SUPPORTING DOCUMENT FOR 7.1.4

WATER CONSERVATION FACILITIES AVAILABLE IN THE INSTITUTION

KAMALA NEHRU COLLEGE
(University of Delhi)
NAAC Accredited with 'A' Grade
August Kranti Marg, New Delhi – 110049
Phone: 011-26494881, Telefax: 011-26495964

Estd.1964

कमला नेहरू कॉलेज
(दिल्ली विश्वविद्यालय)
रा. मू. एवं प्र. प. द्वारा 'ए' श्रेणी प्रत्यायित
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1. Rain Water Harvesting as one of the best practice
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Rain water harvesting as one the best practices of college

To make the College campus more environmentally sustainable, the College has had rainwater harvesting system installed in the library building for a very long time. It is a Rooftop Rainwater Harvesting system. Here, the rooftop is the catchment area that catches the rainwater which is then diverted through down pipes to the gutters. The gutters then divert the rainwater to the main pit where the bore is made. The main pit can also be referred to as settlement or filtration tank. All the rainwater diverted to the main pit passes through a filter media (gravel bed) to remove silt, dust and organic matter. After passing through filter media, water percolates, and recharges the groundwater through bore. The College also has vast open grounds with soft soil cover to allow the percolation of water and serves as a natural water recharge system.

LINK- https://www.knc.edu.in/rainwater.php

1.Rainwater Harvesting

July, 2021

For

Kamala Nehru College, Hauz Khas

Indian National Trust For Art and Cultural Heritage Natural Heritage Division
New Delhi

What is Rainwater harvesting?

Rainwater harvesting is

- Collection and storage of rainwater.
- That round off from catchment area like roofs, roads, pavements, etc.
- This rainwater can recharge the ground water.

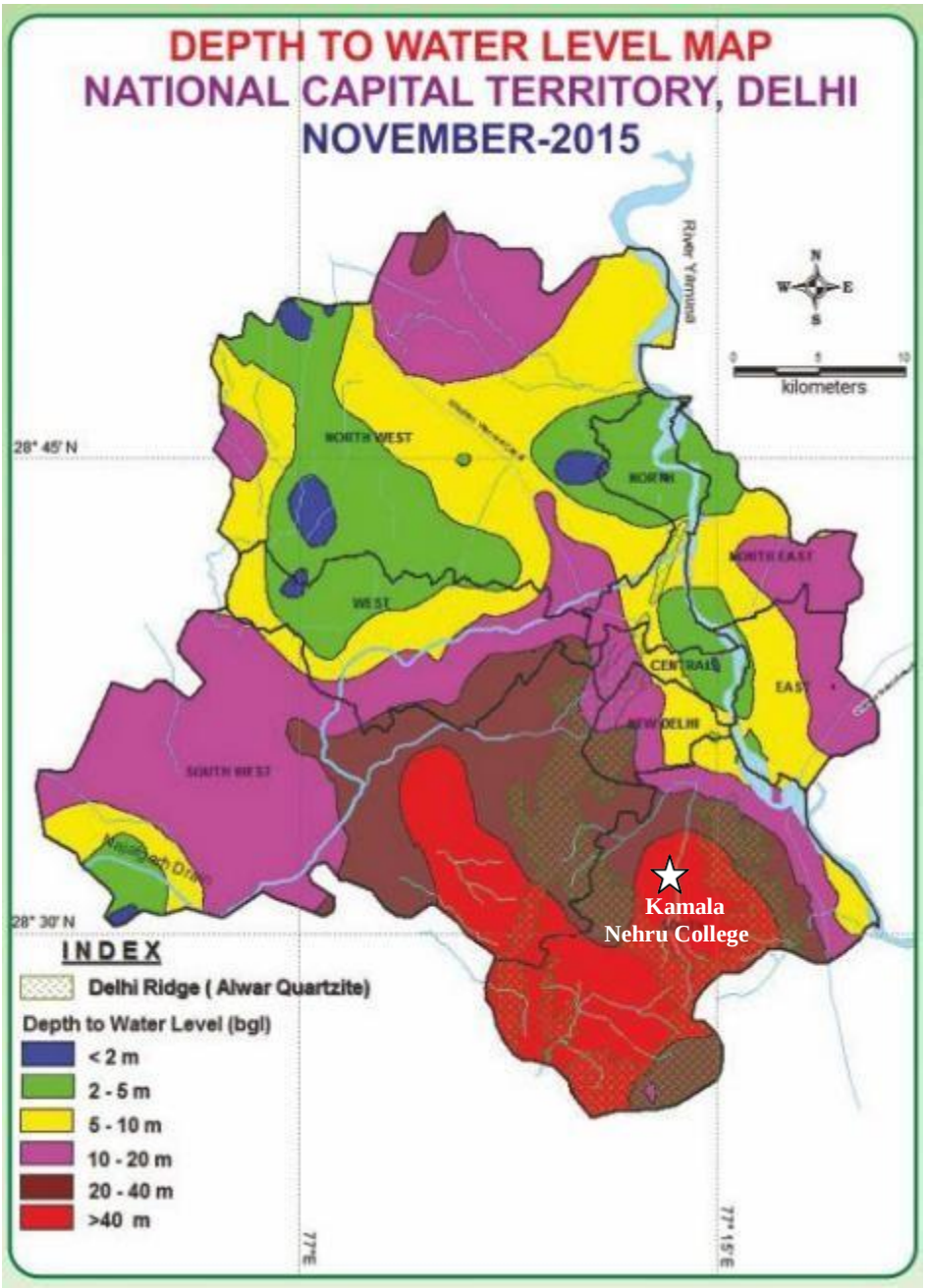


Figure No. 1 : Delhi Ground Water Level Map

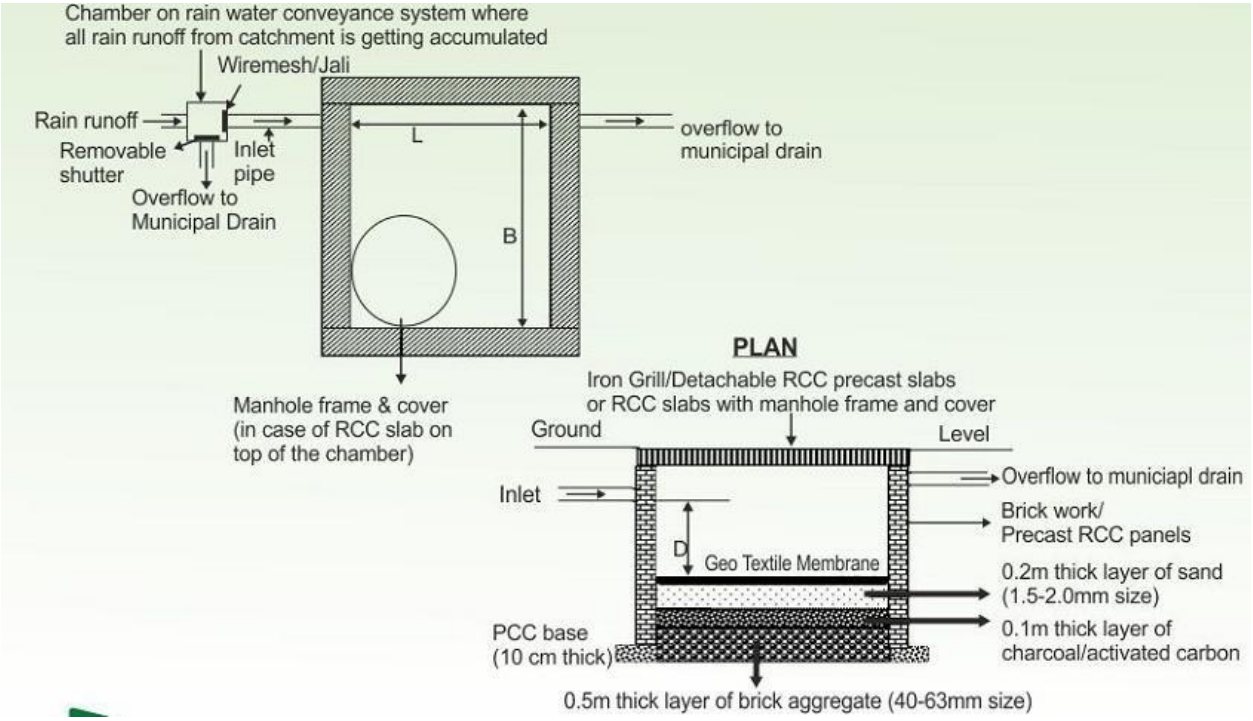
Importance of Rain Water Harvesting

Rainwater Harvesting is critical for Delhi's Water Security. By adding to Delhi's own limited water resources it will

- Augment the water supply.
- Stop the rapid fall in Ground Water Level.

Two Type of RWH Recharge Chambers

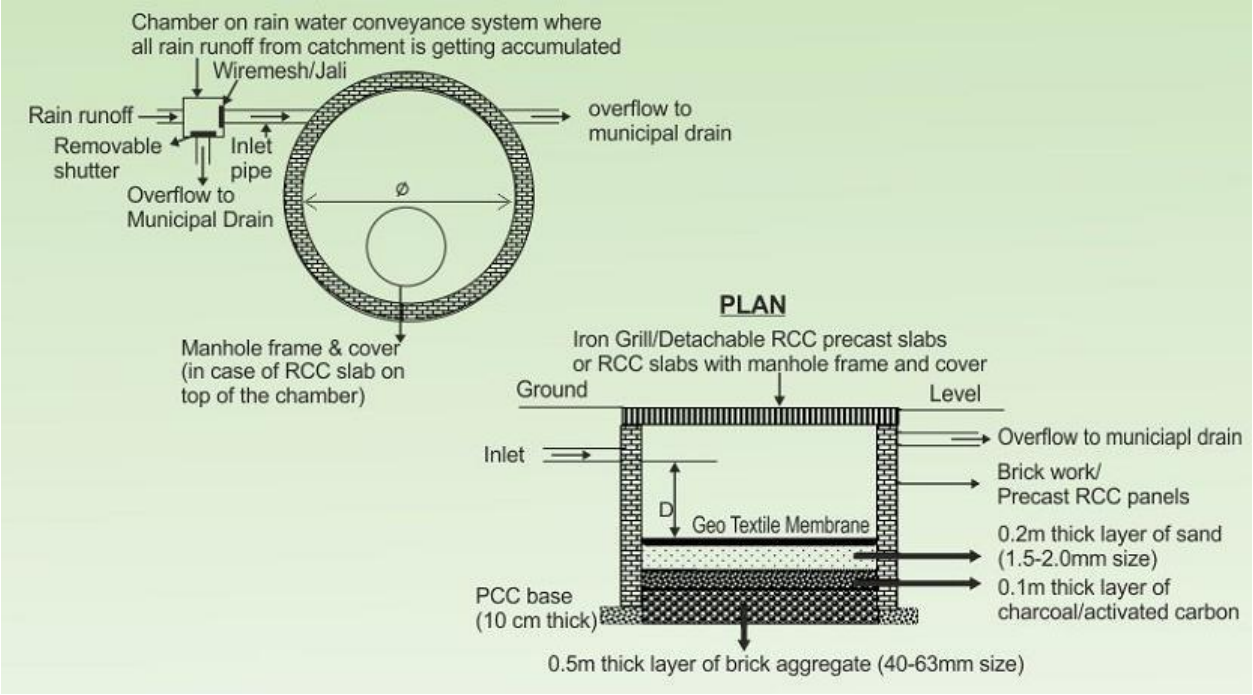
1) Typical Rectangular Recharge Chamber for RWH



Area Required

S. No	Plot Area (sq.m)	Maximum Roof-top area as per DDA MPD-2021	Required Capacity (cum)	Suggestive dimensions of Recharge Chambers/Trenches {length (L) X breadth (B) X depth (D) in meters}
1	100	90	1.8	1.2X 1.2 X 1.25
2	200	150	3	1.2 X 1.2 X 2.1
3	300	225	4.5	1.5 X 1.5 X 2.0
4	400	300	6	1.8 X 1.8 X 1.85
5	500	375	7.5	1.8 X 1.8 X 2.30

2) Typical Circular Recharge Chamber for RWH



Area Required

S. No	Plot Area (sq.m)	Maximum Roof-top area as per DDA MPD-2021	Required Capacity (cum)	Suggestive Diameter (Ø) (internal) of Circular Chambers (mtrs)	Depth (D) of Circular Chambers (mtrs)
1	100	90	1.8	1.2m (4 ft)	1.6
2	200	150	3	1.5m (5 ft)	1.7
3	300	225	4.5	1.5m (5 ft)	2.5
4	400	300	6	2 structures of size mentioned in S. No. 2	
5	500	375	7.5	1 structure of size mentioned in S. No. 2 & 1 structure of size mentioned in S. No. 3 (i.e. total 2 structures)	

Design criteria for RWH System

RWH System should be designed in such a way that;

- Even if it rains with high intensity continuously for 1 hour, system should be able to store and recharge the runoff that flow into it.
  It is safe, easy to make and easy to maintain.

- it complies with the DJB guidelines so that you are able to avail of the RWH rebate.

based on this, some recommendations for Implementation, Operation and Maintenance of RWH systems are

- It has to be ensured that no waste water enters recharge structures.
- An overflow pipe in recharge structures should be provided leading out/falling into municipal storm water drains/open areas. Under no circumstances should they be connected to the sewer.
- Post monsoon cleaning and maintenance of recharge structures shall be carried out.
- Calculate the water holding capacity of the pit (in cubic meters) that will build by using this simple formula:

Rooftop Area (Sqm) X Rainfall intensity (m/s) X 0.8 (Runoff coefficient)

Location:

The Kamala Nehru College is located at northern side of Siri Fort Institutional Area. Campus is spread over 3.75 ha. approx.

Figure No. 2 : Kamala Nehru College Location Map

Site Plan - Kamala Nehru College

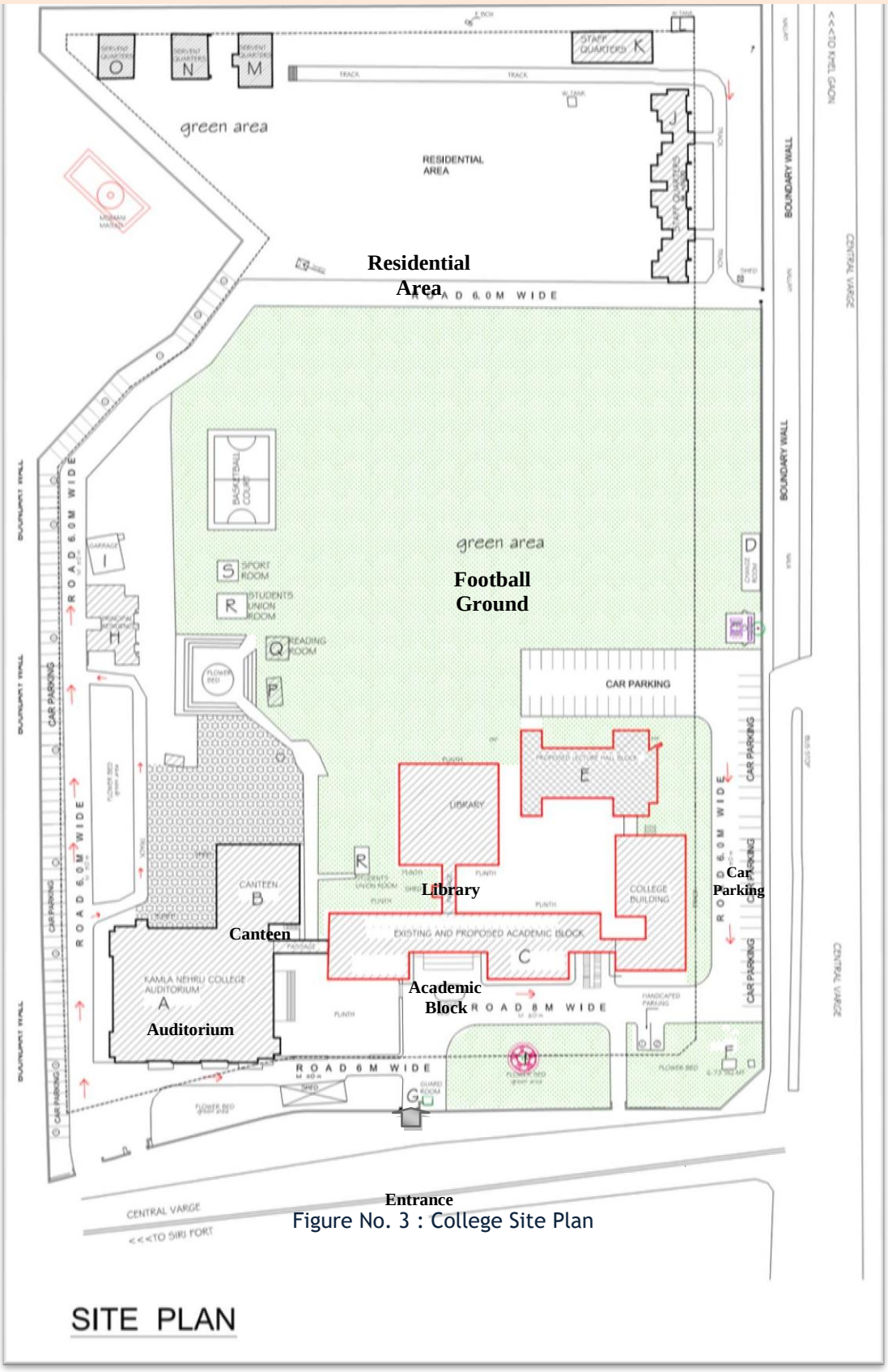


Figure No. 3 : College Site Plan

Kamala Nehru College is spread over 37647.54 sqm. The campus is comprised of Academic Block, Auditorium, Canteen, Library, Staff quarters, Servant quarter, Football ground, Basketball court, Pathway, open green area etc. The total built-up area is 4735 sqm and the openareais33112sqm.70% oftheopenareahassoftlandscape,whererunoffwater drips at ease to recharge ground water.

C.NO	ITEMS	AREA IN HQ.MT
	AUDITORIUM + CANTEf° N (A—LBJ	I TO. 27
2	COLLLCE BU fLDINC (Cj	I 744.84
3	CNANGZ ROOM (D)	5 3.46
a	UAU RE CALL (E)	445.34
	‹rj	33.66
6	GUARD ROOM (CJ	4.2
7	PRINCIPLC RE5ID£NCC ‹<J	16739
6	GARRAGE (I)	29.27
s	uTArr QuARTE ‹J)	283.89
!	S+A+F QUAR+£A (by	12609
J I	WATER TANK (L)	I 6
I 2	SERVANT QUARTERS (M)	94.24
I 3	SERVANT QUARTERS (N)	62. 19
14	SERVANT QUART CA (OJ	7943
16	READING ROOM *!O)*	2605
17	STUDY NTB UNION ROOM (R}	38
!	SPORTS ROOM(SJ	2 I
	*OTAL TI'RRAC£ AREA	4735.88

SITE AREA-37847.544 SQ.MT

3ITE AGA-TOTAL TERRACE AREA= 37B47.5 4 - 4*45.68

——33 I I . 664 HQ MT

Total built up area of the campus is 4735 sqm. As per the site analysis, effective built up rooftop area from where runoff would be collected for rainwater harvesting is 3000 sqm.

Total volume of runoff which would be stored per hours is

3000 sqm X .025m X 0.8 = 60cum

As per the site slope analysis a single storage point would not be possible and multiple recharge pits would have to be appropriately sited. In addition there would be runoff from paved areas which is mostly discharged into soft areas.

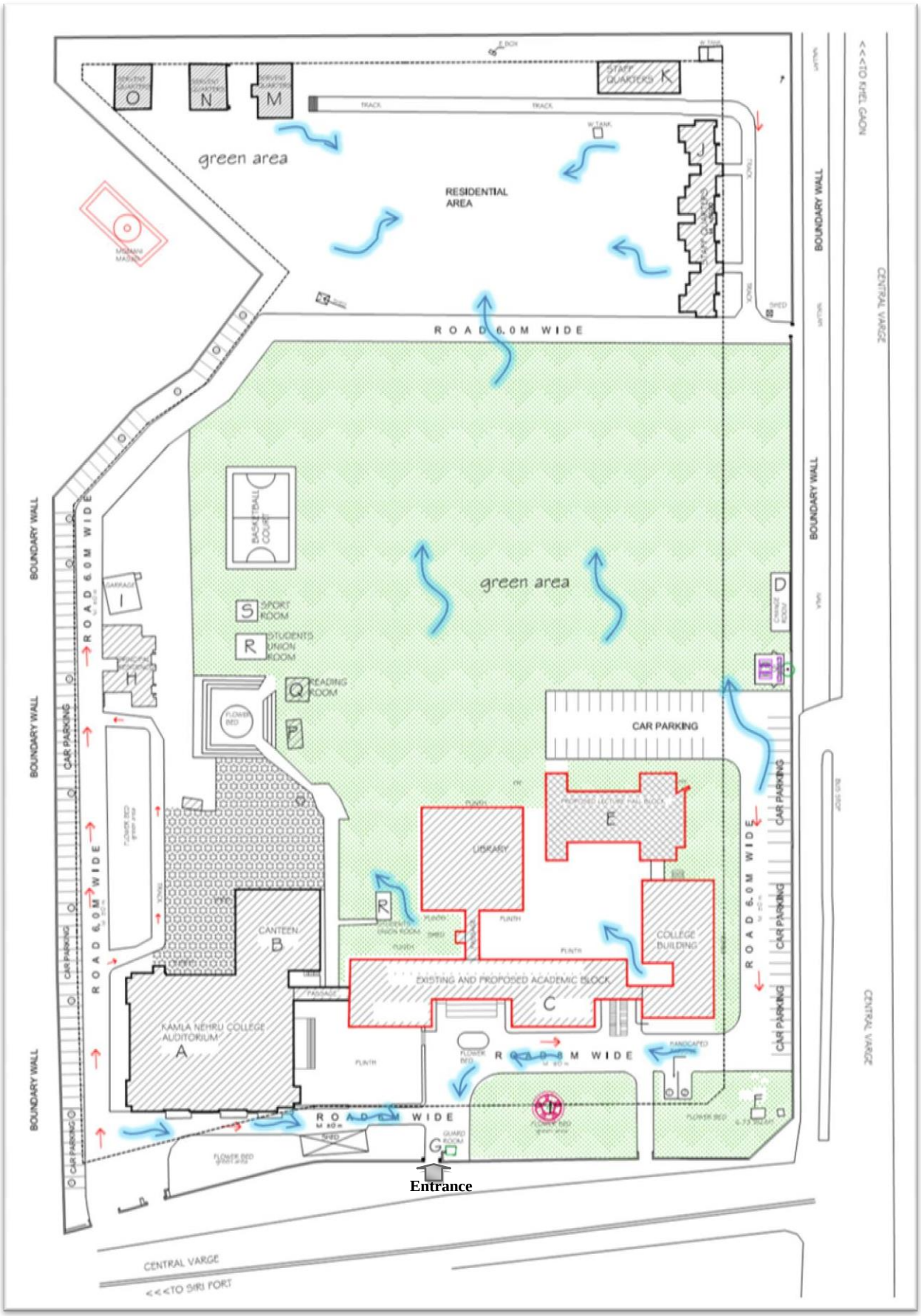


Figure No. 4 : Map Showing Ground Slope of the Campus

Recommendations

Analgising the site slope, 5 different sites (as marked in proposal map) have been identified for the storage pits which would act as recharge chamber.

Figure No. 5 : Proposed Tanks Location

Site 1:

Location =Right side of the entrance gate.

Catchment area = Auditorium

Area = 950 Sqm

Required Volume of Structure = 950 X 0.025 X 0.8 = 19Cum

Radius of circular tank = 1.75 m

Depth = 2 m

Site 2 :

Location = Left side of the entrance gate

Catchment area = Partial Academic Block (50%)

Area = 370 Sqm

Required Volume of Structure = 370 X 0.025 X 0.8 = 7.4 Cum

Radius of circular tank = 1m

Depth = 2 m

Site 3 :

Location = Back Side (right) of the Academic Block

Catchment are = Canteen & Partial Academic Block (20%)

Area = 315 + 200 = 515 Sqm

Required Volume of Structure = 515 X 0.025 X 0.8 = 10.3 Cum

Radius of circular tank = 1.3m

Depth = 2 m

Site 4 :

Location = Back side (left) of the Academic block

Catchment area = Partial Academic Block (30%)

Area = 475 Sqm

Required Volume of Structure = 475 X 0.025 X 0.8 = 9.5 Cum

Radius of circular tank = 1.25m

Depth = 2 m

Note: *Site 1, 2, 3 & 4 Recharge tanks are in cylindrical shape of different radius as per calculation. These tanks are 2m deep with brick work on its wall and stone boulders, gravels & coarse sand on tanks bed . M.S grill has been used to cover the tanks.*

Site 5 :

Location = Staff Quarters area

Catchments Staff Quarters, Servant Quarters & Football Ground (25%)

Area = 665 Sqm + 2100Sqm = 2765 Sqm

Required Volume of Structure = 2765 X 0.025 X 0.8 = 55 Cum

Radius of circular tank = 3m

Depth = 2 m

Note: *Site 5 Recharge tank is in bowl shape with base radius 3m and top radius 4 m. This tank is more similar to an open pond with natural grass on its slope (no brick work) and stone boulders, gravels & coarse sand on tank bed .*

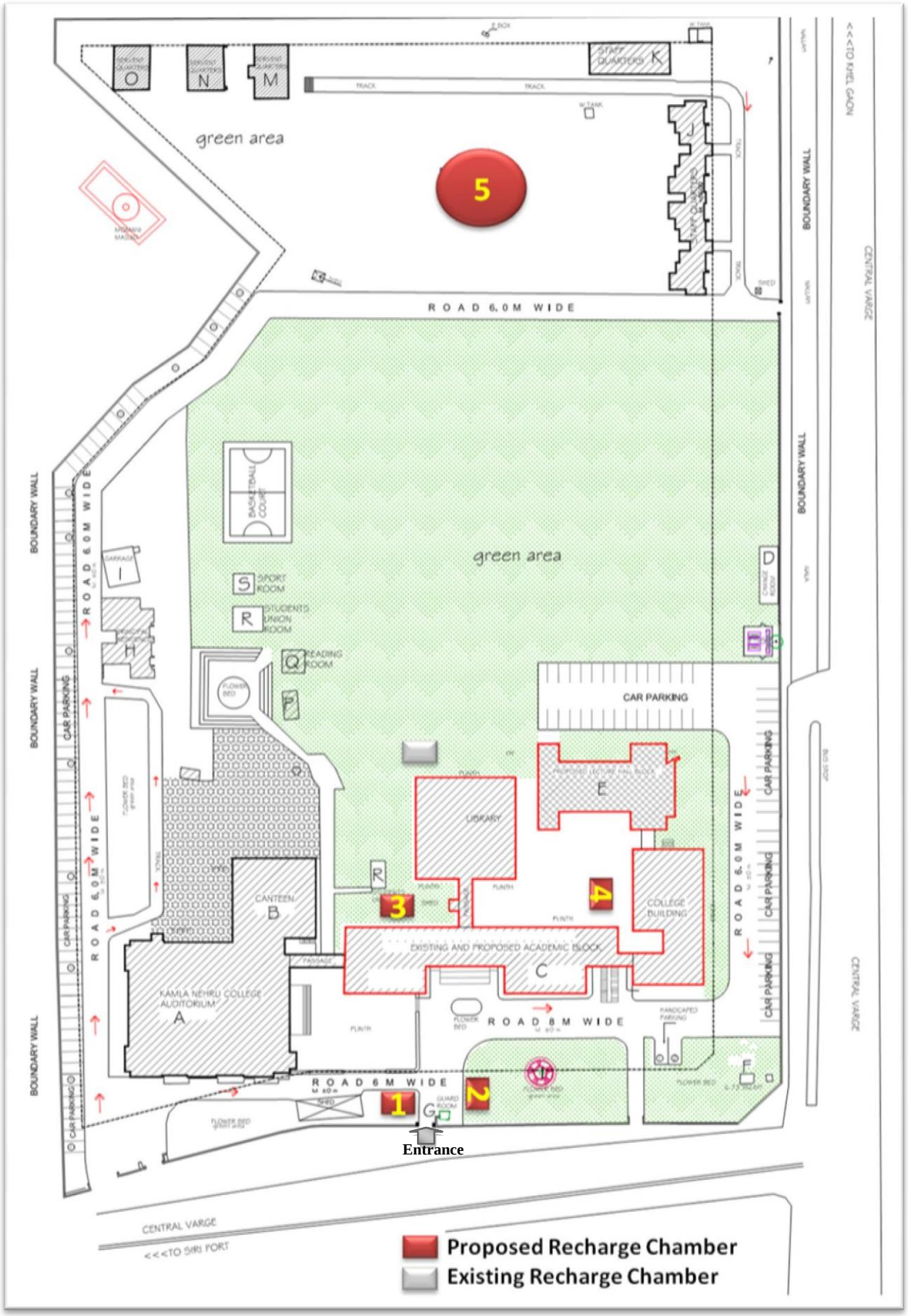


Figure No. 6 : Proposal Map

Design Details: Recharge Tank 1, 2,3, & 4

- Earth excavation Work as per tank dimension.
- Excavating trenches as per requirement.
- PVC pipe to direct the runoff to tanks.
- Constructing brick masonry tanks wall.
- Filling, Spreading & Levelling stone boulders, gravels & Coarse sand.
- M.S Grill to cover the recharge tanks.
- Surrounding surface Improvement to direct the overall slope towards tanks.

Design Details: Recharge Tank S

- Earth excavation Work as per tank dimension.
- Excavating trenches as per requirement.
- Filling, Spreading & Levelling stone boulders, gravels & Coarse sand.
- Surrounding surface Improvement to direct the overall slope towards tank.

Rainwater Harvesting at Kamala Nehru College

Abstract of Cost

Sl.no	DSR 2018	Descriptions	Qty	Unit	Rate (Rs)	Amount (Rs)
1	2.6	Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Engineer-in-charge. *note: Tank 5 is in bowl with lower radius 3m and top radius 4m*				
	2.6.1	All kinds of soil	185	cum	181.85	33,642.25
2	2.10	Excavating trenches of required width for pipes, cables, etc including excavation for sockets, and dressing of sides, ramming of bottoms, depth upto 1.5 m, including getting out the excavated soil, and then returning the soil as required, in layers not exceeding 20 cm in depth, including consolidating each deposited layer by ramming, watering, etc. and disposing of surplus excavated soil as directed, within a lead of 50 m :				
	2.10.1	All kinds of soil				
	2.10.1.2	Pipes, cables etc. exceeding 80 mm dia. but not exceeding 300 mm dia	200	metre	364.20	72,840.00

3	2.26	Extra for every additional lift of 1.5 m or part thereof in excavation / banking excavated or stacked materials.				
	2.26.1	All kinds of soil	34	cum	90.40	3,073.60
4	10.2	Structural steel work riveted, bolted or welded in built up sections, trusses and framed work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete. MS TUBE Section 50mm x 100mm x 4.5 thick	950	kg	101.75	96,662.50
5	16.15.2	Welded steel wire fabric of required width having rectangular mesh painted with two or more coats of enamel paint of approved shade over a coat of primer (Priming & Painting to be paid for separately). 7.75kg/sqm.	700	kg	74.35	52,045.00
6	6.1	Brick work with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in foundation and plinth in:				
	6.1.1	Cement mortar 1:4 (1 cement : 4 coarse sand)	100	cum	6376.25	6,37,625.00
7	4.1	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level :				
	4.1.8	1:4:8 (1 Cement : 4 coarse sand (zone-III) : 8 graded stone aggregate 40 mm nominal size)	15	cum	5789.6	86,844.00
8	15.2	Demolishing cement concrete manually/ by mechanical means including disposal of material within 50 metres lead as per direction of Engineer - in - charge.				
	15.2.1	Nominal concrete 1:3:6 or richer mix (i/c equivalent design mix)	10	cum	1737.45	17,374.50
9	15.60	Disposal of building rubbish / malba / similar unserviceable, dismantled or waste materials by mechanical means, including loading, transporting, unloading to approved municipal dumping ground or as approved by Engineer-in-charge, beyond 50 m initial lead, for all leads including all lifts involved.	10	cum	138.85	1,388.50

10	16.60	Manufacturing, supplying and fixing retro reflective overhead signage boards made up of 2 mm thick aluminium sheet, face to be fully covered with high intensity and encapsulated lens type heat activated retro reflective sheeting conforming to type - III of ASTM-D-4956-01 as approved by Engineer-in-charge, letters, borders etc. as per IRC : 67-2001 in silver white with blue colour back ground and with high intensity grade, pasted on substrate by pressure sensitive adhesive backing which shall be activated by applying pressure conforming to class II of ASTM-D-4956-01 and fixing the same to the plate of structural frame work by means of suitable sized aluminium alloys, rivets or bolts & nuts @ 300 mm centre to centre all along the periphery as well as in two vertical rows along with theft resistant measures, including the cost of painting with two or more coats of epoxy paint in grey colour on the back side of aluminium sheet including appropriate priming coat. The rate includes the cost of rounding off the corners, lowering down the structural frame work from the gantry, fixing and erecting the same in position all complete as per drawings, specification and direction of the engineer-incharge.(Structural frame work including M.S. plate to be provided separately. Rectangular area of the sheet only shall be measured for payment).				
	16.60.1	Overhead informatory road signage	5	sqm	5284.45	26,422.25
11	13.2	15 mm cement plaster on the rough side of single or half brick wall of mix :				
	13.2.1	1:4 (1 cement: 4 fine sand)	100	sqm	307.9	30,790.00
12	23.5	Supplying, filling, spreading & leveling stone boulders of size range 5 cm to 20 cm, in recharge pit, in the required thickness, for all leads & lifts, all complete as per direction of Engineer-in-charge.	25.6	cum	1326.55	33,959.68
13	23.6	Supplying, filling, spreading & leveling gravels of size range 5 mm to 10 mm, in the recharge pit, over the existing layer of boulders, in required thickness, for all leads & lifts, all complete as per direction of Engineer-in-charge	5.11	cum	1326.55	6,778.67
14	23.7	Supplying, filling, spreading & leveling coarse sand of size range 1.5 mm to 2 mm in recharge pit, in required thickness over gravel layer, for all leads & lifts, all complete as per direction of Engineer - incharge	10.23	cum	1326.55	13,570.61

15		**Sub Total**		Rs		**11,76,623.56**
16		ESI and PF @4.25% on 25% of sub total				12,501.63
17		**Total**		**Rs**		**11,89,125.18**
18		Add Departmental Charges @8.00%				95,130.01
19		**Total**		**Rs**		**12,84,255.20**
20		Add Contingencies @5%				64,212.76
21		**GRAND TOTAL**		Rs		**13,48,467.96**
		Say		**Rs**		**13,48,500.00**

Rupees Thirteen Lakhs Forty Eight Thousand Fifty Hundred only

2. RAINWATER HARVESTING PROJECT

MAY 2018

SURVEY

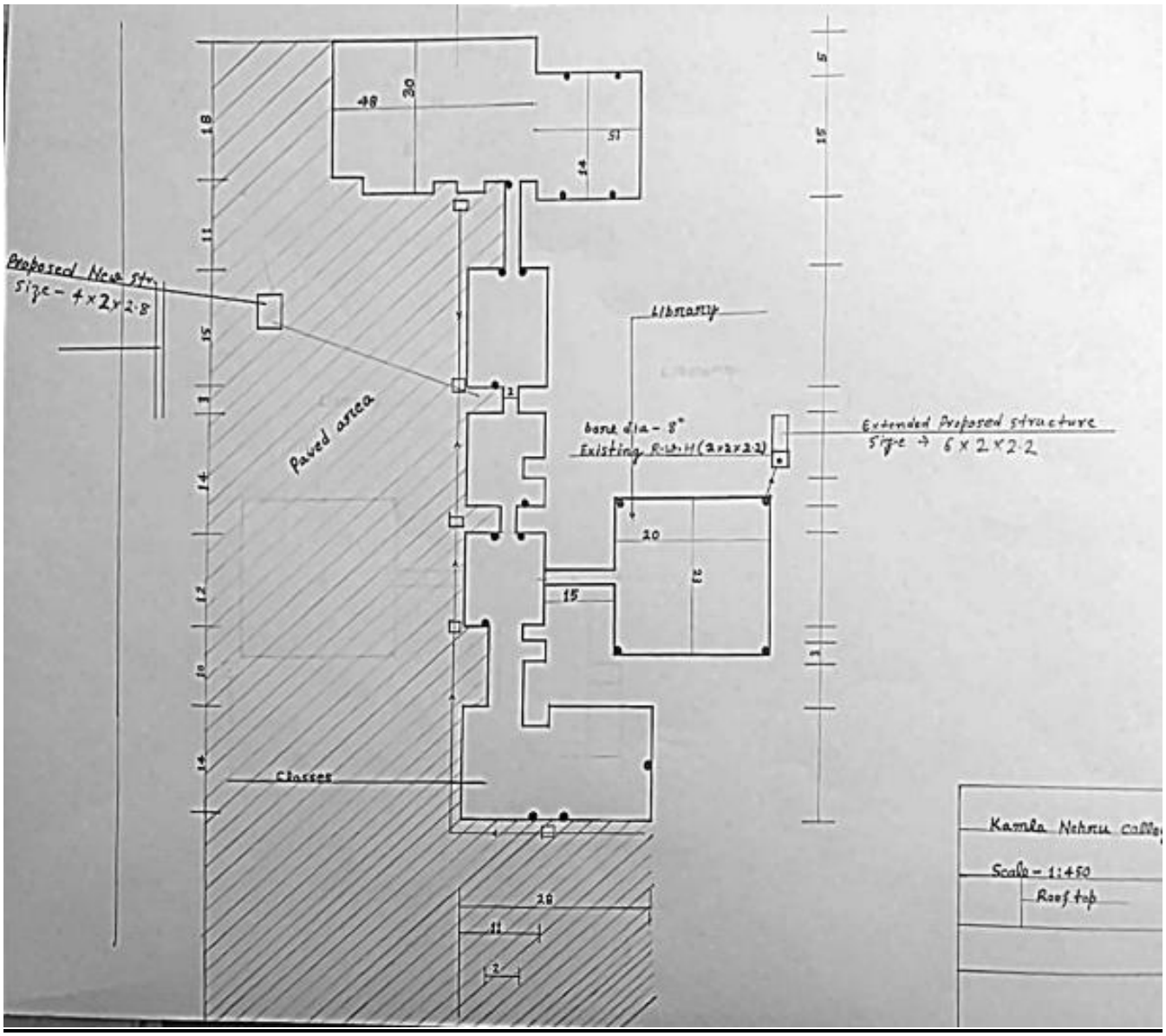
For

KAMLA NEHRU COLLEGE, HAUZ KHAS

F O R C E

F O R C E
Forum for Organised Resource Conservation and Enhancement
For more information on FORCE visit our website: www.force.org.in
FORCE–C-8/8035, VasantKunj, New Delhi–110070.T: 11 46018754 M: 9899812888 email jyoti@force.org.in

MAP SHOWING TOTAL AREA OF KAMLA NEHRU COLLEGE


Proposed New Str.
Size - 4 x 2 x 2.8
Paved area
Classes
Library
base dia - 8"
Existing R.C.C. (2 x 2 x 2.2)
Extended Proposed structure
Size → 6 x 2 x 2.2
Kamla Nehru
Scale - 1:450
Roof top

***As per college site map total roof top area is calculated = 3000 Sq meters**
***As per calculated area, volume of structure should be (3000 m2*0.025m*0.8) = 60 cum**
***After survey, KAMLA NEHRU College have already made RWH structure of capacity (2m *2m *2.2m)+5 cum = Approx. 14 cum.**

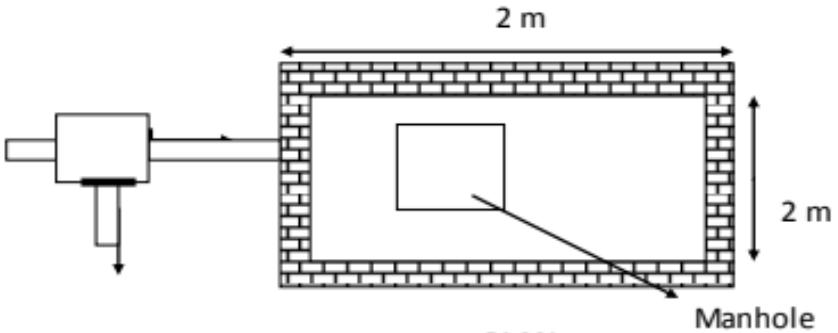
RECHARGE POTENTIAL

Site No.	Land use break-up	Area (sq.m)	Annual Rainfall (m)	Hourly Rainfall (m)	Coeffic ients	Hourly Runoff (cum/hr)
S-1	Roof top	3000	0.54	0.025	0.8	60
	Total	3000				60

DETAILS OF STRUCUTRES

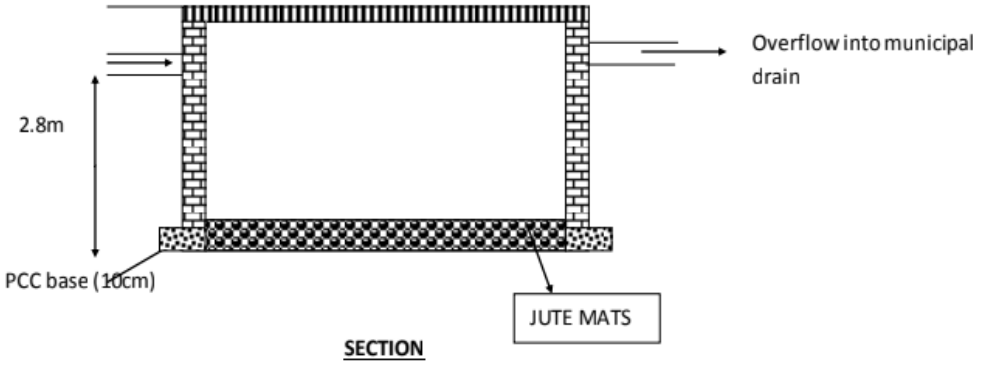
Site No.	Structure Size(m)	Location of structure	Channelization (m)
S-1	2m*2m*2.8m	At left side of entrance gate	120
S-2	6m*2m*2.2m	Attached to the existing pit	100
	Total		220

DESIGN OF RWH STRUCTURE PROPOSED: 2m*2m*2.8m



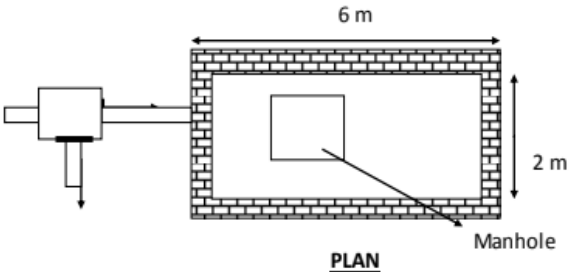
PLAN

DESIGN OF RWH STRUCTURE PROPOSED: 6m*2m*2.2m

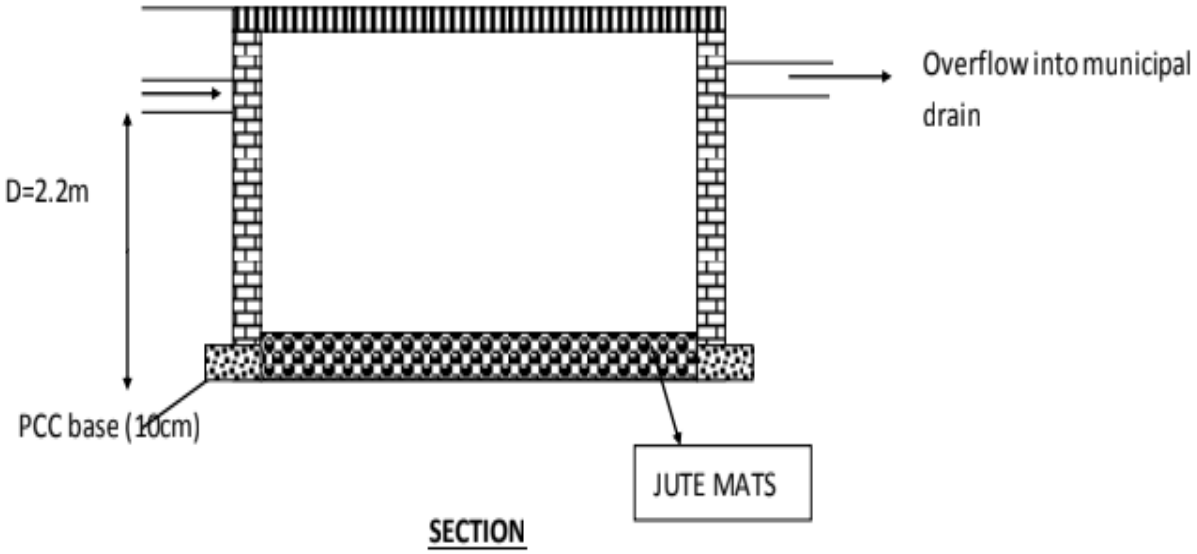


SECTION

DESIGN OF RWH STRUCTURE PROPOSED: 6m*2m*2.2m



PLAN



SECTION

COST OF RECHARGE STRUCTURES PROPOSED: (2m*2m*2.8m)

S No.	Items	Quantity	Amount (Rs)
1	Construction of pit of size. 2m*2m*2.8m	1	155436
2	Manholes cover	2	4000
3	RCC Manholes	5	15000
4	Channelization through 4"/6" dia pipe	120m	96000
5	Shutter	1	2000
6	Disposal of malba/earth excavated	From structures/channelization	4000
7	Foot steps	7	2100
8	Jute mats	3-4 folds	2500
	Total		281036/-
	FORCE Overhead	**10% of construction cost**	28103.6/-
	Grand Total		**3,09,139.6/-**

COST OF RECHARGE STRUCTURES PROPOSED: (6m*2m*2.2m)

S No.	Items	Quantity	Amount (Rs)
1	Construction of pit of size. 6m*2m*2.2m	1	126892
2	Manholes cover	2	4000
3	Channelization through 4"/6" dia pipe	100	8000
4	Shutter	1	2000
5	Disposal of malba/earth excavated	From structures/channelization	4000
6	Foot steps	7	2100
7	Jute mats	5-6 folds	3000
	Total		149992/-
	FORCE Overhead	**10% of construction cost**	14999.2/-
	Grand Total		**1,64,991.2/-**

Note:-
*The cost of manholes and channelization is on actual. If it will increase, cost will increase.
*The above mentioned costing is for normal soil condition, if hard rock will found cost will increase.

PAYMENT TERMS

*60% Advance payment.
*40% after completion of 85% work.
*Rainwater harvesting certificate will be provided in next 30 days after completion of work and received of payment.

References

1. **D.A Kampman (2007), 'The Water Footprint of India'**
2. **A. Y. Hoekstra, M.M Mekonnen (2011), 'National Water Footprint Accounts'**
3. **Water Footprint, Centre for Science and Environment**
4. **A. Y. Hoekstra, M.M Mekonnen (2010), 'The Green, Blue and Grey Water Footprint of Farm Animals and Farm Products'**
5. **A. Y. Hoekstra, A. K. Chapagain (2005), 'Water footprints of nations: Water use by people as a function of their consumption pattern'**

For the master data set: Water Footprint of students of Kamala Nehru College
https://onedrive.live.com/edit.aspx?resid=EC5E742A2C430CCA!1471&cid=07a2aeaf-d50d-41a1-9790-e6901f523084&ithint=file%2cxlsx&wdOrigin=OFFICECOM-WEB.START.MRU