ARTIFICIAL METHOD TO INCREASE GROUND WATER RECHARGE BY BHHUNGROO TECHNOLOGY

Snehal Sidram Shete[1], Prof P.A. Hangargekar[2]

[1]ME Student, Department of Civil Engineering, Shri TuljaBhavani College of Engineering Tuljapur, India
[2]Assistant Professor, Department of Civil Engineering, Shri TuljaBhavani College Of Engineering, Tuljapur, India

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Abstract -*The necessity of artificial recharge of aquifers is increasing day by day due to excessive demand of water by the ever-growing population and also because of the scarcity of good dam sites available for construction. Artificial recharge is the process of adding water to an aquifer through human effort. The main purpose of artificial recharge is to store water for later use while improving upon the quality of water. This paper will review the method of artificial recharge of aquifers by bhungroo technology. With the help of case studies conducted in the recent past at various places.*

Key words: *recharge, human effort, aquifers, infiltrations, artificial*

1. INTRODUCTION:

The vital purpose of artificial aquifer is to preserve superfluous water to meet the needs of the future generation. It is one of the manmade efforts to add water to the aquifers. Hundreds of techniques have been developed in the past few years for the sufficient supply of water for the human use. Thus, the ground water has been considerably amplified and the salinity of water has been declined, thus improving the quantity and quality of water. The artificial recharge methods are proving to be effectual in maintenance and replenishment of the aquifers. The recharge of ground water occurs both naturally and artificially. The natural recharge occurs through the process of infiltration where the water percolates from the surface to the bed of the aquifer.

1.1 Aim: To increase ground water storing capacity.

1.2 Objective:

1. To study Bhungroo technology.

2. To analyses the design parameter for pvc pipe in ansys software.

3. To compare bhungroo technology result with bore well recharge percolation tank.

1.3 Problem Statement:

- Drought is a serious issue now a days particularly farmers whose livelihood depends on the monsoon. Limited rainfall in the state lead to waterlogging in peak cropping season. For the rest of the year, farmer experience severe water scarcity.
- Due to scarcity of water people are facing many problems in their day to day life, such as they have to travels miless of distance for drinking and daily use.
- Due to use of fertilizer water is getting contaminated and many peoples are affected by dangerous diseases such as cancer.

2 LITERATURE REVIEW

Subhra Chakravarty in countries like India, with an ever-increasing demand for water, the importance of rainwater harvesting and groundwater recharge cannot be overemphasised. With this background in view, the laboratories of the Council of Scientific & Industrial Research have developed and demonstrated various technologies for the enhancement of recharge through various means. These are: the use of injection bore holes in hard rock; recharge through tanks wells; siphon recharge; enhancement of run off through treatment of catchment with polyamine material; use of chemicals for control of evaporation and also for stabilising and sealing of soil through hydrophobic chemicals, etc.

This paper attempts to consolidate the experiences gathered in respect of the case studies in various rainfall regions with different soil characteristics.

H. Hashemi1, R. Berndtsson1, M. Kompani Estimating the change in groundwater recharge from an introduced artificial recharge system is important in order to evaluate future water availability. This paper presents an inverse modelling approach to quantify the recharge contribution from both an ephemeral river channel and an introduced artificial recharge system based on floodwater spreading in arid Iran. The study used the MODFLOW2000 to estimate recharge for both steady- and unsteady-state conditions. The model was calibrated and verified based on the observed hydraulic head in observation wells and model precision, uncertainty, and model sensitivity were analysed in all modelling steps. The results showed that in a normal year without extreme events, the floodwater spreading system is the main contributor to recharge with 80 % and the ephemeral river channel with 20 % of total recharge in the studied area. Uncertainty analysis revealed that the river channel recharge estimation represents relatively more uncertainty in comparison to the artificial recharge zones. The model is also less sensitive to the river channel. The results show that by expanding the artificial recharge system, the recharge volume can be increased even for small flood events, while the recharge through the river channel increases only for major flood events.

Leena Singh1 and S. Ravichandran Ground water plays a crucial role in the country in increasing food and agricultural production, providing drinking water and facilitating industrial development. Ground water meets nearly 55% of irrigation, 85% of rural and 50% urban and industrial water needs. In most of the states the ground water extraction has exceeded annual recharge and water table has gone down. The growing needs of population and urbanisation have generated an urgency to evolve innovative methods for holding up of the ground water resources through appropriate recharge activities. Ground water recharge is the process by which water percolates down to the soil and reaches the water table, either by natural or artificial methods. In this paper, various methods of estimating artificial ground water recharge are outlined which can be adopted to improve the ground water situation.

Debu Mukherjee Artificial groundwater recharge is as a process of induced replenishment of the ground water reservoir by human activities. It is the planned, human activity of augmenting the amount of ground water available through works designed to increase the natural replenishment or percolation of surface water into the groundwater aquifers, resulting in a corresponding increase in the amount of groundwater available for abstraction. The primary objective of this technology is to preserve or enhance groundwater resources in various parts of India which includes conservation or disposal of floodwaters, control of saltwater intrusion, storage of water to reduce pumping and piping costs, temporary regulation of groundwater abstractions, and water quality improvement by dilution by mixing with naturally-occurring groundwater (Asano, 1985). In such areas, there is need for artificial recharge of groundwater by methods such as water spreading, recharge through pits, shafts, wells and many more. The choice of a particular method is governed by local topographical, geological and soil conditions; the quantity and quality of water available for recharge; and the technological-economic viability and social acceptability of such schemes. This paper discusses various issues involved in the artificial recharge of groundwater.

Mahati Kavuri1 the necessity of artificial recharge of aquifers is increasing day by day due to excessive demand of water by the ever-growing population and also because of the scarcity of good dam sites available for construction. Artificial recharge of aquifer is the process of adding water to an aquifer through human effort. The main purpose of artificial aquifer recharge is to store water for later use while improving upon the quality of water. This paper will review the existing methods of artificial recharge of aquifers such as infiltration basins and canals, water traps, cut waters, surface run off drainage wells, and diversion of excess flow from irrigation canals etc with the help of various case studies conducted in the recent past at various places.

Amartya Kumar 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 The choice of a particular method is governed by local topographical, geological and soil conditions; the quantity and quality of water available for recharge; and the technological-economic viability and social acceptability of such schemes. This paper discusses various issues involved in the artificial recharge of groundwater.

Berenice Lopez Mendez Aquifer recharge occurs naturally through infiltration mechanisms. However, due to changes in the vegetation cover and consequently increasing soil erosion, infiltration rates tend to decrease. The recharge of an aquifer can be managed by facilitating natural infiltration processes and/or by the construction of structures that maintain recharge artificially. Several methods are available to enhance the recharge of an aquifer. The implementation of aquifer recharge schemes can massively increase groundwater levels, which is the best possible long-term storage. Recharge can also help to address objectives such as improvement of source water quality, recovering of yields, creation of barriers to prevent saline intrusions and/or other contaminants, prevention of land subsidence, reducing potentially harmful runoff of stormwater. Alternatives to recover natural infiltration can be the application of ecosystem-based adaptation (EbA) measures or agricultural practice with permanent vegetation cover as permaculture. Artificial recharge methods, also called managed aquifer recharge (MAR), can be broadly categorized into: a) in-channel modifications, b) well, shaft and borehole recharge, c) induced bank infiltration, and d) rainwater harvesting. The method of recharge depends strongly on the survey of the site. Two key issues that are to be considered are the hydrogeological properties of the aquifer and the source of water. Recharge through living topsoil, as in swales, provides treatment and is by far preferable. In addition, it should not be forgotten that a humus rich soil with adequate vegetation cover provides retention and recharge without any technical intervention. However, the techniques described below are often needed to get restoration started at all.

3. THEROTICAL CONTAIN

3.1 What is Bhungroo?

Bhungroo, a Gujarati colloquial, means straw or hollow pipe. Bhungroo is unique innovative and efficient rain water conservation technology, by use of pipes of ten to fifteen centimeters in diameter. The globally recognized disaster mitigation and irrigation guarantee technology filters, injects and stores excess farm water or storm water underground for uses in lean periods. Bhungroo delivers its services in waterlogged areas; drought affected areas as well as in areas affected by erratic rainfall. it also works in salt affected soils as well as seasonally eroded soil.

Technology details: bhungroo works on filtered injection method create water lenses due to density varation between filtered surface and sub-surface layers top soil gets free from water logging guarantees survival of standing monsoon crops In winters the farmers lift the injected water from subsurface storage for winter irrigation from a lesser depth.

3.2 Highlights of Bhungroo technology:

makes land productive, winter irrigation guarantees both monsoon and winter cropping double farmers income less than a year brings the poor farmers above poverty level enables poor farmers to have dignified life with food security.

3.3 Bhungroos Benefits:

The underground reservoir can hold water and can supply for as long as seven months. Additionally, the non-saline rain water, when mixed with the underground saline water, brings down the salinity of the groundwater and makes it fit for agriculture.

The technology also helps avoid evaporation loss and wastage of water during monsoon season.

3.4 How does it work?

Bhungroo rain water harvesting methodology:

1) Design depends upon agro climatic zones, top soil, soil strata, community, agricultural pattern and sustainability.

2) To be built on land having slight gradient to ensure water catchment.

3) To injects run-off rain water underground and recharge aquifers.

4) Modules to be built are:

a) Water filtration system

b) Water injection system

c) Soil land leveling

d) Water lifting system

4. METHODOLOGY

4.1 Implementation of bhungroo project For Laxmi Township

- Name of site: Laxmi Township
- Location of site: Bhusaval Jalgaon, Maharashtra 411021

4.2 Data Used for Case Study

- Depth of Pipe:30m
- Diameter of Pipe:150mm
- Sand Layer:2 M
- Gravel Layer:2 M
- Type of Pipe: Pvc
- Rainfall of Laxmi Township Bhusawal:736mm
- Run Off of Laxmi Town Ship:68.44cm
- Soil Type: Deep Black Cotton Soil
- Ground Water Quality: The Quality Of Ground Water Is Alkaline And Generally Suitable For Drinking And Irrigation Purpose, However Localized Nitrate Contamination Is Observed In Rural Areas.
- Type of Water: Ca-HCO3 And Ca-Cl

Fig 4.1: Bird Eye View of Laxmi Township

- Before application of Bhungroo project on site the first bore well failed at 106.68m (700 ft and 10 casing pipes are used)

1. **Bore well**

Fig 4.2

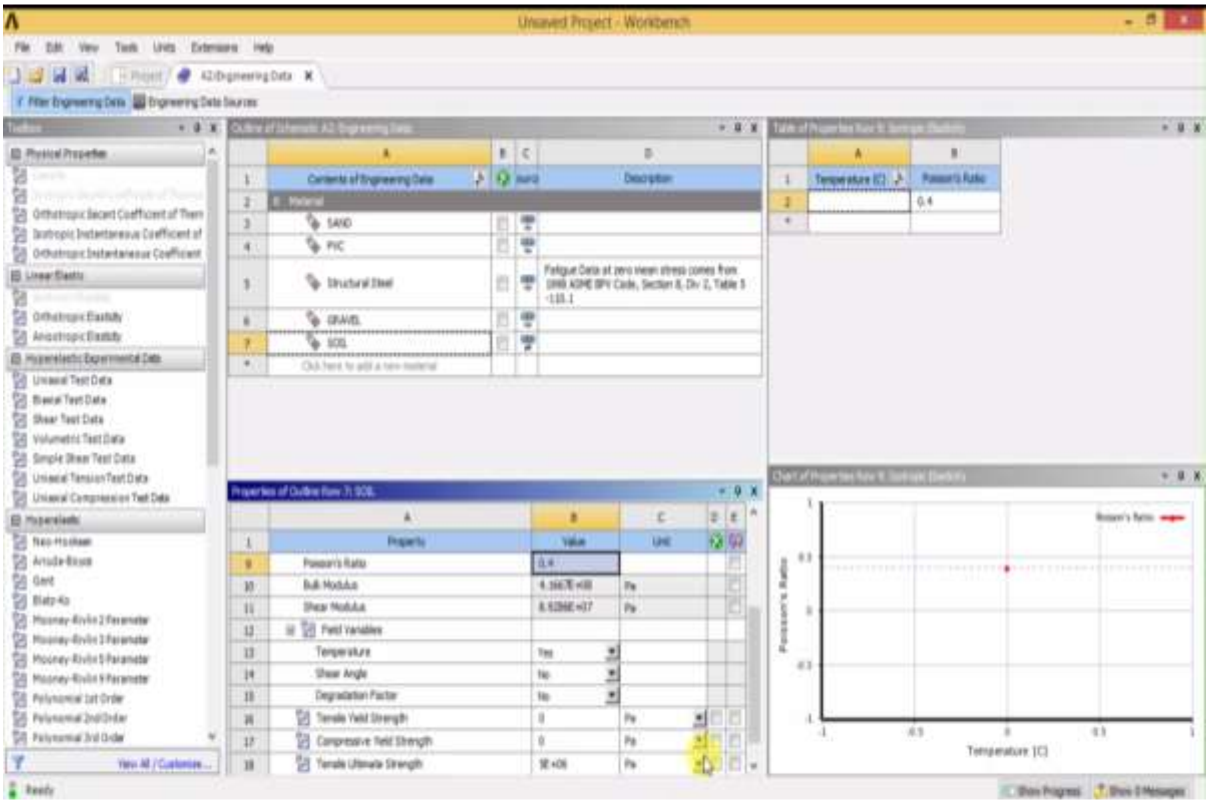
2. After application of Bhungroo system in area the water is available at 30m depth.

The extra pumped water is stored in low cost storage called as farmpond (shettale), farmpond is constructed after successful completion of bhungroo project.This water then used for trees, irrigation, construction.fi

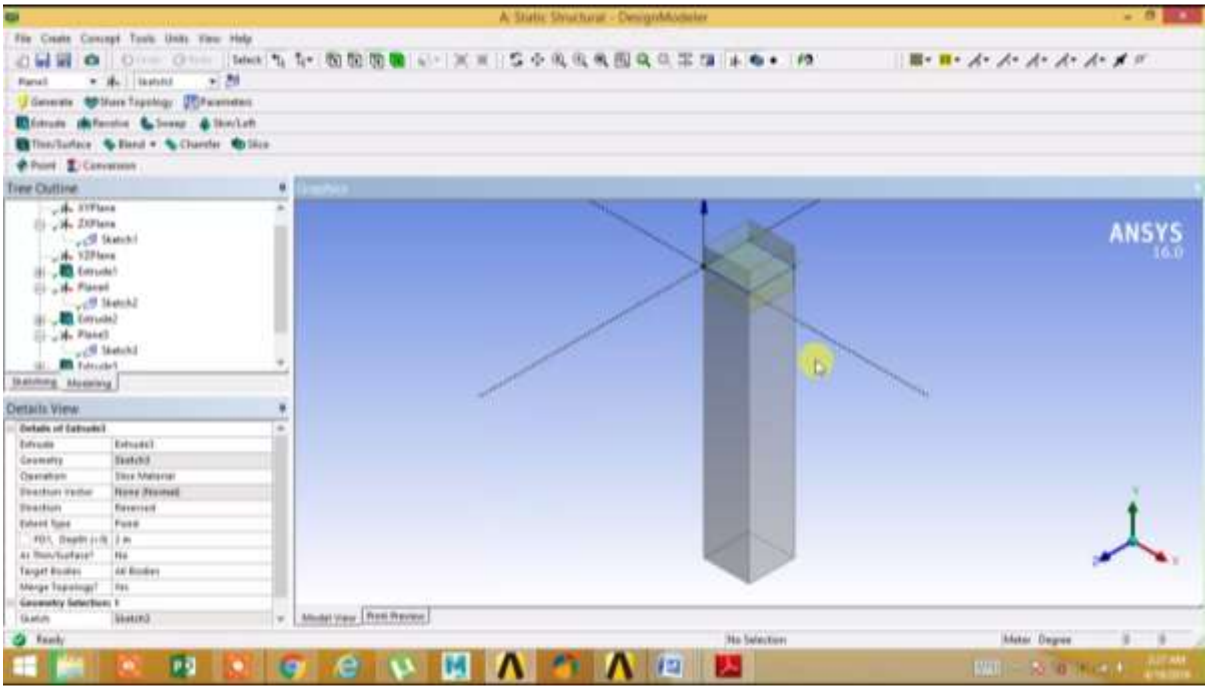
Fig 4.3

4.3 Modeling in Ansys of Bhoongroo Project

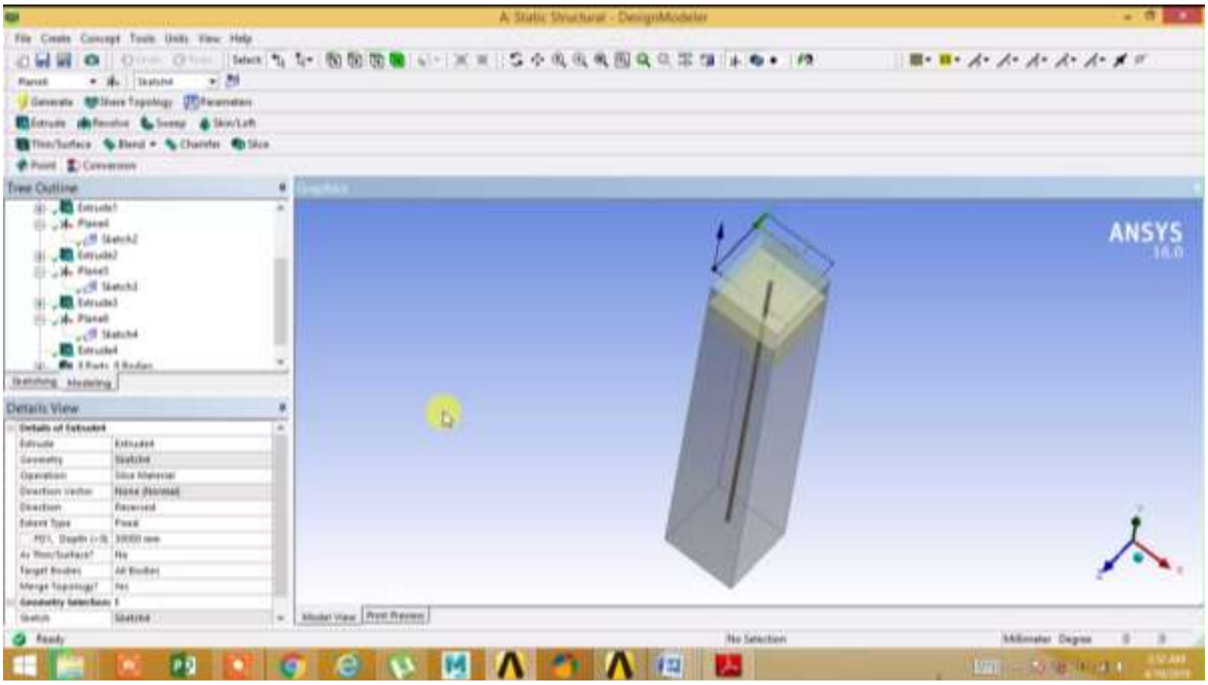
Step 1: Add Material of Sand, Gravel, Soil and PVC



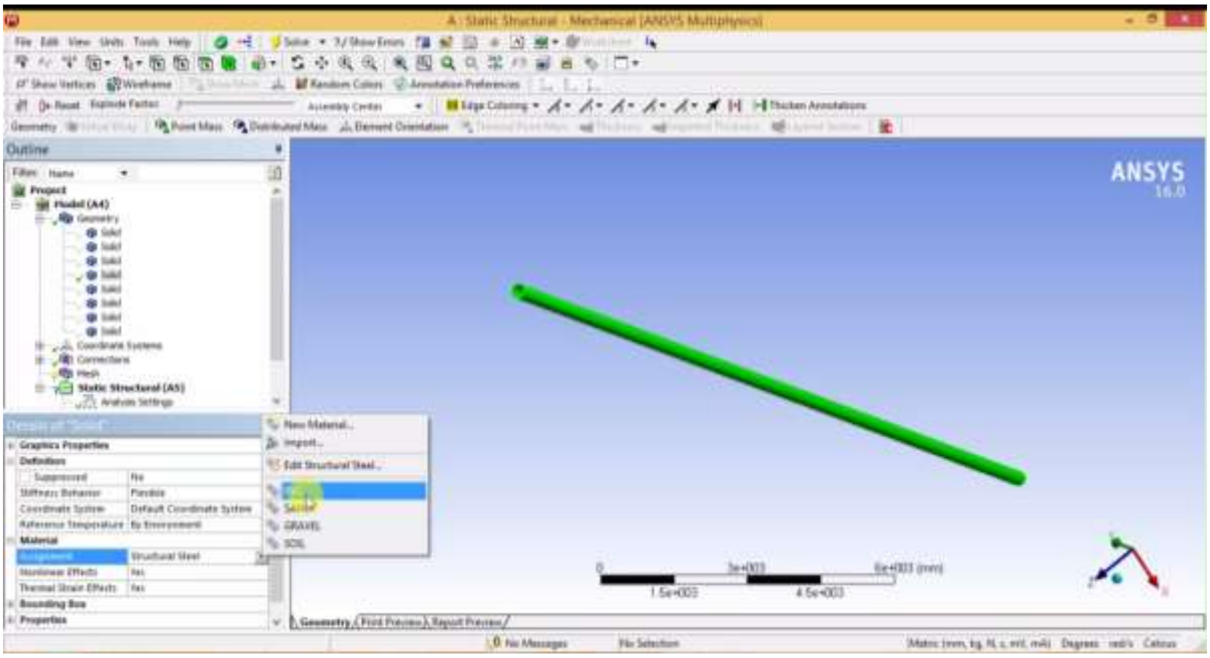
Step 2: Preparation of Sand Gravel and Soil Model in Ansys



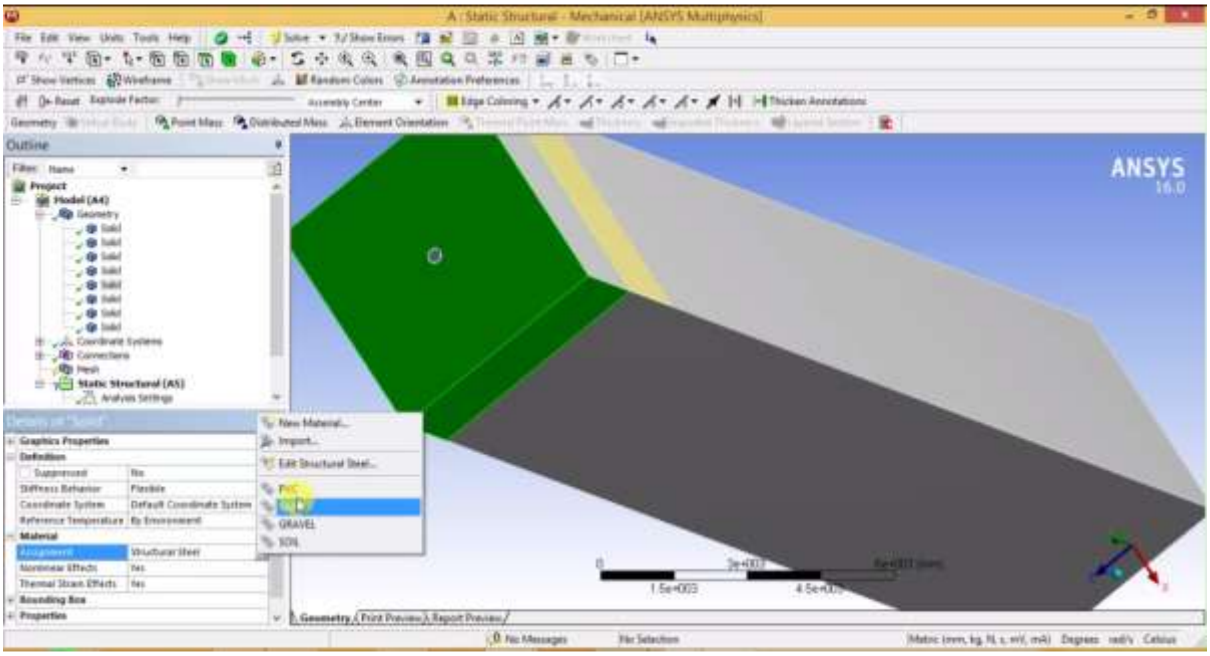
Step 3: Preparation Of pipe Model in Ansys through Sand Gravel and Soil



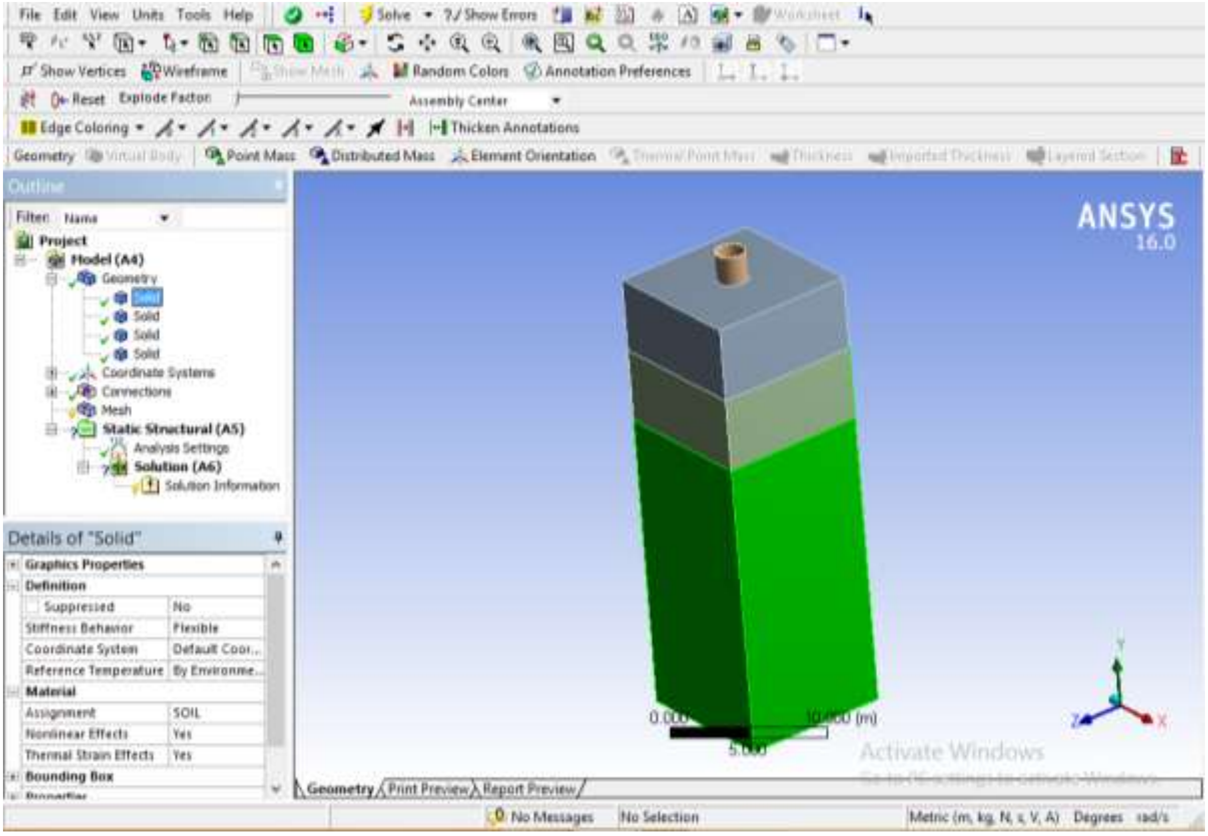
Step 4: Add Material of PVC to the layer of PVC Pipe



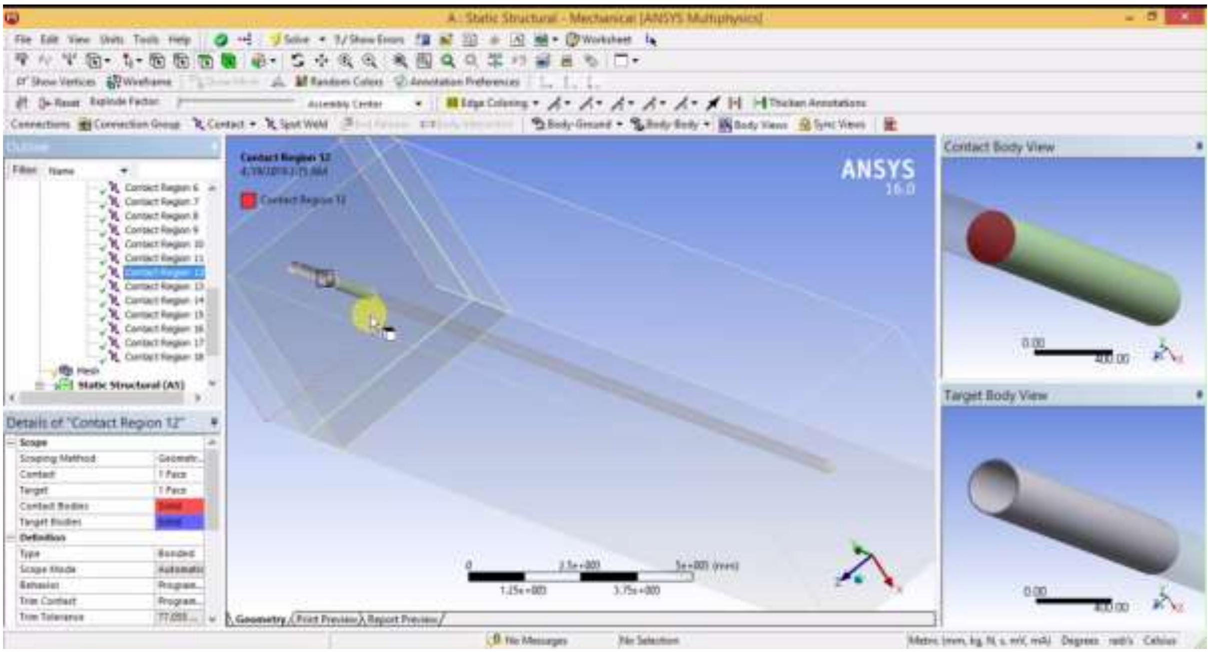
Step 5: Add Materialof Sand to the layer of Sand



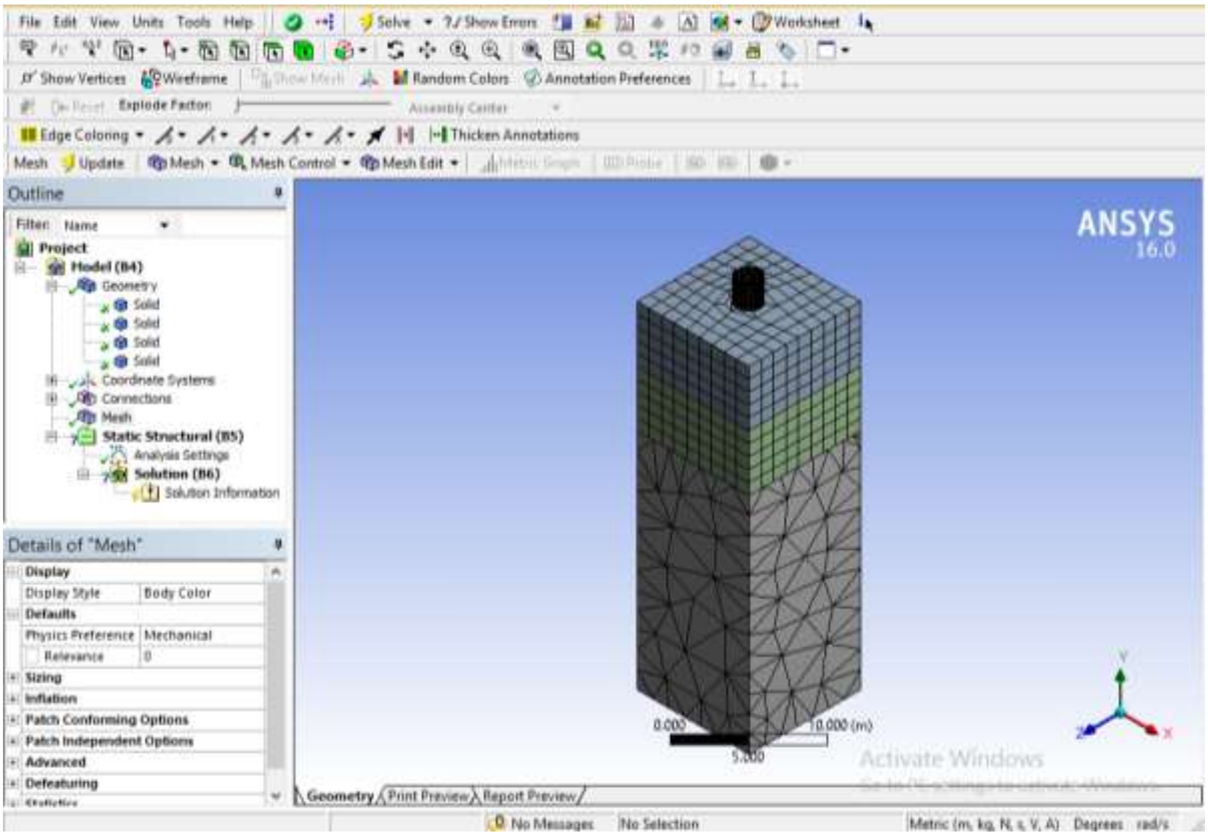
Step 6: Add Material of Soil to the layer of Soil



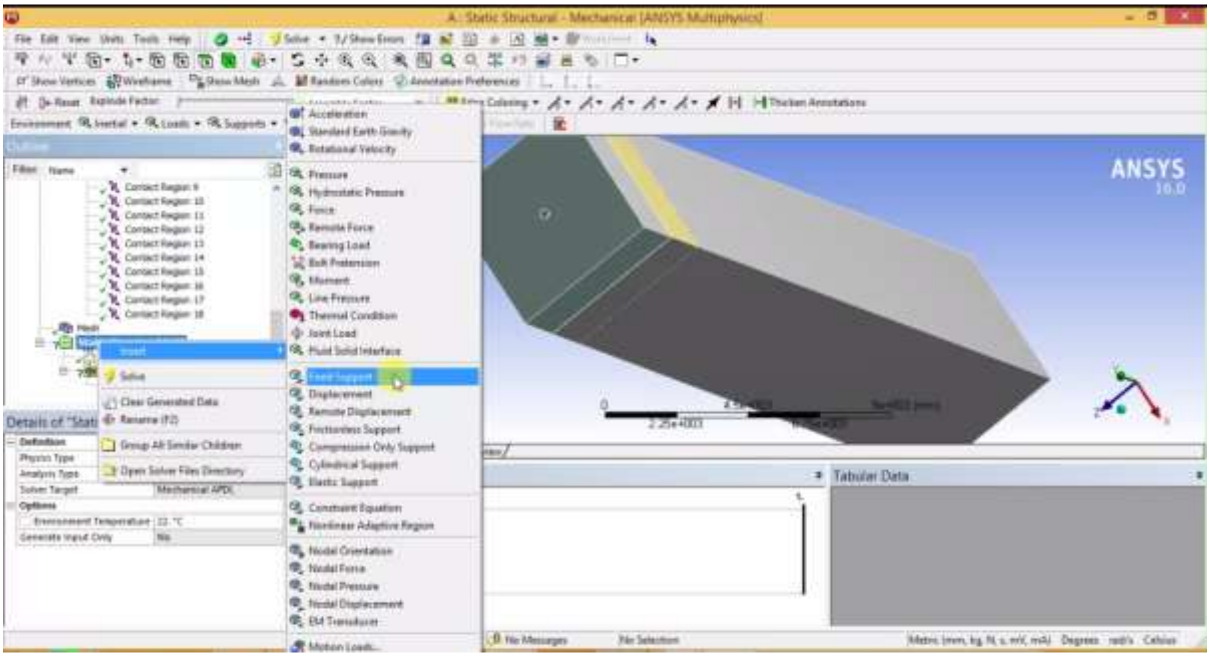
Step 7: Add contact of to the layer Sand Gravel and Soil to the PVC pipe



Step 8: Add meshing of to the layer Sand Gravel and Soil



Step 9: Add Fix Support to the layer Soil At bottom



5. RESULTS AND DISCUSSION

COMPARATIVE STUDY OF 30m and 40m depth

Table 1

TOTAL DEFORMATION mm	
30mDEPTH	40 m DEPTH
27.32	47.53

Table 2

NORMAL STRESS MPa	
30mDEPTH	40 m DEPTH
1.7079	2.5931

Table 3

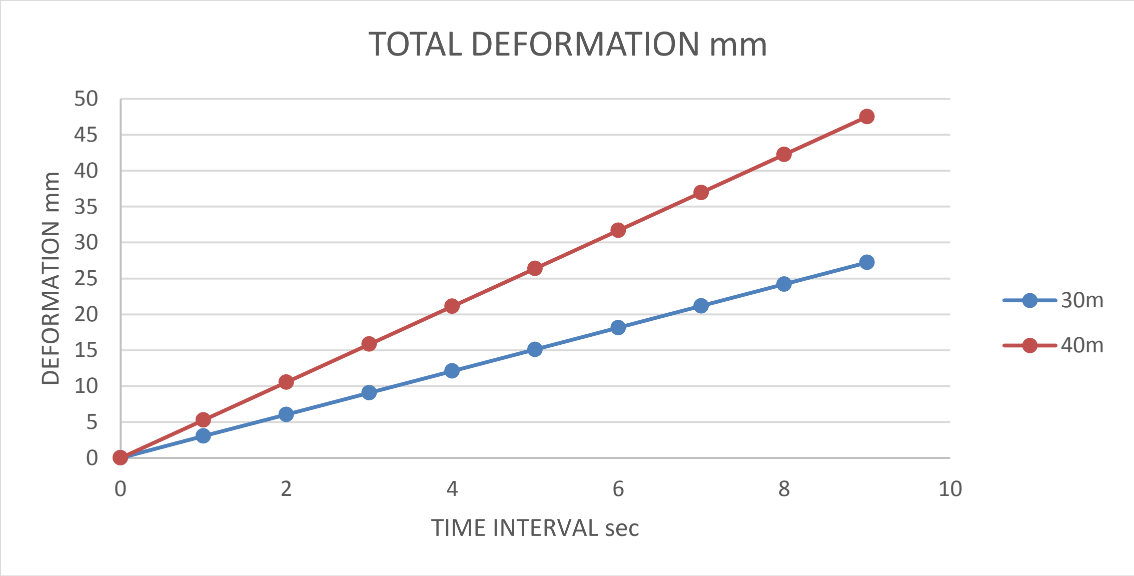
SHEAR STRESS Mpa	
30mDEPTH	40 m DEPTH
0.5288	0.99

Table 4

EQUIVALENT STRESS Mpa	
30m DEPTH	40 m DEPTH
2.49	2.59

Table 5

TOTAL DEFORMATION vs TIME INTERVAL		
TIME INTERVAL	30m	40m
0	0	0
1	3.0528	5.28
2	6.051	10.56
3	9.0772	15.84
4	12.1	21.12
5	15.12	26.4
6	18.15	31.69
7	21.18	36.972
8	24.206	42.254
9	27.232	47.536



Advantages of Bhungroo Technology

- Water depth in tubewell 700 ft needs an investment of 100000 RS. For deep tubewell. Bhungroo needs a onetime investment of < 30000 RS.
- The erratic rainfall and current water storage process does not result better conservation. It solves that problem
- As the runoff water contains various chemicals from fertilizer used for crops, by this technology this water gets naturally filtered underground and additional sand filter is also provided.
- It does not require acquisition of large piece of land as in case of percolation tanks.
- There are practically no losses of water in the form of soil moisture and evaporation, which normally occur when the source water has to traverse the vadose zone.
- Disused or even operational dugwells can be converted into bhungroo technology, which does not involve additional investment for recharge structure.
- Technology and design of the bhungroo is simple.
- The recharge is fast and immediately delivers the benefit. In highly permeable formations, the bhungroo are comparable to percolation tanks.
- Due to heavy sheet flow of muddy water the water percolation rate is very low. By reducing the water logging it is actually increasing soil productivity
- In Alternative season injected water is pumped out for irrigation= cash crops=higher income= economic richness.

5. CONCLUSIONS

1. This project gives an overview of the existing techniques in the artificial recharge of aquifers. It can be now observed from the case studies mentioned in the paper, that the artificial recharge aids in improving the natural yield and capacity of the aquifers.
2. This ensures a consistent and continuous supply of safe and fresh water, even during the dry periods.
3. Bhungroo is a water management system that injects and stores excess rainfall underground and lifts it out for use in dry spells.
4. Artificially recharging aquifers by adding rainwater to underground water reservoirs enables the communities to continue farming for more than half of the year.
5. The non-saline rainwater when mixed with the underground saline water brings down the salinity of the groundwater, making it fit for agricultural use.

6. In the present case study, it is clear that implementation of Bhungroo project leads to increase in ground water recharge over the period of time.
7. ANSYS software is used to evaluate the stresses and strains, deformations developed in ground as well as in pipes for depth recommended by Bhungrooteam. The depth is compared from 30m to 40m

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