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ENVIRONMENTAL IMPACT OF LOWER USUMA DAM, FEDERAL CAPITAL TERRITORY, ABUJA-NIGERIA)

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Abstract

This research focuses the environmental impact of dam construction with case lower Usuma dam Abuja Nigeria. Life is dependent on water to live; plant vegetation, man and animal need it in various qualities and quantities to survive. Yet with the advancement of time and in the present technological age, water has been restricted and has become strategic in nature. Dams for examples are structures used in restraining this water from flowing rapidly in rivers and streams. They are constructed for the purpose of hydroelectric power, domestic water supply, irrigation, navigation and recreation. Many dams in times past have been very successful, yet other has been disasters to life and properties. The aim of this research is to assess the environmental impact of lower Usuma dam, with some objectives that justifies the broad aim of the research. The method uses in data collection are primary and secondary source and the methodologies used in carrying out the project are questionnaire methods, oral interview and public health survey. While data collected are analyzed using charts and graphs. The results shown changes in river channel, flooding and channel erosion, land lost, land used changes, dam and the displaced people and the discussion on living condition of the people in the study area. These researches therefore study the environmental consequences in which dams and its construction can affect or deteriorate our environments which were not in existence before the construction of the dam. And necessary recommendation/suggestions were given.

INTRODUCTION

Background to the Study

By definition an "environmental impact" is any alteration of environment condition or creation of new set of environmental condition, adverse or beneficial, caused or induced by the action or set of action under consideration.

The dam constructions have impact in a number of area and which are disturb by the natural state of area by changing the land areas to water areas. It also change land firms, vegetation, fish, wildlife and other biota. It can lead to displacement of people and destruction of existing natural vegetation and changes in soil structure and texture. Dam construction may also induce other beneficiary actions such as provision of employment opportunities, provide for irrigation system to be practiced and provide for a tourist site.

Water is one of the most essential resources in this planet. It is man's second most important necessity after air. Right from time of creation till death of man, water is never in abundant in need. These needs including agricultural, industrial, recreational and domestic needs. As water is demanded for various uses, so water supplied is affected by the population size which when is high the demand for water will be high.

Despite man's need for this essential commodity, it is not always available to meet its demands in various part of the world. The earth, though known as a water planet, consists only of about 2% of the 100% water as readily available fresh water. Even then, of

this same 2%, 87% of this is stored in icecaps and glaciers and in deep underground water. Only about $126,125\text{km}^3$ is at any instant readily available as lake, rivers and shallow ground water for numerous human needs.

For these reasons, the thought of conserving and managing this water, as earlier stated varies greatly in different countries. It depends to a large extent on the size of the population and the prevailing level and pattern of socio-economic development. This water is conserved through the construction of dams and diversion of rivers to store water from wet season rainfall for use in the dry season or for transfer to drier lands. The need for conservation has also risen due to available run-off.

In Nigeria, during the past decade, most of the water resources conservation measures were aimed at supplying water for human needs. As example of such a water resources management project is the construction of the Lower Usuma Dam in Abuja, the Federal capital Territory. The Lower Usuma dam which is located in the North eastern part of Abuja began construction from 1980 and it was completed in 1987 and later commissioned in 1989. The dam is 1,300m long, 45m high, and it has a reservoir capacity of 120 million cubic of raw or untreated water (FCT, 1993).

The embankment at Lower Usuma dam is an earth dam that is, this made up of impervious materials like literite, granite, and gneiss and migmatite rock materials. It also comprises of pervious materials like soil or earth to cover the impervious materials on the left hand side of the embankment. The dam is of two sides, the main dam and the saddled dam. The embankment of the main dam is 1.3km long with a crest size of 10m and the height of 15meters. These two dams were constructed to capture the necessary water capacity needed for the provision of domestic water to the Federal Capital Territory.

Like any other type of resources development, the Lower Usuma dam project has both positive and negative impacts. The benefits of any dam should exceed the adverse effect of the dam to the environment and the people well-being. However, this is not the case, most especially in many countries in Africa. Hence the study of the Lower Usuma dam, which is newly constructed dam. This investigation is on the environment impact of the area of about 10km radius.

Statement of Problems

It has been known from various researchers on dam construction that its environment impact is of greater consequences than its importance. That is to say that the environment hazards from dam development projects result either directly from inundation of trees from impoundment, (Ahmed, 1982).

The Lower Usuma dam for example, though young, has undergone series of excavation of borrows pits over seven large areas, deforestation and destruction of the former ecological niche in the environment. Also changing the socio-economic importance of the area from farming, cattle rearing and fishing, to only fishing. This effect has altered and tampered with the ecological setting of the area, for this reason, this research will look at the physical or environmental impact of the construction of the Lower Usuma dam.

Aim and Objectives of the Study

The aim of this project work is to assess the environment impact of lower usuma dam Abuja, Nigeria. With view of identifying those impacts carried by the construction and various environmental problems associated which are likely to be associated with dam construction.

The following are the objectives of the study.

- i- To assess the environmental impact of lower Usuma dam on the adverse and beneficial impact.
- ii- To determine the extent of erosion in the river channel resulting from the dam construction.
- iii- To determine the occurrence of flooding and amount of land lost after construction of the dam.

Scope and Limitation

The research will be looking at the environmental impact of the dam construction within a radius of 10km around the dam site. The settlements involved are: Pawi, Jigo and Pabara. Information and data collection in relation to the aim was not easy to obtain. Maps were issued out which cover the dam site after construction. Also various data sets regarding rainfall, temperature and relative humidity were not adequately kept. As it is, the records were not available for every month, the reason for this is given as inadequate and improper storage of files. Through it was indicated that the data was stored in a computer, it was not easy to access. A lot of time and money was used to obtain the little Usuma dam, of what most of the data used were obtained from field observation and measurement.

Significance of the Study

Dams generally, are not void of their negative impact most especially to the environment. This often results in the long term in affecting the dwellers and ecological balance of the area. Therefore, the study of the environment of physical impact of dam construction may enlighten the people, government as well as construction engineers of the adverse and consequential effect of dams and impoundment can constitute. Though the benefits of the dam construction will be highlighted in this study, yet there is need to know of the dangers, which out-weight the benefits of dam construction.

The river Usuma, which is the major source of water to the dam, within is the Lower Usuma dam, is also the major river, which flows within Abuja. Due to this construction, various environmental changes have occurred both up and downstream. Now the stream flow is regulated causing a reduction (compared to times before the dam construction) in the stream flow. This in effect encourages river channel erosion which is just one of the various environmental effects of dam construction.

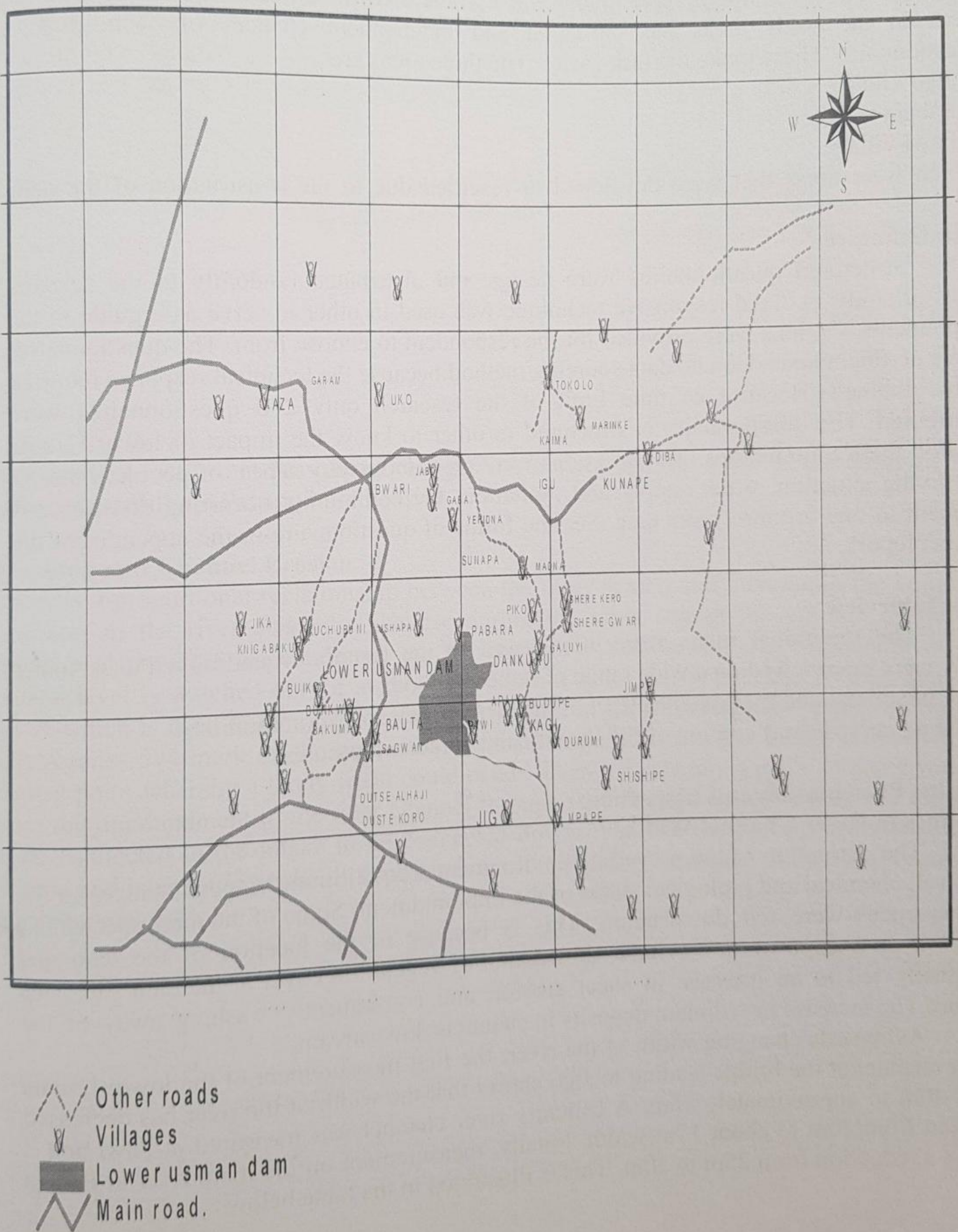
1.6 Description of the Study Area.

Lower Usuma dam is located in outskirts of Bwari area council of federal capital territory, which is situated at the geographical heart land of the nation, the F.C.T was bounded by Niger, Nassarawa, Kaduna and Kogi. It is located in what is often referred to as the "Middle Belt" a, area of transition between the northern ecological one with its characteristic savanna vegetation (80% of the FCT's land mass) and the southern ecological zone dominated by forest vegetation. Its picturesque relief is characterized by clusters or images of hills and vast undulating plains punctuated by inselbergs and rock outcrops. Its weather is moderated by its relief and high altitude. The F.C.T is a well drained site, with a good system of rivers and streams dominated by River Usuma and River Gurara.

The lower Usuma dam is situated in the North Eastern part of the Federal capital territory, Abuja lies within the central part of Nigeria, above the Niger Benue trough

covering a land area of 8000Km². The Bwari Aso range surrounds the dam, which is being fed by the tributaries of the River Usuma, which flows to join with the tributary of River Gurara at western part of the Federal Capital Territory. Map of lower Usuma dam and its position in the FCT is illustrated figure 1.1.

FIG. 1.0 MAP OF THE STUDY AREA



Data Collection and Methodology

To meet the requirement of the study two basic types of data source were used. That is primary and secondary data source.

Primary data- These are data that were obtain by the student directly from the field. These include terrestrial photograph of the study area.

Secondary data- These are data obtain from text books, journals, previous research works, encyclopedia, libraries, magazines and publications.

Sampling Techniques

A random sampling technique was use in the distribution of the questionnaires. All areas in the study areas has an equal and independent chances of been given a questionnaire. These make the task easier. The three areas are:

- 1- Jigo village.
- 2- Pabara village.
- 3- Pawi village.

Which were areas that were developed or resettled due to the construction of the dam.

Questionnaire

Structured questionnaires were design and distributed randomly to the selected areas of study. A fixed responsive technique was used in other to serve as a guide to the respondents. Options were provided for the respondent to choose from. The questionnaires prove pertinent and adequate data sourcing method because the technical response required were obtained. Because of time limit of the research only 200 questionnaires were distributed. The questionnaire is structured in other to know the impact of lower Usuma dam on their communities. The questions were on demography aspect of people, housing and living situation, water supply and sanitation, the community occurring diseases and frequent in one or more years e.t.c. See the forms of questionnaire in the appendix of the project report.

Oral Interview

The traditional rulers were interviewed in the three surrounding villages under study were interviewed on a wide range of issues include:

- i- The beneficial and the adverse effect of the dam to their local communities.
- ii- The perceived short coming of the locality and curative measures.

Results, Presentation and Discussion

Changes in River Channel Width

The disruption of the prevailing environmental equilibrium triggers changes in the physical, chemical and biological status of the impoundment. Some of the most spectacular consequences were felt downstream. This is because of the location of the dam and reservoir on a slope with inevitable destruction of vegetation cover at the dam site. This eventually led to an increase in sheet erosion and consequently washing away of the topsoil. The increase in sediment deposits in channels downstream.

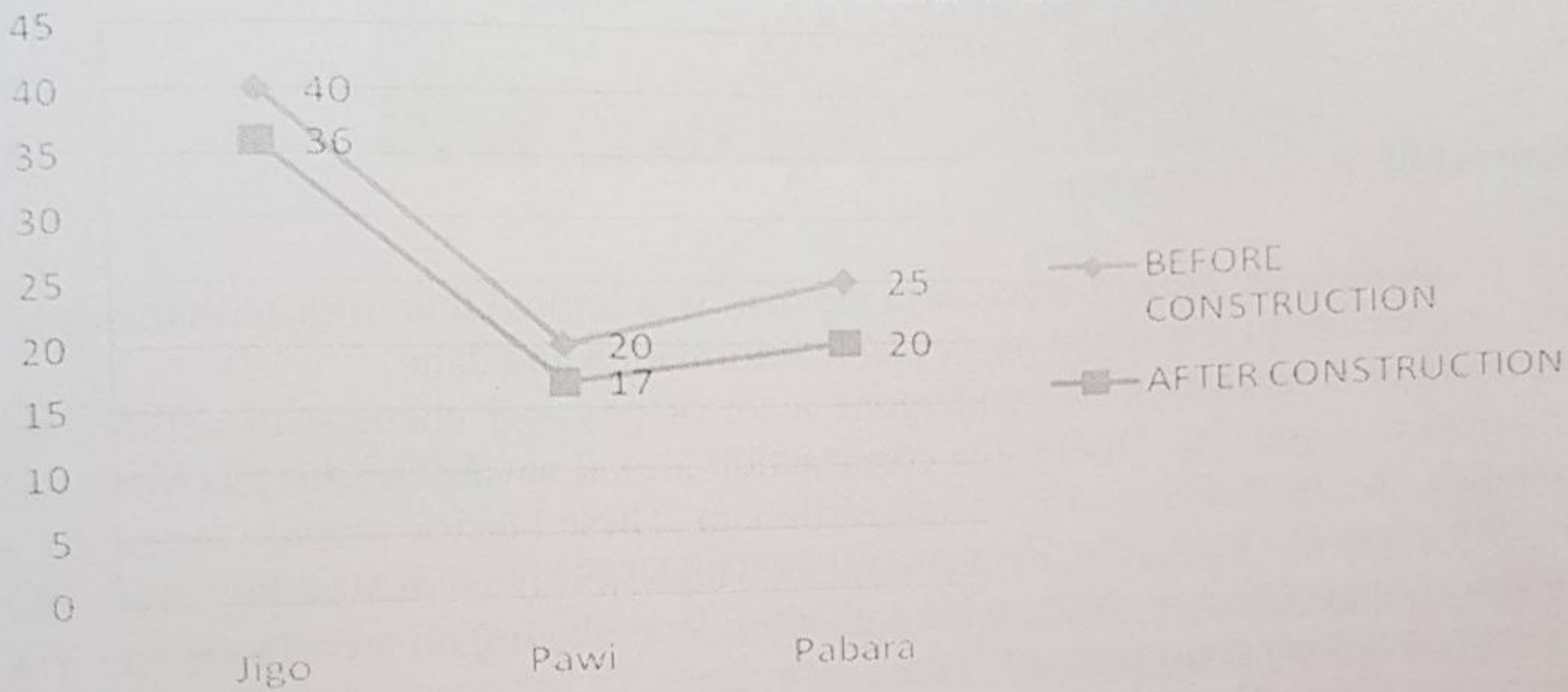
As regards changing width of the river, the first measurement of the lower Usuma River channel at the bridge leading to Jigo shows that the width of the river has decreased from 40m to approximately 36m. A tributary river channel was measured at Pawi and it reduced from 20m to about 17m width. Finally, measurement on the main river at Pabara shows a reduction from 25m to 20m. This is illustrated in the table below.

TABLE 4.1 SHOWS CHANGES IN RIVER CHANNEL WIDTH

LOCATION	BEFORE CONSTRUCTION	AFTER CONSTRUCTION
Jigo	40m	36m
Pawi	20m	17m
Pabara	25m	20m

Source Federal Capital Territory, Water Board 2008

FIG. 4.1 SHOWS CHANGES IN RIVER CHANNEL WIDTH



And another factor that has caused changes in the river channel width is the dumping of refuse, especially in Pabara, into the river.

Flooding and Channel Erosion

There is a proportional relationship between the rainy season and increase in the volume of water in the river channel. Likewise during the rainy season the volume of water increase in the dam impoundment. As the level of water increases in impoundment, a critical level is watched out for at the lower Usuma dam. This is checked on a graduated tower which is used to read off the volume of water in the impoundment. Once the water level reaches 574 mark on the graduated tower or intake tower, it has therefore reached a critical point whereby a likely flood could occur. Then a discharge is made of some water to be connected to the river channel through the "Bottom outlet" which is a tunnel flushed and later settle gradually downstream with the heavy particles. This process causes river channel erosion.



Dam Channel Flows Downstream

Landlost

Information regarding the area of landlost to the dam was limited. This information was not adequately source due to restriction on available information and data.

The lower Usuma construction has undergone a lot of physical changes to achieve the present condition of the site. During the construction a total seven burrow pits were dug for soil samples the construction of road and earth dam. These burrow pits are averagely a depth of 20m^2 each. The water treatment plant, which receives raw water from the impoundment, is approximately 200m wide and 800m long making on area $16,000\text{m}^2$. The reservoir area (catchment area) is about 200m^2 .

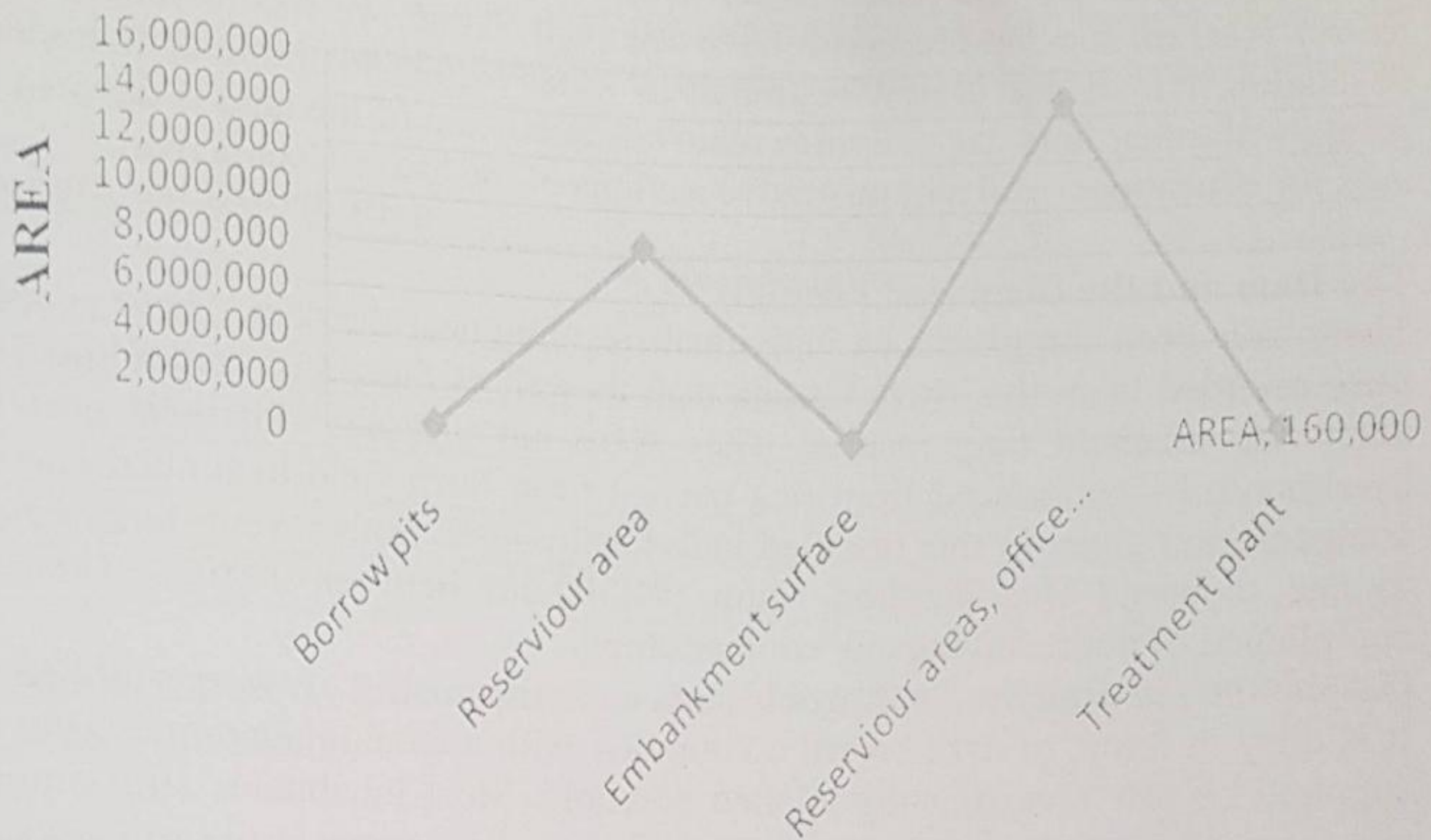
Conclusively, the lower Usuma dam covers on area of 25km^2 including offices. Schools and staff quarters. The breakdown is given in the table below.

TABLE : SHOWING LAND AREA LOST BY THE PROJECT

PURPOSE	AREA
Borrow pits	410,000
Reservoir area	4,400,000
Embankment surface	16,000
Reserved areas, offices and quarters	14,716,000
Treatment plant	160,000
TOYAL	25,016,000 or 25.02km^2

Sources: Federal Capital Development Authority 2008

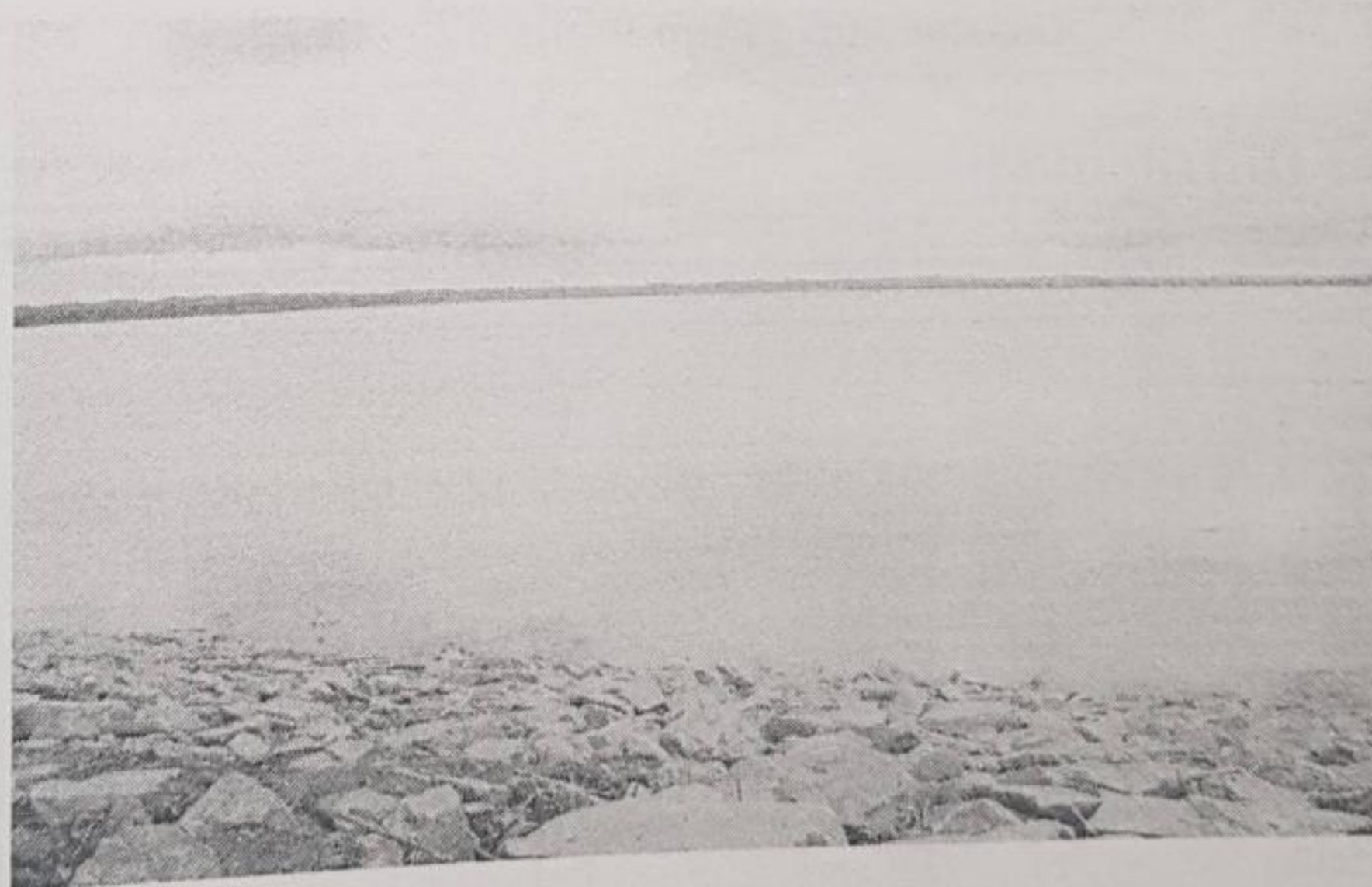
Fig:



SHOWING LAND AREA LOST

SOURCES: FEDERAL CAPITAL DEVELOPMENT AUTHORITY 2008.

The embankment is 10m wide, 1.3km long at the main dam and 0.3km long at the saddle dam. The two are connected by a rock with a tunnel within the tunnel is 240m long with a diameter of 240m.



**VAST LAND COVERED BY THE DAM
LAND USE CHANGES**

The entire land use previously such as farming cattle rearing has been halted due to the present land use. The ecological niche has been tampered with due to the landlost resulting in a change.

Within the lower Usuma dam vicinity the land is used mainly for fishing activities. A lot of land has been lost to the reserved area which are not to be hampered or touched to prevent erosion. Also farming as an occupation and user not encouraged within this location. Likewise cattle rearing which cause the loosening the top or mighty winds come

is not allowed at the dam site. The forest with in the dam site cannot be limdered for any reason. Also the dam and reservoir have occupied a zone, which was full of rich vegetation, but its use is now restricted to water supply to the inhabitants of the city of Abuja with other land use activities removed. A section of the land is devoted to resdential uses for educational and administrative stations of the lower Usuma dam.

The Dam and the Displaced People

There have been complaints by individuals residing near the dam. These people (those that were resettled from the lower Usuma dam as well as those just settled there) complained about the treament thay receive. They were not pleased with their present means of lovelihood. It has reduced from rich harvest from farm yield to limited harvest. Also the compensation given to this resettled individual ranged from seventy – five Naira (#75.00) to one thousand five hundred Naira (#1,500.00) between 1980 – 1986. Some even complained of not receiving any compensation.

Despite the proximity to the lower Usuma dam, the quality of water supplied is very poor. It is dirty in terms of dark brown colouration with a strange abnormal taste. The water is supplied by tow mechanically applied borehole. Most inhabitants still return to the dam site from where they were evacuated to from where more fertile soil is in abundance. This, however is detrimental to the impoundment by increasing the rate of reservoir sedimentation from increased soil erosion.

Living Condition of the People in the Area

In all the respondents totalling 200, were randomly selected in the settlements of the study area. They were all interview by questionnaires. All of them were male 30% were over 65years old, 34% in 50-64year age group while 37% in 18-49%years.

Table : Area Distribution

Age Group (Year)	% Respondents
19-49	37
50-64	34
65 year and above	30

Table : Family Size

	Range	Average
No. of Wives	1-4	2
No. of Male Children	1-7	4
No. of Female Children	1-5	3
No. of Dependents	0-3	2

From the result obtained majority of the people (respondents) are married (89%) and the family sizes are generally large in the areas. Therefore, this will increase their level of participation in the achievement of the dam constructed since most of the residents are farmers.

Table : Level of Education

Education	% Respondents
No. Formal Education	60
Secondary Education	7
Qur'anic Education	14
Primary Education	18
Post Secondary Education	2

The level of education is generally low; 60% have no formal education. Also there is no full awareness of the irrigation project and its importance. So the farmers should be educated on the use of chemicals and fertilizers on their farms so as not to have adverse effect on their crops.

Table : Occupational Distribution

Occupation	% Respondents
Farming only	22
Farming and Teaching	9
Farming and wage labour	19
FarmLand	
Upland and Farmland	20
Upland	80

The predominant occupation of the respondents is farming, but some people combine this with trading, some with labour.

Table : Farm Size

Average Farm Size (HA)	% Respondents
2	6
3	9
4	10
5	20
6	10
7	7
8-9	9
10	10
11-19	7
20 or more	13

According to the respondent there vast land in the area for agricultural purposes which enable the farmers to produce crops. Maize is by far major crop being cultivated in the area. The respondents claim to cultivate in addition to maize such as ground nut, sorghum, yam, cowpea etc. Apart from the application of pesticides such as Gamalin 20 copper sulphate, Basasudin etc. There are little as concession to modern farming pesticides. A few respondents claimed that they would like to use some herbicide but for the exorbitant price that is being sold.

Table : Access to Credit Loans

Occupation	% Respondents
No. Access to Credit Loans	84
Total having access to loan	16
No. of times	4
Once/year	9
Twice/year	3
More than twice/year	

Only about 16% of the respondents claimed to have received loans for farming and about 84% have no access to credit loans. On the issue of microbe good of the co-operatives societies, only about 16% of the respondents claimed to belong to one co-operative society or the other.

Table Problems of Agriculture

PROBLEM OF AGRICULTURE	% Respondents
Pest	97
Lack of Credit Loans	90
Labour shortage	56
Expensive Farm Inputs	79
Poor/Lack of Roads	40
Late Rain	34
Irregular Rainfall	20
None Availability of Farm Input	45

Discussion

To the dam's credit, it is located at a hilly terrain far away from the population of people and excessive erosion and sitting resulting from dam construction activities are still at minimum at the dam site. The could be resultant from in depth research and high quality of and take note of its uniqueness. Other dams have been destructive or ineffective with time both far and near. For example, in the sin Francis dam in 1982 killed four hundred and fifty people also due to disaster caused by uncontrolled waters or rivers in 1887 in Hwang – Ho, China, a dam destroyed and killed nine hundred thousand people (Popoola, 1979).

In nigeria, a project was embarked upon on the construction of a dam in Ferderal Capital Territory. This dam, called Jabi dam was later rendered ineffective. This only says a lot about research activities that were undertaken before the construction of the lower Usuma dam. The forest or trees around including the vegetation cover help prevent the rapid reosion cover in the river channel and inpoundment. They intercept the sediment that is generated.

A lot of land has been lost and land use has changed from cattle rearing, crop production and fishing to fishing alone, new uses for the dam site reserved areas, reservoir, staff quarters and offices have emerged

The Beneficial Impact of the Dam

The gains that are associated to be associated with lower Usuma Dam include the following:

1. **Water Supply:** Provision of water for domestic, commercial and industrial purpose through the creation of the dam.
2. **Food Production:** There will be increase in food production since the irrigation farming project will add to be numbers of crops that is previously grown before. Here crops like vegetables, rice, maize etc will be grown in the area.
3. **Silt Retention:** The deposition of silt in reservoir by the flowing river helps to improve water quality.
4. **Transportation:** The creation of the dam can help in mainly low-cost movement of materials.
5. **Flood Mitigation:** The creation of the dam also has the benefit of flood mitigation to protect life and properly of people.

6. Electricity can also be generated through the development of the dam.
7. Improved infrastructural facility and increase in employment pattern.
8. **Recreation and Beautification:** The creation of the dam adds beauty to the environment and brings several improvements in the standard of living of the people.
9. **Tourist Centre:** The creation of the dam can also provide for a tourist site where people will be visiting on excursions.
10. **Economic Benefits:** These include tax benefits to Local and State Government growth in local tax base from new business and having developments.

The Adverse Impact of the Dam

The potential environmental risk and problems that are associated with the dam include the following:

1. **Land:** The development or creation of the dam has inundated the good land and causes people to be displaced. Both these factors lead to loss of productivity of land and personal hardship faced by the people.
 2. **Soil Texture and Structure:** The construction activities that are being operated on the soil and movement of heavy machineries during construction had a very adverse effect on the soil. This resulted in compaction of the soil and reduction in the porosity and permeability of the soil and making it difficult for water to enter or percolate into the interior. Soils in such area may be unsuitable for crop production and makes the soil renders useless.
 3. **Removal of Top Soil:** This effect lowers the quality of soil during the construction phase, large area of land will be cleared and the fertile top soil and sub soil were removed leaving the infertile bedrock exposed. This area then becomes as no farming can be done in the area.
 4. **Dislodgement of People:** The creation of the dam causes roads and railways. Presently it has caused people displacement during the clearing stage of the project work.
 5. **Wild life:** The filling of a reservoir may drown many small animals species as well as destruction of their habitat and vegetation in which they feed on.
 6. **Water borne diseases:** This is also an adverse environmental impact. This is common when river is subjected to large seasonal floods. Prominent among the diseases is malaria fever, cholera and typhoid fever.
 7. **Archaeological:** The creation of the reservoir may also lead to the inundation and destruction of items of archaeological value and historical.
 8. **Flood Warning:** Alternation or change of the natural flow in the river can be serious to inhabitants as well as to animals and fish life.
 9. **Flooding:** During the rainy season the reservoir used to be filled above maximum capacity. The effect is that farmlands are usually covered with water and some crops and soil are washed away.
- Other environmental impact may include the proliferation of pest, loss of economic trees and pollution.

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

In summary, it has shown that there are tremendous environmental impact of dam construction which are both adverse and beneficial to the people in the surrounding area, with the emergence negative impact such as loss of land, water borne diseases, flooding

etc. which were almost non-existent before people in the surrounding area also the benefit in which the people of the area have from the dam in terms of fishing, domestic use of the water, recreational center etc.

Conclusion

This very research is on the impact of the Lower Usuma Dam on its immediate environment and neighboring settlements. This research has attempted to reveal the adverse effect of the construction of the lower Usuma Dam in terms of deforestation and river channel erosion. This research has discussed the various amount of land lost to the construction of the dam, the resettlement scheme as well as the flood control measures undertaken at the Lower Usuma dam. This however, could not alter the fact that any dam construction at all is a detriment to the environment.

The study findings may be summarized as follows:-

- a. There has been a reduction in the river channel width connected to the Lower Usuma dam.
- b. There has been occurrence of flooding seasonally.
- c. The ecological niche of the area as well as the microclimate has been altered due to deforestation and the impoundment.

Recommendation

Base on the study, the following recommendations were made:

1. Any application for the construction of any project must be accompanied by an environmental statement, which represents a summary of the environmental inventory and finding of the environmental assessment.
2. Dam should be designed for the flood control so as to mitigate people's life and properties.
3. Government agencies/authorities should step up actions and legal means to stop people from polluting environment such pollution include water disposal chemical disposal and oil spillage. The long term effect includes deterioration of the quality of water and damage aquatic life.
4. The high potential of pesticides to pollute water in the environment with consequent threat to animals and aquatic life is of great concern to planning further irrigation development in the area.
5. Ideally the impact of every new project, on the environment should be assessed well ahead of the final take of the project, so that adequate remedial/control measures are incorporated into the project.
6. An effective water treatment plant should be provided at the reservoir, to improve the quality of water for domestic use of the people.
7. Algae are great nuisance in water; therefore the dam should be strictly monitored so as to restrict the people from throwing all sorts of things that aid biological growth into reservoir.
8. Fishermen should be well monitored so that the aquatic lives would be negatively affected and for prosperity of other new fish species or authorised the fishermen.
9. Due to the increase in disease vectors that results to degradation of the health status, more health facilities should be supplied and habitats of the vectors around the peoples environment should be destroyed.

10. If all the above mentioned suggestions are followed properly, there will be good water quality and more water supply for domestic purpose and irrigation practices and also, there will be improvement on the health status of the inhabitants.
11. It is recommended that as an indicator for any change in the quality of the environment, frequent monitoring should be carried out or timely detection of impacts on the environment due to the dam construction.
12. Research institute concerned with river basin development projects should study and put to good use, the quality and standard of Lower Usuma dam for future project.
13. The issue of flood control is very secure at lower Usuma dam but more accurate announcements and enlightenment should be given about the discharges from the dam. This will greatly prevent future occurrences of death through drowning due to these flood control discharges.
14. In terms of data collection, data or information is not easily retrievable as was noticed during this research. More computers for quick retrievable storage of information should be used to render faster services in the future; this should be located at the lower Usuma dam and the Water Board Agency.

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