**APPLICATION OF GEOGRAPHIC INFORMATION SYSTEM (GIS) IN UTILITY MANAGEMENT: A CASE STUDY OF NEW HAVEN WATER DISTRIBUTION MANAGEMENT.**

1. **C. Martins**

 **S/OF/GOU/0078**

**ABSTRACT**

*The need for accurate positions of facilities beneath earth’s surface can never be overemphasized. Detail survey which seeks to record the finished or the existing planimetric features in a piece of land has been utilized over the years for several purposes. The purpose of this study is to map sub – surface water pipelines at New Haven, Enugu North Local Government Area, Enugu State using modern survey techniques. This survey was required for the purposes of knowing the précised position (x, y coordinates) of the water facilities existed beneath the surface of the earth within the area study. This study integrated the use of Geographic Information System, Global Positioning System, Autocad software and aerial photograph of 15cm resolution during data acquisition and processing. The final plan production was done at a scale 1:10,000.*

**INTRODUCTION**

Two main classical approaches of land surveying are usually employed during mapping; namely as-built/detail survey and geographical information system (GIS). As-built survey is an aspect of cadastral survey that provides precised locations of structures (man-made features) and facilities within a given area. Detailed information is defined pertaining to elevations as well as locations of both man-made and natural features relative to each other. All measurements carried out are accomplished with the aid of controls for proper determination of their positions and elevations. However, GIS is an organized collection of computer hardware, software, geographical data and personnel designed to efficiently capture, store, update, manipulate, analyze and display all forms of geographically referenced information (ESRI).This paper considers the use of these survey techniques in mapping sub – surface facilities in New Haven (part of), Enugu North Local Govt. Area since most under – earth pipeline installations in the area study do not have any spatial information.

**STATEMENT OF PROBLEM**

The lack of maps and information of spatial positions of underground installations and facilities have led to massive destructions and damages of existing man – made features beneath the surface of the earth during excavations of various environmental and construction purposes.

Also, the managing of analogue and aspatial data of existing subsurface facilities has become very herculean, clumsy and most times inaccurate.

**AIM**

The aim of this study is to produce a well detailed map and other relevant informaion that will show spatial positions of existing underground man – made features which will in turn aid future developments and planning.

**OBJECTIVES**

1. To detail the existing subsurface water pipeline facilities using survey techniques.
2. To map the extent of the study area (base map) and the Water pipe distribution network map.
3. To develop database that can be queried.
4. To produce a map at a suitable scale that will show the overlay of water pipe distribution network map with the base map.

 **STUDY AREA**

The area of study is located at New Haven (part of ), Enugu North Local Govt. Area of Enugu State which lies between 713263 and 714345 meter North and 335192 and 337754meter East of WGS 84 Origin.

**METHODOLOGY**

The following steps were adopted in the flow chart below;



**RECONNAISSANCE**

Before field observations and data acquisitions, recce was carried out. The author alongside his survey team members had first - hand information and mental overview of the project site. The recce also helped in choosing the survey approaches and techniques that were used, and the equipments deployed for this study.

**DATA**

The data used in the study were divided into primary and secondary data. The primary data were collected through direct field observations with the aid of handheld global positioning system (GPS) which was used to acquire x, y coordinates of points of interest. Also, attributes data obtained during oral interview.

Secondary data used include existing analogue map of New Haven Water Pipe distribution network map which was scanned and saved as Joint Photographic Experts Groups (JPEG) format. The scanned map was then imported into ArcGis 10.2 where it was georeferenced to Zone 32N Universal Transverse Mercator coordinate system (WGS 84) and digitized.

Also secondary data used was 15cm resolution aerial photograph showing study area.

**HANDHELD GPS**

The handheld GPS used was validated. Second order control beacons, MS 28 and SS1MS 28 were used. The difference between the obtained x, y coordinates with the known coordinates was 0.943mN and 0.824mE respectively. The outcome of the test was fair given the accuracy expected for this type of survey.

**ATTRIBUTE DATABASE CREATION.**

After field observations and analysis of data, a database showing the x, y coordinates of facilities, depth of facilities laid, lengths of pipes, size and type of pipe laid etc was created.

**RESULTS AND DISCUSSIONS**

The attribute database table was created as shown on the map; and the spatial locations of sluice valves, end caps, pressure/supply and service pipes mapped and identified as shown below;





**DISCUSSIONS**

The pipe identity points are points established with pegs whose spatial values are known. This pegs where established parallel to the subsurface pipes on the surface of the earth on both sides of the pipe. With the coordinates of the end points of the parallel lines known, the coordinates of points along the lines can be easily extracted. With this, however, the positions of the buried facilities can be marked on the surface of the earth which will improve protection of the buried facilities before any form of excavation is done within the study area.

**CONCLUSION**

The use of GIS has continually played important role in mapping especially natural and artificial features above and beneath the earth surface. The study demonstrates the usefulness of land surveying techniques in mapping subsurface facilities using GIS.

* The total lengths of buried pipes have now been made available by this study which will in turn enhance maintenance.
* The ministry of Environment, Enugu State can make use of this map when allocating areas for future excavations and developments within the study area.
* This study will help in easy and speedy retrieval of information from the database.
* The knowledge of spatial locations of the distribution facilities (subsurface water pipes) will help to avoid and reduce damage done to these facilities during construction works.
* This will also help in planning of routine maintenance and site of new distribution lines.
* The sales of this GIS maps to engineers and other related professionals will boost the revenue of MDA (Ministry/Department/Agency).

**RECOMMENDATIONS**

This study recommends that before any excavations of any purposes, the maps produced for this study must be consulted to avoid total destructions of buried pipes.

It also recommend the need for constant update of this maps and other related information.

**REFERENCES**

Nigerian Journal of Surveying and Geoinformatics , Volume 5 Number 1, March 2016.

“Spatio – Temporal Mapping and Analysis of Aguku – Nanka Gully Erosion Site in Anambra State, Nigeria”. J. I. Igbokwe, U. C. Ibe, J. O. Ejikeme and E. C. Igbokwe.

Ghilani, C. D and Wolf, P. R. 2008. “Elementary Surveying: An Introduction to Surveying.

 Twelfth Edition.

Okoye, J. 2009. “Oral Communication”. January 20, Ezeagu Street, New Haven, Enugu North LGA, Enugu

 State.

Emengini E. J. 2004. “Application of GIS to utility information Management”.

Adekunle A. A. 2005. “Utility Mapping Using GIS Technique”.

Kufoniyi, Olajide. 2008. “Database Design and Creation”.

Alann E. O. and H. C. Ejiobih. 2002. “Utility Information Infrastructure Needs in Utility

 Organizations in Nigeria”.

J. Uren and W. F. Price. “surveying for Engineers”. Fouth Edition.

A. M. Chandra and S. K. Ghosh. “Remote Sensing and Geographical Information System”.

 Eighth Edition.