 meter each. The Filtered Water will enter the injection well through a slotted pipe of slot size 3mm and length 1m. The water is then allowed to absorb in the 2nd aquifer by providing a filter i.e slotted pipe of slot size 1.5mm and length 5m at a suitable depth. The 40 m depth of injection wells provisional and can vary according to the depth of Ground Water and the strata encountered while drilling. Electric Logging will be carried out to know the exact stratification and providing the filter (slotted pipe) at suitable strata. The 10 m slotted pipe can be provided inparts according to the strata available.

It is proposed to install these roof top rain water harvesting and Ground Water recharge Schemes at the buildings of Government Offices/ Schools/ Hospitals

Capacity and No. of Structures

- Calculate Hourly runoff generated within premises in cubic meters------(1)

    =Area*Runoff coefficient * Intensity of rainfall (in meters)

- Quantity of recharge for individual structure = (i+ii+iii+iv+v) ----------(2)

    i. Volume of collection chambers

    ii. Volume of sediment chamber

    iii. Volume of filtration chamber

        a)volume of water in free board=length*breadth*height

        b)Gravel filled part(0.35*L*B*H) (0.35 is porosity)

    iv. Volume of recharge well: $V= \pi r^2 h$

    v. Intake capacity of recharge well 5 to 10 LPS (i.e. 18 to 36 cum/hr)

$$\text{No. of Recharge Structures} = \frac{Hourly\ Runoff\ generated\ (1)}{Quantum\ of\ recharge\ form\ Individual\ Structure\ (2)}$$

The typical rate of absorption/ recharge is 5-10 Lps (18-30 m3 / Hr). The number of structures required at a site can be calculated by dividing the Hourly runoff generated by the capacity of each structure.

Runoff coefficient dependent on type of Area

- a) Roof top area=0.8 to 0.9
- b) Paved/Road Area= 0.6 to 0.70
- c) Open/Green Belt Area= 0.1 to 0.2

Hourly Rainfall Intensity is typically 25 to 30 mm/hr for Punjab and Haryana. For safer side we assumed it to be **40 mm/hr**

Hourly capacity of Structure = Intake capacity + Volume of well + Volume of filtration chambers = 29.51 cubic metre

Equating with Hourly runoff

A*0.8*40mm =29.51 cubic metre

Area =900 sqm.

Therefore the Structure is safe for a roof top area of 900 sqm

Benefits

Some of the benefits of the schemes are listed as below

1. Augments ground water level. Average recharge through one structure in a year = 487mm x 900sq m = 438 m3= 4,38,300 litres

2. Improves quality of ground water by dilution.

3. Protect roads from standing water during rains.

4. Reduces Soil Erosion

5. Reduces the possibility of flooding by reducing the amount of water in rain drains.

6. Reduces Water Stagnation and mosquito breeding

Rates and Cost

The calculations are based on a single structure. The rates of the items have been taken from CSR-2020. Typically a Structure will cost around **Rs 2.81 lakh**. The cost can vary by 10% according to the requirement of pipes and drilling depending upon site to site. The cost roughly comprises 80% of Material and 20% of Labour.

Rooftop Rainwater Harvesting schemes for Ground Water Recharge at roof tops of various Government Buildings across Punjab
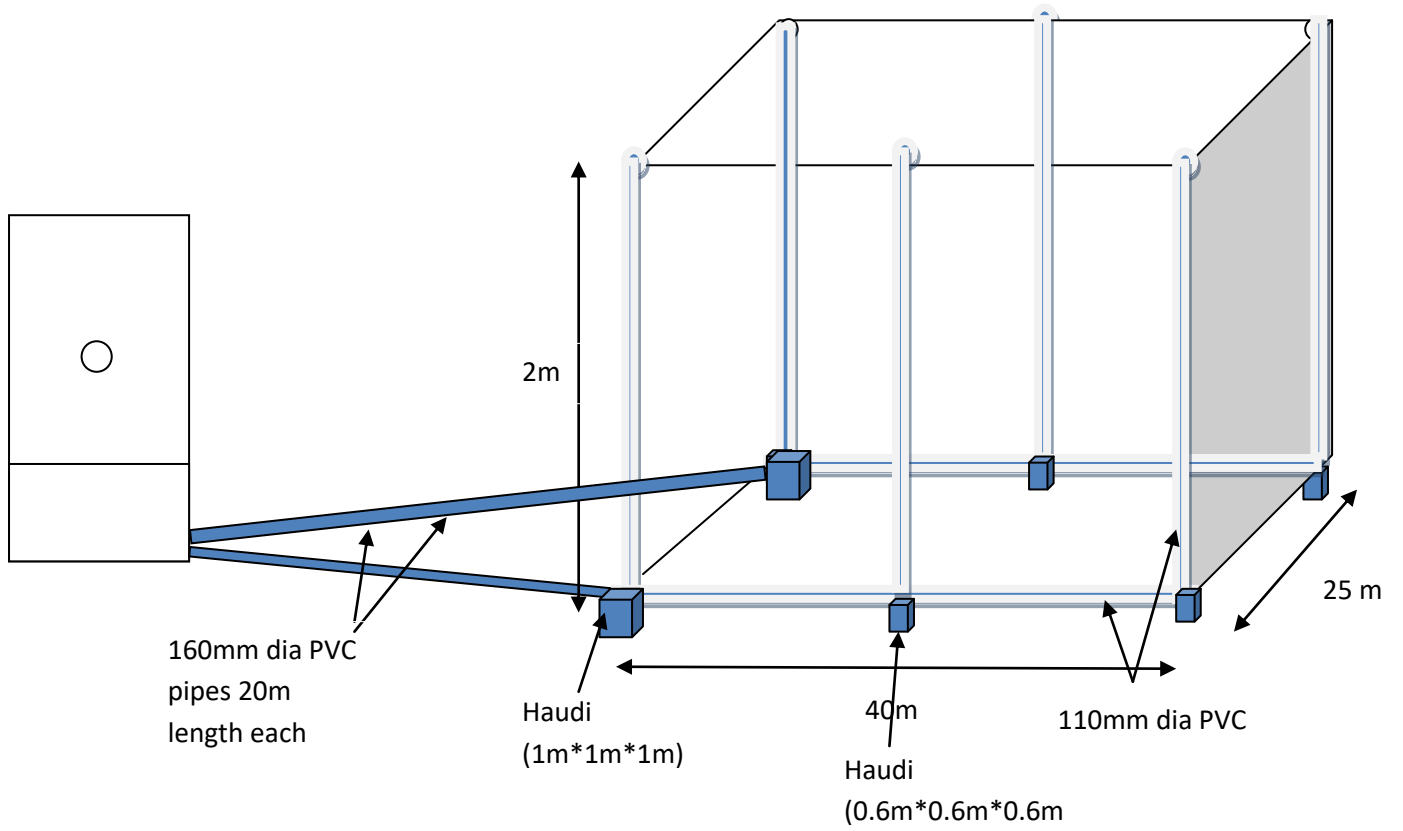
Typical Drawing
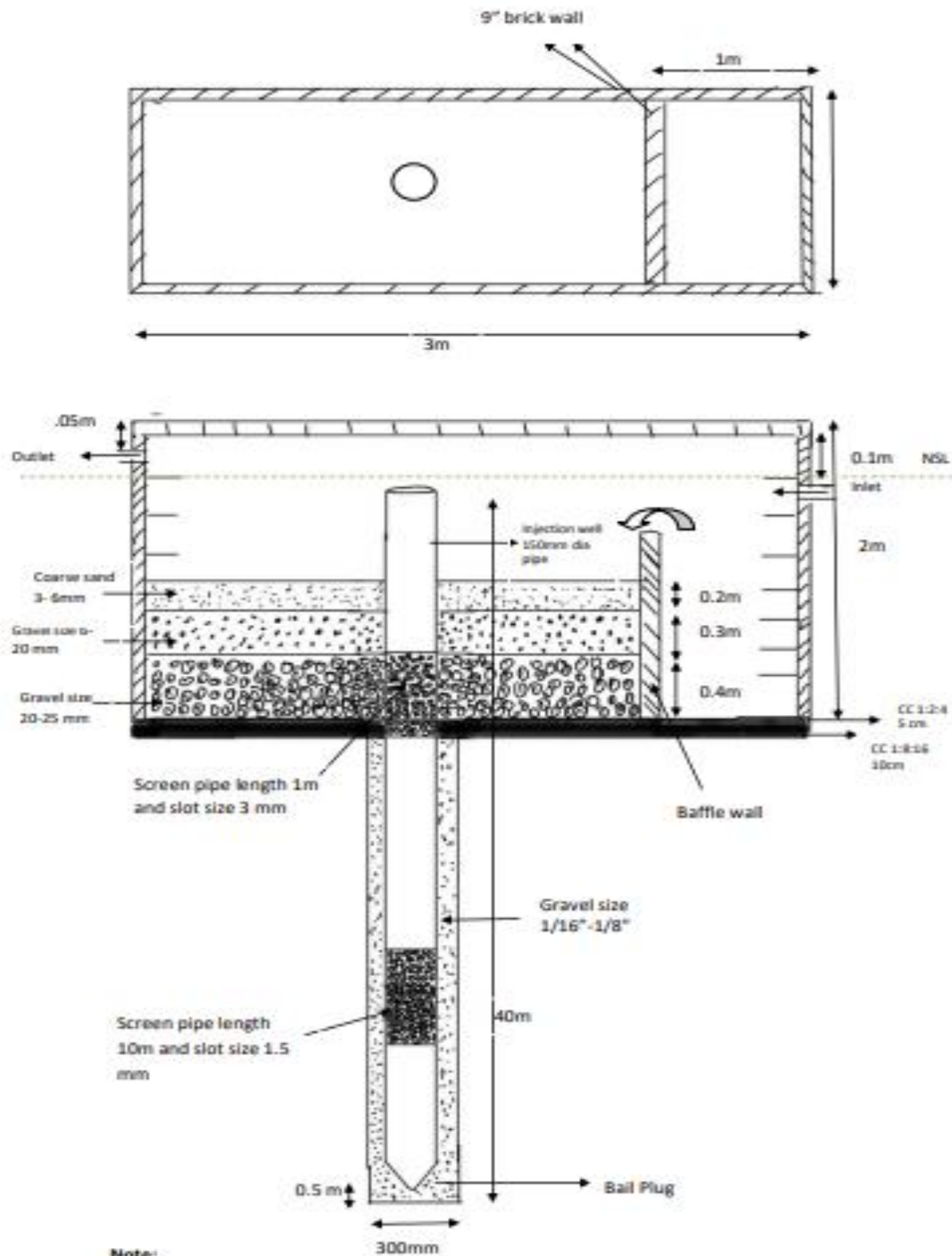
Note:

1. The design is indicative; the actual design/ depth of bore may vary as per site condition
2. The screen pipe should be installed as per strata/aquifer, which can be in parts.

Typical Layout

160mm dia PVC pipes 20m length each

2m

Haudi (1m*1m*1m)

40m

Haudi (0.6m*0.6m*0.6m

110mm dia PVC

25 m

Abstract of Cost

Rooftop Rainwater Harvesting schemes for Ground Water Recharge at roof tops of various Government Buildings across Punjab

S.No.	Description of item	CSR item No.	Unit	Quantity	Rate	Amount in Rs
1	Boring/drilling bore well of required dia for casing/ strainer pipe, by suitable method prescribed in IS: 2800 (part I), including collecting samples from different strata, preparing and submitting strata chart/bore log, including hire & running charges of all equipments, tools, plants & machineries required for the job, all complete as per direction of Engineer – in-charge, upto 90 metre depth below ground level.	28.91 a	meter	40	468.53	18741.2
2	Making electric Logging of borehole with electronic well logger including cost of equipment at site etc.complete in all respect	28.87	No.	1	15848.57	15848.57
3	Supplying, assembling, lowering and fixing in vertical position in bore well,unplasticized PVC medium well casing (CM) pipe of required dia, conforming to IS: 12818-2010, including required hire and labour charges, fittings & accessories etc. all complete, for all depths, as per direction of Engineer – in- charge (b) 150 mm nominal size dia.	28.92 b	meter	28	1012.58	28352.24
4	Supplying, assembling, lowering and fixing in vertical position in bore well unplasticized PVC medium well screen (RMS) pipes with ribs, conforming to IS:12818, including hire & labour charges, fittings & accessories etc. all complete, for all depths, as per direction of Engineer-in-charge for (b) 150 mm nominal size dia. Of slotted pipe	28.93 b	meter	11	1344.64	14791.04
5	Providing, Laying , fixing & jointing of P.V.C. Pipes as per ISI-4985 (ISI marked with the prior approval of Engineer-in-Charge) along the Trenches and laying the same in Trenches to correct alignment and gradients, cutting, jointing and testing complete as per specifications	28.13	metre			

S.No.	Description of item	CSR item No.	Unit	Quantity	Rate	Amount in Rs
	xxii 110mm o/d PVC pipe of 4 Kgf. / sqcm		metre	80	197.83	15826.4
	xxiii 160mm o/d PVC pipe of 4 Kgf. / sqcm		metre	40	408.57	16342.8
6	Providing and fixing on wall face unplasticised Rigid PVC rain water pipes single socketed (working pressure 4 kgf / cm²) conforming to IS : 4985, including fixing with MS clamps (i) U-PVC pipes (working pressure 4 kgf. / sqcm) pipe 110 mm dia.	13.74 a	metre	24	252	6048
7	Providing and fixing 110 mm dia. U.P.V.C bend for Rain water pipe as per IS:14735 including jointing complete as per specifications and to the entire satisfaction of Engineer- in- charge.a) UPVC 110 mm bend	13.75	Nos.	6	135	810
8	Supplying & Fixing of well cap having thread to fix on housing pipe complete in all respect (b) **150mm internal diameter**	28.80 b	No.	2	396.52	793.04
9	Development and Stabilizing of the tubewell with air compressor of required capacity as directed by the engineer-in- charge including cost of tools, appliances & consumable to the satisfaction of Engineer-in-charge (a) Capacity of Air compressor 300 cfm at 250 PSI	28.81 a	Hours	3	3001.17	9003.51
10	Development and Stabilizing of the tubewell with submersible pump of required capacity as directed by the engineer-in- charge including cost of tools, appliances & consumable to the satisfaction of Engineer-in- charge.	28.82	Hours	3	1631.62	4894.86

S.No.	Description of item	CSR item No.	Unit	Quantity	Rate	Amount in Rs
11	Excavation manually in trenches for pipe lines with straight or open cutting in streets and lanes in builtup area where width of street / Lane from wall to wall is less than 3 meter including trimming and dressing sides levelling of beds of trenches to correct grade, cutting joint holes ,refilling consolidation, watering , including the cost of dewatering of rain water, diversion for traffic, night signals. Providing & fixing caution boards, watching, fencing, etc. and removal of surplus soil from the site upto 15 meter distance complete in all respects (b) Exceeding 1.5 m depth but not exceeding 2.25 m depth (i) All classes of soil except rocky	28.1 (b–i)	cum	34.17	175.1	5983.167
12	Cement concrete 1:8:16	10.7 (b-i)	cum	4.92	3027	14892.84
	(b)With stone aggregates 20mm gauge					
	(i)mixing by manual means					
13	Cement concrete 1:2:4 a With stone ballast or shingle (i) mixing by manual means	10.13 (a-i)	Cum	2.46	4564	11227.44
14	Supplying & fixing of M.S Clamp of size 150mm X 12mm made out of MS Flat 1.52m long, suitable to fit Housing pipe including the cost Nut & Bolts of Suitable size complete in all respect.	28.77	No.	1	2673.23	2673.23
15	First class burnt brick work laid in cement sand mortar 1:4 in foundation and plinth	11.7	cum	8.55	5109	43681.95
16	12.5 mm thick cement plaster 1:4	15.9	Sqm.	42.12	189	7960.68
17	Supplying at quarry site of gravel of 1/16" to 1/8" sizes including pouring and packing in the annular space between the pipes assembly and the bore.The gravel should be free from dust,dirt or the vegetables manner as per IS 4097/1967 with latest amendments	28.88	Cum	2.01	738.68	1484.7468
18	Providing and placing in horizontal layers filtering media screened, washed and cleaned as described below:-	28.51				

S.No.	Description of item	CSR item No.	Unit	Quantity	Rate	Amount in Rs
	Bajri (Coarse)screened, cleaned and washed and graded from 20mm to 25mm (fromPathankot or approved equivalent quarry)	28.51(b)	cum	0.8	1319.7	1055.8
	Bajri screened, cleaned and washed and graded from 6mm to 20mm (from Pathankot or approved equivalent quarry).	28.51(c)	cum	0.6	1398.01	838.8
	Coarse sand screened, cleaned and washed and graded from 3mm to 6mm (fromPathankot or approved equivalent quarry)	28.51(d)	cum	0.4	2037	814.8
19	Providing and fixing 14 gauge MS sheet garage doors with 40mmx40mmx6mm angle iron frame with diagonal braces 3.15mm gusset plates including locking arrangement with handles etc. complete in respects	18.1	sqm	4	3900	15600
20	Providing & fixing 650 mm x 650 mm clear inside opening rectangular RCC manhole cover and frame ISI marked as per IS:12592-2002 including carriage from the stores of the Engineer-in-charge to site of work, loading, unloading including stacking and setting the same to correct lines over manholes including cement concrete copping (M:20) around the frame etc. Dia of steel for lifting hook is 16mm. (for EHD and HD). 650 x 650 mm rectangular RCC man hole cover only as per ISI RCC Man hole cover with Frame d)650 x 650 mm rectangular clear opening RCC man hole cover with (iii) Medium Duty	29.34 d (Analysis)	Nos.	4	1455	5820

S.No.	Description of item	CSR item No.	Unit	Quantity	Rate	Amount in Rs
21	Providing & fixing 1050 mm x1050 mm clear inside opening rectangularRCC manhole cover and frame ISI marked asper IS:12592-2002 including carriage from thestores of the Engineer-in-charge to site ofwork, loading, unloading including stackingand setting the same to correct lines overmanholes including cement concrete copping(M:20) around the frame etc. Dia of steel forlifting hook is 16mm. (for EHD and HD).1050 x 1050 mm rectangular RCC man hole cover only as per ISIRCC Man hole cover with Framed)1050 x 1050 mm rectangular clearopening RCC man hole cover with (iii) Medium Duty	29.34 d (Analysis)	Nos.	2	3797	7594
22	Operation and maintenance for 5 years		Lumpsum	Lumpsum		30000
	Total				**Rs**	**281079.08**
						say 2.81 Lakh

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Detail of Quantities

Sr no.	Description of item	CSR item No.	Unit	Quantity in Detail	Total Qty.
1	Boring/drilling bore well of required dia for casing/ strainer pipe, by suitable method prescribed in IS: 2800 (part I), including collecting samples from different strata, preparing and submitting strata chart/bore log, including hire & running charges of all equipments, tools, plants & machineries required for the job, all complete as per direction of Engineer – in-charge, upto 90 metre depth below ground level.	28.91 a	meter	40	40 meter
2	Making electric Logging of borehole with electronic well logger including cost of equipment at site etc.complete in all respect	28.87	No.	1	1 JOB
3	Supplying, assembling, lowering and fixing in vertical position in bore well,unplasticized PVC medium well casing (CM) pipe of required dia, conforming to IS: 12818-2010, including required hire and labour charges, fittings & accessories etc. all complete, for all depths, as per direction of Engineer – in-charge (b) 150 mm nominal size dia.	28.92 b	meter	28	28 meter
4	Supplying, assembling, lowering and fixing in vertical position in bore well unplasticized PVC medium well screen (RMS) pipes with ribs, conforming to IS:12818, including hire & labour charges, fittings & accessories etc. all complete, for all depths, as per direction of Engineer-in-charge for (b) 150 mm nominal size dia. Of slotted pipe	28.93 b	meter	1+10=11	11 meter

5	Providing, Laying , fixing & jointing of P.V.C. Pipes as per ISI-4985 (ISI marked with the prior approval of Engineer-in-Charge) along the Trenches and laying the same in Trenches to correct alignment and gradients, cutting, jointing and testing complete as per specifications	28.13	metre			
a	xxii 110mm o/d PVC pipe of 4 Kgf. / sqcm		metre	80m		80m
b	xxiii 160mm o/d PVC pipe of 4 Kgf. / sqcm		metre	40m		40m
6	Providing and fixing on wall face unplasticised Rigid PVC rain water pipes single socketed (working pressure 4 kgf / cm²) conforming to IS : 4985, including fixing with MS clamps (i) U-PVC pipes (working pressure 4 kgf. / sqcm) pipe 110 mm dia.	13.74 a	metre			24 metre
7	Providing and fixing 110 mm dia. U.P.V.C bend for Rain water pipe as per IS:14735 including jointing complete as per specifications and to the entire satisfaction of Engineer- in-charge. a) UPVC 110 mm bend	13.75	Nos.			6 Nos.
8	Supplying & Fixing of well cap having thread to fix on housing pipe complete in all respect (b) **150mm internal diameter**	28.80 b	No.	2		2 No.
9	Development and Stabilizing of the tubewell with air compressor of required capacity as directed by the engineer-in-charge including cost of tools, appliances & consumable to the satisfaction of Engineer-in-charge (a) Capacity of Air compressor 300 cfm at 250 PSI	28.81 a	Hours	3		3 hours (1 job)
10	Development and Stabilizing of the tubewell with submersible pump of required capacity as directed by the engineer-in-charge including cost of tools, appliances & consumable to the satisfaction of Engineer-in-charge.	28.82	Hours	3		3 hours (1 job)

11	Excavation manually in trenches for pipe lines with straight or open cutting in streets and lanes in builtup area where width of street / Lane from wall to wall is less than 3 meter including trimming and dressing sides levelling of beds of trenches to correct grade, cutting joint holes ,refilling consolidation, watering , including the cost of dewatering of rain water, diversion for traffic, night signals. Providing & fixing caution boards, watching, fencing, etc. and removal of surplus soil from the site upto 15 meter distance complete in all respects (b) Exceeding 1.5 m depth but not exceeding 2.25 m depth (i) All classes of soil except rocky	28.1 (b–i)	cum	(A) For main rain water harvesting structure[1*(3.46*1.46*2) =10.10 Cum] (B) For main haudi (1No.) [2*(1.46*1.46*1.15)=4.9Cum] (C) For small haudi (4 No.) [4*(1.06*1.06*075) = 3.37Cum] (D) For pipeline connection from main haudi to Main RWH structure [2*(20*0.3*1) =12Cum] (E) For pipeline connection from small haudis to Main haudi [(80*0.3*0.45) =10.8 Cum] TOTAL =34.17 Cum	34.17 Cum
12	(b)With stone aggregates 20mm gauge (i)mixing by manual means	10.7 (b-i)	cum	(A) At bottom of trench[(3.46*1.46*0.10)=0.50 cum] (B) IN Main haudis2*[(1.46*1.46*0.10)=0.42 Cum] (C) IN small haudis[4*(1.0*1.0*0.10)=0.40 Cum] (D) IN Trench connecting Main haudi to RWH structure[(20*2*0.3*0.10)=1.2 Cum] (E) IN Trench connecting Small haudis to Main haudi[(80*0.3*0.10)=2.4 Cum] TOTAL=4.92 Cum	4.92 Cum
13	Cement concrete 1:2:4 a With stone ballast or shingle (i) mixing by manual means	10.13 (a-i)	Cum	Quantity equals to half the quantity of 10 no. Item [(4.92/2)=2.46Cum]	2.46Cum
14	Supplying & fixing of M.S Clamp of size 150mm X 12mm made out of MS Flat 1.52m long, suitable to fit Housing pipe including the cost Nut & Bolts of Suitable size complete in all respect.	28.77	No.	1	1 No.

15	First class burnt brick work laid in cement sand mortar 1:4 in foundation and plinth	11.7	cum	(A) For main chamber RWH long walls [2*(3.46*2*0.23)=3.18Cum]short walls[2*(1.0*2*0.23)=0.92Cum]intercepting walls [1*(1.0*1.5*0.23)=0.35Cum] Total(A)=4.45 Cum(B) For main haudilong walls [2*(1.46*1.0*0.23)=0.67Cum]short walls[2*(1.0*1.0*0.23)=0.46Cum] Total(B) for 2 haudis=2.26 Cum(C) For small haudis(4 No. of haudis)long walls [2*(1.06*0.6*0.23)=0.29Cum]short walls[2*(0.6*0.6*0.23)=0.17Cum [TOTAL(C) 4 No. of haudis] =1.84CumTOTAL(A+B+C)=8.55 Cum	8.55 Cum
16	12.5 mm thick cement plaster 1:4	15.9	sqm	(A)Main RWH structure (a)long walls[2*(3.0*2.0)-2*(1.0*2.3)=11.54sqm] (b)short walls[2*(1.0*2.0)=4sqm] (c)intercepting walls[2*(1.0*1.5)=3.0sqm] (d) Top of brick work[2*(3.46*0.23) + (1+2)*(1.0*0.23)=2.28sqm] TOTAL(A)=20.82sqm (B)For Main haudi (a)long walls[2*1.0*1.0=2.0sqm] (b)short walls[2*1.0*1.0=2.0sqm] (c)on top of brick work of long wall[2*1.46*0.23=0.67] d)on top of brick work of short wall[2*1.0*0.23=0.46] TOTAL(B for 2 haudis)=10.26sqm (C)For small haudi (a)long walls[2*1.06*0.6=1.27sqm] (b)short walls[2*0.6*0.6=0.72sqm] (c)Top of wall [2*1.06*0.23+280.6*0.23=0.77] Total(C) haudis 4No. Hence total 4*2.76 =11.04sqm Grand Total(A+B+C)= 20.82+10.26+11.04=39.75sqm	42.12 sqm

17	Supplying at quarry site of gravel of 1/16" to 1/8" sizes including pouring and packing in the annular space between the pipes assembly and the bore.The gravel should be free from dust,dirt or the vegetables manner as per IS 4097/1967 with latest amendments	28.88	Cum	(A)In Bore hole (∏/4)*d*d [0.785*{(0.30*0.3)-(0.15*0.15)}*38]=2.01Cum	2.01 Cum
18	Providing and placing in horizontal layers filtering media screened, washed and cleaned as described below:-	28.51			
	Bajri (Coarse)screened, cleaned and washed and graded from 20mm to 25mm (fromPathankot or approved equivalent quarry)	28.51(b)	cum	In main chamber(2*1*0.4)=0.80Cum	0.8Cum
	Bajri screened, cleaned and washed and gradedfrom 6mm to 20mm (from Pathankot or approved equivalent quarry).	28.51(c)	cum	In main chamber (2*1*0.3)=0.60Cum	0.6 cum
	Coarse sand screened, cleaned and washed and graded from 3mm to 6mm (fromPathankot or approved equivalent quarry)	28.51(d)	cum	In main chamber (2*1*0.2)=0.40Cum	0.4Cum
19	Providing and fixing 14 gauge MS sheet garage doors with 40mmx40mmx6mm angle iron frame with diagonal braces 3.15mm gusset plates including locking arrangement with handles etc. complete in respects	18.1	sqm	3.24*1.23=4.0sqm	4.0sqm

20	Providing & fixing 650 mm x 650 mm clear inside opening rectangular RCC manhole cover and frame ISI marked as per IS:12592-2002 including carriage from the stores of the Engineer-in-charge to site of work, loading, unloading including stacking and setting the same to correct lines over manholes including cement concrete copping (M:20) around the frame etc. Dia of steel for lifting hook is 16mm. (for EHD and HD). 650 x 650 mm rectangular RCC man hole cover only as per ISI RCC Man hole cover with Frame d)650 x 650 mm rectangular clear opening RCC man hole cover with (iii) Medium Duty	29.34 d (Analy sis)	Nos.	4	4
21	Providing & fixing 1050 mm x 1050 mm clear inside opening rectangular RCC manhole cover and frame ISI marked as per IS:12592-2002 including carriage from the stores of the Engineer-in-charge to site of work, loading, unloading including stacking and setting the same to correct lines over manholes including cement concrete copping (M:20) around the frame etc. Dia of steel for lifting hook is 16mm. (for EHD and HD). 1050 x 1050 mm rectangular RCC man hole cover only as per ISI RCC Man hole cover with Frame d)1050 x 1050 mm rectangular clear opening RCC man hole cover with (iii) Medium Duty	29.34 d (Analy sis)	Nos.	2	2
22	Operation and maintenance for 5 years		Lumps um	Lumpsum	1 Job

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\multicolumn{3}{c}{Analysis of rates}		
Item Sr. no	Description	Analysis
18	Providing & fixing 650 mm x 650 mm clear inside opening rectangular RCC manhole cover and frame ISI marked as per IS:12592-2002 including carriage from the stores of the Engineer-in-charge to site of work, loading, unloading including stacking and setting the same to correct lines over manholes including cement concrete copping (M:20) around the frame etc. Dia of steel for lifting hook is 16mm. (for EHD and HD). 650 x 650 mm rectangular RCC man hole cover only as per ISI RCC Man hole cover with Frame d)650 x 650 mm rectangular clear opening RCC man hole cover with (iii) Medium Duty	Rate for cover of size 450 mm x 600 mm= Rs 956 CSR item 29.34 d) iii) rate for 650*650 size = 956*650*650/(455*610) =Rs 1455
19	Providing & fixing 1050 mm x 1050 mm clear inside opening rectangular RCC manhole cover and frame ISI marked as per IS:12592-2002 including carriage from the stores of the Engineer-in-charge to site of work, loading, unloading including stacking and setting the same to correct lines over manholes including cement concrete copping (M:20) around the frame etc. Dia of steel for lifting hook is 16mm. (for EHD and HD). 1050 x 1050 mm rectangular RCC man hole cover only as per ISI RCC Man hole cover with Frame d)1050 x 1050 mm rectangular clear opening RCC man hole cover with (iii) Medium Duty	Rate for cover of size 450 mm x 600 mm= Rs 956 CSR item 29.34 d) iii) rate for 1050*1050 size = 956*1050*1050/(455*610) =Rs 3797