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Study and Design of Ground Water Techniques

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Abstract: The technique of ground water recharge involves the process of enhancing the natural replenishment of groundwater by artificial means. This technique is often employed in areas where the groundwater level has depleted due to overexploitation or other factors such as climate change.

Various methods are used to recharge groundwater, including surface water spreading, injection wells, recharge trenches, and recharge pits. These methods involve diverting water from streams, canals, or storm water drains to recharge areas. The water then percolates through the soil, replenishing the groundwater reservoir. In addition to artificial methods, natural processes such as infiltration, seepage, and percolation also contribute to groundwater recharge. However, the effectiveness of these natural processes is limited in areas with impermeable soil, low rainfall, or high evaporation rates. Groundwater recharge techniques have numerous benefits, including increasing water availability, improving water quality, reducing soil erosion, and enhancing vegetation growth. Recharge also helps in mitigating the effects of droughts and climate change by maintaining the water table level. Implementation of groundwater recharge techniques requires proper planning and monitoring to ensure the sustainability of the process. Factors such as the source of recharge water, the type of soil, and the depth of the water table need to be considered. In addition, appropriate technology and infrastructure must be in place to facilitate the recharge process.

Overall, groundwater recharge techniques offer an effective and sustainable solution to the problem of depleting groundwater resources. By enhancing the natural replenishment process, these techniques provide a reliable source of water for various purposes, including domestic, industrial, and agricultural use.

Keywords: groundwater recharge, artificial recharge, natural recharge, aquifer, hydrogeology, water management, sustainable water resources.

I. INTRODUCTION

A. Overview

- The primary source of freshwater that meets the needs of the domestic, agricultural, and industrial sectors is groundwater. It is now a necessity for home applications, notably for the country's billion-person population's access to safe drinking water and food.
- The sources of groundwater supply roughly 70% of the water used in rural areas and 50% of the water utilised in urban and commercial areas.
- Since 1991 (2300 m3) to 2015 (1720 m3), the average annual per capita water availability has been progressively declining throughout the nation. For the years 2025 and 2050, respectively, these are anticipated to decrease to 1400 m3 and 1190 m3.
- There has been an exponential increase in the number of ground water structures during the past three decades.

1) Systems For Harvesting Rainwater And Their Features

- A straightforward method for capturing and storing rainwater where it falls is called rainwater harvesting. Depending on the situation and the need, we can either use it to recharge groundwater or store it in tanks.
- Economically cheaper in construction compared to other sources, such as dams, diversion, etc.; Ease in system development in less time. In places with insufficient surface resources or groundwater supplies, rainwater collection is the ideal solution.
- Aids in utilising the main water supply and stops runoff from entering storm or sewage systems, lessening the burden on treatment facilities.
- Recharging aquifers with water, which enables dilution to improve the quality of groundwater already present.

2) *Introduction*

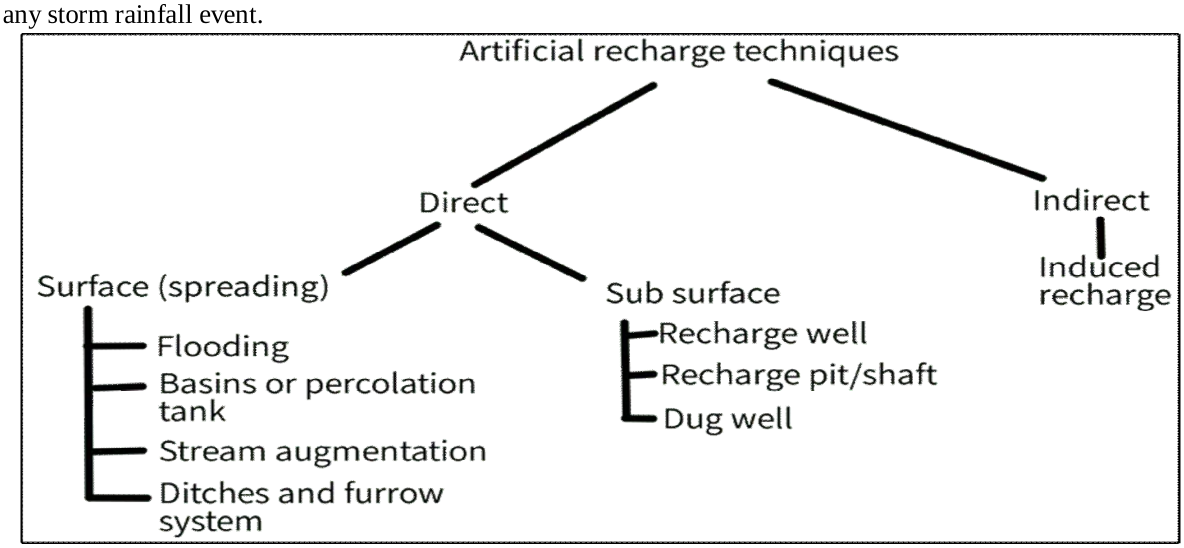
Groundwater, as a vital source of freshwater, plays a crucial role in supporting human societies, agriculture, and ecosystems. However, unsustainable groundwater extraction practices and increasing water demands have led to widespread groundwater depletion and degradation of aquifers worldwide. Groundwater recharge, the process of replenishing groundwater through artificial or natural means, has emerged as a promising solution to restore groundwater levels and improve aquifer health. In this thesis, we review the current techniques of groundwater recharge, including both artificial and natural methods, and highlight their advantages, limitations, and challenges. We also discuss the socio-economic, environmental, and hydrogeological factors that influence the selection and implementation of groundwater recharge techniques. Finally, we identify the research gaps and future directions for sustainable groundwater recharge practices.

Importance of groundwater as a freshwater source.

- Groundwater depletion and degradation issues.
- Need for groundwater recharge as a solution.
- Artificial Groundwater Recharge Techniques.
- Spreading methods (basin, furrow, and trench)
- njection methods (recharge wells, borehole, and direct injection)
- Induced recharge (infiltration galleries, shafts, and pits)
- Challenges and limitations of artificial groundwater recharge.
- Natural Groundwater Recharge Techniques.
- Infiltration basins and ponds.
- Riverbank filtration.
- Floodwater spreading.
- Managed aquifer recharge (MAR) and aquifer storage and recovery (ASR)
- Challenges and limitations of natural groundwater recharge.
- Socio-Economic, Environmental, and Hydrogeological Factors in Groundwater Recharge.
- Economic feasibility and cost-effectiveness.
- Social acceptance and community participation.
- Environmental impacts and sustainability.
- Hydrogeological conditions and site suitability.
- Legal, regulatory, and institutional frameworks.

3) *Defination*

Groundwater recharge can be defined as water added to the aquifer through the unsaturated zone after infiltration and percolation following any storm rainfall event.



4) Direct Surface Techniques

The most popular and easiest form of groundwater recharge is this one. With this technique, surface water that has been held is transferred directly into an aquifer without any infiltration, and water spontaneously percolates via the unsaturated zones of the soil profile to join the groundwater table.

Flooding and water spread

This is a very typical technique for recharging groundwater (Figure 1) . Here is

This technique works well with topography that is mostly flat.

A thin sheet of water is spread out.

ore vertical infiltration occurs at a higher rate.

The country's alluvial region is a potential use for this technology.

Figure 1 Water spreading technique.

5) Percolation tank/basin

- A percolation tank can be defined as an artificially created surface water body in a highly permeable land submerged area so that the surface runoff is made to percolate and recharge the groundwater storage (Figure 2) [9].
- It is the most prevalent structures in India because it is used to measure the recharge the groundwater reservoir in highly permeable land areas.
- It is applicable in both alluvial as well as hard rock formations regions.
- Its efficacy and feasibility is more in hard rock formation regions than alluvial regions.

Suitable in the States of Himachal Pradesh, Jammu & Kashmir, Uttrakhand, Sikkim,

Figure 2 Percolation tank for water storage.

6) Stream Augmentation (Check dams/Nala bund/ gabions)

- It is feasible to construct across small streams having gentle slope (less than 6 percent) [6].
- It is applicable in both hard rock as well as alluvial formation region.
- It is mainly confined to stream course and its height is normally very less (less than 2 m).
- To harness the maximum run off in the stream, series of such check dams can be constructed (Figure 3).
- A nala bund acts like a mini percolation tank.
- These are popular and feasible in Bhabar, Kandi and talus scree areas of Uttar Pradesh, Punjab, and Maharashtra.

Figure 3. Steam Agumentation

7) Recharge Pit and Shaft

- These are the most efficient and cost effective structures to recharge the aquifer directly (Figure 5) [6].
- In area where impervious layer is encountered at shallow depth.
- Where phreatic aquifer is not hydraulically in connection with surface water.
- The diameter of shaft should be more than 2 m for recharging rate 7–14 lps.
- These structures are common in the states of Maharashtra, Madhya Pradesh, Andhra
- Pradesh, Bihar, Gujarat, Himachal Pradesh, Jammu& Kashmir.

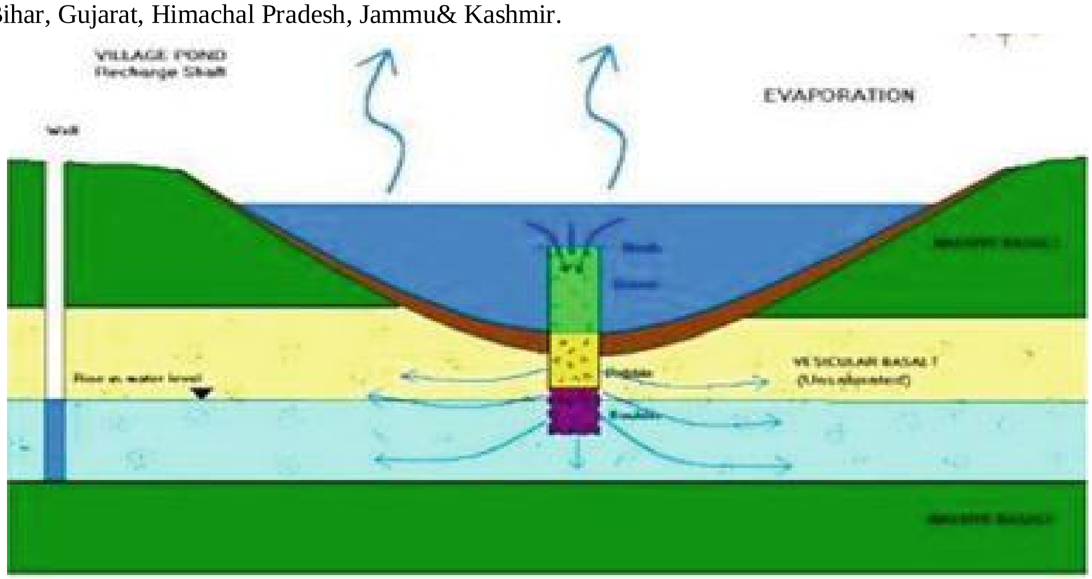


Figure 4. Recharge Pit and shaft

8) Direct sub-surface techniques

a) Dug well recharge

Construction across minor streams with a gentle slope (less than 6%) is possible [6].
Both areas of alluvial and hard rock formation can use it.
It is mostly restricted to stream courses and typically has a relatively low height (less than 2 m).
A sequence of these check dams can be built to capture the stream's maximum runoff (Figure 3).
An analogous little percolation tank is a nala bund.
In the Bhabar, Kandi, and talus scree regions of Uttar Pradesh, Punjab, and Maharashtra, these are common and practical.

Figure 5 Dug well recharge

b) Injection Wells

In metropolitan settings, an injection well is typically advised (Figure 6). It is effective for groundwater recharge in some hydrogeological settings when the aquifers do not receive natural recharge due to confining layers with limited permeability [11].
The installation of an injection well has the following benefits:
It is designed to add to a limited aquifer's ground water storage by pumping in treated surface water under pressure.
The aquifer that has to be recharged is typically overused.
It can survive ground subsidence issues in areas where constrained aquifers are over-pumped, making it useful for coastal regions where they need to capture seawater.
Water that is available for groundwater recharge must undergo equitable treatment to remove suspended debris, stabilise chemicals.

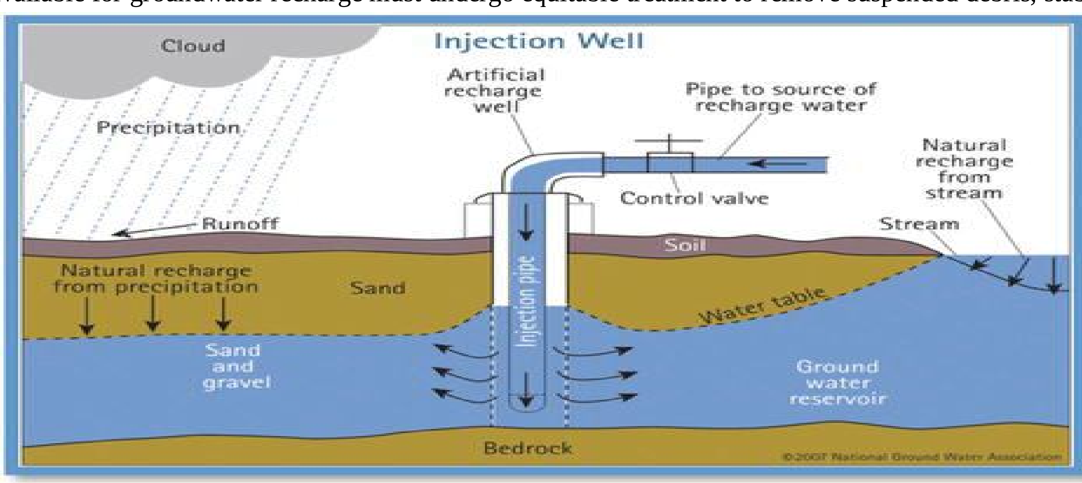


Figure 6. Injection well

B. Problem Statement

Due to unsustainable groundwater extraction methods and rising water demands, groundwater depletion and degradation have emerged as major global issues.

Aquifers are thus experiencing dropping water levels, decreased storage capacity, and diminishing water quality. Significant socioeconomic and environmental repercussions result from these problems, including decreased freshwater availability for human societies, agriculture, and ecosystems, higher energy costs for pumping groundwater from deeper depths, land subsidence, and ecological effects on ecosystems that depend on groundwater.

Groundwater recharge has been identified as a potential remedy to address these problems, restoring groundwater levels and enhancing aquifer health. But there are a number of issues with groundwater recharge methods that must be resolved, such as:

Technical difficulties: Groundwater recharge procedures, whether man-made or natural, are complicated and call for technical hydrogeological competence.

C. Objectives

1) Selection of appropriate ground water recharge technique.
2) Most suitable technique for the consider project.
3) Design of rainwater harvesting systeme and implication to GHRIET campus.
4) Review the various techniques of groundwater recharge available for sustainable water resource management.
5) Analyze the effectiveness of these techniques in different hydrogeological settings and environmental conditions.
6) Identify the challenges and limitations associated with the implementation of these techniques.
7) Provide recommendations for the selection of appropriate groundwater recharge techniques for specific hydrogeological settings.

II. LITERATURE SURVEY & REVIEW

A. Review of Literature

1) Hussain Musa Hussain (2005)

Rapid industrial development, urbanization and increase in agricultural production have led to increased groundwater withdrawals, resulting in freshwater shortages in many parts of the world. In view of this, greater emphasis is needed on the studies focusing on the sources and impact of groundwater recharge. The present study was taken up with the objective of assessing the groundwater recharge and its impact on the groundwater quality of Roorkee town, with a special consideration of the portion of the Upper Ganga Canal (UGC) passing through the town area.

2) Amartya Kumar Bhattacharya (2010)

Artificial groundwater recharge is a process by which the groundwater reservoir is augmented at a rate exceeding the augmentation rate under natural conditions of replenishment.

In some parts of India, due to over-exploitation of groundwater, decline in groundwater levels resulting in shortage of supply of water, and intrusion of saline water in coastal areas have been observed. In such areas, there is need for artificial recharge of groundwater by augmenting the natural infiltration of precipitation or surface-water into underground formations by methods such as water spreading, recharge through pits, shafts, wells et cetera.

3) Rakh Usha M (2020)

Artificial recharge of groundwater is accomplished through placing surface water in basins, furrows, ditches, or different centers wherein it infiltrates into the soil and actions downward to recharge aquifers. synthetic recharge is an increasing

Number of used for short- or lengthy-term underground garage, where it has several blessings over floor storage, and in water reuse. artificial recharge requires permeable surface soils. in which these are not available, trenches or shafts in the unsaturated sector can be used, or water can be at once injected into aquifers via wells.

To design a machine for artificial recharge of groundwater, infiltration rates of the soil have to be determined and the unsaturated area among land floor and the aquifer ought to be checked for good enough permeability and lack of polluted regions.

4) Ahsen Maqsoom (2020)

Globally the researchers are identifying the new ways for better urban sustainability. One major issue in the current world is the lack of fresh water availability in cities due to rapid increase in the population. To meet water requirement, scientist are exploring different ways to enhance the groundwater recharge capacity. One such solution is the use of building information modelling (BIM) technology to identify multiple structures that can be constructed to provide the potential recharge. This research aims to develop multiple structures which can provide ground water recharge capability.

5) Lonkar Swapnil Suni (2019)

At the rate in which Indian population is increasing, it is said that India will surely replace China from most densely populated country in the world after 2020-2030. These will lead to high rate of consumption of most valuable resource 'water'. In order to conserve and meet our daily demands of water requirements, we need to think for alternative cost effective and relatively easier method of conversing water. During monsoons lots of water goes waste into gutters, drains.

6) Roohul Khan (2016)

Estimates of groundwater recharge constitute fundamental input for most approaches used to evaluate and manage groundwater resources. Most approaches for quantifying groundwater recharge measure recharge directly or indirectly over a limited area (point or small-basin scale) and for short periods of time. Estimation of recharge, by any method is normally subject to large uncertainties and errors. In this paper, various methods of estimating ground water recharge are outlined and critically reviewed with regard to their limitations.

B. Patent Search

1) Ramesh Chand et. al. (2007) studied technique for quantitatively measuring the characteristic physical parameters of a porous medium viz. 'natural groundwater recharge', in hard rock terrain is developed by using tritium injection technique for the estimation of natural groundwater recharge.
2) Nepal Chandra Mondal & Vijay Shankar Singh (2007) In the semi-arid region, particularly in hard rock terrain, shallow aquifers are major source of potable groundwater. These aquifers are indiscriminately exploited to meet the growing demand of water for domestic, irrigation as well as industrial use by using cross correlation technique to delineate groundwater recharge potential zone in hard rock terrain.
3) Balbir singh sukhija. et. al. (2007) Naturally present chloride concentration in natural water is utilized for the development of the technique to gauge the performance of percolation tanks in space and time. By using Method for evaluation of performance of percolation tanks using environmental chloride as a tracer.
4) Steve Surowinski & Liang Guo (2016) The present invention provides a groundwater monitoring system and method. The system in one aspect uses sound-based distance measurement techniques to measure groundwater level with one transducer generating an acoustic burst and another receiving it. By using Groundwater monitoring system and method.
5) Marian J. Singer et. al. A module gathers information about the level of water in a water well and sends the information to a database. By using Wellhead water level sensor.
6) Vijay Kumar Kedia (2008) A Method of preserving and harvesting rain water comprises making a trench underground along the farm boundary, (perpendicular to the slop) of the farm land measuring 5 to 10 feet in depth and 2 feet wide; placing PVC sheet along the trench wall by using Method of preserving and harvesting rain water in trench lined with pvc sheet to prevent flood and soil erosion.
7) Gregory E. Granato & Kirk P. Smith (1998) A method of monitoring the quality of water at a ground water sampling site without human intervention. Water at the sampling site is purged until at least one preselected purge criterion is satisfied by using Automated groundwater monitoring system and method.
8) Gregory Miller & Neil Mansuy (2004) The invention uses apparatus, methods or systems, e.g., fine pore diffusers (18), to saturate ground water with a gas, preferably oxygen, but also possibly methane, air, inert or noble gasses and/or carbon dioxide. By using Apparatus, method and system of treatment of arsenic and other impurities in ground water.
9) Stanley R. Peters et. al. (2002) An underground reservoir for storing water in alluvial deposits utilizes slurry walls keyed to an aquiclude beneath the reservoir to form a substantially impermeable water seal. By using Underground alluvial water storage reservoir and method.

10) Ronald Shaw & Lee A. Shaw (2010) Provided is an aquifer replenishing pavement formed above soil having a sand lens above the aquifer and a clay layer above the sand lens by using Aquifer replenishment system with filter.
11) Kevin Charles DuttJohn & Randolph Eggleston (2011) A method for monitoring, controlling, and recording performance of a storm water runoff network includes receiving, by a storm water management component, environmental data associated with a storage node by using Methods and Systems for Monitoring, Controlling, and Recording Performance of a Storm Water Runoff Network.
12) David T. Snow (2007) Method for drilling horizontal or deviated fresh water wells through such volcanics as occur in Hawaii, including hard lavas and fragmented interbeds that are prone to caving by using Deviated drilling method for water production.
13) Jehangir Framroze PUNTHAKEY (2012) The invention relates to a method of managing ground water resources, where bores are used to extract ground water such as for agricultural, mining and town water supply purposes by using Groundwater management system.
14) David Snow (2005) Method for drilling horizontal or deviated water wells through hard and fragmented rock formations that are prone to caving, such as Hawaiian basalts by using Deviated drilling method for water production.
15) David J. Rossi et.al. Sensors are permanently placed in the ground near observation and injection wells in order to passively and continuously monitor the status of seawater advance toward fresh water aquifers near coastal cities as well as the status of fresh water injected into the injection wells by using Method and apparatus for monitoring the advance of seawater into fresh water aquifers near coastal cities.

III. WORKDONE

A. *Methodology*

1) *Hydrological Assassination*

A law determining the rate of flow through soils was established in 1865 by the French scientist Mr. H. Darcy on the basis of experimental data. He claimed that this discharge was inversely proportional to the length of the soil sample (L) and directly related to head loss (H) and the area of the soil's cross-section (A). Q is therefore equal to runoff (m3/s). Head loss (m) = H
L is the soil sample's length in metres.
A = Area of the soil's cross-section (m2)
Here, H/L stands for the head loss or hydraulic gradient (I), and K is the permeability co-efficient. hence, finally
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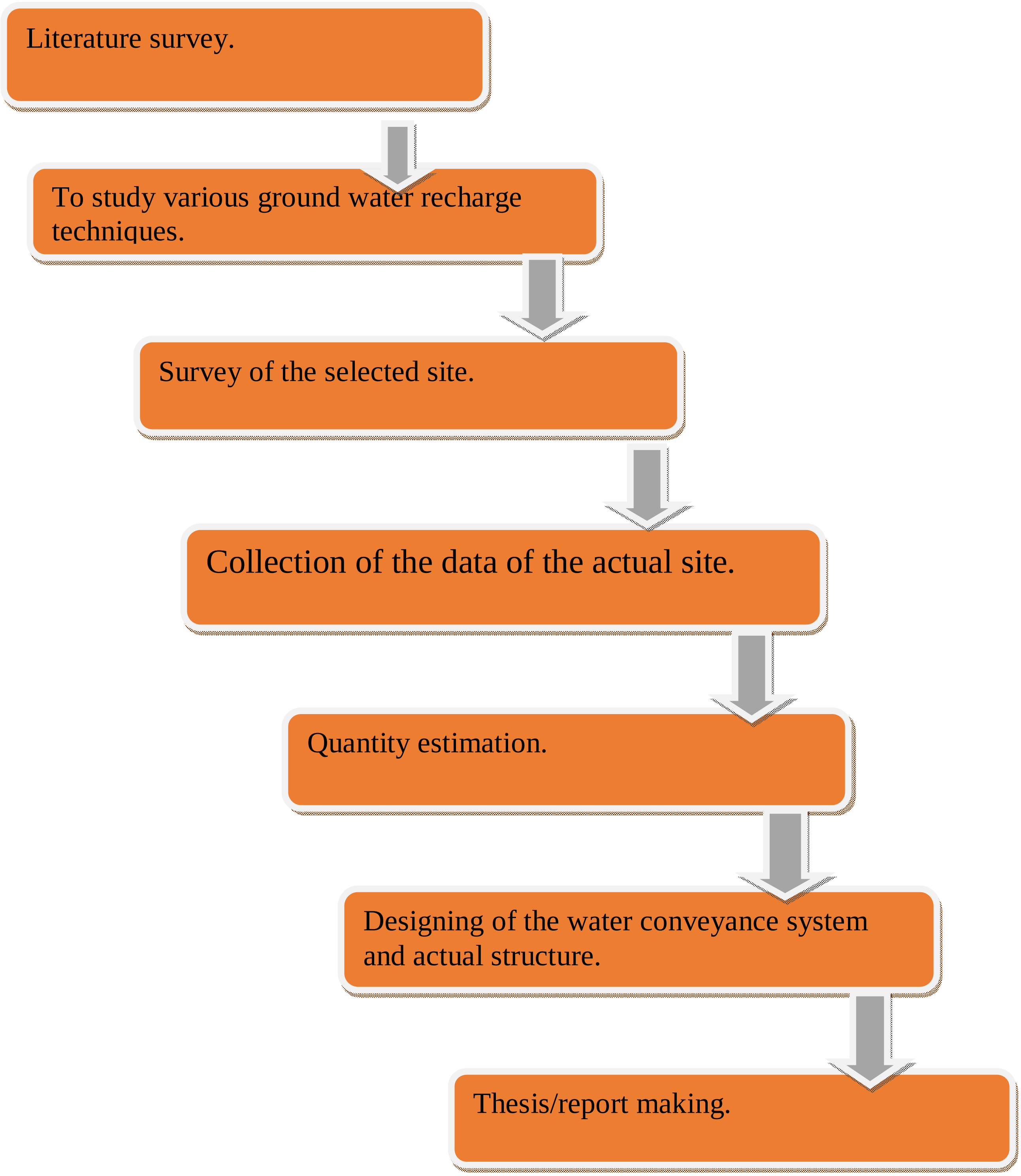
2) *Calculation of Rainwater Collection*

The total volume of the water rainwater available from any rooftop survey is a product of total rainfall and the surface area of collection. Runoff coefficient is usually applied to account for infiltration, evaporation and other losses and it varies from 0.8 to0.95. in order to estimate the average annual monsoon rainfall data for location needed to be used and using table 1 of IS 15797:2008 (Roof Top Rainwater Harvesting-Guidelines.)

Station	Temperature (in C)				Relative Humidity (%)		Rainfall (in mm)			Rainfall (in cm)	
Nagpur	Maximum	Departure	Minimum	Departur	At 8:30 Hrs	Departure	Last 24 Hrs	Since 1/10/22	Departure	Annual Total	Annual Normal
	29	-2	11	-4	67	2	0	146	73	165.25	115

Table No. 1 Rainwater Collection
Source- Regional Meteorological center mumbai

B. Flow Chart of Project Process



1) *Case study of GHRIET campus.*

a) Data collection.

b) Rainfall data table collection

c) Ground water level data

d) College survey

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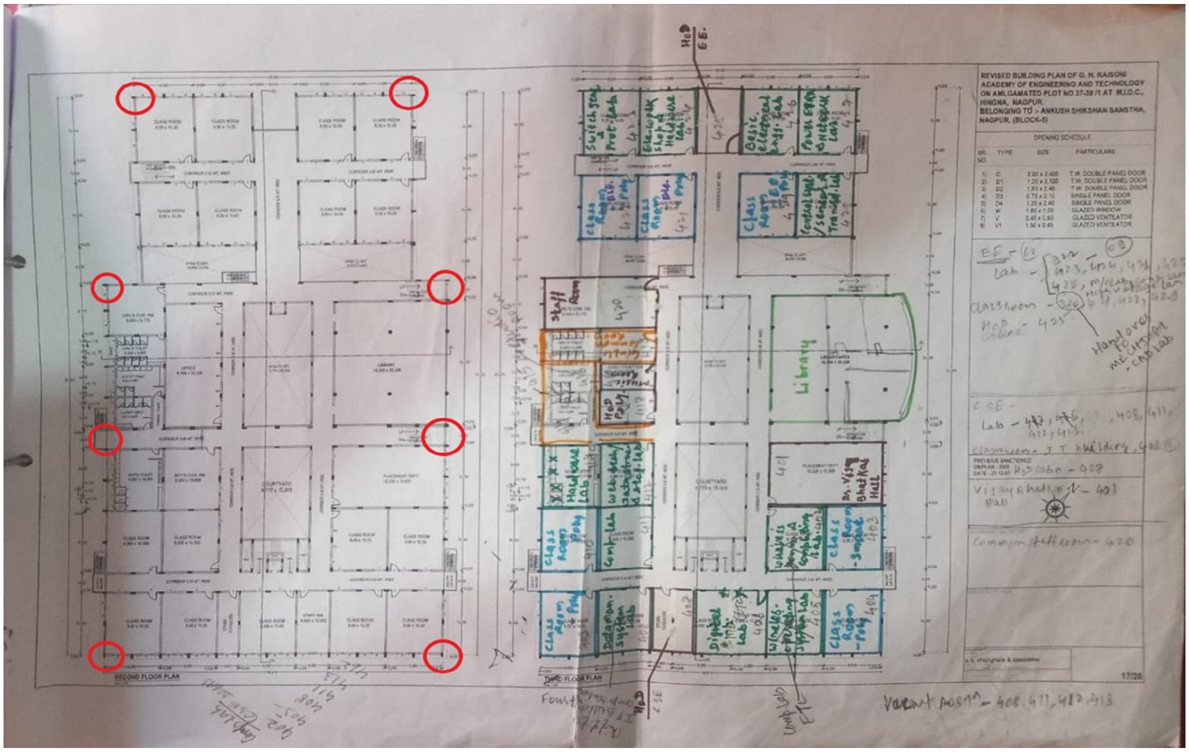
2) Observation

a) Currently rooftop rainwater is carried through a pipe line which leads the water sewage system.
b) The approximate location of ground water recharge structure has been finalized.
c) The topography of college area is sloppy and favourable for ground water recharge.



No. of outlets shows in plan

d) It has been decided to provide recharge pits for the points….(1,2,3,4…)
e) The rainwater from the outlets (1,2…) will be used for the well recharge. (planning & design for well water recharge will be given in next stage of the project)
f) Water from outlet (3,4…) will be skipped for the direct use for sub-surface irrigation.

Sr. No.	Name of building	Volume of water	Percolation coefficient	Net volume of Rainwater Available (cu. m)
1	Admin 1	612.97	0.9	551.68
2	Admin 2	2150	0.9	551.68
3	Admin 3	475.93	0.9	428.33

Table No. Calculation for Rainwater Collection

C. Soak Pit Design

Soak pits may be any shape and size are generally constructed 1to 2 m wide and 2 to 3 m deep which are backfill with boulders (5 to 20cm) , gravels (5 to 10mm) and course sand (1.5 to 2 mm) in graded from- boulders at bottom, gravels in between and coarse sand at top so that sit content that will come with runoff will be deposit on the top of the course sand layer and can easily removed. For smaller roof areas, pit may be filled with broken bricks.

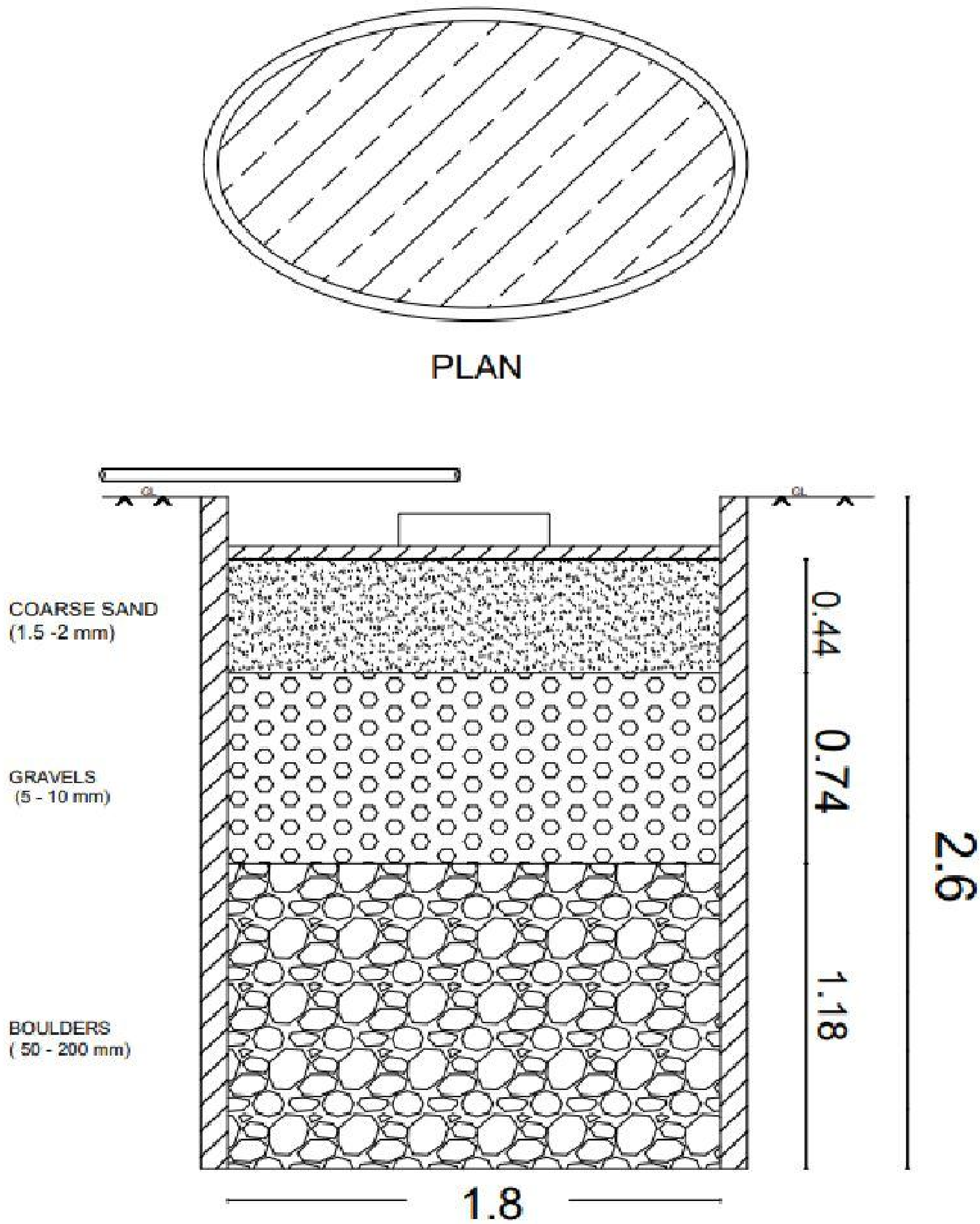


Figure 7. Soak Pit Design

D. Design Of Plumbing Units

Plumbing is any system that conveys fluids for a wide range of applications. Plumbing uses pipes, valves, plumbing fixtures. tanks and other apparatuses to convey fluids.

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Following are the various plumbing units used in the Rainwater Harvesting System.

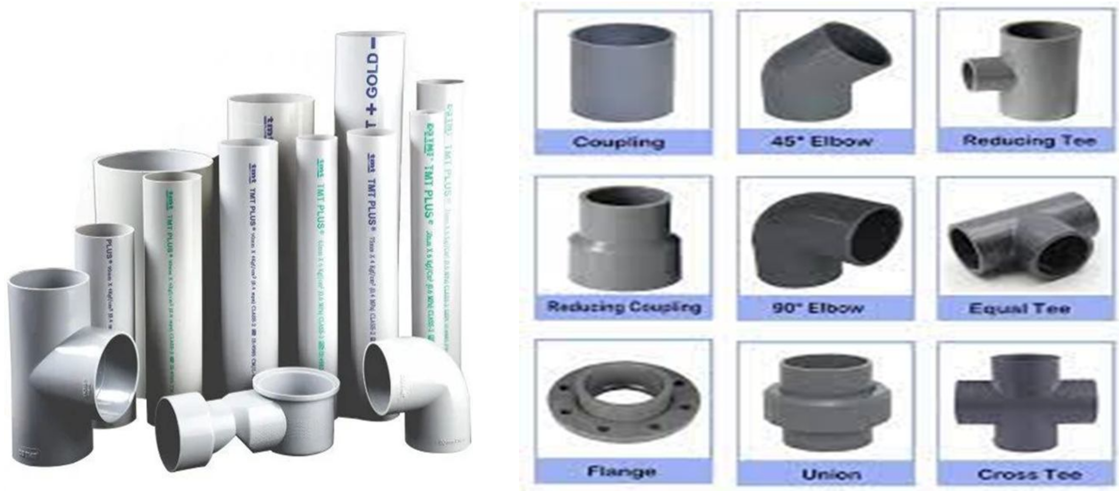

Figure 8: Plumbing units

E. Percolation Test

This test is used to figure out how well the soil can absorb water. The design of the septic system depends on the results of this test. In order to comprehend how soil behaves when there is moisture present, this test is also performed while purchasing land. As per test is another name for this test. For the precise computation of line length, pit depth, etc., each contour may have a different set of rules. The percolation test, however, follows the same technique. According to IS2470-part-2, this test is conducted in India.
The percolation rate is the amount of time in minutes needed for water to fall 25 mm into the test hole, according to IS2470 part 2. To allow generating results, a test in trial pits should be conducted in more than one location in the area.

F. Percolation Test Procedure

The permeability of the soil at the depth where the effluent needs to be disposed of is assessed using a percolation test.
A circular or square hole that is boarded to the necessary depth for the planned absorption test has a diameter of 100 to 300mm. To eliminate any smeared soil surface and create a natural soil interface into which water may percolate, the bottom of the hole is carefully scratched. To prevent the bottom of the hole from scouring, all loose debris is removed, and course or fine sand with a 50mm thickness is added.Then, water is poured over gravel to a minimum depth of 30holes 6 to 10 inches in diameter with vertical sides should be dug or bored. Intensity of the projected absorption trenches' approximate depth, usually 24 inches below the surface, must be reached by the holes. Place a plug in the hole if it is greater than 6 to 8 inches. Put a 4-inch-diameter perforated pipe piece into the hole, and then add drain rock to fill the area between the pipe and the hole's walls. It is advised that the reviewing authority receive a sketch or photo of the hole. Scratch or roughen the sides and bottoms of the holes to create smooth, natural surfaces. Take out any extra material. Fill holes with about 2 inches of washed gravel of a 3/4-inch thickness to prevent scouring caused by water.0mm. The wettest time of year will be used to conduct this test.

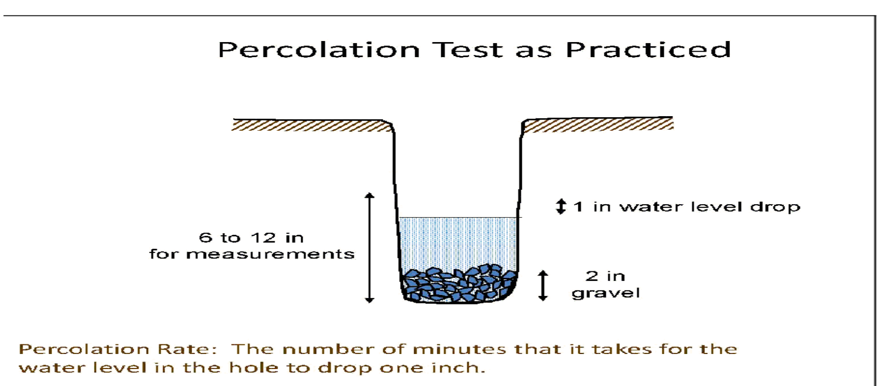

Figure 9: Percolation Test

G. Manual Contouring

We have carried out the contouring survey on the ground of the college campus for the setting out the contours.

Date: 4 march 2023

Instruments used: Auto level levelling staff, ranging rod, 30 m measuring tap, chain, arrows tripod stand

Type of method used: Grid method

Procedure:

we first fixed suitable instrument station from where each boundary points of ground can easily be located and measured.

Then we divided radial area surrounding in strips of measuring angle of 20 each.

Each line of single is ranged and ranging rods ate rowed at interval of 5m on that line.

Level of each ranging rod point is measured with the help of transit theodolite and benchmark was assumed to be equal to 100.000m.

Reduced level are calculate based on that readings.

Contour intervals both vertically and horizontally are fixed and based on the approximate contour map is prepared.

Figure 10: Contouring of the site

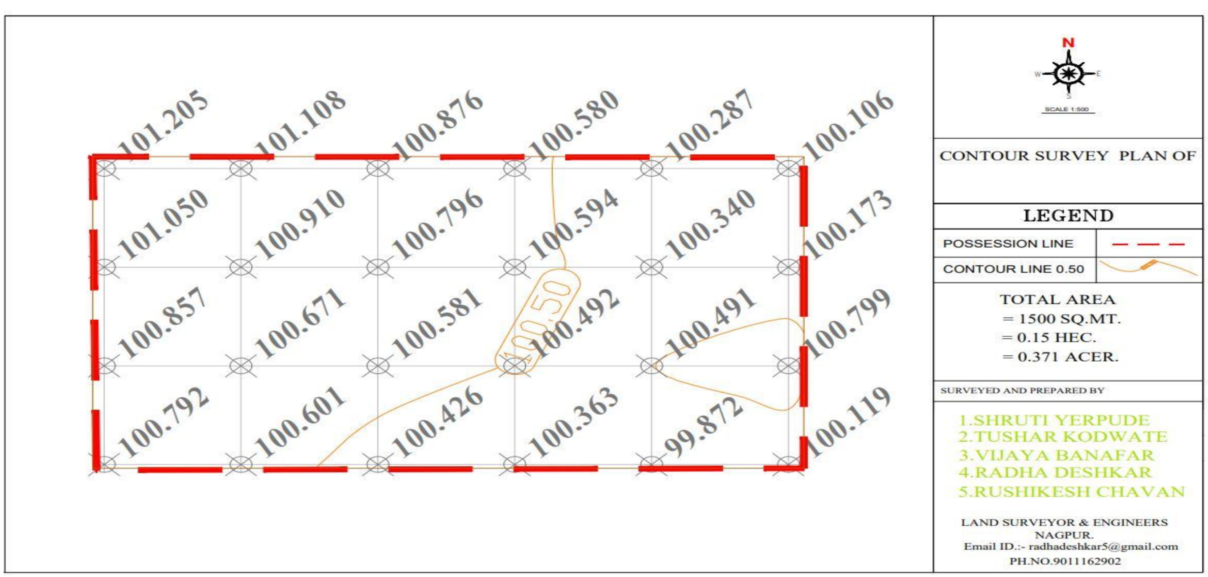

Figure 11: Countour Sheet

IV. RESULT AND DISCUSSION

The use of artificial recharge at GHRIET campus (site consider for this case study) can raise the groundwater table and make more groundwater available. It is crucial for reducing surface runoff, increasing water availability for campus use and industrial use, improving drainage, reviving springs, and improving the quality of groundwater, among other things. Additionally, it is thought to lessen the effects of changing rainfall patterns caused by various meteorological conditions. Meeting the demand for spatial water productivity and availability at a regional and global level is also crucial.

V. CONCLUSION

In order to manage and maintain water resources, groundwater recharge technique design is quite important. Groundwater recharge techniques are efficient tools for recharging depleted aquifers and sustaining a sustainable water supply, it can be determined after examining various techniques and strategies. The following are some important findings about how groundwater recharge strategies are designed:

1) Site-specific design: The hydrogeological characteristics of each site should be taken into consideration while designing groundwater recharge strategies. To guarantee maximum efficacy, factors such soil type, aquifer characteristics, land use, and rainfall patterns should be carefully studied.
2) Multiple methods: To increase the recharge potential, a variety of recharge methods should be used in conjunction. Techniques like recharge wells, recharge trenches, infiltration basins, and percolation ponds can be used, depending on the site's features.
3) Maintenance: It's critical to regularly check on recharge sites to gauge their effectiveness and spot any modifications that may be required. To guarantee optimal performance, maintenance procedures such as desilting, vegetation control, and periodic cleaning should be carried out.
4) Integration with land use planning: To maximise their efficiency, groundwater recharge techniques should be combined with land use planning. For long-term success, it is essential to locate suitable recharge regions, take runoff patterns into account, and control possible pollution sources.
5) Participation of local stakeholders and communities in the planning and execution process generates a sense of ownership and guarantees long-term sustainability. Communities must be informed about the value of groundwater recharge, and prudent water use must be encouraged.
6) Scalability and adaptability: The plan should be scalable and able to adjust to changing hydrological conditions, such as shifting patterns of rainfall or rising water demand. Scalability is crucial because recharge methods could need to be multiplied or increased in response to escalating water stress.
7) Considerations for Water Quality: The plan should take them into account. To get rid of impurities and make sure the recharged water fulfils quality standards, pre-treatment procedures like sedimentation basins or filtration systems could be required.

In conclusion, it should be kept in mind that the design of groundwater recharge techniques should be site-specific, take into account a variety of options, address water quality issues, connect with land use planning, entail monitoring and maintenance, involve communities, and guarantee adaptability and cost-effectiveness. Groundwater recharge techniques can greatly support sustainable water management by taking these factors into account, as well as help to lessen the difficulties brought on by water scarcity.

VI. ACKNOWLEDGEMENT

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Lastly, we would like to thank all those who were directly or indirectly related to our project and extended their support to make the project successful.

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<u>Part C</u>
12 Chapters Numerals/page no. from 2nd page onwards of every chapter
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1.1 Overview
1.2 Problem Statement

Sr. No.	Authors	Title of Paper	Name of International Journals / International Conference	Place and date of Publication with **Citation** Index

LIST OF PARTICIPATIONS

Sr. No.	Name of Participants	Name of Activity	Place and Date of Activity	Position if any
01				
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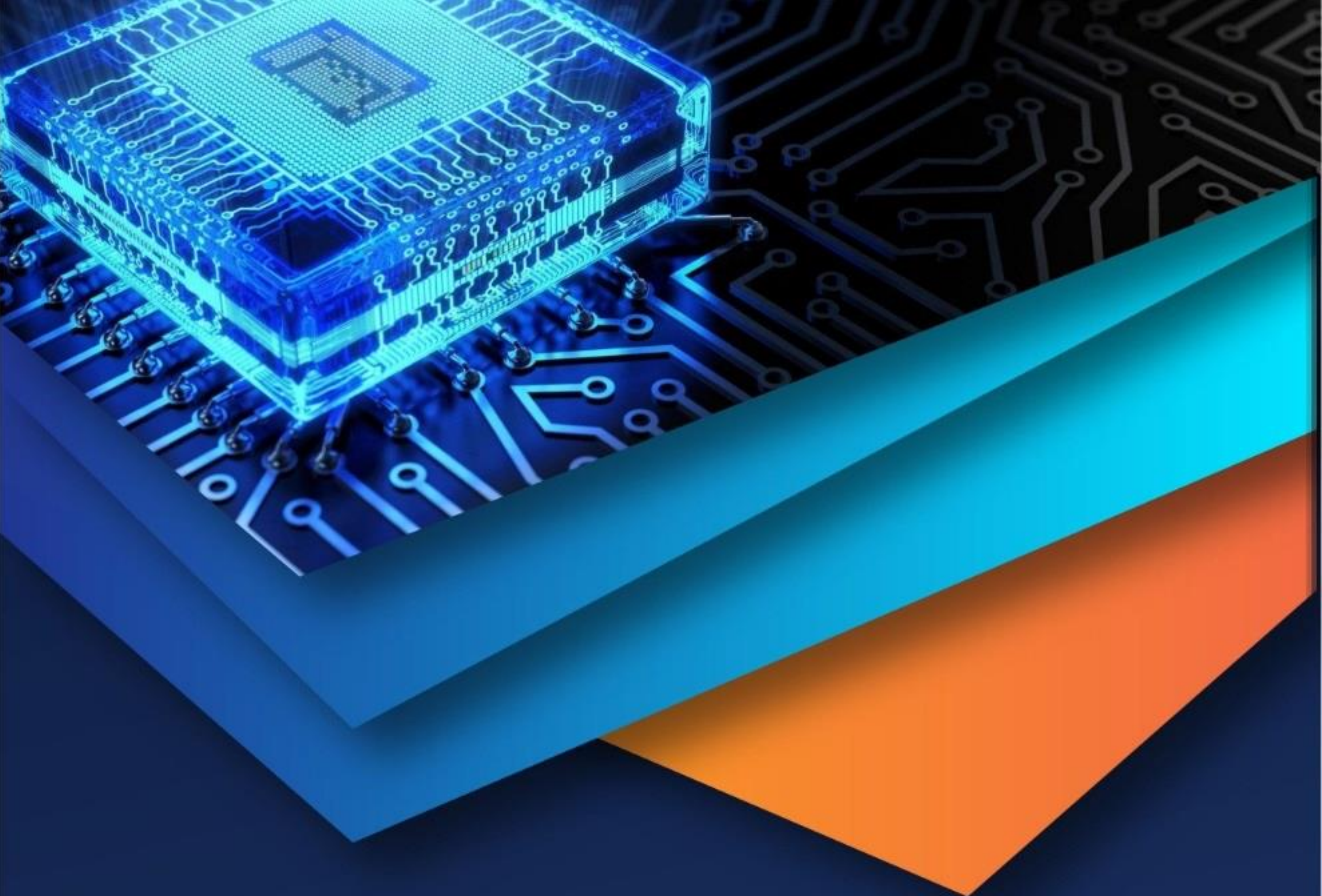

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