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Water Conservation at Chandigarh University, Gharuan, Punjab-Recommendations and Observations

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Abstract: ***The technical aspect of this paper is water conservation. Water table is getting depleted in the area because of rapid withdrawal of water. University needs nearly twenty lakhs liters of water every day. Farmers in the adjoining areas also pump out lot of water required for irrigating paddy. Paddy needs 150 cm of water for growth stage .Part of it is met by monsoon and largely by pumping out of water. There had been a decline of 50-100 cm per year sin the water table in the last two decades. All this has led to the need for water conservation. It involves harvesting, recycling of water and improving infiltration. The campus works on the principle of zero discharge. It means we are not discharging water into any municipal drain or rivulet. Waste water is recycled through 1.5mlpd sewage treatment plant and used for horticulture. Roof top rainwater and storm water is harvested through ten rain water harvester located after proper hydrologic analysis. Interlocking tiles are preferred over impermeable pavement to improve infiltration***

Key Words: ***Catchment Area, Conserve, Groundwater, Rainwater Harvesting, Rainfall Data, Recharge, Runoff. , Water conservation***

I. INTRODUCTION:

Punjab experiences 70-80 cm of rainfall annually. The state has witnessed large population growth, huge construction & unplanned urbanisation in the last two decades. Due to the rapid unplanned urbanisation, streets are inundated with the water & water table is getting lowered. people have started experiencing the water woes. Rice is also sown in adjoining areas for commercial reasons. Rice is not the natural crop of this region. It is naturally grown in coastal areas and is staple diet for people living in coastal areas. Rice needs 150 cm of water during sowing season and another 5cm for sapling stage. Majority of it is met by pumping out water and partially by monsoon. Unplanned rapid urbanisation causes soil erosion & sedimentation during rain. There is rapid & huge withdrawal of ground water leading to depleting water table. .. Pumping out of water for domestic and other purposes has depleted the water table. Where as water was available at 70 to 80 feet few years back, it has fallen to 200 to 300 feet fallen at the rate of 50 cm to 100 cm per year. Rain water harvesting is the panacea for depleting water table, soil erosion & flooding of streets during storms. Whereas rooftop harvesting is a simpler task, flood water harvesting is a daunting and challenging task. Rainwater is dissipated in three ways. Evaporation, infiltration and run off. Due to construction, there are lot of areas where no infiltration takes place. It increases the run off. We at Chandigarh University are concerned about the depleting water table. It is primarily due to pumping out of water and reducing infiltration due to construction of roads and buildings. Depleting water table can be checked by increasing infiltration and harvesting rain water. At Chandigarh University, water conservation is done by harvesting, recycling of water and by improving infiltration.

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II. RAINFALL AND CLIMATE:

The average annual rainfall is 800 mm with standard deviation of 58.4 variance is 8.2 percent. Rainfall season commences in mid june and stretches to mid September. Around 600mm of the total rainfall occur in this monsoon season. Maximum precipitation occurs in the month of july. The weather can be termed as extreme as both winters and summers are harsh. Maximum temperature goes upto 45 Celcius in summers and minimum touches around 0 celcius in january. May and june are the hottest months and December and January are the coldest months. Relative humidity in the morning is higher than that in the evening.It goes to 62.25% in the morning and 40% in the evening. The velocity of wind remains between 4km/hour to 15km/hour.

III. GEOMORPHOLOGY

It lies on eastern part of Punjab state and lies between North latitude30°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. It is broadly divided into alluvial fans and alluvial plains. The soil types mainly consist of intermittent layers of thick sand, silty sand, silty clay and clay. The density of population is 960 person per square km. So these alluvial plains are of vital economic importance to as support this dense population.

IV. DRAINAGE

The district is divided into derabassi , kharar and majri block. sGhaggar river and its tributaries carry the drainage and runoff waters of the district.Siswan nadi which emerges from shivalik hills drains the northern part of the district joins satluj rivers in the ropar district. Two more rivulets Janti devi ki rao and patiali rao also emerge from shivalik hills drain in NE and SW directions and joins Ghaggar river. Irrigation in the district is done mainly by tubewells. Water table is going down at the rate of 50-100 cm per year due to huge withdrawals of ground water.

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The main khariff crop is paddy whereas wheat is the major rabi crop. 750 square km of area is under agriculture which is 73% of total area.

VI OBJECTIVE:

The objective of this paper is not only to cater to the needs of Chandigarh University but also be helpful in water conservation practices in other institutes and universities and also in policy formulation by various government agencies. Efforts have also been made to suggest a more economical and efficient model for rain water harvester .Suggestions have been made to make storm water harvesting successful and time interval for replacing top layer of filter material.

VII. NEED ANALYSIS OF WATER CONSERVATION

Water conservation is basically checking the declining water table .Due to huge withdrawal of water for agricultural and domestic needs; water table is getting depleted at the rate of 50 to 100cm per year. It results in increased power required to pump out water from greater depths. Toxicity levels in the ground water are increasing. Rise of lead contents in the ground water is a cause of concern as it causes a draconic disease like cancer. There are some twelve thousand residents in Chandigarh University. Considering consumption of 135lpcd the total total consumption of these residents is approximately fourteen lakh liters. Another twenty thousand visit university on daily basis and considering 25 lpcd demands, their consumption is five lac liters. So the university needs at least nineteen lac litres of water everyday. It produces lot of grey water and waste water. Considering it a social responsibility to check the declining water table , water is recycled through STP and grey water is harvested. At Chandigarh University, we are doing both roof top and storm water harvesting.

VIIa) RAIN WATER HARVESTING

We are doing both roof top and flood water harvesting. Water collected on roofs of all the buildings is used to recharge ground water. Water is filtered before it is allowed to go to aquifer. Water from roof top first comes to de silt chamber by rigid PVC pipes. Sedimentation of fines takes place in de silt chamber. This water then goes to recharge well which has filter material consisting of (40-60) mm coarse gravel at the bottom followed by 20mm coarse aggregate and finally has a sand layer at the top. This sand layer is replaced annually or as and when required. There is a perforated 5" diameter pipe at the centre of the recharge well. Roof top harvesting is almost maintenance free and has only initial cost on infrastructure. Flood water harvesting needs continuous clearing of drains as water contains leaves and fine soil particles. These leaves and other insoluble impurities tend to block mechanical filters and dissolved fine soil tends to block sand filter. It requires monitoring and manually clearing the blockages. We have total ten recharge wells. Nine of these recharge wells are catering to roof top harvesting and one of them is harvesting rain water falling on roads

VIIb) SEWAGE TREATMENT PLANT

There is 1.5 mlpd capacity sewage treatment plant at Chandigarh university. Waste water from hostel and academic block is directed to this sewage treatment plant where it undergoes various processes starting from screening. Screening is a mechanical process to remove leaves, polythene etc from the water. After screening, floating sludge is removed and is spread for drying. The dried sludge changes to manure after decomposition in six to eight months. It is then sold to farmers. The next process is aeration in which air through ducts is passed in water depending upon oxygen demand of water. The last process is chlorination which removes turbidity and odor. Water after chlorination is used for horticulture. Recycled water reduces our dependence on ground water

VIIc) INTERLOCKING TILES

.We also have a policy of using interlocking tiles on footpaths and other spaces so that water can percolate through the joints in interlocking tiles. These tiles are laid on permeable sand bed so that the process of infiltration is unhindered due to paving of roads.

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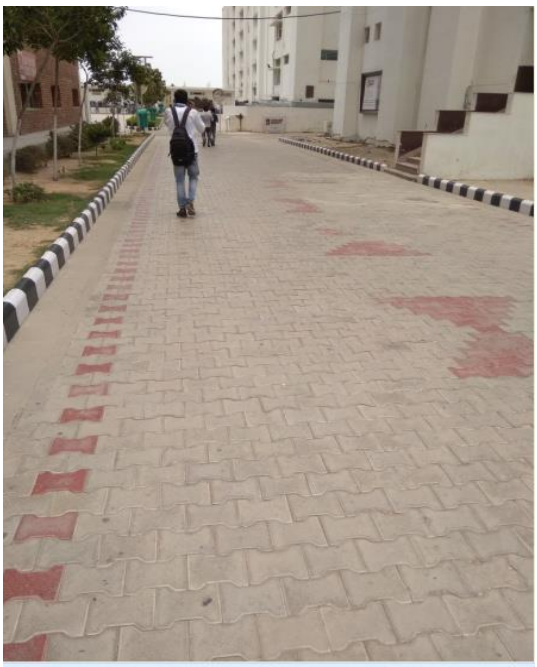
We have reduced the run off by using interlocking tiles instead of concrete slabs. In parks and green areas, only 5% area is allowed to be paved. Footpaths are paved with locking tiles and paver blocks. In our pursuit to lead in every arena, we have further changed our policy for footpaths and walking areas. They will have a boundary made of kerb and backfilled with filter material in the form of well graded aggregates ranging from 1mm size to 5mm. It will have series of advantages over the conventional footpath in terms of increased infiltration, water holding capacity and less impact on knees.



VIII POLICY

In the University the rain water harvesting is done through:

- **10 recharge wells** all across the campus for Ground Water recharging.
- The waste water from Academic blocks & hostel is treated and used for horticulture
- Improving infiltration by using interlocking tiles and filter materials.

University strives towards developing water conservation and water efficiency through following strategies:

1.Educating about the importance of water conservation to all stake holders .

2 Recycling of waste water after passing it through sewage treatment plant.

3.Zero discharge campus which means there is no runoff.Storm water is harvested.

4.Promotes planting indigenous trees in and around the university to reduce water usage..

5 Improving infiltration by using permeable surfaces for pavement.

Campus also maintains efforts of students, faculty and staff to implement sustainable water consumption system through the above mentioned interventions .

The students' awareness regarding the conservation of water is increased through

1) E- Square Club (Environmental Engineering Club)
2) Create awareness among the students through celebration of World Environment Day
3) Introducing the students to the subject of 'Green Buildings' & University core subject Environment & Waste Management and elaborating on its scope.

IX WORKING OF PRESENT HARVESTER

Water is brought to de silt chamber through concrete channels or PVC pipes. Some sediments settle down in de silt chamber. Relatively clean water is taken from top of desilt chamber and directed to filter pit. Filter pit has filter material in the form of sand (1-2)mm, gravel(5-10)mm, pebbles(10-20)mm and cobbles(20-40)mm . Sand is at the top and cobbles are at the bottom. Out flux is taken from bottom of this filter pit. It is directed to recharge the ground water through 15cm diameter pipe.It has a reverse well point where it encounters sand. Reverse well point is a perforated pipe with geotextile wrapped on it. Water is released in aquifers or dried aquifers. Sand bed in the filter pit is replaced annually or as per requirement to check clogging. There are two main considerations for filter material. Hydraulic conductivity and to check the migration of soil particles. Terzhagi has given a criterion of filter material. With the identification of effective stresses in soils by Terzaghi and his co-workers in the early thirties of the last century, (Terzaghi 1936) a new era in soil mechanical engineering was initiated. There are two criterion to fulfill the two main requirements of filter materials. Firstly there should be no migration of soil particles or filter efficiency.

D15filter/d85base soil ≤ 4

This criterion is for filter eff**iciency and** ensures water is clean and transparent after passing through filter.

D15fine-side filter/d85coarse-side base soil ≥ 4

This criterion ensures hydraulic conductivity. The filter has good drainage characteristics and there is no clogging as long as filter material follows this criterion. The first criterion ensures no immigration of soil particles and the second criterion ensures hydraulic conductivity

X . RECOMMENDATIONS FOR FUTURE HARVESTER

Out flux from de silt chamber should be taken to a deep pit of size two feet by two feet. The depth of the pit should be up to the first sand layer encountered but should not be less than ten feets. . Walls of this pit should be brick lined and plastered to prevent it from collapse. This pit should be backfilled with filter material in the form of well graded aggregates from size 1mm to ten mm This size will ensure permeability and also Heavy metals, e.g. zinc (Zn),lead (Pb) copper (Cu), cadmium (Cd),mineral oil hydrocarbons(PAH),polycyclic aromatic hydrocarbons (PAH), and readily soluble salts in runoff are within permissible limits. After a certain period clogging will occur in this pit and permeability will be reduced.

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It is at this time that top two to three feet of filter material have to be replaced with fresh filter material or sand. This type of harvester is highly economical , more efficient and easy to monitor.

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