GIS Based Analysis for Pit Positioning For Rain Water Harvesting

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***Abstract*-This paper concerns with preprocessing and analysis of proposed model of (RWH)Rain Water Harvesting," Ground Level Water Harvesting" using open source QGIS (Quantum GIS) Software tool & Google Earth. Google Earth is used to determine the view of road areas with proper resolution & the entire road network is captured. Slope analysis has been done with the 'Slope Elevation Profile' in Google Earth for making pits decision on the roads which depends onslope angle.**

QGIS tool is used for digitizing road areas, some parameters need to be determined in order to get maximum benefit. Through digitization, raster file are converted into vector file for calculating the areas. Compute the required road areas for collecting the rainwater with a minimum or maximum average rainfall of the particular area. Then the amount of rain water and the tank capacity is calculated to collect water from roads. This paper provides the necessary parametric specification to make DSS (Decision Support System)for setup rain water harvesting plant.

Keywords-Rain WaterHarvesting, Slope analysis, Slope Elevation Profile, digitization, Google Earth, QGIS.

I. INTRODUCTION

Water harvesting is the way through which the water is preserved for future consumption without large investments. The water harvesting is the prominent way to preserve the water for future perspective. There are different ways to hold the water by harvesting. This document concerns with rain water harvesting, which is basically the collection of water from rain. The rain water harvesting is the conventional irrigation method that can be used for the livestock, crops and the most important thing is that it can be used for drinking purpose in arid and semi-arid regions, and can be preserved for household work like washing clothes, bathing etc. Prinz et al. [1] present two major groups of techniques of rainwater harvesting**.**

Micro catchment water harvesting is a method of collecting surface runoff (sheet or rill flow) from a small catchment area and storing it in the root zone of an adjacent infiltration Basin. The basin is planted with a single tree or bush or with annual crops.

Macro catchment water harvesting is also called "water harvesting from long slopes" or harvesting from external catchment systems" In this case, the runoff from hill slope catchments is conveyed to the cropping area, which is located below the hill foot on flat terrain.Prinz et al. [1] in Fig. 1 give the classification of the traditional methods which operate efficiently and can be applied without large investment.

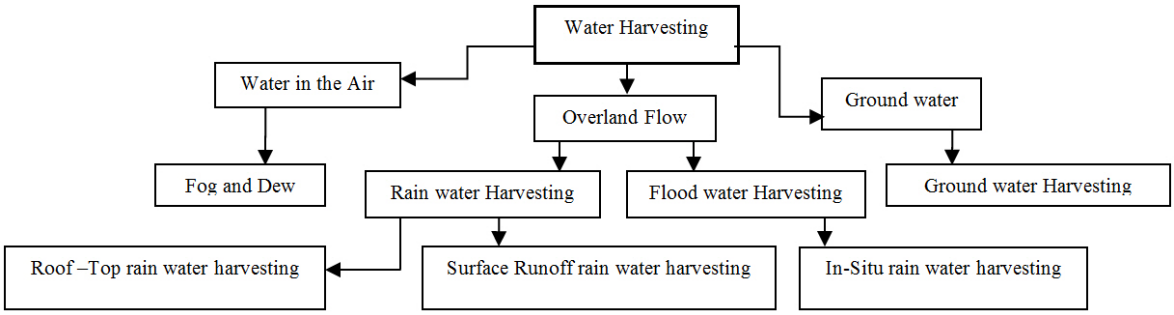


Figure1.Water Harvesting Methods

Julius et al. [2] describes that RWH (Rain Water Harvesting) is facilitating the pressure on water supplies and the drainage system. It is the best way to collect water when and where it is required. It is an old technology but still can be used using the latest trends. Harvested water is stored for direct use in above ground and underground cesspit / above ground tanks and recharge ground through pits, dug wells, bore wells, souses pits, recharge trenches, etc.

This document analyses road area and various parameters of roads like slope, average rainfall amount, runoff coefficient, and tank capacity for make pits at the right place and right direction. So digitization process has been performed and for this process different areas images is acquired from google earth.

II. RELATED WORK

A lot of work has been done related to road network analysis and web based GIS mapping applications for finding shortest path and creates maps with spatial information and showing on the internet. But both the technologies have not been used together much i.e. developing a decision support system for rain water harvesting using QGIS tools and Google Earth with the help of GIS. There are a number of sources that can help to study and work with QGIS tool. Many sites are available which provide the complete introduction of QGIS and its working with starters and also can serve as a useful guide for making maps, joining different maps on the basis of some common features and modifying maps as needed.

Many papers have been published on road network analysis.Sarup et al. [4] present road analysis, to find the shortest path or route, so that these types of information can be displayed using GIS (Geographic Information System) technique. In this paper web based Web GIS architecture is described and implemented using open web GIs tools like Post GIS and Open Layer Plug-ins. Road network was created using QGIS.Rosca et al. [5] present the capabilities of GRASS and Quantum GIS to perform spatial quantitative analysis on landscape morphology. Perform the statistical analysis, using the quantum GIS.Ilayaraja et al. [6] present that Road network is captured by using open- layer plug-in in QGIS. The shortest path between any two points within the road network is determined using the tool shortest path in Quantum GIS. This database can be used many solutions to develop new service area closest facility and traffic control.Ha et al. [7] Present synchronizing coordinates and photos by using open source software QGIS and Cloud computing software i.e. Google Earth. Environmental information, synchronization also helped with environmental monitoring, investigation, survey, and samples collection.

There are number of sources that can help study and work with QGIS. One such is by Sutton et al. [4]. It provides a complete introduction of GIS and QGIS. It Serve as a useful guide for adding vector and raster layer in QGIS. Itserve how to import Lat\Long coordinates as CSV file and only displaying single point in QGIS by using Delimited Text Layer Plug-in serve digitization process in QGIS by adding raster layer.

Understandingthe working of all features of Google Earth might need some assistance, especially for exploring the features of Google Earth. While talking about the documents, variety of them is available. Sutton has given a paper regarding the use of Google Earth with QGIS. Data from goggle earth cannot be used directly into QGIS. The data from Google Earth is in Keyhole Markup Language (KML) format. To convert the data in a form usable by QGIS, kml fileis converted into shape files. Its serve how kml file is converted into shape files in QGIS.

III. TECHNOLOGIES

For the purpose of experiment, the software package QGIS version 2.10.1, the software Google Earth tool has been used.

1) *Quantum GIS*

Quantum GIS is open source GIS desktop software morepopularly known as QGIS.QGIS 1.0 was first released in January of 2009 although development on the software began back in 2002 by Gary Sherman with the first versions of the software intended as a GIS data viewer for PostGIS. QGIS is increasingly becoming a viable alternative to commercial GIS desktop software options due to its user friendly interface and user support resources.QGIS built using C++, this open source GIS software can be downloaded for free, and runs on Linux, UNIX, Mac OSX, and Windows operating systems.CustomPlug-ins can be created using either C++ or Python. Latest at present we used the QGIS version 2.10.1.

The additional characteristics include improved support for creating KML, easier to create high performance web map services, better web security etc. The software package allows us to store, manipulate, analyze and display spatial data. The desktop products allow us tointegrate and edit data create new map layers, and author maps. QGIS desktop includes a series of scalableproducts. QGIS desktop products includeQt designer with custom widgets, SAGA GIS, GRASS GIS, OSGeo4W, and MSYS Shell.

2) Google Earth

Google Earth is a virtual globe computer program. Someversions of the software are not freely available and the freely available Google Earth can be easily downloaded. It provides high resolution aerial and satellite imagery. One can identify and mark places and any other data of interest. Google earth and QGIS allow for some inter-compatibility through the use of keyhole Mark-up Language (KML) and so Google Earth has been to get the data for the research KML, a programming language similar to HTML, was specifically designed to allow spatial map data to be displayed in virtual earth browsers, such as Google Earth. By supporting KML, QGIS allows shape files to be converted for viewing in Google Earth. Data imported from Google Earth is in the KML format and can be converted to shape files of QGIS.

IV. METHEDOLOGY OF PROPOSED MODEL

As per thestudy about rain water harvesting, analyzed and proposed a model Fig. 2 whereby 'Ground level Rain water harvesting 'can be done, with the help ofDSS (Decision support System) and GIS (Geographic Information System) system. In this the ground water from the rain can be collected in form of pits. According to the slope of the roads, pits can be positioned, together with water being collected, filter can be used here to make the water clean and make it useable for everyone.

In this model water from rain can be made to fall on the roofs, roads and hilly areas. Water is in excess on the roads so it can be stored and preserved for the future use.The pit storage model can be easily implemented where the suitable conditions like slope, high rainfall, hilly areas where it can be easily implemented.

Containers are used for collecting water and the size of container is dependent upon the conditions like the amount of rainfall, slope of road, run-off coefficient and the area available.

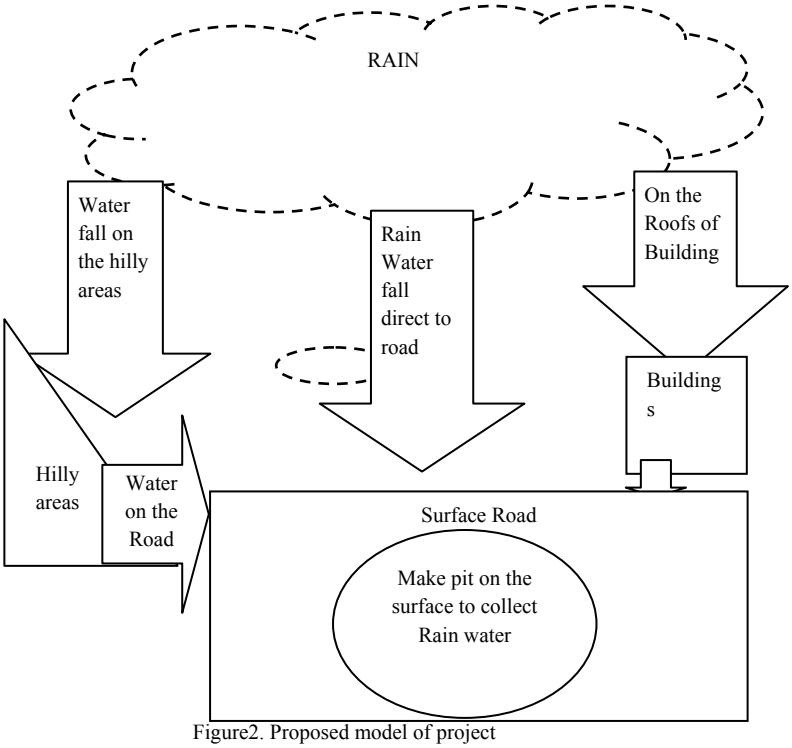
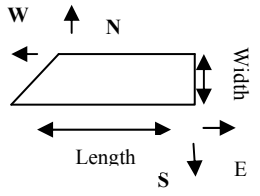
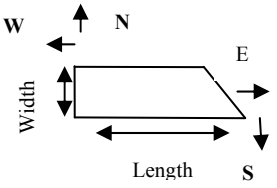
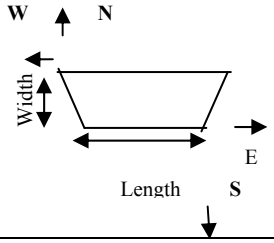
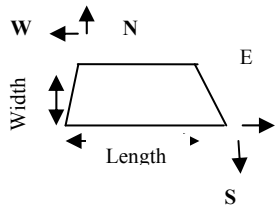


Figure2. Proposed model of project

Table [1] Represent road structure with definite slope condition;it will help to make decision for pit position on the roads. Roadscontain various types of slope along length and width in west, east, south and north directions.

TABLE1. ROADS WITH DIFFERENT TYPES OF SLOPE

No.	**Road structure**	**Define slope**	**Description of Pit position in accordance with slope condition**
1.		Slope along with Length in West direction	Make a pit along with length in West and along with width in South direction
2.		Slope along with Length in East direction	Make a pit along with length in East and along with width in South direction
3.		Slope along with width in south direction	Make a pit along with length in both East and West & along with width in South direction
4.		Slope along with width in north direction	Make a pit along with length in both East and West & along with width in North direction

V. CASE STUDY

This research uses available resources to get the required information to get a set of parameters that will be used to digitize the area, slope analysis, and measuring tank capacity to collect rain water.

The following sections depict the steps for collecting the information and processing for slope analysis, digitizingor calculation of tank capacity.

A. Data Collection

- For the research, the place where view shed analysis needs to be carried out is marked in Google-Earth using polygons, paths and place marks. The following steps have been followed to collect the data from Google Earth.
- Firstly install google earth and startworking in it.
- Identify the area on google earth after that
- In now save the image from google earth.
- For save the image on Google Earth>File>save>save image to initiate the process, and then select the resolution we want.
- With the save option we will get a JPEG image.

Now savethis jpeg image as tiff Format. This tiff image is used for digitization.

Table [2] depicts the identified selected two areas on goggle earth. In these areas, there is minimum, average, and maximum Rainfall, has been chosen for monitoring the effect of collecting rainwater. Some portion of these complete intersection areas is taken into account to calculate the area of the roads, average rainfall and also viewing the effect of placing the container to collecting the rainwater.

TABLE2. IDENTIFY AREAS ON GOOGLE EARTH WITH LATITUDE AND LONGITUDE

No.	Identified Area	Coordinates with Latitude and Longitude on Google Earth	Viewing Area
1.	**SarojiniMarg, Statue Circle, c-scheme area, Jaipur, Rajasthan.**	Latitude 26°54'27.91"N and the longitude 75°48'21.76"E.	
2.	**BrijVihar colony, Ajmer, Rajasthan.**	Latitude 26° 35'0.01"N and the longitude 74°49'52.76"E.	

B.Slope analysis of the selected area and decision making for the pits to be built for rain water catchment

In proposed model 'Ground Level Water Harvesting', ground water from the rain is collected in the form of pits. According to the slope of the roads pits can be positioned. So we need to analyze the slope of the selected region.

So here several steps to perform the slope analysis are:

- Select the site from the Google Earth.
- First, we find the location to mark for the slope analysis.
- Click the push pin icon  in the tool bar at the top of the earth window.
- This will place the icon in the middle of current view and open the **newplacemark window**.
- Click and drag the push pin in to the correct location.
- In the **Name box**, enter the name we want to display beside the marker on the map.
- An item with the same title will be added in the places panel in the left column under **my places**section.Latitude and longitude of the placemark get by the snapshot current view in the **view** option.
- And we reset the view tab for different **placemark** in the google earth.

For slope analysis make 15 place marks named as A,B,C,D,E,F,G,H,I,J,K,L,M,N,O shows in fig.3 at the different altitude in our selected site region i.e. statue circle, jaipur in Googleearth and save as filename of elevations.kml file in Google earth.

Figure3. Place mark created at Statue Circle, Jaipur in Google Earth Image

I. *Slope calculation*

Slope is calculated from a grid of elevations. Slope is defined as an angle. Slope measure the steepness of the surface at any particular location is often measured in degrees or in percent rise.

In our analysis slope is calculated in two ways-

a. Manually:

- Slope is calculated at each point in the grid, by comparing the point's elevations to that of its neighbors.
- Measured from an elevation bathymetry raster.
- Compare elevations of points in a 3×3 neighborhood.
- Slope at one point estimated from elevations of it and surrounding 8 points.
- To calculate the slope for cell —E, needs elevations at point A, B, C, D, F, G, H, I.
- Calculate slope for E cell using by this formula

A	B	C
D	E	F
G	H	I

1. Calculate East-West gradient

$$\Delta X = ((Z_C+2*Z_F+Z_I)-(Z_A+2*Z_D+Z_G))/8\times \text{Cell size} \quad (1)$$

2. Calculate North-South gradient

$$\Delta Y= ((Z_A+2*Z_B+Z_C)-(Z_G+2*Z_H+Z_I))/8\times \text{Cell size} \quad (2)$$

$$\text{Tan (Slope (E))} = \sqrt{((\Delta X)^2+(\Delta Y)^2)}$$

- Cell size is taken here 30m.
- For manually calculation need to export the latitude and longitude for the placemark from the google earth.
- Placemark is saving in the folder at **my places** in the google earth.
- These placemark save as kml file.
- Now this kml file is converted in csv (comma separated values) file through the online converter.
- Now we add the altitude attribute in the csv file to show the elevation of the selected placemark.
- Now we get csv file with latitude and longitude data and elevation data.
- These elevation points used in calculating slope.

Now fig. 4 shows the csvfile (comma separated values) which contains the latitude and longitude information of different placemark shown in google earth image. This is converted csv file, which is saved as kml file in google earth and after that in fig. 5 slope calculation has been done by using formulas which shows slope calculation and their required parameter calculations like delta X, delta Y, square of delta X & Y, sqrt, slope in radians and degrees.

Name	Latitude	Longitud	Altitude(m)	Dist	AvgSpd	Descripti	Icon	IconScale	IconAltit	IconHea	IconColo	LineStrin	HideNameUntilMouseOve		
A	26.9073	75.8061	435	0	0	NO.0<br	196	0.3	0	line-180	yellow	aqua	true		
B	26.9071	75.8065	436	0	0	NO.1<br	196	0.3	0	line-180	yellow	aqua	true		
C	26.9069	75.8067	435	0	0	NO.2<br	196	0.3	0	line-180	yellow	aqua	true		
D	26.9066	75.8066	436	0	0	NO.3<br	196	0.3	0	line-180	yellow	aqua	true		
E	26.9064	75.8064	436	0	0	NO.4<br	196	0.3	0	line-180	yellow	aqua	true		
F	26.9069	75.8068	435	0	0	NO.5<br	196	0.3	0	line-180	yellow	aqua	true		
G	26.9064	75.8069	435	0	0	NO.6<br	196	0.3	0	line-180	yellow	aqua	true		
H	26.9062	75.8054	435	0	0	NO.7<br	196	0.3	0	line-180	yellow	aqua	true		
I	26.9064	75.8051	433	0	0	NO.8<br	196	0.3	0	line-180	yellow	aqua	true		
J	26.907	75.8051	432	0	0	NO.9<br	196	0.3	0	line-180	yellow	aqua	false		
K	26.9064	75.8048	433	0	0	NO.10<l	196	0.3	0	line-180	yellow	aqua	true		
L	26.9078	75.8046	433	0	0	NO.11<l	196	0.3	0	line-180	yellow	aqua	true		
M	26.9088	75.8022	430	0	0	NO.12<l	196	0.3	0	line-180	yellow	aqua	true		
N	26.9095	75.8006	431	0	0	NO.13<l	196	0.3	0	line-180	yellow	aqua	true		
O	26.9081	75.8058	436	0	0	NO.14<l	196	0.3	0	line-180	yellow	aqua	true		

Figure4. Export CSV File from Google Earth

Points to measure slope	Altitude(m)	Δ X(m)	Δ Y(m)	Square of Δ X(m2)	Square of Δ Y(m2)	(ΔX^2 + Y^2)=Sum	Square Root of Sum	Slope =tan(-1)(Sqrt)Radi	Slpoe (Degree)
A	435	0.004	0.012	0.000016	0.000144	0.00016	0.012649111	0.012648436	0.724702005
B	436	0.004	0.012	0.000016	0.000144	0.00016	0.012649111	0.012648436	0.724702005
C	435	0.012	0.012	0.000144	0.000144	0.000288	0.016970563	0.016968934	0.972248293
D	436	0.025	0	0.000625	0	0.000625	0.025	0.024994794	1.432096184
E	436	0.016	0.004	0.000256	0.000016	0.000272	0.016492423	0.016490927	0.944860542
F	435	0.004	0.02	0.000016	0.0004	0.000416	0.020396078	0.020393251	1.168447184
G	435	0.012	0.012	0.000144	0.000144	0.000288	0.016970563	0.016968934	0.972248293
H	435	0.025	0.041	0.000625	0.001681	0.002306	0.048020829	0.047983968	2.749278839
I	433	0.033	0.041	0.001089	0.001681	0.00277	0.052630789	0.052582274	3.012742395
J	432	0.029	0.012	0.000841	0.000144	0.000985	0.03138471	0.031374411	1.79762134
K	433	0.041	0.025	0.001681	0.000625	0.002306	0.048020829	0.047983968	2.749278839
L	433	0.008	0.07	0.000064	0.0049	0.004964	0.07045566	0.070339425	4.030152196
M	430	0.05	0.041	0.0025	0.001681	0.004181	0.064660653	0.064570763	3.699632179
N	431	0.029	0.012	0.000841	0.000144	0.000985	0.03138471	0.031374411	1.79762134
O	436	0.05	0.016	0.0025	0.000256	0.002756	0.052497619	0.052449471	3.005133313

Figure5. Slope Calculation in Degrees of Different Place marks

II. Slope Elevation Profile in Google Earth:

- Select area>click on Add path tool  .
- Draw the path between to selected points.
- Save path>my places> click on show elevation profile

Hold the mouse over the elevation profile, show a red arrow on map marking the location and also display the height above sea level. Data from elevation profile and manually calculation of slope are match. Then this data will help to make a pit on the selected path on the basis of slope angle. Pits make by select the **add placemark tool** from google earth toolbar.

Elevation Profile for both the selected area:-

a) Statue Circle Jaipur

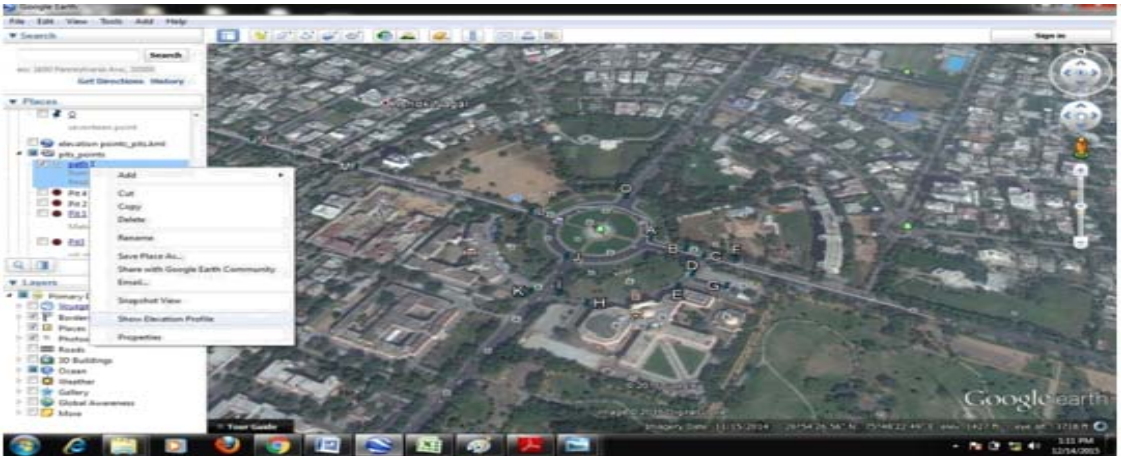


Figure6. Elevation Profile Show in Google Earth for Statue Circle, Jaipur

First we select statue circle, jaipur area in google earth. For elevation profile click on add path tool and draw path between two points from N to G placemark, towards west to east direction. Now save as path1 in my places. Now click on path1 and click on show elevation profile. Fig. 6 shows path1 and elevation profile. Fig. 7 shows elevation profile window in google earth and the red arrow shown in earth screen and it moves according to elevation profile. In this figure red arrow show the elevation for altitude value 1421 ft at near the'L' placemark. This shows the option for pit because slope from both directions is highest at this point.Finally in Fig. 8 shows the all four pits for different altitude values ,pit 1 at 1422ft near 'L', pit 2 at 1424ft near 'O' , pit 3 at 1412ft near N' , pit 4 at 1425ft near F' placemark. Right Place for pit is marked where the decision of both the techniques manual slope calculation as well as elevation profile matches. All these path and pits are savedin elevation profiles folder in my places and saved as kml file in google earth.

Figure7. Pit position with elevation angel show in the elevation profile for statue circle

Figure8. Different Elevation by the elevation profile and manually slope calculation for statue circle

b) *BrijVihar Colony, Ajmer*

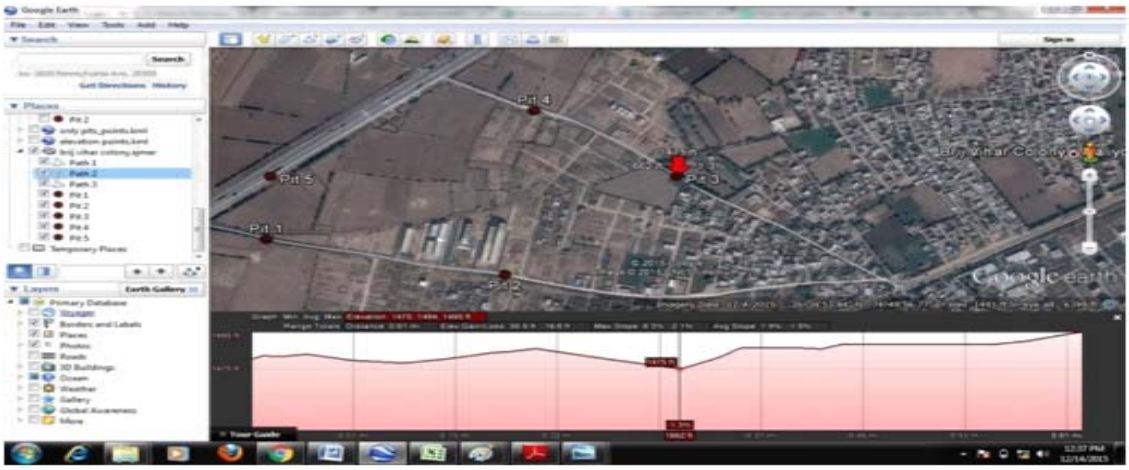


Figure9. Pits Placed by Elevation Profile

Fig. 9 shows the selected second area, brijvihar colony Ajmer.Same as above repeat the process which was done for finding elevation profile for statue circle. Draw three paths named as path 1, path2, path3 for this area and find elevation angle for different places and place pits at different altitude values in google earth image. Five pits places named as pit 1 to pit 5 for this selected area. After that save all the three paths in elevation profiles folder and save as kml file in google earth.

C. Digitization in QGIS

Digitization is the one of the most common tasks inGIS. In our analysis digitize raster data to create vector layers.Quantum GIS has powerful capabilities to digitize raster data.We will take some high resolution satellite imagery and digitize it to create a vector polygon layer.After finding slope points of these selected areas images are save ingoogle earth for the further digitization.Now these images save as tiff image to start digitization over this. In our analysis retrieve complete road network of the chosen area under study through digitization from google earth.

Digitization can be done in qgis. So here are several steps for performing digitization:

a. Firstly digitize the area statue circle,C-scheme,jaipur.

For starting the digitization process in qgis, open qgis tool load the tiffimage inqgisby clicking layer>add raster layer. Browse for tiff file st_final and click ‘open‘to load the image into qgis. A coordinate reference system selector dialog box is opened and selects**CRS WGS 84**. Now image is visible in Fig. 10 qgis.

Next create an empty layer for roadsin Fig 11 where digitization ofall the road features is doneand for this click on layer>new>new shapefile layer. Dialogue box appear asking about the information for the new layer. According to the requirements we select layer as polygon layer to digitize roads. After that section named ‘new attribute’ appears in which the information we want to collect is specified. Enter the details and click the ‘add to attribute list button’. Through this add ‘name’ and ‘class’ attribute. And then save layer as st_Roads in .shp format. Fig. 12shows this new shape file layerst_Roads.Similarly, add two other shape files st_Point and st_Area to digitize pits and area as polygon layer.

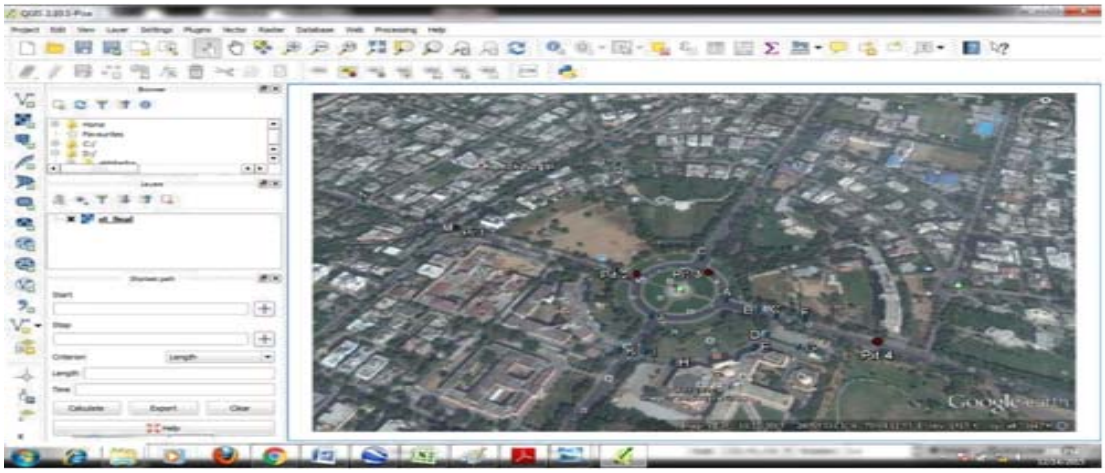


Figure10. Loaded raster image (tiff image) of Statue Circle is st_final in QGIS

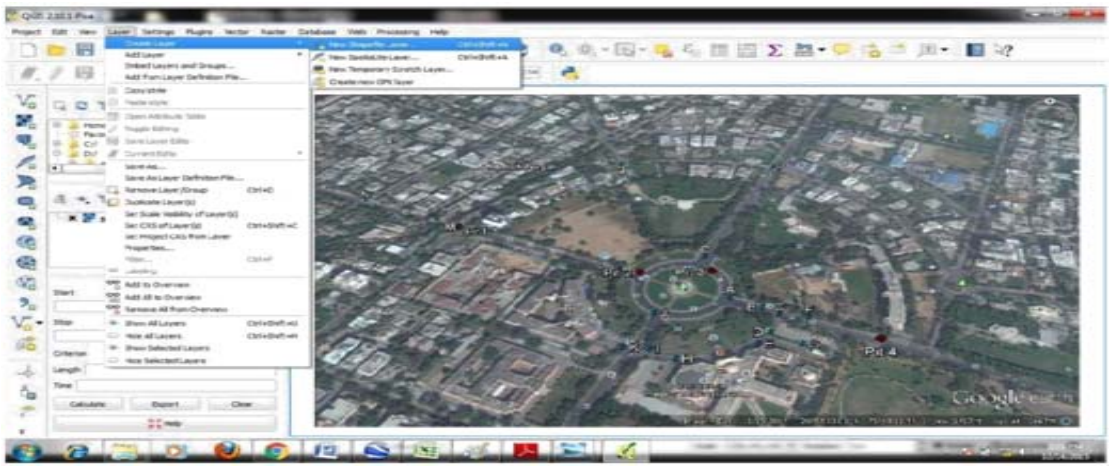


Figure11. Adding new shape file layer in qgis for statue circle

- Now enable the digitizing toolbar.
- Click the Toggle editing button. Various other buttons in the toolbar will be enabled now.
- On the digitizing toolbar Click>Add feature button >start making to digitize polygons in the image.
- To digitize road areas use polygon.
- Draw the polygon by click on the edge of the selected road area .Keep clicking till the polygon is complete.
- Right click to join the last node to the first node and close the polygon.
- Dialog will pop-up asking for attribute information.

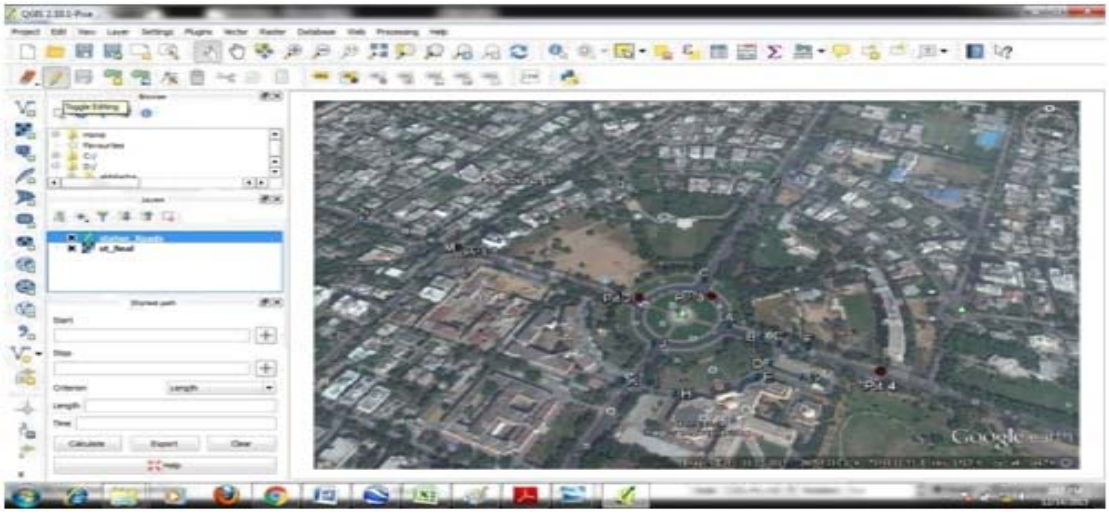


Figure12.Added new shape files (Point/Polygon) layer for statue circle in QGIS

- Enter the 'Id'and'Name'& 'class 'of the feature we just digitized and click OK.
- After draw the polygons in the image, we can look at the other options in the toolbar for editing.
- Once we have done, click on the 'save layer edits'.
- After digitizing roads to make pit points need to digitize points by point layer. So create new empty shape file layer of point layer for pit positioned and add the attribute information for each point.
- Dialog box pop-up and asking for new information about the new layer and follow the same process as we used to digitize polygon layer. Now the digitization is complete. Finally digitize image of st_final in Fig. 13 and save as staue_new.qgs project in qgis.

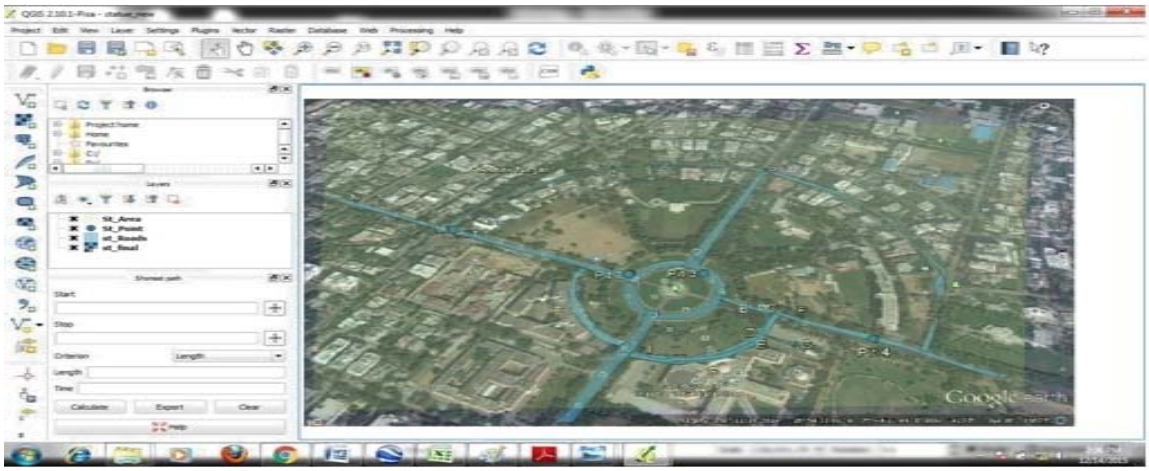


Figure13. Digitized image of Statue Circle Image in QGIS

Use of Field Calculator to calculate Area of Road Polygons:

Need to calculate areas of roads to calculate assessments of water. For this calculate the area of roads in qgis tool with the help of field calculator. For this process need first

- Click onst_Roads.shp layer>  open attribute table.
- Click on toggle editing mode  and open the field calculator dialog  .
- Select the Create a new field checkbox to safe the calculations in a new field.
- Add Roads_area as output field name, decimal (real) as output field type and define output field width 10 and of precision of 2.
- Now click on the function area in the *Geometry* to add it as $area in to field calculation expression box and click Ok.
- We can now found a new column area in the attribute table shown in Fig. 14.
- Area is calculated in $m^{2.}$

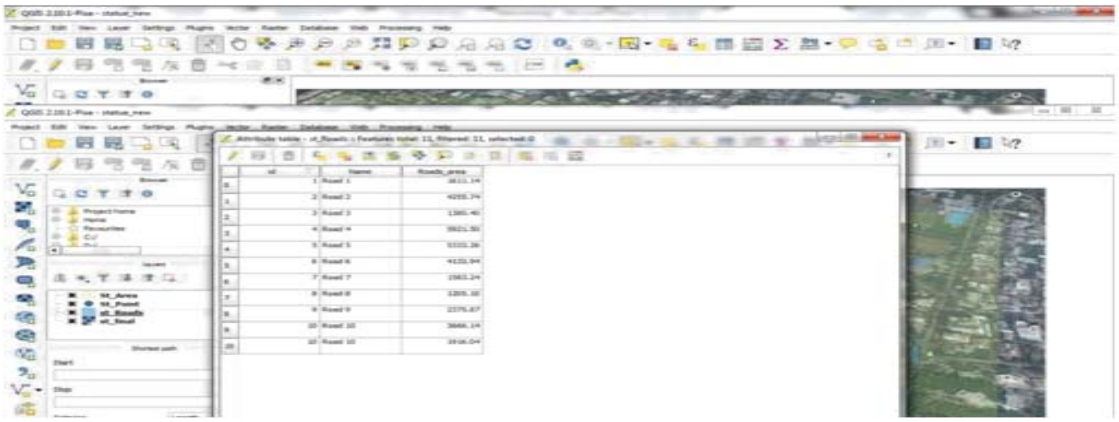


Figure14. Calculated area for roads in QGIS shown in open attribute table for statue circle

b. Digitization of BrijVihar colony ,Ajmer:-

To digitize the second area brijvihar colony, Ajmerrepeats the same process as we did for statue circle. First load the tiff image bvc_pit1 in qgis in Fig. 15 and then add new shapefile layer for both roads and pits by adding area_bvc as polygon layer andpoint_bvc as point layer. By enabling toggle editing button digitize the area. Finally digitized image of brijvihar colony, Ajmer area isshown in Fig. 16and finally calculate the roads area of polygon layer to calculate the assessments of water for this area. Calculateroad areas by using field calculator shown in Fig. 17.

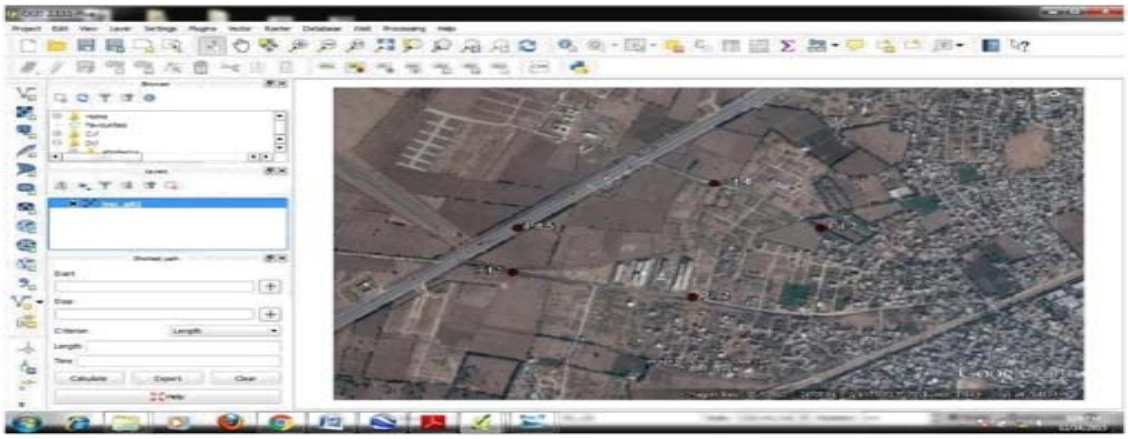


Figure15.Load Raster image of BVC, Ajmer in QGIS

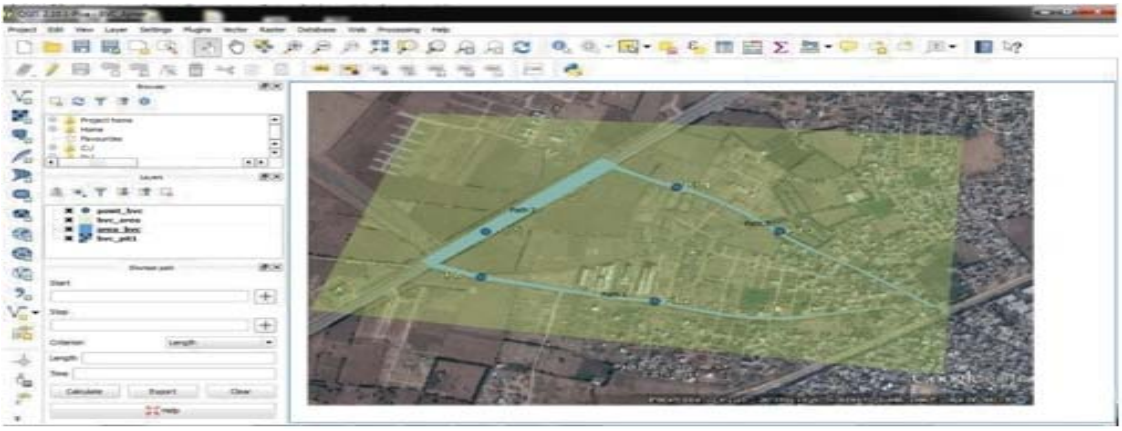


Figure16. Digitized Raster image of BVC, Ajmer in QGIS

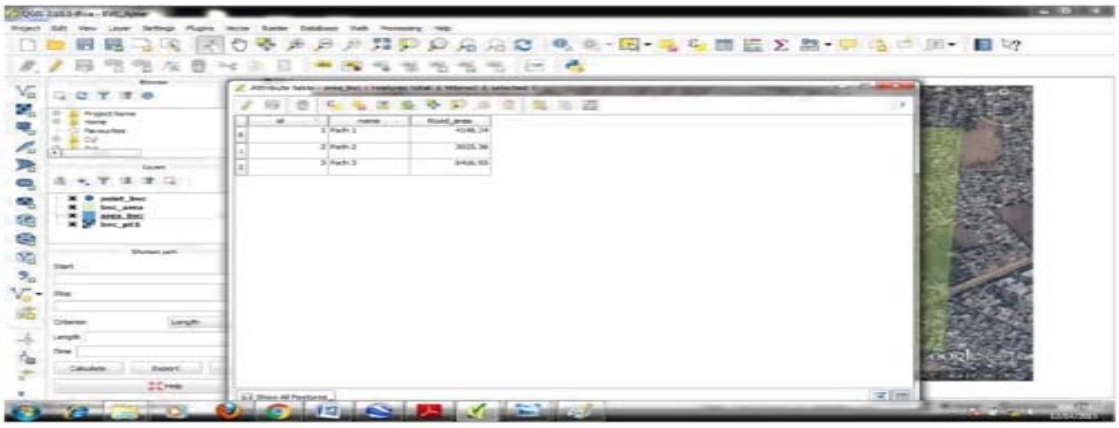


Figure17. Calculated area of Roads for BVC, Ajmer Shown by Open Attribute Table

D. Assessments of the collection of rain water

Assessments of water calculated by certain parameters are:

- Average annual rainfall amount
- Area of particular selected region. In our analysis road areas are uses on which rain fallen down and is collected in the form of pits.

So the calculate of assessments of water by this formula:

Assessments of water on the Roads(Liter)(A) = Average annual Rainfall in the City ×City (area)(mm) × Road_areas(m^2)×1000

According to the assessments of rain water tank capacity is identified and it also represents in Table 3 & 4 on the basis of road area calculations.

a. Tank Capacity

Capacity of tanks is estimated according to the collectedwater from road areas. The diameter and the height of the tanks are decided according to the collected water and beyond the collected water. The tank is also placed according to the area. Tanks can be placed underground or on ground level also.

b. Assessment of water calculated in Tables:

I. *Jaipur Profile*

Jaipur is situated in the eastern part of Rajasthan. The totalarea of Jaipur is11, 117SqKm. with an average population density of 470 people per sq km. as per 2011 census. Total average annual rainfall of Jaipur district is 640mm.So average rainfall data is use to find the assessments of water which we collected from the digitize roads in our analysis.Through digitization and field calculator using open attribute table feature got the calculated values of areas for different roads network for which digitization we have performed .Average annual rainfall of jaipur 640mm**.**

So the assessments of the water on different digitize roads:

Average annual rainfall of Jaipur is 640 mm/year, and 0.64m/year.

TABLE3. CALCULATION OF ASSESSMENTS OF WATER FOR STATUE CIRCLE, JAIPUR

Name	**Road_areas(m^2)**	**Assessment water on roads(A)(Liter)=(Avg.annualRainfall(mm)*Road_areas))×1000**	**Tank Capacity(Liter)**
Road 1	1611.14	1031.13×1000=10,31,100	11,000,00
Road 2	4255.74	2723.67×1000=27,23,670	30,000,00
Road 3	1380.40	883.45×10000=88345	90,000
Road 4	5921.50	3789.76×1000=37,89,760	40,000,00
Road 5	5333.26	3413.28×1000=34,14,280	35,000,00
Road 6	4132.94	2645.08×1000=26,45,080	27,000,00
Road 7	1583.24	1013.27×1000=10,13,270	11,000,00
Road 8	1205.10	7712.64×1000=77,12,640	78,000,00
Road 9	2375.87	1520.55×1000=15,20,550	16,000,00
Road 10	3666.14	2346.32×1000=23,46,320	24,000,00
Road 11	1916.04	1226.26×1000=12,23,260	13,000,00

II. Ajmer Profile

Average annual rainfall of Ajmer is vary from 38-51cm

So take an average of 44.5 cm/y and 445 mm/y, 0.44m/y.

TABLE 4.CALCULATION OF ROADS FOR ASSESSMENTS OF WATER OF BVC, AJMER

Name	**Road_areas(m^2)**	**Assessment water on roads(A)(Liter)=(Avg.annualRainfall(mm)*Road_areas))×1000**	**Tank Capacity(Liter)**
Road 1	4148.34	1825.26×1000=18,25,269	20,000,00
Road 2	3025.36	1331.16×1000=13,31,158	14,000,00
Road 3	8416.95	3703.458×1000=37,03,458	40,000,00

➢ Є shows the maximum capacity of tanks to collect rain water from Roads_area.

Table 3 and table 4 shows the assessments of water for road areas in liter which is denoted as 'A' for both selected areas statue circle, jaipur and brijvihar, Ajmer and calculate the tank capacity in liter which is always maximum from the collectedwater. Table 3 & 4 shows the calculation of predicted amount of water and required capacity of tank, which should be established to avoid any wastage of water

VI. RESULT AND DISCUSSIONS

In India and other countries,water scarcity is a major challenge.The proposed system of pit positioning for rain water harvesting can be usedto tackle the water scarcity problem in future. For proposed system, analyzed slopes according to various road conditions, road areas and average rainfall amount.

System result is generated on the basis of some parameters like finding slope with elevation profile from google earth and road areas calculating from QGIS by using attribute table field calculator.

Slope analysis has been done by two methodologies that are slope elevation profile and manually calculation for different placemarks in google earth.

For the manual calculation different place marks were located on the selected areas in googleearth and for all these placemarks, latitude and longitude information is stored which is used to calculate slope calculation using the slope formula. Slope calculation of all these placemarks is stored in degrees as CSV file to denote difference between maximum and minimum slopeangle.

Second method is used i.e. slope elevation profile for the placemarksin google earth and their corresponding altitude values are stored in CSV file. Finally match the result which is generating from both slope calculation methods i.e. Altitude values from slope elevation profile and manually calculated result for the selected placemarks.

Values are matched and thus points are selected for making pits at that place. Hence locating pits on the roads on the basis of slope analysis, to collect water from grounds for better harvesting structure. Decision for establishment of pits has been taken through two methodologies to avoid any errors.
It has been observed that the decisions of two techniques are similar, thereby increasing the reliability.

VII. CONCLUSION

Harvested water can be used for various purposes like agriculture, livestock, domestic uses etc.Adaption of RWH technologies and their contribution are making possibility for preserving water for prolong time for harvesting rain water there is aneed to analyze the road area with location and slope condition.In this paper the road information data has been given according to the characteristics of geographic data like area with location and pit position according to slope direction.For this in the paper two areas are selected of two different cities to analyze. Digitization process to achieve goal of finding the pit position for collecting harvested water .QGIS and google earth has been used to calculate area of roads, amount of water and tank capacity. A GIS based analysisof road area, slope analysis and pit positioning for rain water harvesting have been carried out successfully. This analysis is very much useful in future planning of decision support system for rain water harvesting.

Adaption of decision support system for rain water harvesting technique will make it possible to preserve water for prolonged time.

REFERENCES

[1] Prinz, Dieter. "The role of water harvesting in alleviating .water scarcity in arid areas." Keynote Lecture, Proceedings, International Conference on WaterResources Management in Arid Regions. 2002.
[2] Julius, J. R., R. Angeline Prabhavathy, and G. Ravikumar. "Rainwater Harvesting (RWH)-A Review." International Journal of Innovative Researchand Development 2.5 (2013)..
[3] Sutton, T., O. Dassau, and M. Sutton. "A gentle introduction to gis." Chief Directorate: Spatial Planning & Information, Eastern Cape (2009).
[4] Sarup, Jyoti, and VimalShukla. "Web-Based solution for Mapping Application using Open-Source Software Server." International Journal of Informatics and Communication Technology (IJ-ICT) 1.2 (2012): 91-99.
[5] Rosca, Bogdan, Dan-Adrian Chelaru, and SergiuPlescan. "The Analysis Of Landscape Morphology In Lower BistritaValey Using Grass And Quantum Gis." International Multidisciplinary Scientific GeoConference: SGEM: Surveying Geology & mining Ecology Management 1 (2013): 951.
[6] Ilayaraja, K. "Road network analysis in Neyveli Township, Cuddalore District by using Quantum GIS." Indian Journal of Computer Science and Engineering 4 (2013): 56-61.
[7] Ha, Pham Thi, et al. "Using open sources program and online applications to support environmental monitoring." EnviroInfo. 2012.
[8] Liaw, Chao-Hsien, and Yao-Lung Tsai. "Optimum storage volume of rooftop rain water harvesting systems for domestic use." Journal of theAmerican Water Resources Association 40.4 (2004): 901-912.
[9] Lye, Dennis J. "Health risks associated with consumption of untreated water from household roof catchment systems." Journal of the American waterresources association 38.5 (2002): 1301-1306.
[10] Pratishtha,Gupta,G. N. Purohit, and Amrita Dadhich. "COMPUTING INSTALLATION PARAMETERS OF CCTV CAMERAS FOR TRAFFIC SURVEILLANCE." International Journal of Computer Science & InformationTechnology 4.6 (2012): 105.
[11] Patel, Utsav R., et al. "ROOFTOP RAINWATER HARVESTING (RRWH) AT SPSV CAMPUS, VISNAGAR: GUJARAT-A CASE STUDY."

WEBSITES:

[1] http://akvopedia.org/wiki/Rainwater_Harvesting
[2] http://akvopedia.org/wiki/Surface_water
[3] http://www.disasterriskreduction.net/fileadmin/user_upload/drought/docs/W ater%20Harvesting%20poster.pdf
[4] http://drprem.com/green/greentopia-revivedold practice-becomes-the-trend-of-today
[5] http://python.about.com/od/gettingstarted/ss/whatispython.htm#step2
[6] http://www.edc.uri.edu/nrs/classes/NRS409/RS/Lectures/HowRemoteSens Work.pdf
[7] http://www.amssdelhi.gov.in/RESEARCH_FILES/JAIPUR_RF_PROFILE. pdf
[8] http://www.indovacations.net/visitrajasthan/RajasthanWeather.htm
[9] http://www.qgistutorials.com/en/docs/digitizing_basics.html
[10] http://www.igismap.com/convert-kml-shapefileqgis/
[11] http://www.asiannature.org/sites/default/files/Qgis%20tutorial%20compiled.pdfhttp://gis.stackexchange.com/questions/52388/importing-lat-long-coordinates-as-csv-file-only-displaying-single-point-in-qgi