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Determining the Of Proximity of Waterworks at the Polytechnic, Ibadan Using Gis Approach

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ABSTRACT: Water distribution systems constitute a vital part of civil infrastructure. The purpose of a water distribution system is to ensure the supply of water to users at specified demands. The main objective of this works is to study the exiting water supply system of The Polytechnic Ibadan source of the water and then planning water distribution system using ArcGIS. This task addresses the use of ArcGIS for mapping and planning water distribution network. GIS based tools were used for the digitization of Building (polygon), water distribution network (polyline) and nodes (point) which are important from the water distribution point of view. The use of Global Positioning System (GPS) with Remote Sensing imagery in determining proximity of water works in the polytechnic Ibadan is discussed. In order to carry out the acquisition of geospatial data for the water infrastructure development, coordinates were acquired by the method of Differential GPS survey. GPS acquired data was downloaded into the computer system and processed using HGO solution and GNSS enabling the generation of final coordinates of GPS observation. Buffering and query were performed on the processed data aiding the preparation and production of the necessary plan.

KEYWORDS: Water distribution, Proximity, Topography and Reservoir

I. INTRODUCTION

Water is vital for man's existence and without it, there would be no life on earth. As a resource to any nation, it should be well planned, developed, conserved, distributed and managed.In many areas, the overexploitation of groundwater for agricultural use has significantly impacted drinking and domestic water supplies (Molden et al., 2007). Yet water has been a universal liquid that cannot be jettison with in terms of usage, despite the importance of water,yet, distribution of water in many areas in Nigeria remain unreliable and unrealistic.The source of water commonly determines the nature of collection, purification, transmission and distribution works. Common natural sources of water are rainwater, surface water and ground water. A water distribution system consists of a complex network of interconnected pipes, services, reservoirs, hydrants and other appurtenances including valves and flow meters which deliver water from the treatment plant to the consumer (Chadwick and Morfett, 1993; Nathanson, 1997; Walski et al. 2003 and Izinyon, 2007).

According to Lansey and Mays (2000), a water distribution system consists of three major components: distribution piping network, pumps and distribution storage. One of the major problems facing the inhabitants of developing countries is inadequate potable water supply (Akinwunmi, 2016). Many households cannot boast of piped water supply, whilesome experience scarcitybecause of low yielding water aquifers To have effective distribution of water, geographic reference data has to be put in place such as ZIP codes, street addresses, or x,y coordinates that can be used to link it to a map. Data structure either in database management system has a great potential for use in GIS Application of geographic information system (GIS) and remote sensing has proven productive for delineation of groundwater potential zones over the years (Jha et al. 2007; Chowdhury et al. 2009; Malik et al. 2016). A geographic information system (GIS) is a useful tool to understand spatial relationships and visualize problems in new ways. Remote sensing facilitates a wide range of study and synoptic view of the space–time distribution observations in better and quicker assessment, of regional groundwater flow studies (Yeh et al. 2009; Machiwal et al. 2011).

Distribution water can only be meaningful by mindful of siting of Waterworks with topographic map. A topographic map describes the shape, size, position, and relation of the physical features of the area such as mountains, hills, valleys, and rivers. Most topographic maps also show the culture of a region, that is, political boundaries, towns, houses, roads, and similar features.. The Polytechnic Ibadan is not indifferent in water problem.The aim of thistask is to delineate approximate zones for water works for the provision of drinkable and useable water in the institution using an integrated approach of topographical survey method and geographical information system (GIS).

STUDY AREA : The study area is The Polytechnic Ibadan, Ibadan North Local Government Area Oyo state, Nigeria. The geographical location of the study area is approximately longitude 07° 25’ 36.61”N and 07° 27’ 22.7”N and latitude 03° 52’ 38.51”E and 03° 53’ 45.81”E. The study area covers an estimated area of about 245 Hectares.

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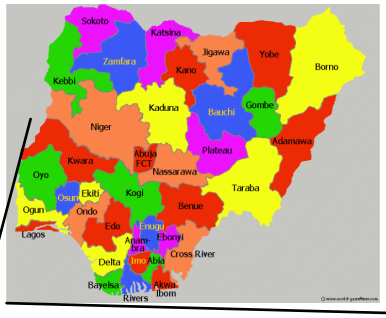
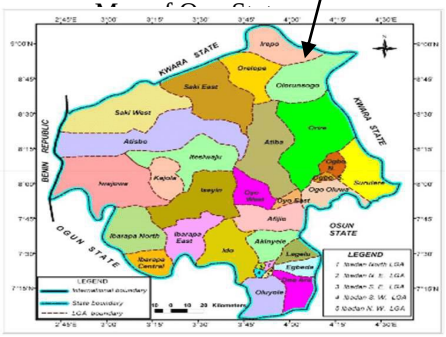
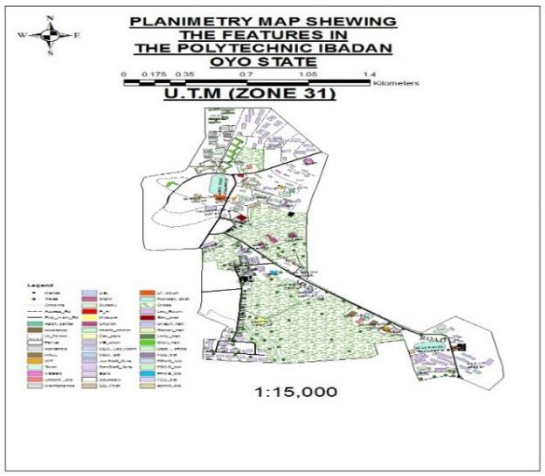
Map of Nigeria

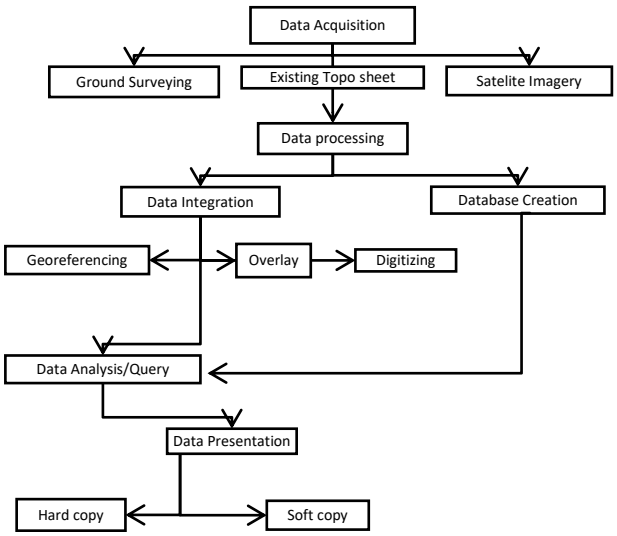






METHODOLOGY

`Fig. 3.1 Methodology Workflow hart



The methods to be adopted for the execution of this project will from both be primary and secondary source of data. In this study, the cross-sectional survey type of design will be used. These include descriptive, exploratory and explanatory designs to describe each of the many variables that are necessary for the study.

SOURCES OF DATA: The sources of data are Primary and Secondary base on the objective to produce information for the waterworks sitting

Table 3.1 Source of data

1. Primary	Data	Source
	DGPS Receiver (x, y) coordinates	Acquire geometric data of the boundaries, boreholes, wells and contours
2.Secondary	Satellite imagery	IKONOS satellite imagery (resolution 0.6m)
	Existing map of The Polytechnic Ibadan (Toposheet)	Department of surveying and Geoinformatics

EQUIPMENT USED : The equipment used for the execution of the task are: Hardware and Software which comprises of Differential Global Positioning System (Hi-Target v30) base and one rover with its accessories, HP Intel core i5 Laptop with 700GB of HDD, 4GB of RAM 64-bit operating system, ArcGIS 10.2, Hi-Target Office (HGO), GNSS Solution,Surfer 11and Microsoft excel respectively.

II. RESULT AND ANALYSIS PRESENTATION

The final result was presented inform of plans/maps, map queries, charts, pictures, and statistical table generated from attribute data of field observation structured for query..

Result 1: QUERY ON WATER WORKS CONDITION AS CAUSE OF PROXIMITY

Database for boreholes condition on ArcMap was created using good, very near and fair for boreholes condition. The syntax [status]='bad' was used to probe for the boreholes condition that are in bad condition, the syntax [status]='good' was used to probe for the borehole condition that are in good condition while the syntax [status]='fair' is used to probe for bore hole condition that are in fair condition.

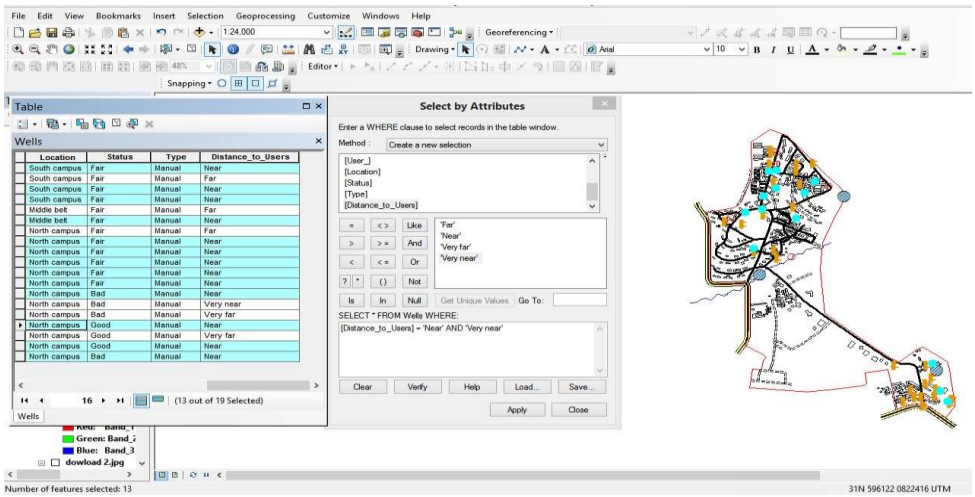
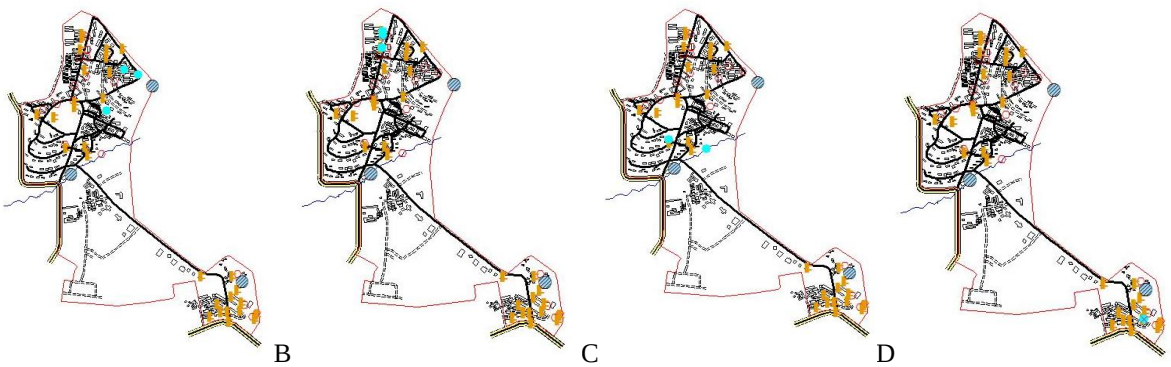


Fig. 4.3 distance of borehole to the users and it is denoted using near and very near



A B C D

Figure 4.4: Boreholes at good condition within the Campus :(A)North Quarters(B)North Hostels (C)Middle Belt (D)South Hostels

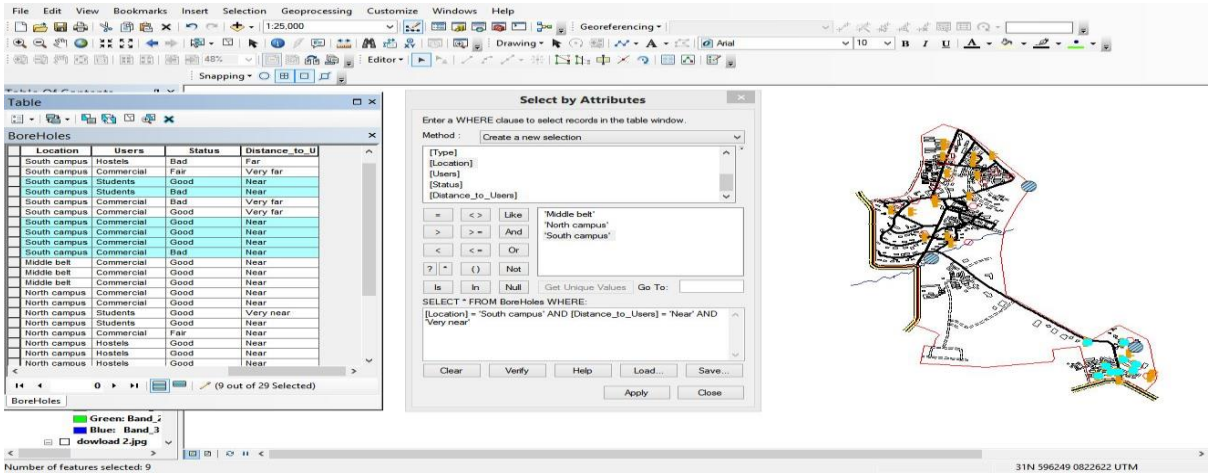


Fig. 4.10 Distance of bore holes to the user at south campus, near and very near.
The query above shows that the condition of the boreholes and wells has a great impact on the supply of water in the study area.

Result 2: QUERY ON TOPOGRAPHICAL CONDITION OF THE TERRAIN

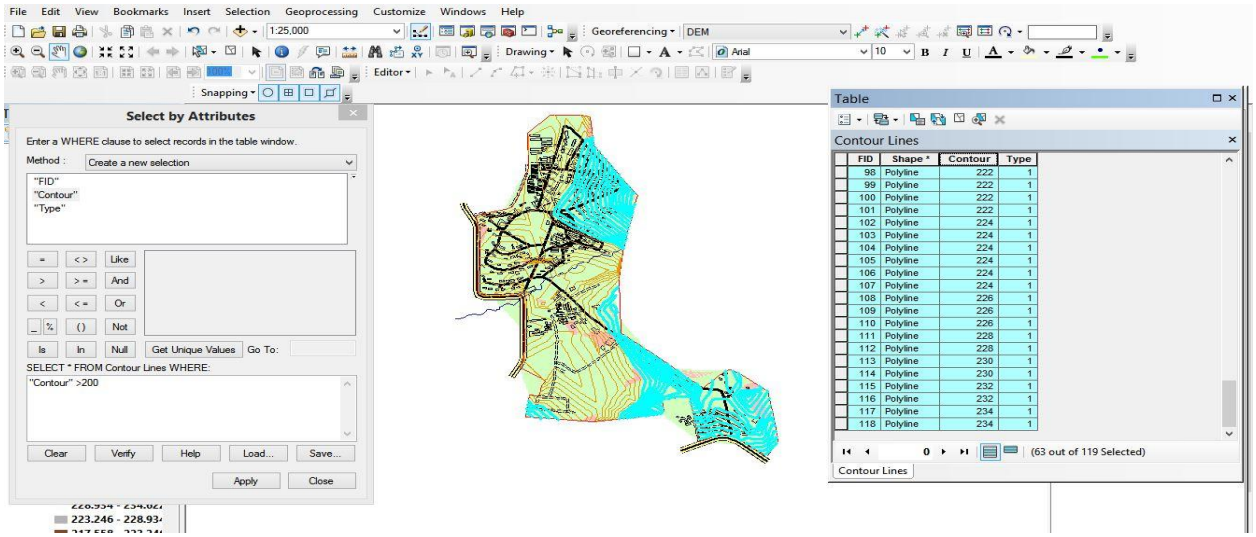


Fig 4.11 Height of points in the study area which are above 200meters

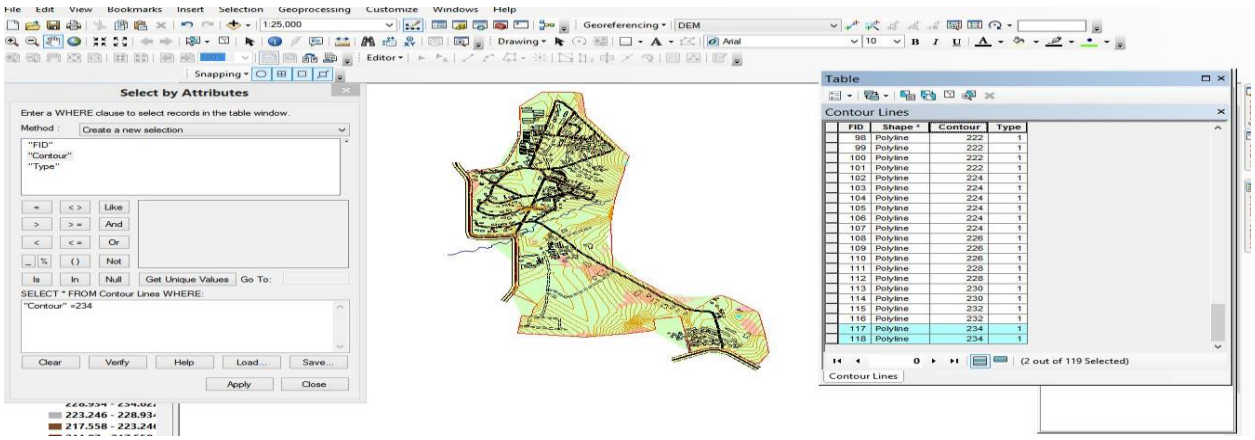


Fig 4.12 Areas with the highest elevation within the study area which will besuitable for the citation of water works

Chart Analysis

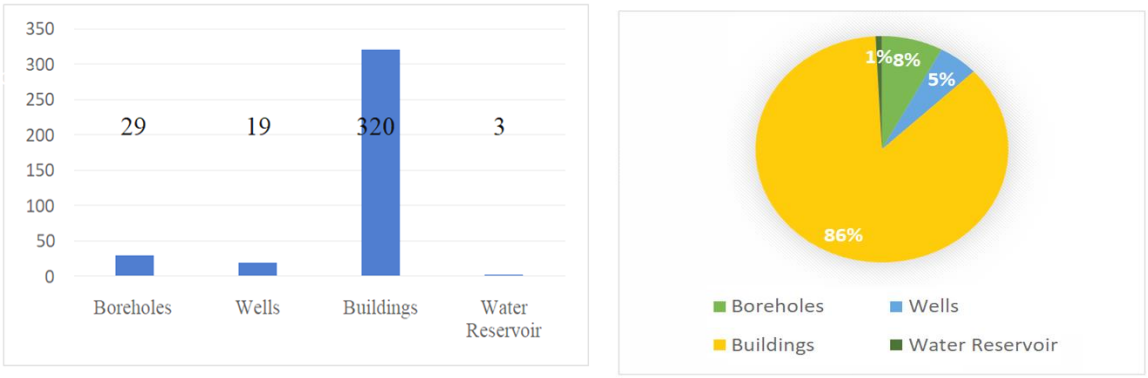


Fig. 4.13 Bar chart and Pie chart showing the Numbers and Ratio of Boreholes, Wells, Buildings and Water Reservoirs in the study area.

From the above chart analysis, it is observed that the percentage of existing functioning water works i.e. boreholes and wells, compare to the building, where they are being used, is very minute. There are also three other existing water reservoir which are not functioning and need rehabilitation. Meanwhile some of these boreholes as well are not in good condition.

Topographic Result Analysis and Operations

Topographic operations are carried out to determine the surface characteristics of the area which showed the undulation of the area of study. These operations were performed on the topographical map which was generated from the database with the use of relevant software, in this case ArcGIS 10.3 was used. The following map were produced from topographic operation and analysis.

- Topographical map of the study area showing the contours and spot height: showing the point with highest elevation and also where the available water reservoirs are situated.
- Composite map of the study area.
- Digital Elevation Model (DEM) map.
- Triangulation Irrigation Network (TIN) map of the study area: Irregularly spaced sample points are adopted to the terrain.
- 3D wireframe.

III. CONCLUSION

Access to clean water supply is one of the major problems in the Polytechnic Ibadan, this project focuses on locating places favorable for siting of water works module in the campus in other proffer a lasting solution to the causes of water scarcity. This research shows that borehole congestion issue is on the rise in the study area particularly in north campus and yet water does not still reach some consumers as the number of houses outnumber the available water system. Also, as a of result this a research work or findings it been made known that some of these boreholes are not functioning due to mismanagement to too much pressure over them. These necessitate the creation of sanitary water module which will be at the highest position and will supply the entire campus with useable water.From the research analysis, it is shown that water works is having positive impacts on the study area especially in the area of economy and social life area.

RECOMMENDATION

From the analysis made in this study, the following recommendations were made:

1. The study needs to be replicated in the areas with significant need of water for irrigation and drinking purpose.
2. This map should be made available to serve as a base map which helps to guide allocation of lands for residential purposes and also a guide for siting waterworks system in the study area.
3. This would prevent constructing buildings on areas that are viable. Remaining aspects of ground water occurrence, movement and utilization like ground water table condition and water requirement of various locations may be considered for future studies.

IV. CONCLUSION

It is an indeed achievement ascertaining the aims and objectives of the project according to laid down rules and regulations. Moreover, the project result analysis shows that there are two locations with highest elevation

where waterworks can be sited and these are already existing but not functioning and needed to be rehabilitated. Also, the location with lowest altitude with high proximity of water for extraction has a sewage system (sewer tank) but not working as well.So, if necessary, reconstruction or rehabilitation of these existing waterworks system can be actualized, the study area will be alleviated of the challenge of useable water.
This project proof a good training ground for me since it has offered me more knowledge and skill on mapping, GIS data manipulation and analysis.

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