DIGITAL MAPPING AND CREATION OF CADASTRAL INFORMATION SYSTEM OF STATE HOUSING CORPORATION CALABAR, CROSS RIVER STATE, NIGERIA

BY

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DECLARATION

I hereby declare that the work in this dissertation titled "DIGITAL MAPPING AND CREATION OF CADASTRAL INFORMATION SYSTEM OF STATE HOUSING CORPORATION CALABAR, CROSS RIVER STATE, NIGERIA" was carried out by me in the Department of Geography and Environmental Management under the supervision of Dr. B. Akpu and Prof. B.A. Sawa. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this work has been presented for another degree or diploma at any institution.

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Name of Student	**Signature**	**Date**

CERTIFICATION

This dissertation titled "DIGITAL MAPPING AND CREATION OF CADASTRAL INFORMATION SYSTEM OF STATE HOUSING CORPORATION CALABAR, CROSS RIVER STATE, NIGERIA" meets the regulations governing the award of Master's Degree of Geography and Environmental Management of Ahmadu Bello University, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This dissertation is dedicated to Almighty God and my family

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ABSTRACT

This research characterizes the existing land users in the study area, analyzed the various land uses in the study area, assessed the compliance of parcel use to development control standards in the study area, examined the factors responsible for development control violations and the effects in the study area. This research used geospatial techniques to map and create a cadastral information system (CIS) for the area. Zenith 45 GNSS RtK was used to obtain coordinates of all the beacons in the estate while the dimension of parcels and size of structures on each plot were digitized from a high spatial resolution satellite imagery. Adjudication form was administered to obtain information about the characteristics of parcels and parcel users. These acquired data were processed using ArcGIS 10.5 to create a CIS for the area. The findings revealed that 85.4% of the parcels are owned by males while 14% are owned by females and 0.6% by the Government; about 61% and 35.1% of the land parcels are owned by civil servant and business men/women respectively while 0.6 is government used. More so, 94.6% of the parcels are developed while 0.3% and 5.1% parcels are under construction and undeveloped respectively. Some of the parcels (63.4) in the layout are of medium density. Also, about 93% of the parcel were meant for residential purposes but only 80% are used for residential purposes. Furthermore, the study revealed that about 2.7% of structures in the study area have encroached upon the right of way of the express way while 45.2% of the structures have encroached upon the right of way of access road in the area. More than 36% of the parcels in the layout have been overdeveloped based on the Standard applied in the area (table 2.1). Right setback was the highest form of violation with 76.5% on high density parcels while front setback was the most (54.1%) on medium density parcels. Left setback was the highest form of violation on low (38.1) density parcels while special residential parcels

were dominated (50.6) by left setback violations in the study area. Majority of the opinions of respondents' points to corrupt practices (4.44) as responsible for the violations and 4.59% were of the opinion that overdevelopment of parcels (4.59) is the major effect of development control violation in the study area. It is recommended that CIS should be established uniformly throughout the state with effective office and field-based surveillance to ensure a controlled development.

TABLE OF CONTENTS

Title	Page
Title Page	i
Declaration	ii
Certification	iii
Dedication	iv
Acknowledgement	v
Abstract	vi
Table of Contents	vii
List of Tables	xi
List of Figures	xii
List of Appendices	xiv
CHAPTER ONE: INTRODUCTION	**1**
1.1 Background of the Study	1
1.2 Statement of the Research Problem	4
1.3 Aim and Objectives of the Study	7
1.4 Scope of the Study	7
1.5 Justification of the Study	7
CHAPTER TWO: CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW	**8**
2.1 Introduction	9
2.2 Conceptual Framework	9
2.2.1 Concept of Land	9
2.2.2 Land Administration	10
2.2.3 Land Right Management	10

2.2.4 Cadastral Mapping and Land Registration in Nigeria 11

2.2.5 Reforms in Land Registration and Cadastral Mapping 12

2.2.6 Remote Sensing and Geographic Information System in Cadastral Mapping 13

2.2.7 Adjudication 14

2.2.8 Development 14

2.2.9 Development Control 15

2.2.10 Remote Sensing 20

2.2.11 Geographic Information System 20

2.2.12 Cadastral Information System 21

2.3 Literature Review 22

CHAPTER THREE: STUDY AREA AND METHODOLOGY 31

3.1 Introduction 31

3.2 The Study Area 31

3.2.1 Location and Size 31

3.2.2 Climate 31

3.2.3 Vegetation 32

3.2.4 Relief 33

3.2.5 Drainage 33

3.2.6 Soil 33

3.2.7 Population and People 34

3.2.8 Economic Activities 34

3.3 Methodology 34

3.3.1 Reconnaissance Survey 35

3.3.2 Data Types 35

3.3.3 Sources of Data 35

3.3.4 Methods of data acquisition 35

3.3.5 Data Processing 35

3.3.6 Building of Cadastral Database 37

3.3.7 Data Analysis 38

CHAPTER FOUR: RESULTS AND DISCUSSION 42

4.1 Introduction 42

4.2 Characteristics of Parcel/Owners 42

4.2.1 Classification of Parcel Owners According to Gender 42

4.2.2 Classification of Parcel Owners According to Occupation 44

4.2.3 Classification of Land Parcel According to Development to Status 46

4.2.4 Classification of Land Parcel According to Density 48

4.3 Land Uses in the study area 50

4.4 Level of Compliance to Development Control 53

4.4.1 Road Encroachment 53

4.4.2 Building Density Violations 55

4.4.3 Setback Violations of High Density Parcels 59

4.4.4 Setback Violations of Medium Density Parcels 64

4.4.5 Setback Violations of Low Density Parcels 69

4.4.6 Setback Violations of Special Residential Density Parcels 74

4.5 Factors Responsible for Development Control Violations in the Study Area 79

4.6 Effects of Development Control Violations in the Study Area 82

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS 86

5.1 Summary of Findings 86

5.2 Conclusion 87

5.3 Recommendation 87

References **89**

Appendices **94**

LIST OF TABLES

Table	Page
Table 2.1 Some Planning Standards for Residential Development in Cross River State	19
Table 3.1: Residential Plot Standards	40
Table 4.1: Classification of Parcel Users According to Gender	42
Table 4.2: Classification of Parcel users According to Occupation	44
Table 4.3: Classification of Parcels based on Development	46
Table 4.4: Classification of Parcels According to Density	48
Table 4.5: Proposed and Existing Land Uses of the Study Area	50
Table 4.6: Encroachment of Express Way and Access Roads	53
Table 4.7: Building Density Violation	56
Table 4.8: Setback Violation of High Density Parcels	58
Table 4.9: Setback Violation of Medium Density parcels	63
Table 4.10: Setback Violation of Low Density Parcels	68
Table 4.11: Setback Violation of Special Residential Density parcels	73
Tattle 4.12 Factors Responsible for Development Control Violations in the Area	80
Table 4.13: Effects of Development Control Violations in the Study Area	84

LIST OF FIGURES

Figure	Page
Figure 3.1: State Housing corporation Calabar, Cross River State	32
Figure 3.2: The Workflow Chart of the Methodology for the Project	37
Figure 4.1: Classification of Parcel Owners According to Gender	43
Figure 4.2: Classification of Parcel Owners According to Occupation	45
Figure 4.3: Classification of Land Parcels According to Development Status	47
Figure 4.4: Classification of Land Parcels According to Density	49
Figure 4.5: Proposed and Existing Land Uses of the Study Area	51
Figure 4.6: Land Use Violations in the Study Area	52
Figure 4.7: Encroachment of Express Way	54
Figure 4.8: Encroachment of Access Road	55
Figure 4.9: Overdeveloped Parcel	57
Figure 4.10: Front Setback Violations of High Density Parcels	59
Figure 4.11: Rear Setback Violations of High Density Parcels	60
Figure 4.12: Right Setback Violations of High Density Parcels	61
Figure 4.13: Left Setback Violations of High Density Parcels	62
Figure 4.14: Front Setback Violations of Medium Density Parcels	64
Figure 4.15: Rear Setback Violations of Medium Density Parcels	65
Figure 4.16: Right Setback Violations of Medium Density Parcels	66
Figure 4.17: Left Setback Violations of Medium Density Parcels	67
Figure 4.18: Front Setback Violations of Low Density Parcels	69
Figure 4.19: Rear Setback Violations of Low Density Parcels	70
Figure 4.20: Right Setback Violations of Low Density Parcels	71
Figure 4.21: Left Setback Violations of Low Density Parcels	72
Figure 4.22: Front Setback Violations of Special Residential Density Parcels	74
Figure 4.23: Rear Setback Violations of Special Residential Density Parcels	75
Figure 4.24: Right Setback Violations of Special Residential Density Parcels	76
Figure 4.25: Left Setback Violations of Special Residential Density Parcels	77

LIST OF APPENDICES

Appendix	page
I: Letter of Introduction and Adjudication Form	89
II. Satellite Imagery of the Study Area	91

CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

Land is a great resource and indeed, the backbone of wealth in many communities, whether urban or rural. People depend on land for food, shelter, employment, resources, cultural and religious needs. Land is the foundation of all human activities. The relationship between people and land is fundamental to human existence (United Nations Economic Commission for Africa [UNECA], 2009). Issues of land have been identified to be a major cause of civil and international wars and genocide. For example; the Palestinians' struggle for the return of their homeland, the Zapatista movement in Mexico, the Bakassi peninsula dispute between Nigeria and Cameroon, Movement for the emancipation of Niger-Delta, the Jukun/Kuteb/Tiv land disputes in Taraba state, Calabar/Aqua Ibom, Ogoja/Abakaliki land dispute in Cross River and many others. Conflicts over ownership, land grabs, social disharmony, reduction in farm yields, diminished food security, weak land market and negative impacts on the environment among others are more associated with regions that have poor system of land information and management (Henssen, 1995).

Digital mapping (also called digital cartography) is that branch of survey that is concern with the surveying and collection of digital data. The primary function of this technology is to produce maps that give accurate representations of a particular area, detailing major road arteries and other points of interest. The main objective of surveying is the gathering of data and the preparation of plans, maps and charts. One of the classifications of surveying based on the surface and the area to be surveyed is land surveying among aerial and hydrographic surveying. Land surveying operation is done for objects on the surface of the earth and it can further be subdivided into topographic survey and Cadastral survey. The latter is a survey operation carried out to determine property boundaries and ownerships including those of fields, houses, plots of land, among others (Maguire and Dangermond, 1991).

Cadastre is the map of ownership and boundaries of land parcels. Land parcel databases describe the rights, interests, and value of property. The legal boundaries of land parcels are defined in the land title deed and are confirmed by survey measurements. Ownership of land parcels is an important part of the legal, financial, and real estate system of any society (Burrough and McDonnell, 1998). Elayachi and Semlali (2001) noted that a Digital Cadastral Map is a map in which attributes (tabular) and map (graphic) data on cadastral unit are stored in the same database. They added that a digital cadastral map registers each parcel and its owners and describes all the spatial structures consisting of location, boundaries and contents. The core component of cadastres, CIS or Land Information System (LIS) is the cadastral map obtained through cadastral mapping.

Cadastral mapping could be described as the process and method of building of information on land. Traditionally, cadastres and cadastral mapping systems have been manual and paper-based (Borzacchiello and Craglia, 2012). It contained a numerical/diagrammatic description (a graphical description of land parcels) and a separate list of land register (containing a list of names and rights of land holder). The characteristics of customary land tenure is that at the earliest beginning, all societies regarded land as belonging to the social group, like village, lineage or family (Zevenbergen, 2002).

Cadastral Information System is a subset of spatial information that is concerned with identifying and maintaining legal boundaries of properties. According to Ndukwe (2001), the classical Cadastre or

method of keeping records and land register using paper file or cards has many inherent problems. It is not only inefficient but also cumbersome to operate, these classical methods of land record exposes data to such risk as physical damage from rain, excessive wear and tear, fire and other hazards. These shortcomings can be efficiently addressed with computerization.

Developments in Remote Sensing and GIS and web-based GIS, internet communications, band width technology and speed of transmission have made possible the creation of digital cadastres and cadastral mapping systems allowing the map and the register to be integrated into one single system (Mabogunje 2010). With the development of Geo-Information Technologies (GIT) adjudication of land rights benefits greatly from the use of Remote Sensing/Photogrammetry (Jing, 2011). Remotely-sensed georeferenced orthophotos have been used for adjudication in various regions of the world. Remote Sensing and Geographic Information Systems (GIS) have therefore become important geometric tools for building of digital cadastral systems (Maguire and Dangermond, 1991).

Africa like most continents, having a written law influenced by colonial administrations, statutory land tenure is thus characterised by private freehold, private leasehold, public freehold and public leasehold (Platteau,1996). Land records presently cover less than 1% of sub-Saharan Africa, and 90% of land parcels are undocumented in developing countries. It can be presumed that the Cadastral layer in any existing or future of the system in a country will in all likelihood either not be present at all or it will exist in an extremely incomplete form (Onyeka, 2000).

Land administration in Nigeria must of necessity involve a cadastral input; since land must be discussed in terms of location, extent, size, shape and ownership rights. Cadastral survey information has been positively improved by the advancement in computer and space technology as well as techniques of information gathering, storage and dissemination for good land administration since land plays a major role in human activities (Kufoniyi, 1998). The author further said; most of the maps being used for development in all parts of the country are maps produced over two decades. This made development in some areas difficult because some of the locations on the maps had been physically built up.

Development control is the process of implementing building and land sub-division regulations and specifications. It is a mechanism to maintain standards and process laid down by legislation, which regulates development of land and building. It is a professional activity carried out by town planners in order to ensure compliance with the approved master land thereby ensuring orderliness. (Osibanjo, 2004).

The Cross River State Housing Corporation like most African communities, is characterised by customary land tenure. It is the basis of holding and using land, giving a high measure of security to people with groups, clans, stools and tribes. However, irregularities in land conveyance procedures, lack of furnished basis for equitable taxation, unavailability of needed information for resource management and environmental planning. Correct and up-to-date information on the parcels of land in the study area have created a *lacuna* through which dubious elements and corruption have explored (Cross River State Ministry of Lands and Housing [CRMLH], 2019). Hence, the need for digital mapping and creation of CIS of State Housing Corporation Calabar, Cross River State, Nigeria.

1.2 Statement of the Research Problem

A report by United Nations Economic Commission for Africa [UNECA] (2009), concluded that land parcel database creation is indispensable in monitoring natural disasters, home mortgage foreclosure

crisis, wildfires, energy resource management, administrative and legislative options and various aspects of national development among others.

State Housing Corporation Calabar, Cross River State still depends on the age-old methods of creating and maintaining the paper-based land records system of manual surveys, cloth bound cadastral maps and non-uniform structures of record of rights. State Housing Corporation Calabar suffers such consequences and problems as data loss, data redundancy, haphazard storage of land documents, high maintenance cost, data integrity, inability to allow for instantaneous data access and retrieval by multiple owners among others especially after the issue of fire outbreak in the ministry of Lands and Housing that destroyed most of the records around September 2004. These problems often degenerate into inter household disputes and in some cases communal disputes as evident in some recent clashes between Wanikade and Wanihem in Ukele North around June 2012, Onyoadama of obubura and Yakur around March 2018 to mention but a few. These numerous challenges can however be surmounted by digital mapping and CIS.

A couple of researches have been carried out on land registration and the application of Remote Sensing and GIS in cadastral mapping. Babalola and Kardam (2012) developed a Cadastral Information System for part of Fadaman-Mada area of Bauchi Metropolis. The cadastral layout plan of the area of interest, consisting of 60 plots, were integrated and updated with a comprehensive digital map and cadastral data. An accurate digital map of the area was produced which include feature details shown in graphics and tables. Their findings include changes to roads initially designed for dual carriage which were reduced to single lanes; others that were initially closed were extended to intersect the major ones. It was concluded that computer technology plays a vital role in keeping cadastral record by making it possible for information to be kept in different formats.

Pindiga and Orisakwe (2013) assessed the development of a Cadastral Information System of Tumfure residential and commercial layout in Akko Local Government Area (LGA) of Gombe State. The methodology involved the creation and testing of a multimedia relational database of the attributes of the individual parcels, which were linked to the polygonised spatial positions of the parcels in Geographic Information Systems. A high-resolution satellite imagery covering the layout was obtained, georeferenced and overlaid with the parcel layer to reveal the features contained in each parcel pictorially. The structured information contained in the database was evaluated, tested, and found to be easily and readily accessible and retrievable through locational and attribute queries. The results demonstrated the efficacy of Cadastral Information System as the most effective tool for land administration in the study area.

Wulga (2014) used Remote Sensing and GIS to develop a Digital Cadastral Information System for Banjiran, Adamawa State. A satellite imagery obtained online from Google Earth Pro was used to develop an indexed map of the area and the related land parcel records were collected from the registry. The records were used to create an attribute database. The findings revealed that: there were 1,278 parcels with 1,166 owners. Fifteen percent of the parcels were not allocated while 84.978% parcels were allocated. Most of the parcels were developed while few were not developed with residential use the predominant in the area.

From the forgoing, conversion of analogue and paper based maps and attribute information into digital form and the creation of CIS is an indispensable decision making tool for sustainable development. While a few literatures have directly addressed this concern within Nigeria, no

previous study was found where land ownership records including existing surveying information about the layout do not exist completely. More so, this type of research has not yet been carried out in the study area. This is the gap in knowledge which this study intended to fill. The following are fundamental questions that this research sought answers to:

i. What are the characteristics of land owners in the area?

ii. What are the different land uses in the study area?

iii. What is the level of compliance to development control standards in the area?

iv. What are the factors responsible for development Control violations in the area?

v. What are the effects of development control violations on environment in the area?

1.3 Aim and Objectives of the Study

The study aimed at mapping and creating a CIS for the parcels of land in state housing Corporation Calabar, Cross River State, Nigeria. This is to address the challenges of the age-old methods of creating and maintaining the paper-based land records system of manual cadastral maps characterised by data loss (fire outbreak as in the case of the study area), data redundancy, haphazard storage of land documents, high maintenance cost, lack of data integrity, inability to allow for instantaneous data access and retrieval by multiple users among others. This will go a long way when implemented to enhance the management and control of land resources for sustainable development.

The specific objectives of the study include to:

i. characterize the existing land owners in the study area

ii. analyse the various land uses in the study area

iii. assess the level of compliance of parcel use with development control standards in the study area

iv. identify the factors responsible for development control violation in the study area

v. examine the effects of development control violations in the study area.

1.4 Scope of the Study

This research covers Cross River State Housing Corporation (CRSHC) Calabar, Nigeria. The study identified, mapped and developed a CIS of the study area, characterized the existing land owners, analysed the various land uses and assessed the compliance to development control, factors responsible for violations and its effects. The study covered the parcels of land as at 2018.

1.5 Justification of the Study

Cadastral Information System is important in land administration and management. This is required for decision making by individuals, investors, Government Agencies among others for development purposes (Fadahunsi, 2011). The rapid pace of development and increase in population in Calabar Municipal area has brought about a heavy burden on the state Survey Department due to the complexity, volume and diversity of land information expected from the Department. This study will provide the needed information to the management authorities (CRMLH) in the area of allocation of parcels of land and in determining the types of development suitable and sustainable for parcels of land allotted to individuals or groups. Similarly, the recommendations of this study if successfully implemented will provide the needed protection/security to tenants, land rent, the confidence and incentives to put each parcel of land to its optimum utilization.

CHAPTER TWO
CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

2.1 Introduction

This chapter is divided into two sections. The first section discusses the concepts of land, land administration and development control while the second reviews literatures on two major headings about information on land ownership and violation of development control standards.

2.2 Conceptual Framework

2.2.1 Concept of land

According to Dale and Mclaughlin (1998), land forms the basis for all forms of human activity, from it we obtain the food we eat, the shelter we need, the space to work and the room we relax. The usefulness of land is enormous; therefore, man has to guard it jealously considering its scarce nature. For this reason, conflicts most often arise in the sharing of resources or right of ownership of the land. This of course, is due to the rapid population growth of man on earth and his desires to explore land in myriad of ways.

Land is a delineable area of the earth's terrestrial surface, encompassing all attributes of the biosphere immediately above or below this surface including those of the near-surface, climate, the soil and terrain forms, the surface hydrology (including shallow lakes, rivers, marshes, and swamps), the near-surface sedimentary layers and associated groundwater reserve, the plant and animal populations, the human settlement pattern and physical results of past and present human activity (FAO, 1995).

2.2.2 Land administration

In a broad sense, land administration is defined as an operational system designed to implement land policies. The UN (1996) defines land administration as "the process of determining (sometimes known as the adjudication), recording, and disseminating information about ownership, value and use of land when implementing land policies.

Land administration serves a number of broad social objectives (to effect a more equitable distribution of resources); economic objectives (to foster economic growth by using resources more effectively and to generate revenue); environmental objectives (to protect scarce and fragile resources); and political objectives (to connect government more closely to its citizens). The sub-system of information management integrates the outputs of all the other subsystems. It provides the link within land administration sub-systems through sharing and disseminating information. As such, land administration is affected directly and indirectly by policies, laws and organisational arrangements (Barry, 1999).

The processes of land administration include the transfer of rights in land from one party to another through sale, lease, loan, gift and inheritance; the regulating of land and property development; the use and conservation of the land; the gathering of revenues from the land through sales, leasing, and taxation; and the resolving of conflicts concerning the ownership and the use of land. Land administration functions may be divided into four components: Juridical, regulatory, fiscal, and information management. These functions of land administration may be organized in terms of agencies responsible for surveying and mapping, land registration, and land valuation (Dale and McLaughlin 1999).

2.2.3 Land right management

Prior to the colonial invasion, land in Nigeria was managed by the community, village or family and there was no such thing as individual ownership. All members of the community, village or family had an equal right to the land but in general, the Chief or Headman of the village or the head of the family had responsibility for the land and was considered the administrator (Mabogunje, 2010). Formal recording of individual rights and interests in land started with the British Colonial Administration in 1863 (with the land registration law) based on European laws (Oboli and Akpoyoware, 2010). The former Capital city of Nigeria, Lagos with its environs was the first to be covered by the Land Registration Law, which was later extended to other parts of the country by the "Registration Ordinance" No. 2 of 1894. Currently, land administration in the Federal Republic of Nigeria is guided by The Land Use Act (Decree No.6 of 1978) (Oboli and Akpoyoware, 2010).

Before the Land Use Act, there were two systems of land ownership; one in the Northern and the other in the Southern parts of the country. Land in Northern Nigeria were held and administered by the emirs while land in the Southern part was owned and held by communities, clans and families (Oboli and Akpoyoware, 2010). It was intended to usher in land reforms in Nigeria, through comprehensive tackling of four major challenges of land management: lack of uniformity in the laws governing land use and ownership; uncontrolled speculation in urban land; the question of access to land rights by Nigerians on equal basis; and the issue of fragmentation of rural lands arising from

application of traditional tenets of inheritance or population growth and increasing land uses which exert tremendous pressure on available land (Edmead, 2010).

2.2.4 Cadastral mapping and land registration in Nigeria

Land registration and cadastral recording was introduced in Nigeria during colonial rule which led to the establishment of a Land Registry in Lagos in 1863. This operated for some time and later, land registration laws were based on regional basis until 1915 when the Land Registration Ordinance No.12 was enacted which unified the systems of land registration in the colony of Southern and Northern protectorates (Nuhu, 2009). There was only one Survey Department in the country with branch offices in Lagos, Ibadan, Kaduna and Enugu. It was vested with the responsibilities of execution of geodetic, topographical and cadastral surveying throughout the country.

Following regionalization in 1951, the Survey Departments in Ibadan, Kaduna and Enugu became the Regional Survey Headquarters for the Western, Northern and Eastern regions respectively, so they were then to provide essential cadastral survey services for the regions in which they were situated (Birner and Okumo 2011). The Federal Survey Department was then charged with the responsibility of providing cadastral survey services for the Federal Territory of Lagos executing all geodetic and topographical survey in the country, and for the profession of surveying (Birner and Okumo 2011).

The Office of the Surveyor General of the Federation is now an institution that provides the much needed control over survey and mapping in Nigeria and is recently into development of a Cadastral Geographic Information System (CGIS) that would allow defining land parcel data of Federal Lands that can seamlessly integrate with Federal Land Information System (FELIS) for effective management and Administration of Federal Lands in Nigeria (Nuhu, 2009). At the demand side, rural land owners may not be aware of the possibility of such a mechanism and they may, therefore, not demand this local service (Edmead, 2010).

2.2.5 Reforms in land registration and cadastral mapping

Oboli and Akpoyoware (2010) noted that there are efforts at improving the Cadastre and modernizing land administration in some parts of the country which include Lagos, Kano and Enugu States as well as FCT Abuja. In Lagos State the Electronic Document Management Systems (EDMS) was launched to provide services in the improved land registry. Most of the records pertaining to titles on landed property for urban lands where documentation exists have been converted to digital format and the Land Registry has completed computerization of its records. In the Federal Capital Territory (FCT) the Abuja Geographic Information System (AGIS) was set up in 2004 to serve as a spatial data infrastructure for Abuja (Oboli and Akpoyoware, 2010). Thus, AGIS is expected to assist in conflict resolution in plot allocation and innovation in land registration. On 25th May, 2006 Enugu State commissioned the State's computerized land registry called Enugu State Land Information Management Service (ESLIMS). In the year 2015, Kaduna state established her Kaduna Geographic Information System (KADGIS) and also in 2020 Borno state established Borno State GIS (BOGIS) among others to enhance land and its resource management and developments relating to land.

2.2.6 Remote sensing and geographic information systems in cadastral mapping

Remote Sensing and Geographic Information Systems (RSGIS) have been instrumental in cadastral mapping (Albert, Edmund, Merem and Yaw, 2006). Remotely-sensed high resolution satellite images are effective in carrying out adjudication of rights in land (Delville, 2006). High Resolution Satellite Imagery (HRSI) has been successfully used in some African countries, like Ethiopia (Lemmen,

Zevenbergen, Lengoiboni, Deiniger and Burns, 2009). Lemmen *et al.* (2009) argued that almost without exception, local people could easily recognize the area and building where they are living on the imagery during an imagery base adjudication. Jing (2011) in a study to assess Larsi-Integrated Participation Procedure for Urban Adjudication in China stated that the new procedure will contribute to improving efficiency, saving labour and reducing cost of adjudication.

Mapping components of cadastres can be improved significantly through the use of Geographical Information System (Adeel, 2010). GIS has been used for cadastral mapping in different parts of the world. According to Gavish and Ester (2009) by the year 2000 the Survey of Israel (SOI) had accomplished the building of a GIS driven cadastral database and the main efforts were turned to updating and maintenance. GIS has revolutionized cadastral data management in the Nigerian FCT Abuja. It has greatly reduced corrupt practices in land administration in the Federal Capital Territory of Nigeria (Akingbade, Navarra and Georgiadou, 2010).

2.2.7 Adjudication

Adjudication, according to Lawrence (1985), is the process of determining rights in a land unit (that is a parcel, or in more general sense, a physical space). Adjudication is often referred to as first registration or land titling, which involves the initial compilation of the land register. According to Dale and McLaughlin (1999), adjudication is the formalization of unwritten evidence of ownership into sworn written statement to be legally recognized as a documentary proof of ownership. It is the procedure to formalize land through land rights identification, demarcation, cadastral surveying and mapping (Zevenberngen, 2001).

In certain cases of cadastral reform conversion from the 'old' to the 'new' system may be applied. But when virtually no written documentation is available, a careful procedure is necessary to inventory all relevant interests that exist and should be entered in the register. This process is called 'adjudication'. During adjudication particulars of all rights and liabilities in a parcel must be ascertained and determined conclusively (Larsson 1991).

2.2.8 Development

The term development just like the term planning has so many facets. Generally, development can be seen from the economic, social, political and physical perspectives. Anyebe (2001) defined development as a total transformation of a system. Thus, when used to describe a nation, it implies the transformation of the various aspect of the life of the nation. It further refers to a progression from a lower and often undesirable state to a higher and preferred one. Following this definition, therefore real development involves a structural transformation of the economy, society, polity and culture that permit the self-generating potentials of the area therein.

Adeyeye, (2015) provides two broad sources of the meaning and definition of development. These the research identified as statutory and non-statutory sources. The statutory source is the Nigerian Urban and Regional Planning Law (NURPL), Decree No. 88 of 1992, Section 91 which defines development as "carrying out of any building, engineering, mining or other operations in, on, over or under any land, or the making of any environmentally significant change in the use of any land or demolition of buildings including the felling of trees and the placing of free-standing erections used for the display of advertisements on the land". The non-statutory source from the Black Law Dictionary cited in Adeyeye, (2015) defines development as "a human created change to improved or unimproved real estate, including buildings or other structures, mining, dredging, filling, grading,

paving, excavating and drilling; and also an activity, action or alteration that changes undeveloped property into developed property".

2.2.9 Development control

Essentially, development control encompasses some related legal and administrative techniques/instruments designed to safeguard, regulate, conserve and disburse' land or part thereof in line with approved land use plans. Development control therefore regulates the building and or rebuilding in, on or under land (Jibrin, 2013). Sanusi (2006) defined development control as enforcement of standards, available regulations and professional expectations in the development of urban land. This definition further explains that professional expectations are the "expected order" to which a settlement must conform. Lawal (2000) saw development control as a tool to regulate land subdivision using planning standards, that is for every development, guidelines and standards are set up for implementation to avoid creating chaotic environment. Groves (2000) conceived development control is the executive arm of the planning process. It is the means whereby policies are implemented and specific land use proposals are brought to fruition and unlawful development prevented. It enables a local authority to protect residential areas from inappropriate intrusions, reserve land for new industries, maintain a green belt, keep valuable buildings and trees and prevent ugly signs. Development control also involves environmental, ecological and pollution control. These include the protection and preservation of areas of greenbelt, parks, land, wildlife, water and air. Performance standards thus become pertinent in preventing pollution in the environment, especially in cities and towns (Jibrin, 2013).

Roberts (1974) identified two main technical devices used in the development control process. These are land use zoning and planning standards. Planning standards have two main dimensions; prescriptive and regulatory. The regulatory standards used in development control by planning authorities include those related to residential density, plot ratio, ventilation, car parking control and highway standards among others. The prescriptive standards are built into development control and are used in preparation of the development plans.

2.2.9.1 Tools of development control

Planning Scheme/Development Plan: Planning scheme and development plan are the same and used interchangeably (Planning Aid for Scotland, 2013). A planning scheme is a statutory document which sets out objectives, policies and provisions for the use, development and protection of land in the area to which it applies. A planning scheme regulates the use and development of land through planning provisions to achieve those objectives and policies (Victoria State Government, 1998). Development plan on the other hand is a document that sets out how places should change and what they could be like in the future. It says what type of development should take place where, and which areas should not be developed. The contents of these plans include: maps- working drawings, sketches and diagrams that give the extent, boundaries, direction and features of the town and the direction of growth; written document or report that sets out the objectives, policies, provisions such as zoning ordinances that explain, when and what to be done in regards to the plan and how to do it.

Planning standards are devices that give what the percentage of coverage of all developments- housing, structures, roads; the setbacks of housing, the density of housing should be; they are divided into two: the prescriptive and the regulatory standards (Robert, 1975). Prescriptive standards prescribe which facilities can be provided at certain locations so as to prevent conflicts and promote harmonious and excellent inter-relationships (Adeyeye, 2010). Regulatory standards ensure that

there is adequate daylight, ventilation, sunlight and car parking in houses and compounds. They are setbacks that serve as tools or specifications before building operations can be approved under the law.

According to Ogundele, Ayo, Odewumi, and Aigbe (2011), there are basically two instruments or tools often used in the development control process. These are:

Enforcement notice: This is served on any breach of Town planning law relating to carrying out development without planning permission (approval). It relates to illegal building, engineering, mining, change of use and so on. This notice may be served either for demolition of such building without approval, or the restoration of an altered building, to its previous condition pursuant to section 47(1). Non-compliance with an enforcement order is punishable, though a breach of planning law is not a criminal offence.

Stop work notice: According to section 53 of the urban and regional planning Decree No. 88 of 1992, a stop – work order could be issued where it appears to the control department that: (a) An unauthorized development is being carried out or; (b) Where a development does not comply with a development permit issued by the control department. This document is used pending the service of an enforcement notice on the user, occupier or holder of such property. It takes an immediate effect upon service of such property. The time frame is usually 21 days within which such development shall comply with the provisions of section 53. It shall cease to have effect if within 21 days' enforcement notice is not served on its contravener.

2.2.9.2 Planning requirements for physical development

These are the planning requirements for physical development in the area.

I. Survey Site Plan: Survey site plan shall be prepared and signed by a registered and licensed surveyor and where necessary, the plan shall be contoured.

II. Site Plan:

i. The site plan shall show the geographical North point, sizes, locations and dimensions of all proposed developments, and their relations to all existing structures and site boundaries. These shall include all roads and access ways, open spaces, sewers, drains, wells, power lines, railway lines, water mains and other features existing or proposed on the site.

ii. It shall show all existing structures to be demolished and those to be retained, if any on the site.

iii. It shall show sufficient details to locate the site of the proposal.

iv. It shall show a drainage scheme of how surface and storm waters from the property and those from the adjoining properties will be drained.

v. It shall show calculation of built-up area as percentage coverage of the plot.

vi. It must show adequate and feasible setback from the front, rear and the side boundaries of plots with minimum setbacks.

2.2.9.3 Minimum requirements for physical development in Cross River State

Building density is simply the number of residential units that can be built, according to the provisions of the plan that applies there, expressed in the number of housing units per a standard land measure, such as hectare, dunam (10 dunams equal one hectare) or acre. In land use, a setback is the minimum distance which a building or other structure must be set back from a street or road, a river or other stream, a shore or flood plain, or any other place which is deemed to need protection.

All residential buildings along arterial roads should be adequately screened with plants; however, buildings shall not take access from arterial road. Table 2.1 presents the minimum requirements for physical development in Cross River State.

Table 2.1 Some Planning Standards for Residential Development in Cross River State

PLOT SIZE	DENSITY	TYPE OF DEVELOPMENT	BUILDING COVERAGE (%)	SETBACKS (M)	NO OF FLOORS	NO OF STRUCTURE
<750m2	High	Block of flats or studio apartments	60	Building line subject to minimum of 6m F: 6(mandatory) S: 3, 3 B: 3	4 1-2	1
<750m2	High density adjoining commercial district employment centre	Block of flats	60% for every additional 2 floors, reduce coverage by 3%	F: 6(mandatory) S: 4,5,4.5 B: 4	4-6 Lift and adequate alternative power supply must be provided	1
>750m2 <1500m2	Medium	Block of flats/ terrace studio apartment	50	F: 6(mandatory) S: 3; 3 B: 3	3	1
>1500m2 <2500m2	Low	Bungalows Duplexes Maisonette	40	F: 6(mandatory) S: 3.5, 3.5 B: 3	Max. 2 suspended floor excluding a penthouse	2; made up of 1 principal and 1 ancillary
>2500m2 <5000m2	Special residential plot	Luxury flats, Service flats; Mixed development	40	F: 6(mandatory) S: 4; 4 B: 4 F: 6(mandatory) *S: 8; 8 *B: 6	**4-6 **maximum 4	1
>5000m2	Comprehensive development	Condominiums: Mixed development Terrace Building	40	F: 15(mandatory) S: 8: 8 B: 6	4	1
	Mass housing				4	

Source: Ministry of Lands and Urban Development Cross River State (1973)

2.2.10 Remote sensing

Remote Sensing (RS) is the science of obtaining data/information about the earth's surface without directly being in contact with it, this is done by sensing and recording reflected and emitted energy and processing, analysing, and applying that information. Similarly, It's the science and art of acquiring information about the Earth's surface without actually being in contact with it (Sabins 1997).

Remote sensing application in urban management as a source of spatial information becomes more obvious if sensors measure the spectral characteristics of interest and their variations in time over large areas and providing data input (Nuhu and Yohana, 2013). Remote sensing, especially using space borne sensors offers the advantage of long term (years to decades) temporal and spectral data sets over relatively large regions (local to global scale) and, therefore, of monitoring the (temporal, spectral and spatial) variations of objects on the Earth's surface (Sabins, 1997).

2.2.11 Geographic information system

Environmental Space Research Institute (ESRI) (2011) defined Geographic Information System (GIS) as an arrangement of computer hardware, software, and geographic data that people interact with to integrate, analyse, and visualise data, identify relationships, patterns, trends and find solutions to problems. Furthermore, the system is designed to capture, store, manipulate, analyse, update and display studied data and eventually use them for analysis. Estes (1992) stated that Geographic Information Systems (GIS) in addition to remote sensing have contributed significantly in state and government monitoring and forecasting projects. GIS technology have been providing resource managers and decision makers with tools for effective and efficient storage and manipulation of remotely sensed information and other spatial and non-spatial information. The weakness of this research is in the fact that the main data which is the survey map that all other data are supporting here is obtained from an old, analogue, less-accurate hand drawn map which alters the integrity of the research.

In addition, ESRI (2011) opined that planners require solutions that address day-to-day work needs while also fostering the ability to effectively predict and respond to chronic urban problems and future market fluctuation. Consequently, the success of planners in combating chronic urban problems is largely determined by their ability to utilize effective tools and planning support systems that allow them to make informed.

2.2.12 Cadastral information system

Cadastral or parcel-based information system is a general systematic and up-to-date register containing information about land parcel including details of the area, values, use and ownership Dale (1991). This parcel-based and information system otherwise referred to as Cadastral Information System (CIS) has been positively affected by the advancement in computer and space technology and greatly improved methods of information gathering, storage, dissemination. Cadastral information system is a sub-set of Geographic Information System (GIS) which is concerned with the provision of spatially reference data (Didigwu and Olakanmi, 2016). It can also be referred to as involving the acquisition and assembly of data, their processing, analysis and dissemination and use of land information in a systematic manner (Dale and McLaughlin 1989).

The task of any Cadastral Information System (CIS) is to register in a condensed manner ownership, rights and other relationship between man and land (Didigwu and Olakanmi, 2016). Every country considers the protection of the land parcel and rights to land to be a government task. Cadastral systems play a key role on this respect (Zevenbergen, 2001). Though it requires huge amount of financial support in maintaining CIS, the authentic and electronic copy of record will aid in keeping up-to-data information about land.

The usefulness of such a system will depend upon up-to-datedness, accuracy, completeness, and accessibility, and also upon the extent to which the system is designed for the benefit of the user rather than for the producer of the information (Dale and Mclaughlin, 1988).

2.3 Literature Review

2.3.1 Characteristics of land owners and land use

To characterize the existing land owners and analyse the various land uses in the study area Bello (2011) used questionnaire and the Abuja master plan to assess the activities of Abuja Geographic Information System (AGIS) in the Federal Capital Territory. The study noted that limited success in implementing parcel administration reform in the FCT has led to inefficiency, incoherent and poor parcel management. The study emphasised that, evaluating the performance of a process or a system is a prerequisite for improving productivity, efficiency and performance. Lack of assessing planning activities has brought inefficient and insecure urban environment. Findings revealed that only 17% of good governance in parcel administration has been achieved by the AGIS.

Atanlode (2014) created a digital cadastre for part of Sunshine Estate, Akure South Local Government Area, Ondo State. The ground control point (GCP) UTM Coordinates of some five selected pillars and the analogue cadastral layout were obtained from office of the Surveyor-General, Ondo State Ministry of Lands and Housing, while the attribute data were obtained from the Parcel Allocation Officer, Ondo State Parcel Records Bureau. The layout plan of the project area was scanned. The scanned plan was then exported to ArcGIS 9.3 for Georeferencing and digitizing. Attribute data were typed manually into the computer and were used for creation of database. These data were processed and manipulated to give useful information. Database query results show that there were total of 72 parcels and 1.4% of these parcels were yet to be allocated. The results show that there were 10 road networks of which 80% of them were unpaved. 88.9% of the parcels were undeveloped while only 11.1% of the remaining parcels were developed. In addition, 9.7 % of the total parcels were owned by females.

Bala (2011) created an enhanced geospatial information system for Kabama estate, Sabon Gari, Zaria. The researcher succeeded in creating a reliable database for the management of parcel information in this location. The satellite imagery of the area was acquired, the lay out plan, and its related parcel records were collected from the ministry of parcel and survey. The parcel records were used to create the attribute database in ArcGIS 9.3. The findings revealed that there are 243 parcels out of which residential has the highest number with 235 parcels, others like Religious, educational, recreational centre, petrol filling station, children play ground, clinic and bank each has just one (1) parcel. The total area of the study area is 20.25 hectares. Some individuals own more than a parcel and most of the parcels were owned by civil servants.

Chiemelu and Eze (2011) created a digital cadastre for Bethel Estate, Enugu East Local Government Area, Enugu State. The authors aimed at creating a parcel administration and management database

in order to facilitate an efficient and effective land-use administration in the area. The data collected include the coordinates of some pillar numbers with GPS receiver which was used for geo-referencing of the plan, and the attribute data collected during the ground-truthing to confirm the type of buildings present in the site. The other data used include analogue plan of the layout, coordinates of the boundary pillars, building plan of the site, and attribute of the parcels. The methodology involved scanning the analogue layout plan of the estate and the building plan. Four pillar coordinates were used for the georeferencing of the plans. The attribute data for roads, buildings, parcels, pillar number and block from the field data were integrated with the base map data. geospatial database was created. The results of the queries and analysis show that, 34.6% of the properties were 3Bedroom Detached Bungalow, 2.6% of the properties had an area that is greater than 557.479m^2, the annual ground rent of 12% of the properties had not been paid, 6 % of the properties were used for commercial purposes, 16.6% of the properties were yet to be sold and 4.6 % of the properties were valued less than N 5, 500:00 respectively.

2.3.2 Development control compliance

To assess the compliance of parcel use to development control standards, examine the factors responsible for development control violations and examine the effects of development control violations in the study area.

Ibrahim, Mohammed, Adel, and Ali (2005) assessed the impact of contraventions of building regulations on the architecture of mixed parcel use areas of Kano Metropolis, Nigeria (1990-2009). Copies of questionnaire were used and three groups considered; that is the occupants/owners, principal officers of the Planning Agency and consultants submitting building drawings for approval. Statistical Package for Social Sciences (SPSS) software was used to analyse the findings from the questionnaire. The identified contraventions were; set back (25%), parcel use not in conformity (12.4%), building without approval (13.4%), Parcel development ratio (11%) and insufficient parking space (8%). It was recommended that building regulations should be enforced so as to reduce the negative impact of contraventions, through improved architectural practice within the ambit of the law as regulated by Architects Registration Council of Nigeria. Awareness campaign by the government in promoting adequate respect to the professional practices and compliance with use of professionals in all physical developmental programmes.

Olatunde, Igbokwe, Olatunde and Adeboboye (2014) examined the application of GIS and remote sensing techniques in parcel use analysis of Auchi urban centre Edo state, Nigeria. The study used both Statistical and geometrical analysis to determine the results. Findings show that there was an imbalance in the parcel use structure of Auchi whereby some parcel uses were over represented at the expense of others in a predominantly medium density setup. The research indicated that the urban growth and development in Auchi has been restricted to the low-lying areas, most especially Usogun, Akpekpe and parts of Igbei and Iyekhei quarters. However, there is virtually no master plan for the development of Auchi, no parcel use zoning scheme is adopted and individual claim to parcel is still very high. All these provided the framework for the haphazard development of the city. Thus, a good number of the parcel use problems in Auchi are caused by lack of proper planning and monitoring/evaluation of development. The research further revealed that parcel use activities in the study area are un-controlled and the imbalance in parcel use structure of Auchi is vivid. For instance, residential parcel use account for 56.99 % of the built-up area. Others are commercial parcel use

2.40%, industrial parcel use 0.43%, educational parcel use14.64%, transportation 1.21%, recreation 0.09% and vacant parcel 1.60%. The study identified the achievement of a balanced parcel use pattern as an important aspect of effective development control, so that the planned area is well integrated with the overall structure of the larger community.

Sanusi (2006) examined the pattern of urban parcel development with emphasis on the practice of development control in Minna. The data used were google earth imagery, data from field observation and questionnaire administration. The researcher used descriptive statistics technique. The study revealed that 55% of the developers got building permit while 45% did not. Among the 55% that obtained the permit, 42% of developers within a residential area over developed their properties which are not acceptable by planning standards as little space is left for better internal air circulation and security consideration.

Nuhu and Yohana (2013) assessed the geospatial pattern, problem and prospect of development control in Mubi, Adamawa State. The researcher obtained data from questionnaire and used Quick Bird (2012) satellite imagery. The study revealed that about 53.3% of the landmass was covered with haphazard development and only 18.7 portrayed planned development in the area. About 3.7% of the layout were distorted while 1.8% experienced parcel use conversion in the metropolis. The research also revealed that factors militating against effective development control in the town were interference by personalities, lack of Corporation by the parcel owners, scarcity of man power, inadequate equipment and machinery and Poor and inadequate funding.

Aluko (2011) analysed public compliance to space standards for urban development control in Lagos State. The data used were satellite imagery and Questionnaire in collecting data in the study area. The methodology involved administration of the questionnaire and digitizing the layers in the imagery into a geospatial database. The study identified problems ranging from uncontrolled change of use of property (34%), noncompliance with space standard and approved design (51%), unguided and ineffective enforcement of building regulations (21%). The study noted that in metropolitan Lagos, development control requires special monitoring agency as a result of the daily problems the authorities are confronted with, which are attributed to the sheer size and rate of increase of these settlements and the complexities of the task involved in the control. The author went further than others to explore on building design standard, its welcoming because most researcher will stop at setback and building density.

Jibrin (2013) conducted a study on pattern and urban management challenges of Development Control violations in Wuse District Federal Capital City. The methodology involved the use of satellite imagery, master plan and questionnaire for the creation of geodatabase where queries were made to reveal the desired information. Findings revealed that effective development control in urban management provides easy access to developments and to achieve an efficient circulation within the developed areas. The study further revealed that, 70% of the violation to road set setback was recorded in Wuse II. The author identified that setback enhances proper circulation when adequately observed. This can effectively be achieved through evaluating development control especially during construction period. The author recommended that ICTs which include GIS should be adopted in monitoring and surveillance of development control process to promoting spatial harmony in urban management.

Bogoro and Samson (2014) assessed the knowledge, attitude and practice of development control by developers in millennium quarters Yelwa, Bauchi State. Data from questionnaire administration, interview and on-the-site assessment methods were used. The study revealed that 90% of the developments in the study area was overdeveloped, 51.5% change of parcel use. The researcher believe among other things; that development control rules and regulations should be enforced to the fullest, a community physical development inspection team should be constituted in the neighbourhood to closely monitor and stop encroachment especially in to the right way and to avoid the menace of substandard and irregular parcels, all layouts whether private or public must be designed or supervised by a qualified Town Planner and must be approved by the urban development board before implementation.

Amedu (2017) assessed the development control violations in Badawa using geospatial techniques. Satellite (Google Earth) Imagery of 2016 was digitized and queried to assess the level of development control violation in the area. Questionnaire was deployed to examine the factors responsible for development control on the study area. The development control violations were identified and mapped out using ArcGIS 10.0 while the responses from the respondents were analysed using the mean and standard deviation with the decision rule of 3.0 as accepted. The work revealed that among the violations in the low-density area, the back setback had the highest form of proportion of about 78%. In the medium density area, the front setback had the highest form of violations resulting to about 73%, however this was closely followed by building line setback (71%). In the high-density area, the front setback was the most common (72%). The study also revealed that corrupt practices and Inadequate field-based Supervision were the major factors responsible for development control violations. Overdevelopment of Parcel (maximization) was the major effects of development control violation in the study area. The study recommends that as a matter of urgency the development control board should adopt geospatial techniques to curb development control violations thus provide stringent measures to fight corruption and overdevelopment. The researcher made use of satellite imagery rather than old outdated cadastral map unlike some however, the questioner was administered to only residents which makes the responses one sided.

Shekwoaga (2016) evaluated the effectiveness of development control in Minna metropolis. The Quick bird and Ikonos satellite imagery of 1 metre resolution was acquired and digitized to assess the level of compliance to development control. Interview was deployed as a method of data collection to examine factors influencing non-compliance, the enforcement of development control and implication on non-compliance to proposed plan. The findings revealed that 55.1% of the buildings in the study area have encroached into road. The total area coverage of 16.55% hectares has been developed in the area contrary to the layout proposal of 14.44% hectares. Also, further findings revealed that there is decline in space proposed for public facilities and services in the area as just 49.9% of the parcel uses complied with the proposed plan even though 8.7% of the converted parcel uses were regularised by the Ministry of Land and Housing, 91.3% did not go through the same process. The researcher went further than others to examined the violations that have been regularised and the percentage yet to be regularised. This is a good development directing others to demolition, correction or regularization as control strategy for future researches.

Dawaba, Yusuf and Akpu (2018) assessed compliance to development control in Minna metropolis using the masterplan, Layout plans and 2015 1m spatial resolution Ikonos Satellite imagery of the study area. The masterplan was georeferenced and digitized. The digitized layout plan was overlain on the vectorised satellite imagery to determine extent of deviation from the original plan. Findings

reveal that more than half (55.1%) of the buildings in the area encroached into roads. F-Layout recorded the highest (72.9%) noncompliance level with regards to building into roads while Atlanta (32.9%) ranked lowest. Over-development of Parcels was common in Bosso, Tunga and F-Layout while parcel use change was a common violation in all the Layouts. Inadequate motorable roads was one of the effects of non-compliance to development control. other implications include overstretched public facilities, utilities and services as well as Poor Ventilation and haphazard development. The author's choice of instrumentation and approach to methodology is good however, one factor affecting the integrity of this research work is the fact that the locational data is a manual, hand drawn plan which is less accurate and worst still unrevised to be used for such research.

Addai, Owusu, Poku-Gyamfi and Gyambibi (2011) studied systematic parcel title registration using GIS using the Ghana Land Administrative Project (LAP). Their methodology was based on: reconnaissance survey; public announcement; questionnaire administration; spatial data capturing using the Global Positioning System (GPS) and digital camera and; collection of photocopies of existing documents on parcels of land. They found out that the process of parcel registration can quickly and speedily be carried out at a much-reduced cost with the help of GIS.

Alexander (2018) developed a cadastral information system for Mammy settlement, Takum Local Government Area, Taraba State, Nigeria. The cadastral layout of the study area was acquired, scanned, georeferenced and digitised using ArcGIS 10.1 software package. In order to obtain the parcel ownership information, the administration of adjudication form was carried out. A cadastral database encompassing a spatial database and attribute database were then designed and built using the information gathered. Data querying was carried out, the results revealed that, there were 738 parcels and 653 parcel owners in which vast majority of the parcel owners were males with the proportion of 86.68%. About 46.09% of the parcel owners in the area were civil servants. About 58% of all the parcels were undeveloped. Findings also showed that residential parcel uses had the highest proportion (58%) while the parcels used for institutional purpose and also mixed purposes had the lowest proportion each covering 3% of the total parcel uses. The study also showed that, there was high level lack of compliance of parcel uses and road networks with the layout plan of the area. The State Government should employ GIS technology in creating Cadastral Information System in the State to enhance effective and efficient cadastral management.

From the revised literatures, its observed that CIS in areas where land ownership records do not exist particularly in Nigeria seems not to be well-researched. One factor affecting the integrity of most of the researches is the fact that the locational data is a manual, hand drawn plan which is less accurate and worst still unrevised to be used for such research. The uniqueness of this research is in the fact that there is no existing surveying information about the layout.

CHAPTER THREE
STUDY AREA AND METHODOLOGY

3.1 Introduction

This chapter is divided into two sections; the study area and methodology. The first section discusses location and size, climate, soil, vegetation, relief, drainage and economic activities. While the second section considers reconnaissance, data types, sources, processing and method of analysis.

3.2 The Study Area

3.2.1 Location and size

The study area is State Housing Corporation, Calabar municipality of Cross River State Nigeria. It is located between Latitude $4^{o}58^{'}$N and $4^{o}59^{'}$N and Longitudes $8^{o}10^{'}$E and $8^{o}20^{'}$E on an elevation of 32m (105ft) above the mean seas level (MSL). The study area is bounded to east by Murtala Mohammed Express way, to the north, south and west by MCC Road, Atekong Drive and Ndidem Usang Iso Road. It has an average area of about 80 Hectares (See Figure 3.1).

3.2.2 Climate

Calabar is characterised by a tropical monsoon climate with a lengthy wet season spanning about nine (9) months from March to November while the dry spans 3 months from December to February. The area has a conducive weather condition for agriculture due to its rich soil, unique coastal location and high rainfall. Calabar rainfall averages about 3,000mm annually (Ayeni and Adewale 2001), with temperature of about 27^{o}C at warmest and 15^{o}C at coldest. There is also little variance between daytime and night time temperature, as temperatures at night are typically only a few degrees lower than the daytime temperature (Esteban and John, 2013). See Figure 3.1 for map of the study area.

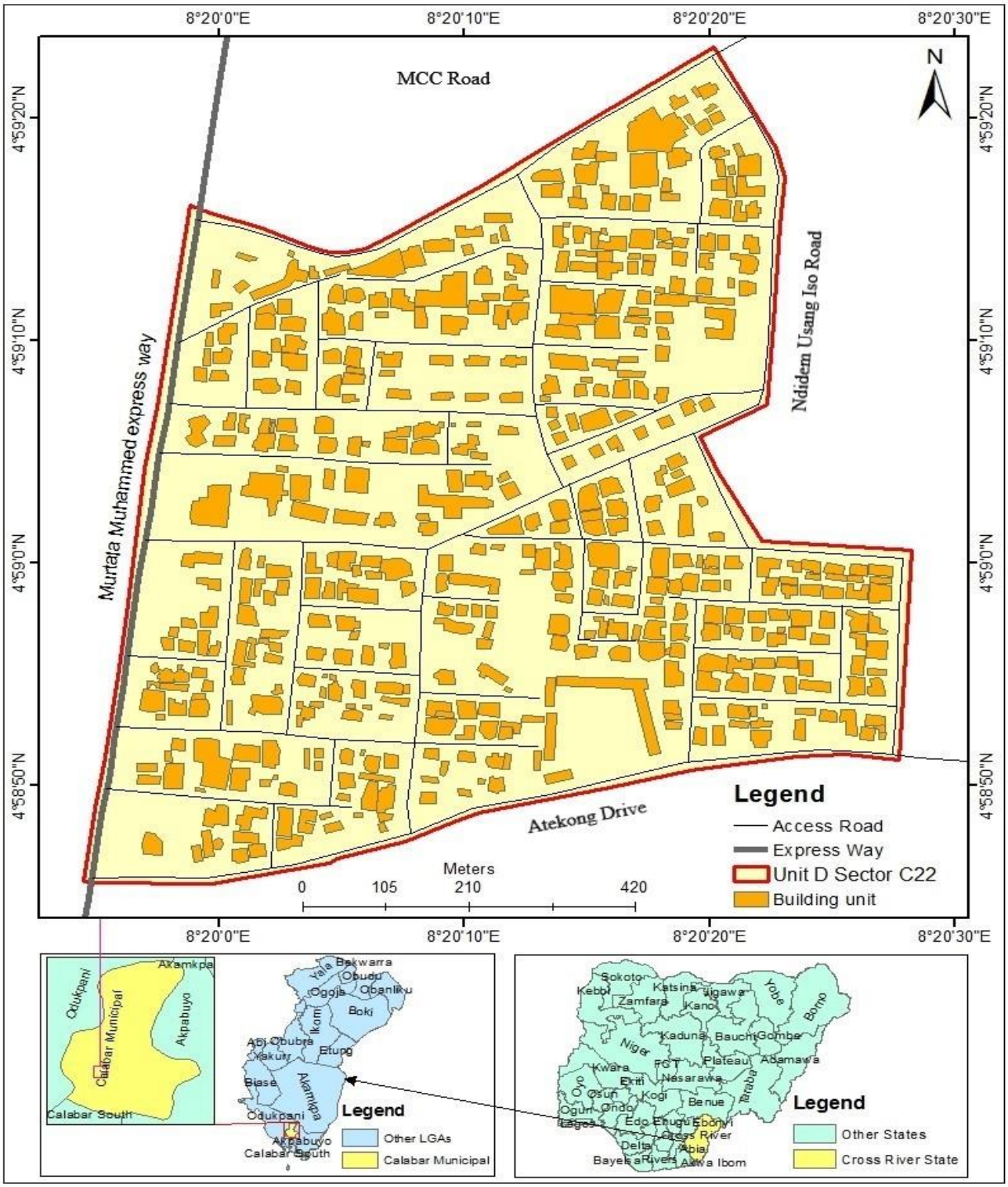


Figure 3.1: State Housing Corporation (SHC) Calabar, Cross River State
Source: Adapted from Satellite (Google Earth) Imagery of the study area (2020)

3.2.3 Vegetation

The vegetation of the study area is mainly riparian and fresh water swamp forests. Small derived savanna vegetation, cultigens and ornamental/avenue tree/shrub species are present in the area predominant are the following: *Alstonia boonei, Ceiba pentandra, Detarium macrocarpum, Distemonathus benthamianus, Agauria salicifolia, Allanblackia floribunda and Cola species* among others. These robust shrubs and trees, which have adapted to changing coastal conditions (such as

inundation, sun exposure, among others), play a substantive role in cultivating the biodiversity and wellbeing of the surrounding landscape (Esteban and John, 2013).

3.2.4 Relief

The topography of the study area is low lying coastal plain of the Calabar River and Great Qua River. The Geology of the area is mainly sand stone. Its relatively undulating with many hills popular among them is the diamond, hiking, summit and Uban hills (Esteban and John, 2013). Areas that have low topography (elevation) are usually good for residential use.

3.2.5 Drainage

Calabar has several rivers/streams, the major ones among them are the Aloma and the Manyu rivers which flow through swampy rainforest with numerous creeks and forms an inland delta near its confluence with the Calabar River. The Calabar drainage consists of two main watersheds trending north to south: the western one parallel to the Calabar River which lies on the left flank of the River; and the eastern one along the Great Qua River. Within the two watersheds are five drainage basins namely, the western, north western, eastern, south eastern and the central basins (Ayeni and Adewale, 2001). Areas that are vulnerable to flooding are not too good for residential parcel use as in the case of the study area but adequate drainage system and other antiflooding constructions are made for flood control in the area.

3.2.6 Soil

The dominant soil type in the study area is the clayey-loamy soil which supports mangrove swamps at the southern shores. Towards the North-East is the sub-humid tropical rainforest soil, which are high in sand fraction and low in silt and clay contents suggesting high organic matter content. They are cementing in nature and the high impact of rainfall on the soil particles causes the topsoil to become very thin and supports varieties of halophytes (Esteban and John, 2013).

3.2.7 Population and people

The estate is made up 22 Upstairs buildings (Area A), 35 duplexes (Area B), 68 bungalows (Area C), 90 Detached (Area D), 106 semi-detached apartments (Area E) and 2 recreation centres (Area F). The study area has an approximate population density of 190/km^2 (National Population Commission 2006), making it one of the heavily populated areas in the state. The SHC is made up of 315 households and 336 parcels, this is because some households occupy more than a parcel like in commercial and also educational facilities among others. The ethnic groups in the estate include the indigenous Efik, Kwa, Nkum-Irede, Nkum-Iborr and other tribes including Yala, Igbo, Yoruba, Hausa among others (CRSMLH, 2019).

3.2.8 Economic activities

Majority of the inhabitants are engaged in civil service with few others in farming and trading. Some of the farm produce found in the area are banana, cassava, Avocadoes, maize, millet, oil palm products among others. The agro-economic activities in the area include poultry farming and animal rearing. Other economic activities include automobile mechanic, carpentry and bricklaying among others (Bell, 2011). Increase in economic activities can lead to change in residential parcel use to commercial parcel use.

3.3 Methodology

This section presents the data types to be used, their sources, the mode of collection as well as how the data was processed and analysed.

3.3.1 Reconnaissance survey

Reconnaissance survey was carried out in order to be familiar with the study area. Cross River Ministry of Lands and Housing was visited, 3 of the staff were deployed to accompany the research team to the site. Data were gathered among which are: total number of parcels, the condition of overdevelopment and encroachment of roads as well as change in land use. Relevant information on the challenges and implications of non-compliance to development control regulations were collected, factors responsible and effects of the violations were identified.
Different types and sources of data were used to achieve the desired aim and objectives of this study.

3.3.2 Data types

The data types used include both spatial and attribute data which include the following:

i. Geographic coordinates of the beacons.

ii. List of all parcel, owners and ownership information for example Ownership data (Name of user, Address of user, C of O number, Date of grant, Sex, among others), Parcel use category (Residential, Commercial, Public and or Recreational) and Parcel development status (Developed, Undeveloped), Parcel address among others. Perceptions of the residents on the factors responsible for development control violation and its effects on the study area among others.

iii. DigitalGlobe Quickbird Satellite Imagery at 15cm resolution of State Housing Corporation Calabar, Cross River.

3.3.3 Sources of data

The data used for the study were obtained from the following sources.

1. Field Measurement: Global Positioning System (GPS) Geomax Advanced GPS Zenith 45 GNSS RtK) was used to obtain coordinates of all the beacons in the estate.
2. Administration of Adjudication Form to obtain list of parcel owners and ownership information.
3. Satellite (Google Earth) Imagery repository
4. Literature materials were obtained from seminar papers, journals, thesis, text books and web reference materials.

3.3.4 Methods of data acquisition

Attribute data of parcels and parcel owners, respondent's perception on the factors responsible for violations and their effects were collected through field work by direct administration of adjudication forms to 291 available respondents out of the 315 households in the study area, this has to do with multiple ownership, unavailability of some house hold heads among other limitations. The adjudication form and a hardcopy indexed satellite image containing vectorized parcels with unique identification numbers were used for ease of identification of parcels. Parcel owners were required to identify their parcels on the satellite image and provide the necessary details to fill the adjudication form. On the other hand, GPS Geomax Advanced GPS Zenith 45 GNSS RtK was used to obtain coordinates of all the boundaries and beacons in the estate.

3.3.5 Data processing

Processing of the data involved digitizing, Polygonization and creation of Spatial Database. The research methodology workflow is presented in Fig. 3.2.

3.3.5.1 Creation of Layers

Map layering is a logical separation of map content according to theme and stored in layers. The basic spatial entities used in digitizing were point, line and polygon. Therefore, the entire plan was dissected into different layers, and each layer represents a particular geographic feature in the study area. Point was used to represent features that are too small to be presented as area for example beacons, while lines was used to represent linear features like roads and parcels was represented as polygons.

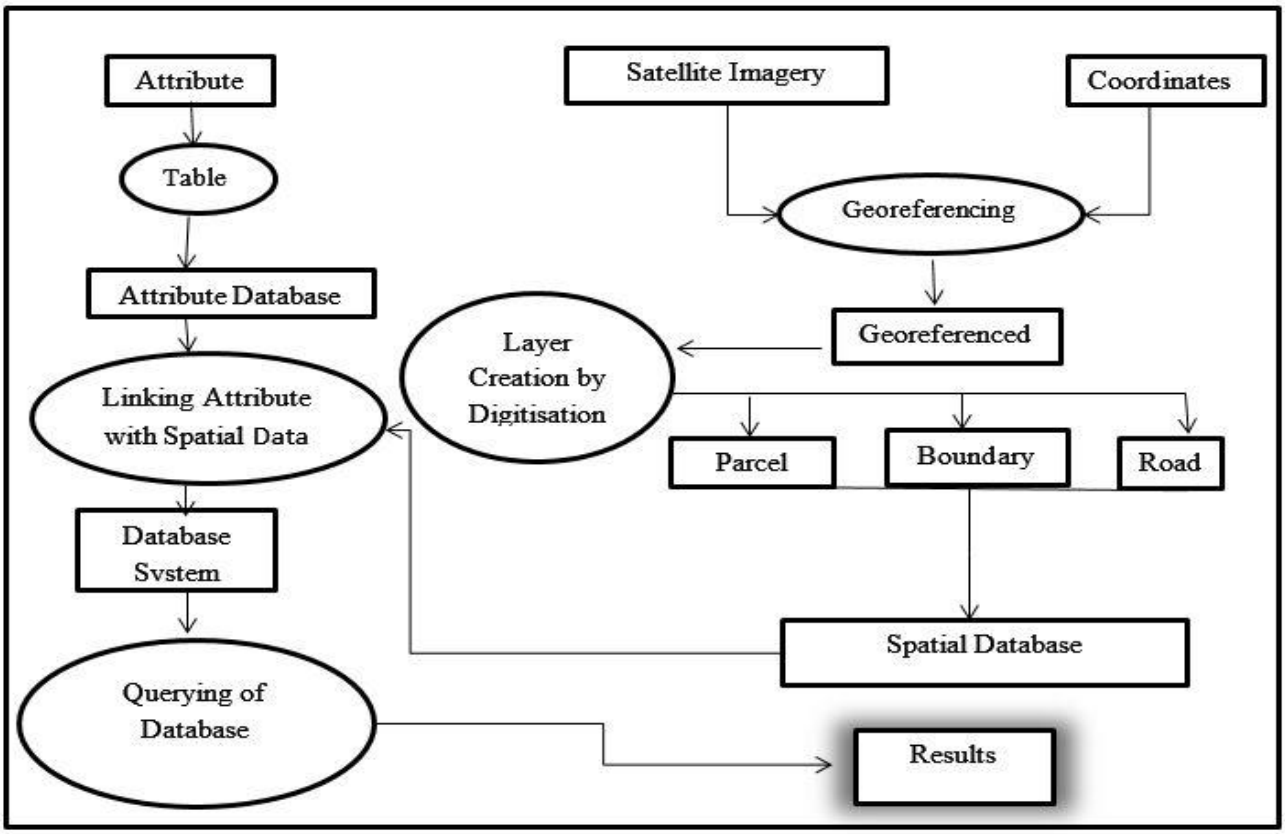


Figure 3.2: The Workflow Chart of the Methodology for the Project
Source: Author's Analysis (2019)

These Spatial data processing include the following procedures:

3.3.6 Building of cadastral database

Three major stages are involved in designing and building a geodatabase; conceptual, logical and physical stages;

3.3.6.1 Conceptual design

The Entity Relation (E-R) model was used for the conceptual design. This involves the identification of entities, identification of attributes, determination of relationships and the drawing of an E-R diagram. Four entities were identified in the design. These include; parcels, owners, parcel titles, and beacon.

3.3.6.2 Logical design

The logical design involved mapping the conceptual entity relationship (E-R) diagram into a logical schema, identification of primary and foreign keys and normalizing attribute table. The Relational Database Management System (RDMS) model was used for the Parcel ID as foreign key in User table among others. The Parcel ID and User ID were identified as primary keys in the parcel and user tables, respectively. The Beacon ID was identified as the primary key in the beacon table while, the parcel Title ID were identified as the primary key in the parcel tile table with User ID as foreign key in Parcel table.

3.3.6.3 Physical design

The two steps of spatial database design involved determining the characteristics of attributes in the logical schema and the creation of new feature attribute table for each of the spatial layers identified in the spatial database. ArcGIS 10.5 version was used for the physical design. Feature classes were created in ArcCatalog for spatial entities-parcels and beacons. Tables were created for non-spatial entities - owners and parcel titles.

Data from adjudication form collated in Microsoft Excel, Spatial data vectorized from the Satellite imagery of the area and the coordinates from the GPS equipment were brought together in ArcMAP. This imported parcels and the attribute data were used to populate the Spatial information in the designed geodatabase to make up the Spatial Cadastral Database.

3.3.7 Data analysis

The data acquired and processed was analysed based on the stated specific objectives:

Objective i: characterization of the land owners

Geomax Advanced Zenith 45 GNSS RTK Differential GPS was used to capture coordinates of the boundary's beacons. The Satellite (Google Earth) Imagery of the layout was downloaded and imported into ArcGIS 10.5 environment in jpeg format where roads were digitized as line while parcels as polygons, these information is used together with the adjudication form administered to land owners in the study area for easy identification of parcels to obtain information about the owner's characteristics. After the updating process of the geometric data, the gleaned information about each parcel was inputted into the created fields in the attribute table of the spatial database leading to easy identification of parcels and the production of digital map of the study area. Query was used to retrieve information about the characteristics of parcel owners in the study area such as gender and occupations among others.

Objective ii: changes in land use

This was achieved by using the proposed and existing parcel use information (1973 and 2020) from the ministry of lands and urban development and adjudication form respectively. Query operation was used to retrieve the information from the database and changes in land use were identified. Frequency table was used to present the level of parcel use change between the proposed and existing parcel uses in the study area as presented in Table 4.5.

Objective iii: analysis of the level of compliance to development control standard in the study area.

This was achieved by digitizing all the buildings on the layout from the Satellite (Google Earth) Imagery of the study area. The shapefiles of the buildings were used to measure the setback distances from each building with reference to the dimensions of each parcel to ascertain and identify the level of compliance to development control standards such as the front, rear, right and left setbacks. The level of compliance was ascertained based on development control standards as presented in Table 2.1. The tabulate intersection tool was used to calculate the percentage of area that have been developed (building density) in each parcel by using the building and parcel shapefiles. Buffer tool was used to create a 45m buffer around Murtala Muhammed express way and 10m buffer around the access roads. The parcels and housing unit shapefiles were superimposed to see the sections of the road's right of way that have been encroached upon by housing units. Query analysis was carried out to identify the compliance to development control standards. According to urban planning regulations in Nigeria, every high way has a right of way of 45 meters while access roads have 10 meters right of way. The development control standards for residential parcel use is presented in Table 3.1.

Table 3.1: Residential Parcel Standards

S/N	Parcel Density	Type of Violation	Standard
1	High Density	Front Setback	<6m
2	High Density	Rear Setback	<3m
3	High Density	Right Setback	<3m
4	High Density	Left Setback	<3m
5	High Density	Building Density	>60%
6	Medium Density	Front Setback	<6m
7	Medium Density	Rear Setback	<3m
8	Medium Density	Right Setback	<3m

9	Medium Density	Left Setback	<3m
10	Medium Density	Building Density	>50%
11	Low Density	Front Setback	<6m
12	Low Density	Rear Setback	<3m
13	Low Density	Right Setback	<3.5m
14	Low Density	Left Setback	<3.5m
15	Low Density	Building Density	>40%
16	Special Residential Density	Front Setback	<6m
17	Special Residential Density	Rear Setback	<3m
18	Special Residential Density	Right Setback	<4m
19	Special Residential Density	Left Setback	<4m
20	Special Residential Density	Building Density	>40%

Source: Ministry of Lands, Housing and urban development Cross River State

Objective iv: examination of the factors responsible for development control violation in the area.

Descriptive statistics of mean and standard deviation of Statistical Package for Social Sciences (SPSS) was used to analyze the data collected from the responses on factors responsible for development control violation in the study area.

Objective v: examination of the effect of development control violation in the study area

The acquired data on effects of development control violations in the study area from the administration of adjudication form were processed and analyze using descriptive statistics of mean and standard deviation of Statistical Package for Social Sciences (SPSS).

CHAPTER FOUR
RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents and discusses the results of this research under three sections. The first is the characteristics of parcel and owners while the second and third sections deal with parcel use change and development control violations respectively.

4.2 Characteristics of Land Owners

The query builder in ArcGIS 10.5 was used to retrieve the different characteristics of parcel owners in the geodatabase as presented in Tables 4.1 to 4.4 and illustrated in maps from Figures 4.1 to 4.4.

4.2.1 Classification of land owners according to gender

There are 336 parcels of land in the estate. Query operation was carried out to retrieve information about the distribution of parcel owners according to gender from the geodatabase and the result is presented in Table 4.1.

Table 4.1: Classification of Land Owners According to Gender

Gender	Frequency	%
Female	47	14.0
Male	287	85.4
Government Owned	2	0.6
Total	**336**	**100**

Source: Author's Analysis (2019)

Table 4.1 revealed that 14% of the parcels were owned by women while 85% were owned by men. Two Parcels were owned by the Government. Spatial Statistical tool in ArcGIS was used to summarise the salient characteristics of spatial distribution of females and males' ownership in the study area. It was revealed from the analysis of pattern that males and females are located in random pattern with the highest clusters of females found close to the government parcel at the southern part of the layout. Most of the female owners are as a result of resale and inheritance. From the reconnaissance, it was observed from the ministry that only five females were originally allocated parcels in the estate and were the plots around the government owned parcel. The relative high number of male owners may be connected to the fact that this part of Nigeria most households are headed by men. This is largely based on societal values and norms. This finding agrees with Atanlode (2014) which revealed that majority (90.3) of the user of parcels were males in Sunshine Estate, Akure South Local Government Area, Ondo State. See Figure 4.1 for classification of parcel owners according to gender.

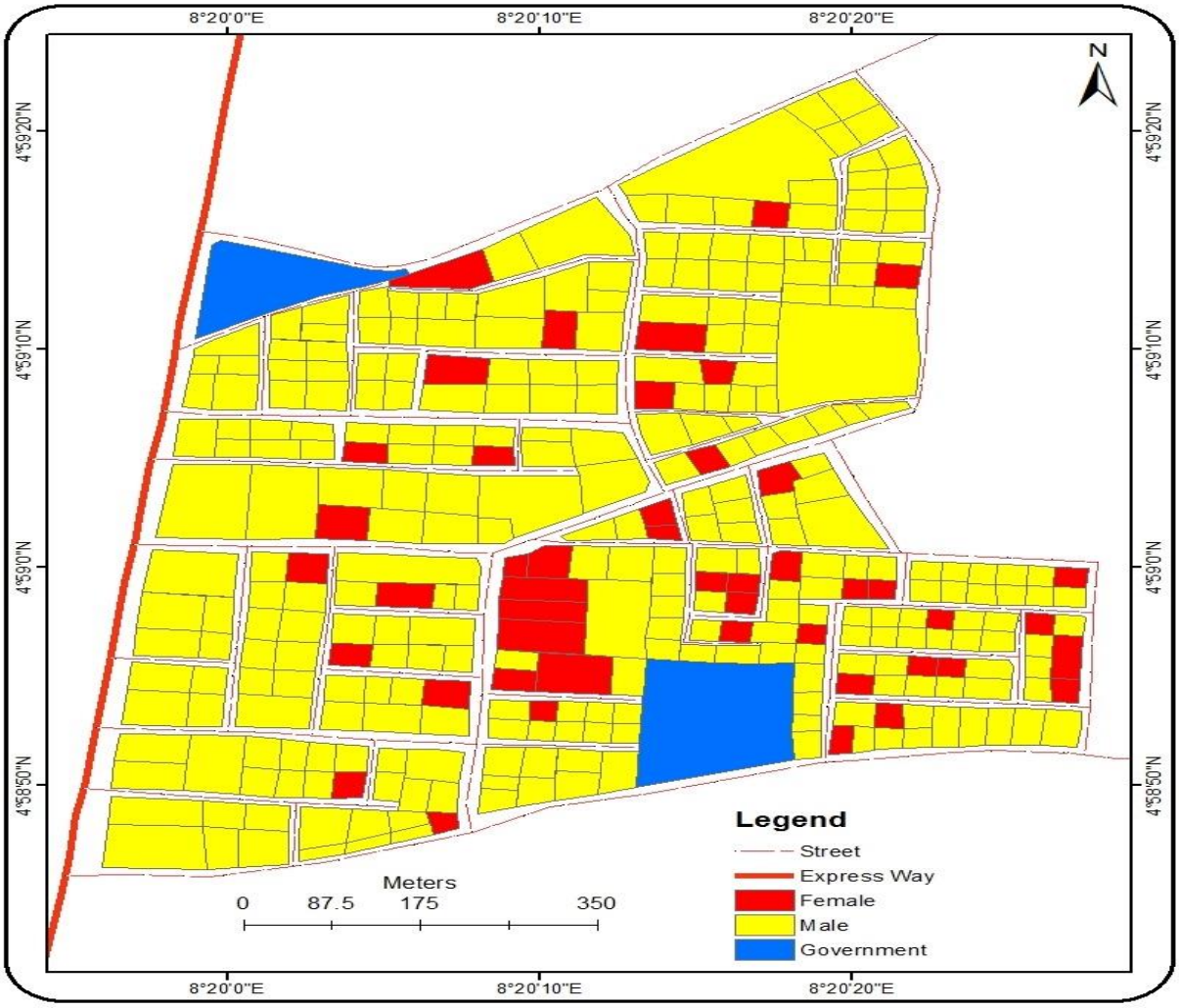


Figure 4.1: Classification of land owners according to gender
Source: Author's Analysis (2019)

4.2.2 Classification of land owners according to occupation

The distribution of parcel owners according to occupation was retrieved from the geodatabase using query operation in ArcGIS 10.5 and the results are revealed in Table 4.2.

Table 4.2: Classification of Parcel Owners According to Occupation

Occupation	Frequency	%
Business	118	35.1
Civil Service	205	61
Farming	11	3.3
Government Owned	2	0.6
Total	**336**	**100**

Source: Author's Analysis (2019)

Table 4.2 revealed that 61% of the parcel owners were civil servants, 35.1% were business men and women, 3.3% were farmers while 0.6% of the parcel belong to the Government. More than a half of the parcel owners in the study area were civil servants. The parcels originally belonging to the government were sold out to individual occupants who were given the accommodation officially

from the office. This condition gave rise to about 100% civil servants' ownership of the parcels in the estate but with time, factors like: retirement, sales, inheritance, gift among others resulted in the present condition. This finding agrees with that of Bala (2011) which revealed that most of the parcel owners were civil servants in Kabama estate, Sabon Gari, Zaria and Alexandra (2018) which revealed that about 46.09% of the parcel owners in Mammy settlement, Takum Local Government Area of Taraba, Nigeria were civil servants. See Figure 4.2 for classification of parcel owners according to occupation.

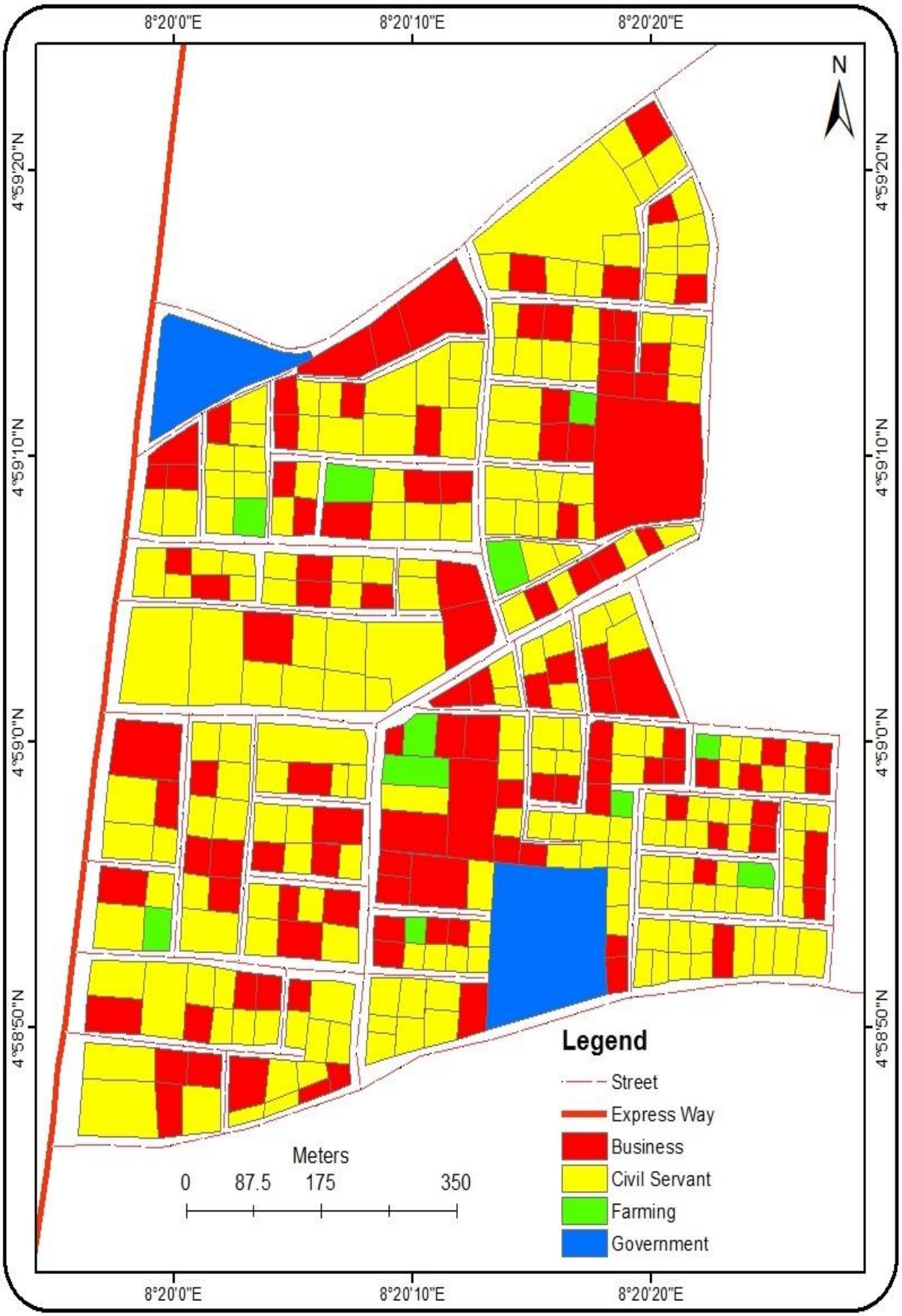


Figure 4.2: Classification of Land Owners according to Occupation
Source: Author's Analysis (2019)

4.2.3 Classification of Land according to development status

The status of every parcel was queried to from the database using the query tool in ArcGIS 10.5 and the results is shown in Table 4.3.

Table 4.3: Classification of Land Owners According to Development Status

Status	Frequency	%
Developed	318	94.6
Under Construction	1	0.3
Undeveloped	17	5.1
Total	**336**	**100**

Source: Author's Analysis (2019)

Table 4.3 revealed that 94.6% of the parcels were developed while 0.3% and 5.1% were under construction and undeveloped respectively. This development status is largely because the parcels were developed as a housing unite by government and given to civil servants for accommodation before it was later sold out to them for a lease except for about 30 plots which were undeveloped at the point of allocation. This means that most of the parcels in the layout have been developed. This finding disagrees with Atanlode (2014) which revealed that majority (88.9%) of the parcels in Sunshine Estate were undeveloped in Akure South Local Government Area of Ondo State. See figure 4.3 for classification of parcel owners according to development status.

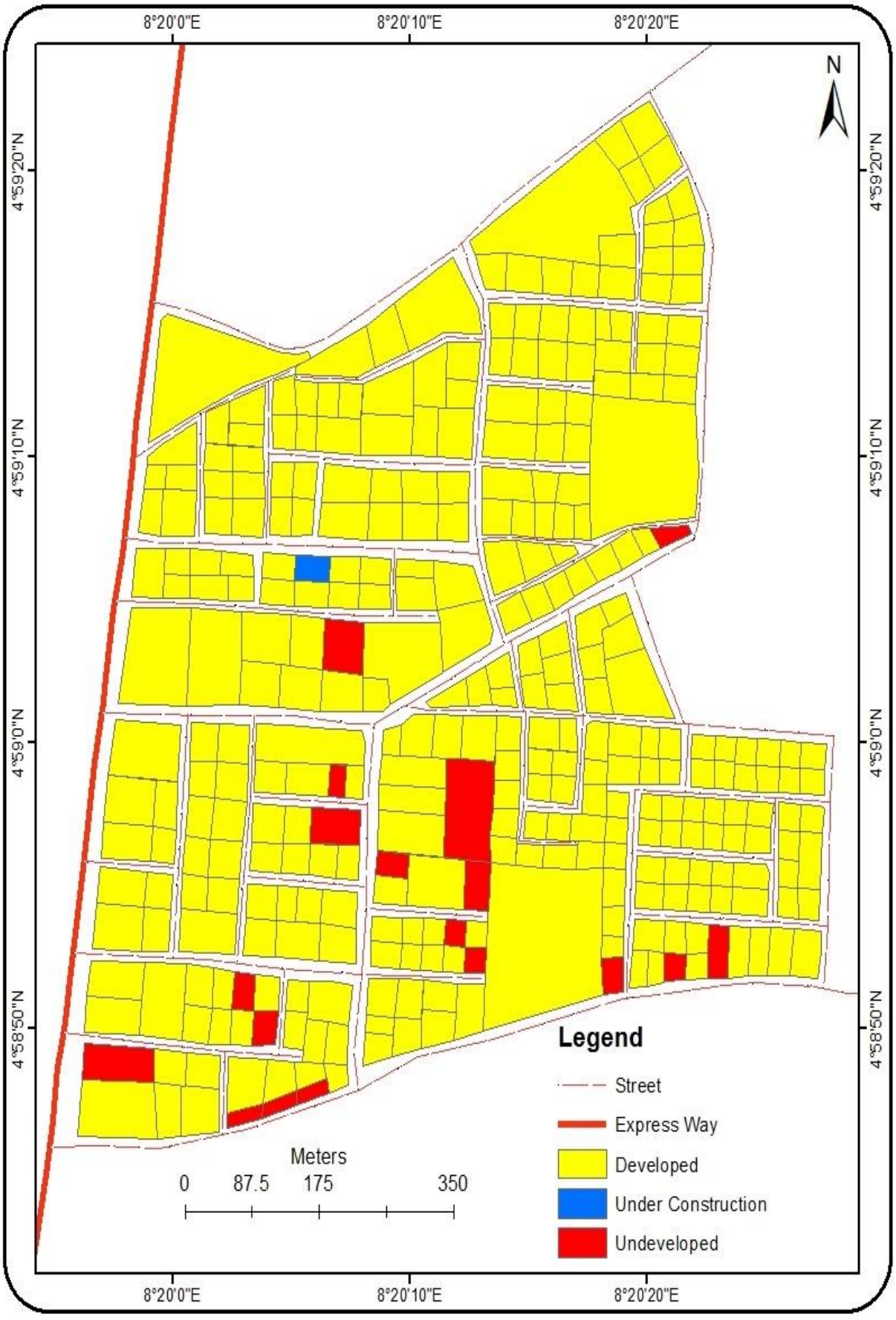


Figure 4.3: Classification of Land Owners According to Development Status
Source: Author's Analysis (2019)

4.2.4 Classification of land parcels according to density

Planning standards for residential development stipulates that a high density parcel so designated shall not be less than 750m^2 in size and the type of development expected shall be a block of flats or studio apartment with a building coverage of 60%, it shall have a maximum of 4 floors and just a structure shall be contained. A medium density shall have a land size greater than 750m^2 and not less than 1500m^2, the development type shall be block of flats/ terrace studio apartment, 50% building coverage and shall contain a maximum floor of 3 and a single structure shall be allowed. A low-density plot also shall have a land size of not less than15000m^2 and not greater than 2500m^2. The building coverage shall be 40% with bungalows, duplexes and Maisonette as development type and the number of floors shall be a maximum of 2 suspended floors excluding a penthouse and the number of structures shall be 2 (made up of 1 principal and 1 ancillary). A special residential parcel on the other hand shall have a land size of or greater than 5000m2 and a development specification of luxury flats, service flats; mixed development with a building coverage of 40%. The numbers of floors allowed shall be 4-6 maximum and number of structures allowed shall be 1 (CRBR, 1987). See Table 2.1 and 3.1 for planning standards for residential development in the study area.
Classification of parcels according to density was carried out using the query builder on the geodatabase in ArcGIS 10.5. Information concerning the distribution of the parcel according to density was retrieved and the results are presented in Table 4.4.

Table 4.4: Classification of Parcel According to Density

Density	Frequency	%
High	17	5.1
Medium	213	63.4
Low	69	20.5
Special	37	11.0
Total	**336**	**100**

Source: Author's Analysis (2019)

According to Table 4.4 there are 5.1% high density parcels, 63.4% medium density parcels, 20.5% low density parcels and 11% special residential parcels in the study area. The layout is predominantly a medium density parcels for residential purpose as designed in the master plan. This finding is in line with Olatunde, Igbokwe, Olatunde and Adebayo (2014) which revealed that medium density residential parcel use accounts for the majority (56.99%) of the built-up area of Auchi Urban centre Edo State. See Figure 4.4 for classification of parcel owners according to density.

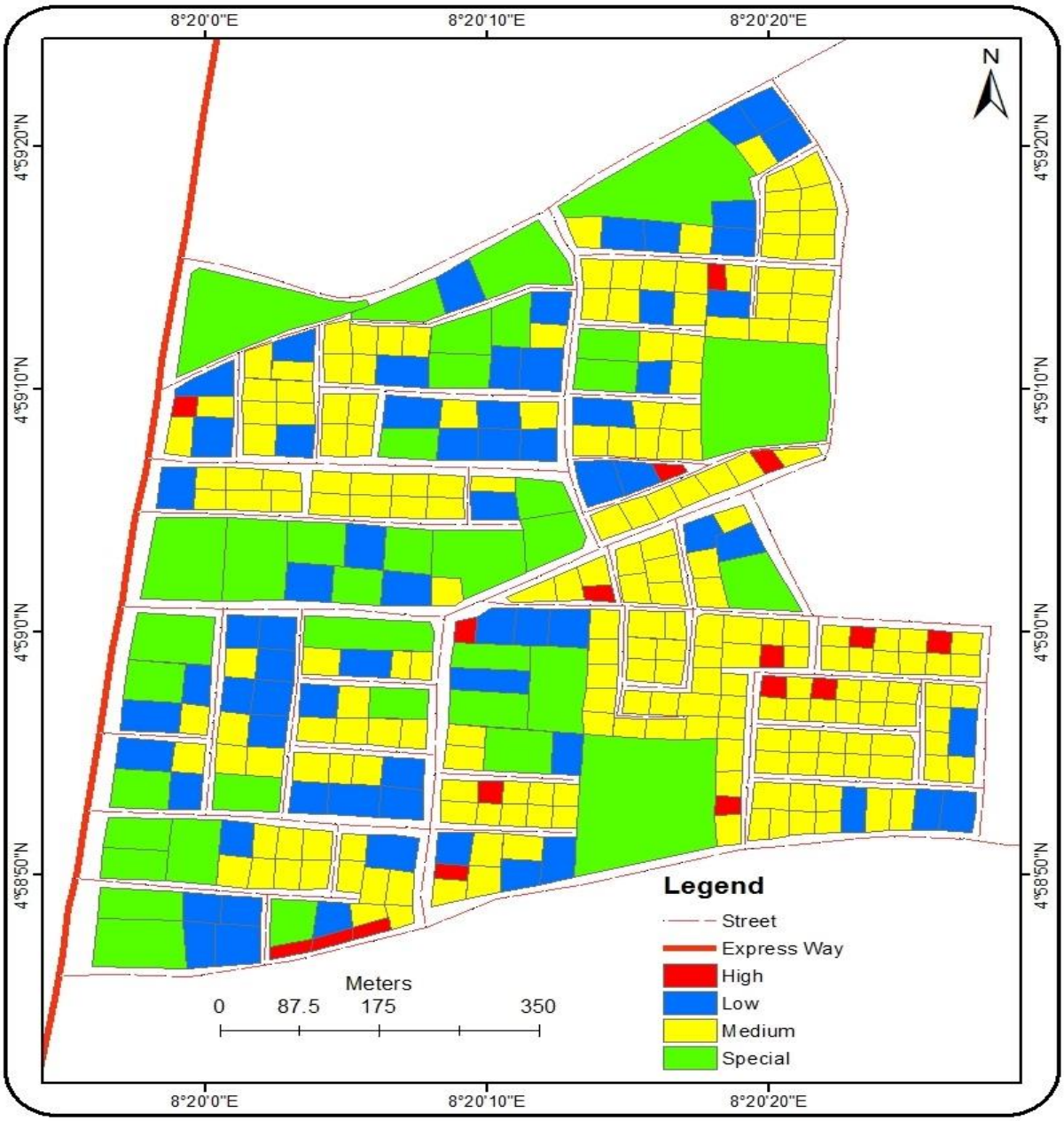


Figure 4.4: Classification of land parcel according to density
Source: Author's Analysis (2019)

4.3 Land uses in the study area

The proposed land use and the existing land use information of the estate retrieved from the database in Arc GIS 10.5 shows the changes detected as presented in Table 4.5.

Table 4.5: Proposed and Existing Land Uses in the Study Area

Land Use	1973 (Proposed)	%	2020 (Existing)	%	% Changed	Trend
Commercial	24	7.14	31	9.2	2.06	+
Mixed	0	0.00	36	10.7	10.7	+
Public	1	0.30	1	0.30	0.00	Neutral
Residential	311	92.56	268	79.8	12.76	-
Total	**336**	**100**	**336**	**100**		

Source: Field survey (2019)

Table 4.5 revealed that 92.56% of the parcels was proposed to be residential while 7.14% and 0.30% were to be for commercial and public uses respectively. But on the contrary, the study area currently has about 79.8% of the parcels being used for residential purposes, 9.2% for commercial purpose while 10.7% for mixed land use respectively. There was no land with mixed use in the proposed layout but the findings show that about 11% of the land is currently used for that purpose, public land use remained unchanged throughout the study period. This shows that the study area is essentially a residential area. It implies also that there is a gradual change of residential land use to commercial and other uses in the study area. This change of use is majorly attributed to population growth which is accompanied with increase in demand for goods and services in the study area. Bribery and corruption and Inadequate field-based Supervision are some of the factors responsible for the violations according to the respondents. This finding is in agreement with the findings of Bogoro and Samson (2014) which revealed that there were 51.5% change of parcel use in millennium quarters Yelwa, Bauchi State. Figure 4.5 presents the proposed and existing land uses in the study area while Figure 4.6 shows the parcels that violated land use plan in the study area.

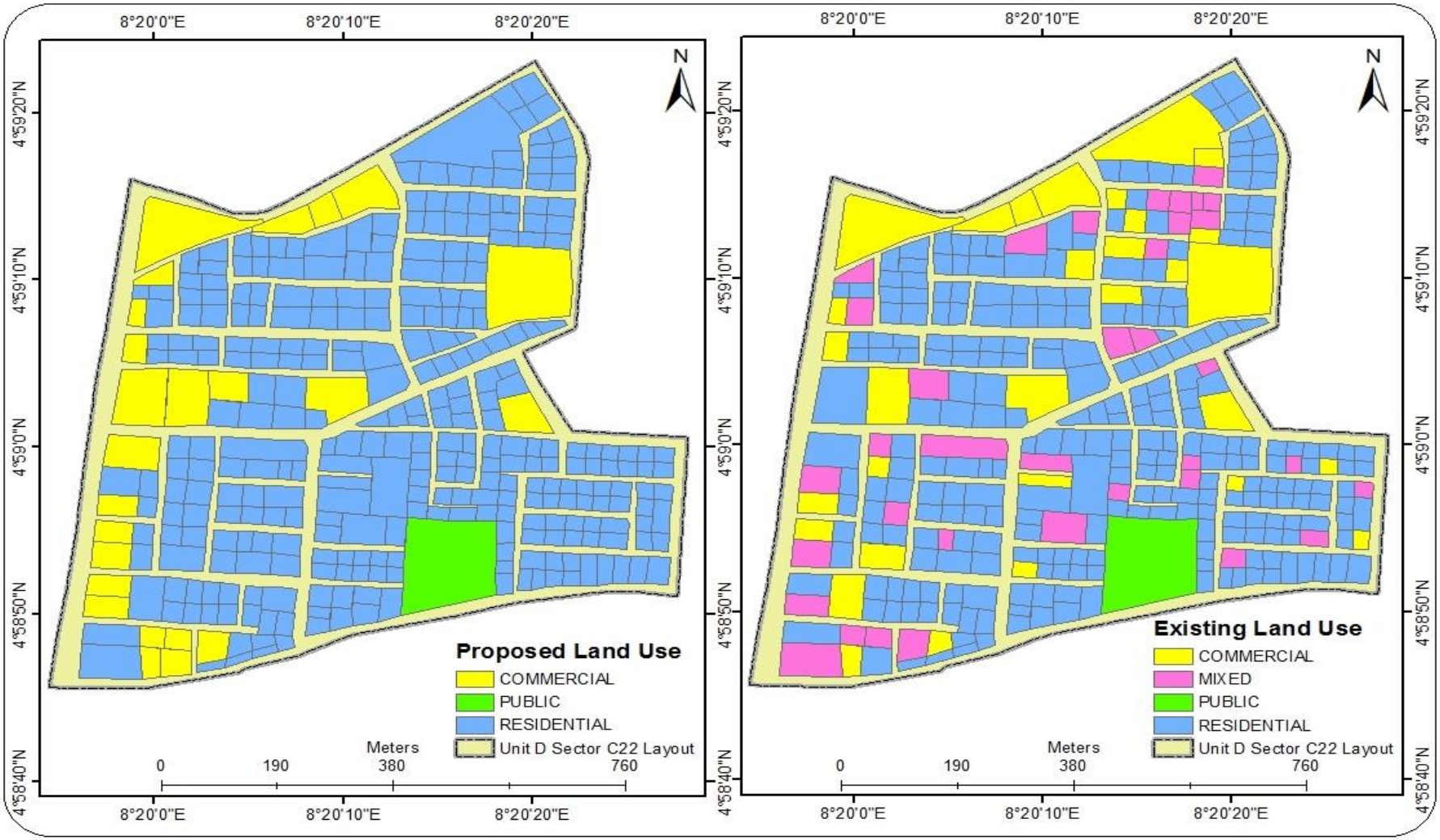


Figure 4.5: Proposed and existing land uses in the study area
Source: CRSMLH (1973)

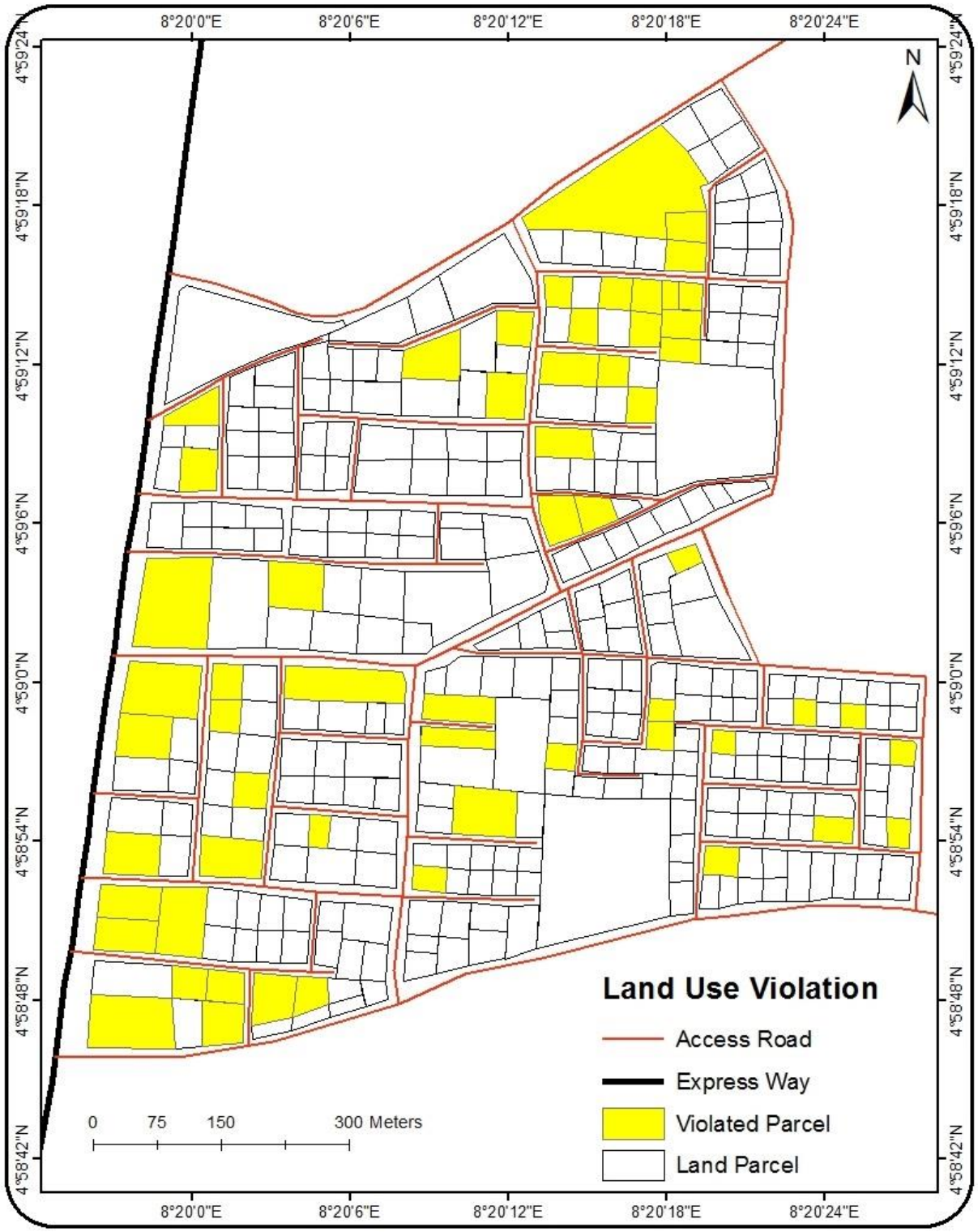


Figure 4.6: Parcels of land where owners violates land use plan in the study area
Source: Author's Analysis (2019)

4.4 Level of Compliance to Development Control

This section presents the results and discussion on the level of adherence to development control standards in the study area. Level of compliance to standard road width, setbacks and building density of low, medium, high and special densities were determined. The minimum setback of each building is determined by its parcel's density and general building line along the street corridor. The front, side and rear setbacks are the major items that determine setback violations. Adherence to Setback standards enhances proper circulation and ventilation while non-compliance generates multiple problems such as parking problem, poor ventilation and disease outbreak control, fire outbreak control.

4.4.1 Road encroachment

According to development control standards in Nigeria, every high way has a right of way of 45 meters while access roads have 10 meters right of way. Therefore, a 45m buffer was generated around the express way (Murtala Muhammed way) while 10m buffer was created around the access roads in the study area. The structures and Parcels that fell within the buffer zones were identified as encroachments and are presented in Table 4.7.

Table 4.6: Encroachment on Express Way and Access Road's Right of Way

	No Structures	**%**
Express way violation	13	2.7
Access road violation	221	45.2
Non violation	255	52.1
Total No. of Structures adjoining Road Network	**489**	**100**

Source: Author's Analysis (2019)

The result shows that about 2.7% of built structures in the study area had encroached upon the right of way of the express way while 45.2% of the built structures have encroached upon the right of way of access road in the study area. Corrupt practices, Lack of/no public awareness and violations of building density are largely responsible for the encroachment into the express and access roads. This implies that the provision made in the layout plan to accommodate bitumen portion, walkway, drainage, utility lines and on-street parking in most sections of the roads in the study area have been encroached upon. This can reduce free flow of traffic in the study area. This finding is in line with the findings of Dawaba, Yusuf and Akpu (2018) which revealed that more than half (55.1%) of the buildings encroached into roads in Minna metropolis. Figures 4.7 and 4.8 illustrate built structures that have encroached into the standard width of the express way and access road respectively.

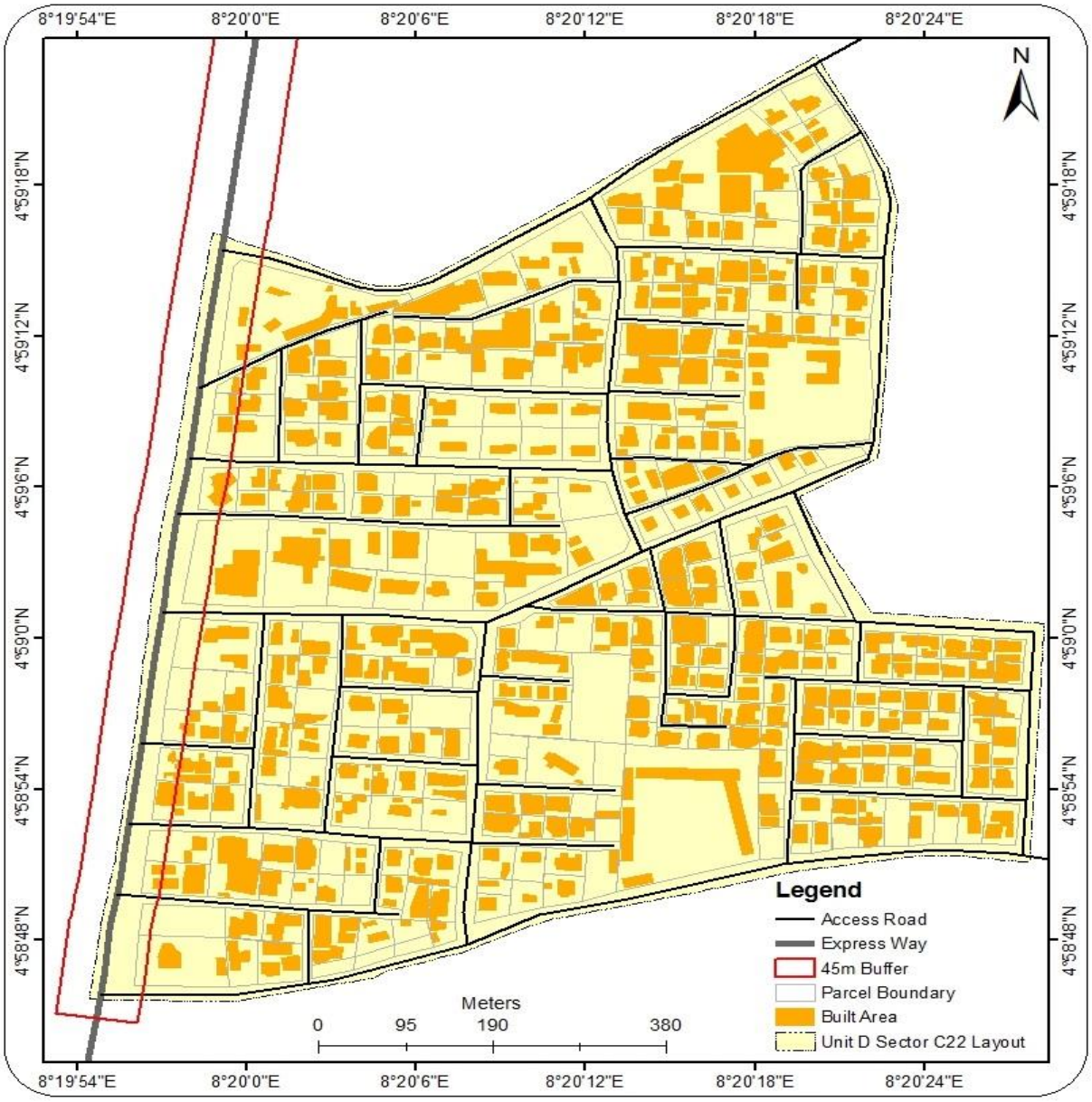


Figure 4.7: Encroachment on expressway
Source: Author's Analysis (2019)

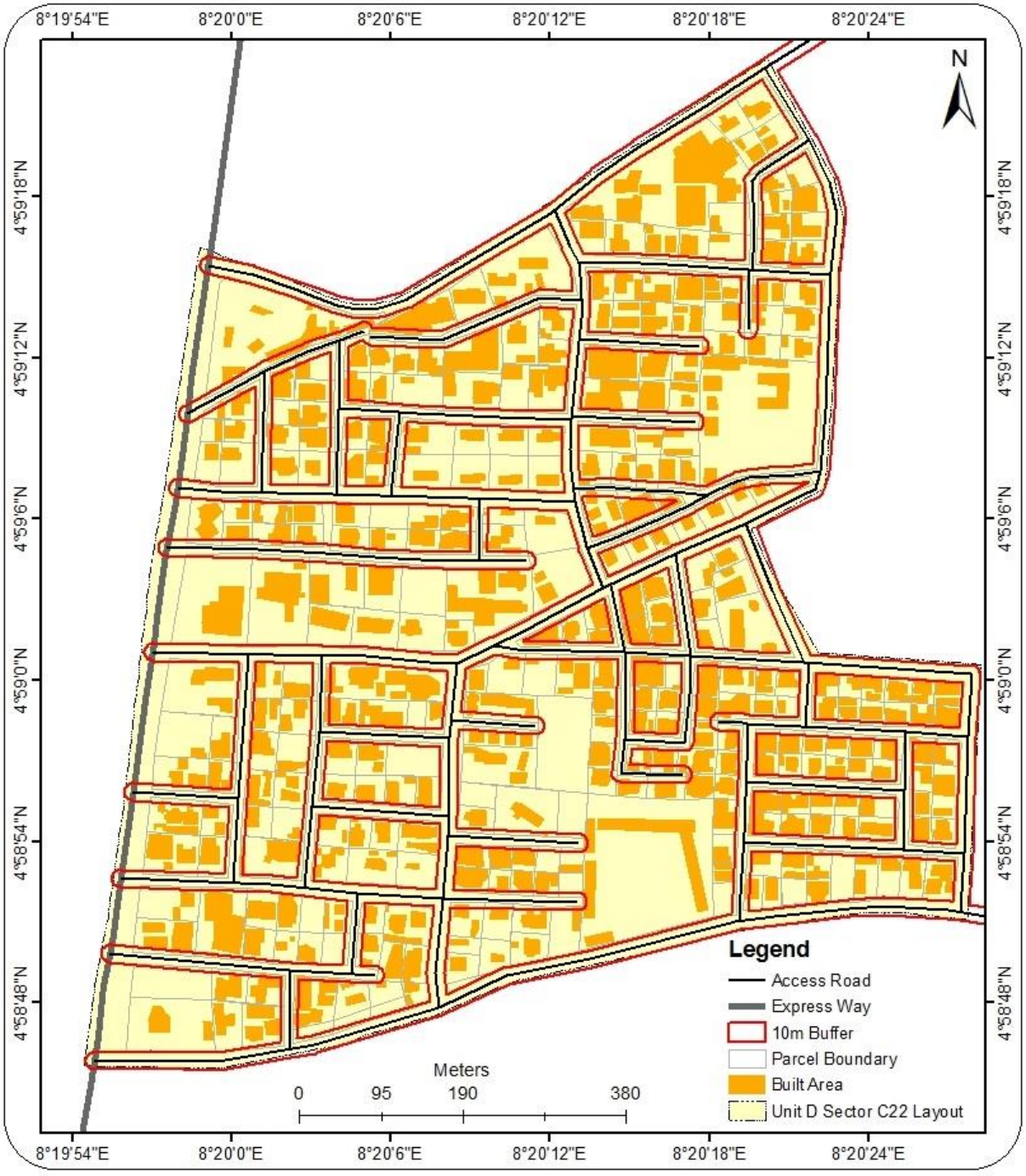


Figure 4.8: Encroachment on access road
Source: Author's Analysis (2019)

4.4.2 Building density violations

The building density of a parcel determines the portion of parcel that can be developed and the type of buildings to be developed. It is the allowable development coverage ratio for every parcel of land (Table 2.1). The four types of densities identified are low, medium, high and special densities. The parcel use regulations in the State provides that a low-density parcel should be

between 1500m^2 and 2,500m^2, medium density is to be between 750m^2 and 1500m^2, high density parcel is ≤750m^2 while special residential parcel is above 2500m^2 (CRBR, 1987). Development control standards stipulates that high and medium density parcels should have a building density of 60% and 50% respectively while low and special density parcels should have a building density of 40% (Table 2.1). Table 4.7 shows the number of overdeveloped parcels according to development control standards. The analysis revealed that there is over development of parcels in the study area.

Table 4.7: Building Density (Development) Violation

Density Types	Total Violations	Total Parcels	%
Low density	23	69	33.3
Medium Density	75	213	35.2
High Density	5	17	29.4
Special Parcel	12	37	32.4
Total	**115**	**336**	**34.2**

Source: Author's Analysis (2019)

Table 4.7 indicates that out of 69 low density parcels in the layout, 33.3% violated building density standards. Similarly, 35.2% of the medium density parcels were overdeveloped, 29.4% of the high-density parcels and 32.4 % of the special density parcels referred to in Figure 4.9 as Special R. Density Building Coverage were also overdeveloped in the study area. In general, over 34% of the parcels in the layout were overdeveloped. Overdevelopment of parcel in this area is largely due to deviations from the approved building plans where additional structures are erected within the parcel to accommodate more household members and for other purposes. Respondents were of the opinion that Corrupt practices and Lack of/no public awareness were largely responsible for the encroachment. This finding is in line with that of Dawaba, Yusuf and Akpu (2018) which revealed that Overdevelopment of parcels was common in Bosso, Tunga and F-Layout of Minna metropolis. This finding also agrees with that of Bogoro and Samson (2014) which revealed that 90% of the development in millennium quarters Yelwa, Bauchi Sate was overdeveloped. See Figure 4.9 for overdeveloped parcels in the study area.

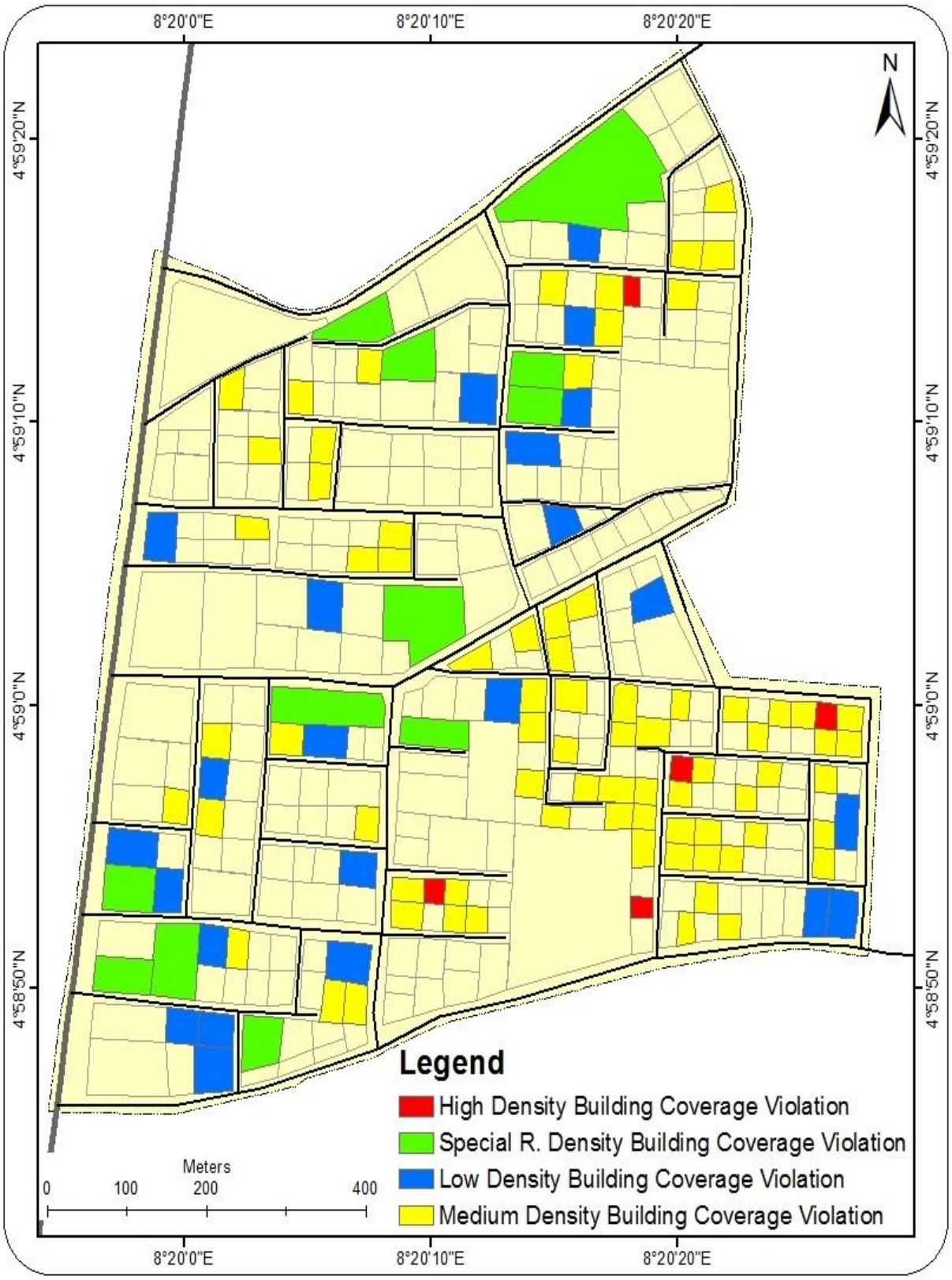


Figure 4.9: Overdeveloped parcel
Source: Author's Analysis (2019)

4.4.3 Setback violations of high-density parcels

These are various development control standards that are meant to regulate and control development in high density parcels. Building setback is a line which establishes a definite point beyond which the foundation of a building in high density parcels shall not extend. For high density parcels, development control standard stipulates that front setback is 6m while that of rear, right and left setbacks are 3m each (Table 3.1). Table 4.7 shows that building density violation was 29.4% in high density parcels. Table 4.8 shows the results of query operations conducted based on the stipulated development control standards to ascertain the number of building units that violated the setback standards on high density parcel in the study area.

Table 4.8: Setback Violations of High-Density Parcels

Standard	**<6m**	**<3m**	**<3m**	**<3m**
Type of Violation	Front Setback	Rear Setback	Right Setback	Left Setback
Total Housing Units	17	17	17	17
Total Violation	12	10	13	10
Percentage	**70.6**	**58.8**	**76.5**	**58.8**

Source: Author's Analysis (2019)

The results as shown in Table 4.8 revealed that right setback was the highest form of violation with 76.5% of building units contravening the stipulated setback standard in the area. Front setback had 70.6% violations while 58.8% housing units on high density residential parcels violated rear and left setback standards each. Majority of the attached buildings are extension for car parks and houses for domestic animals. The residents were of the opinion that bribery and corruption, Lack of/no public awareness and Inadequate field-based Supervision are some of the factors responsible for the violations. The result agrees with the findings of Amedu (2017) which showed that front setback violation (72%) was common on high density parcels in Badawa Layout, Kano metropolis. Figures 4.10 to 4.13 shows the structures that violated setback standards on high density parcels.

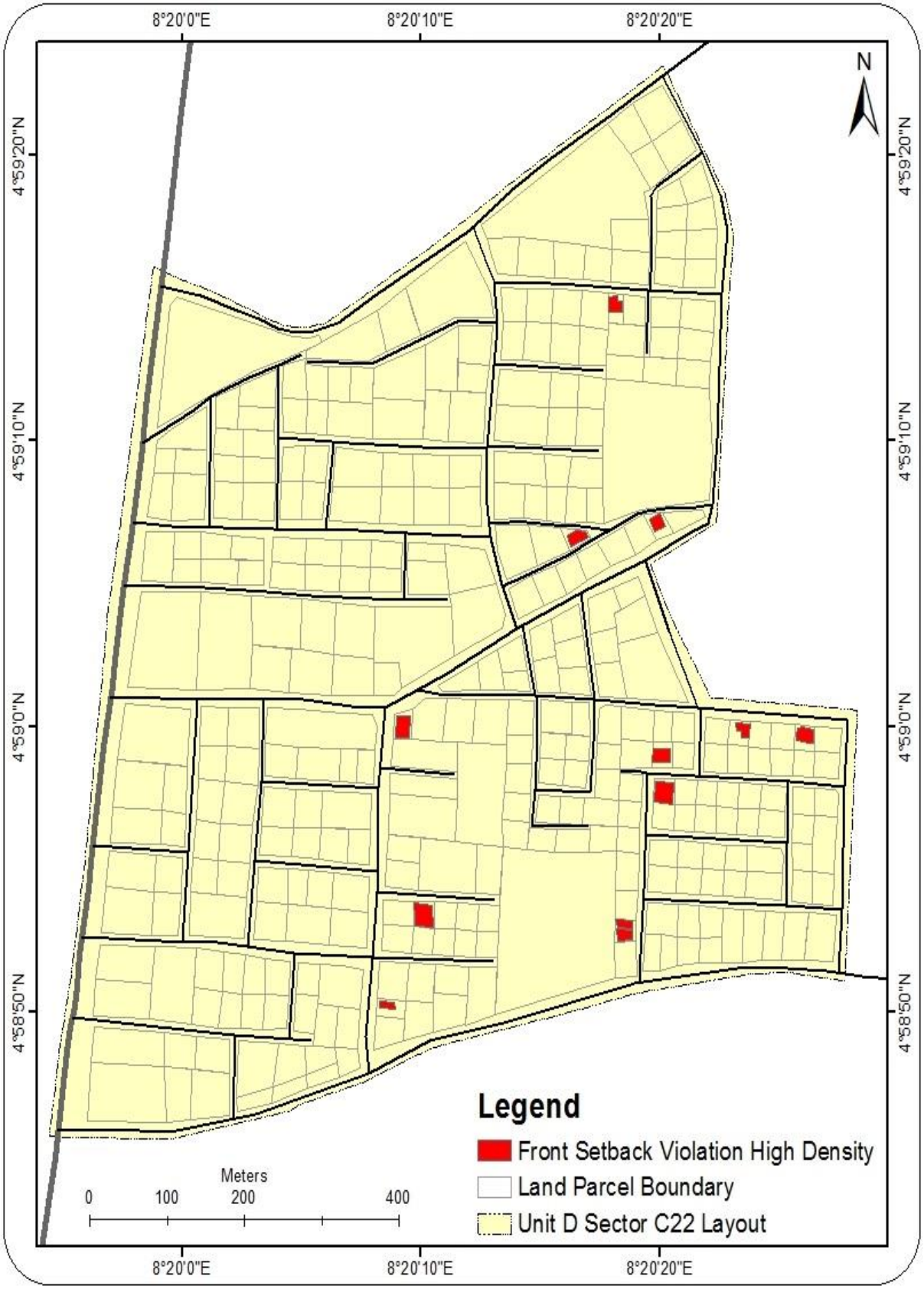
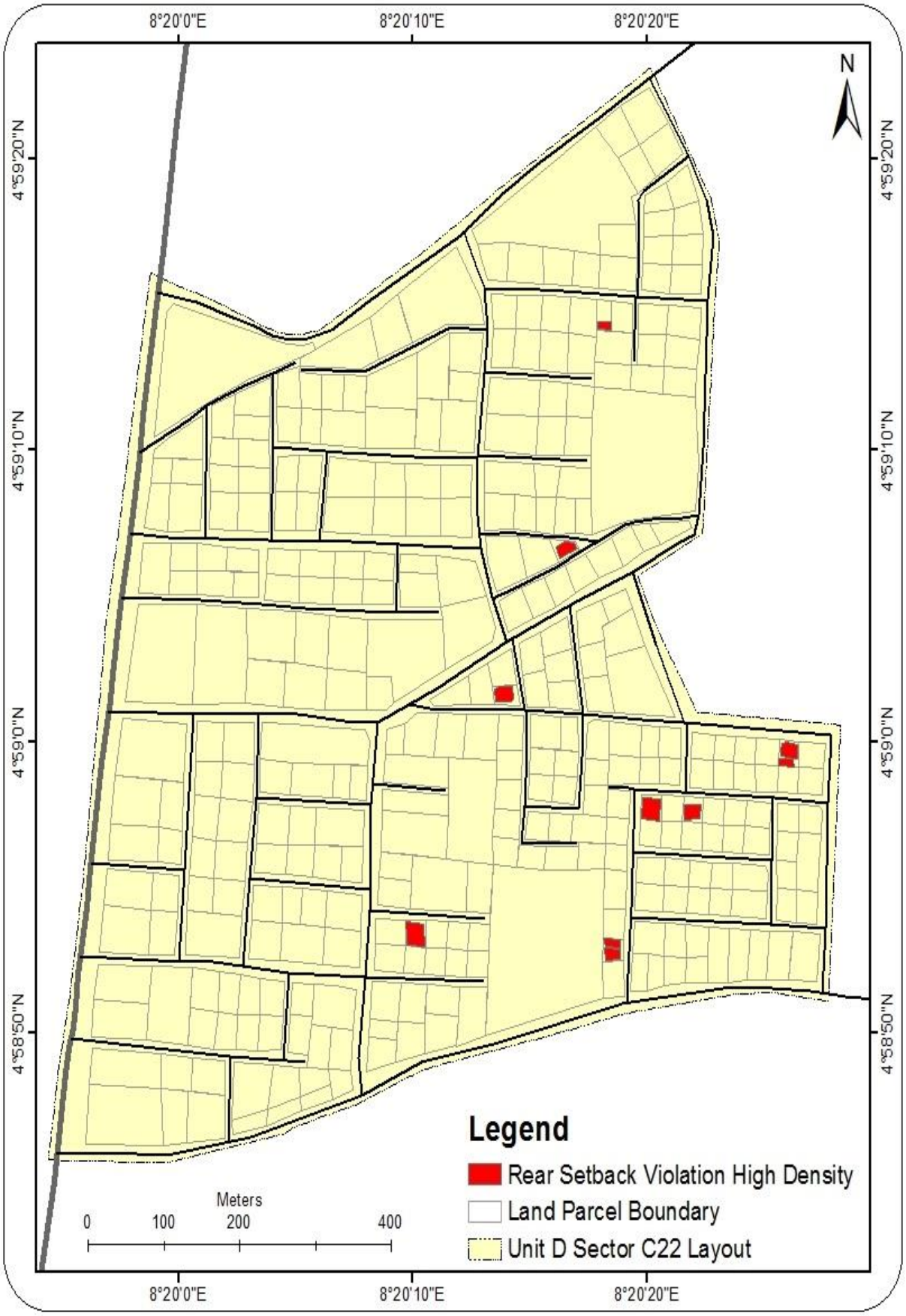


Figure 4.10: Front setback violations of high-density parcels

Source: Author's Analysis (2019)


8°20'0"E
8°20'10"E
8°20'20"E
4°59'20"N
4°59'10"N
4°59'0"N
4°58'50"N
N
Legend
Rear Setback Violation High Density
Land Parcel Boundary
Unit D Sector C22 Layout
Meters
0
100
200
400

x

Figure 4.11: Rear setback violations of high-density parcels
Source: Author's Analysis (2019)

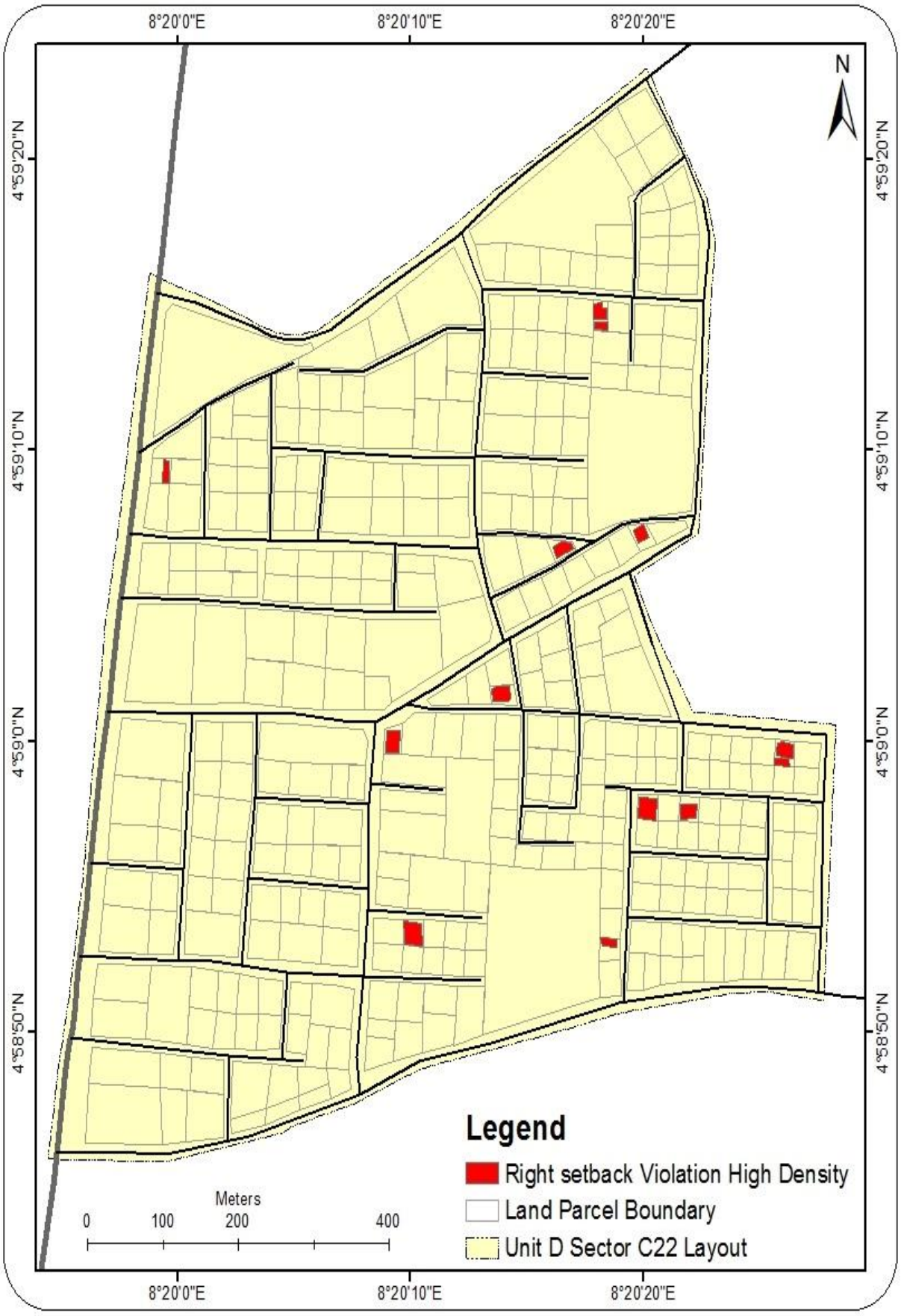

8°20'0"E
8°20'10"E
8°20'20"E
4°59'20"N
4°59'10"N
4°59'0"N
4°58'50"N
N
Legend
Right setback Violation High Density
Land Parcel Boundary
Unit D Sector C22 Layout
Meters
0
100
200
400

Figure 4.12: Right setback violations of high-density parcels
Source: Author's Analysis (2019)

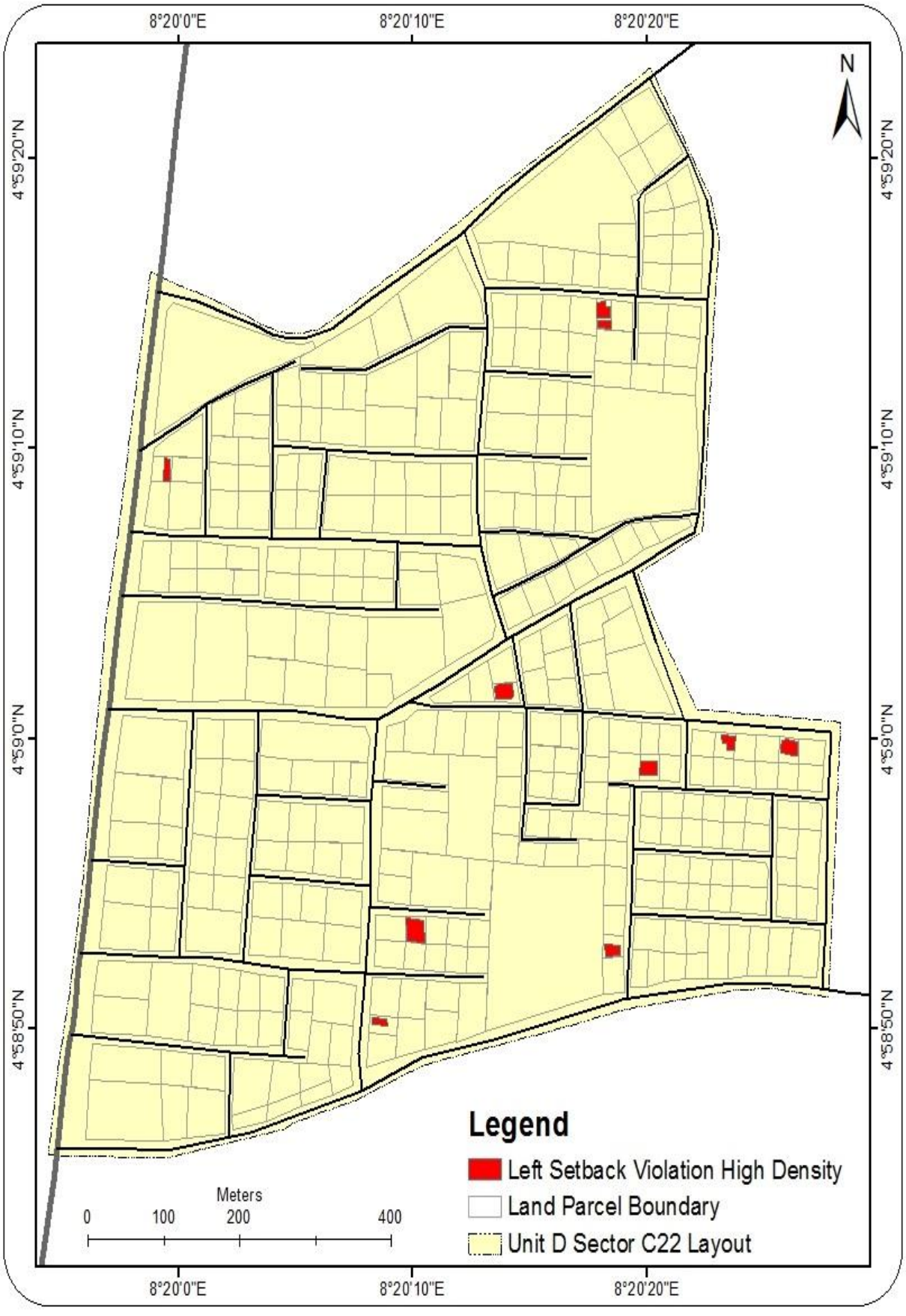

8°20'0"E
8°20'10"E
8°20'20"E
4°59'20"N
4°59'10"N
4°59'0"N
4°58'50"N
N
Legend
Left Setback Violation High Density
Land Parcel Boundary
Unit D Sector C22 Layout
Meters
0
100
200
400

Figure 4.13: Left setback violations of high density parcels
Source: Author's Analysis (2019)

4.4.4 Setback violations of medium density parcels

These are various development control standards that are meant to regulate and control development in medium density parcels. Building setback is a line which establishes a definite point beyond which the foundation of a building in a medium density parcel shall not extend. For medium density parcels, development control standard stipulates that front setback should not be less than 6m while that of rear, right and left setbacks should not be less than 3m each. Table 4.7 shows that building density violation was the highest with 35.2% in medium density parcels, the results are presented in Table 4.9.

Table 4.9: Setback Violation of Medium Density Parcel

Standard	**<6m**	**<3m**	**<3m**	**<3m**
Type of Violation	Front Setback	Rear Setback	Right Setback	Left Setback
Total	268	268	268	268
Total Violation	145	137	126	142
Percentage	**54.10**	**51.12**	**47.01**	**52.99**

Source: Author's Analysis (2019)

The results in Table 4.9 reveal that front setback was the highest form of violation with 54.1% of building units contravening the stipulated setback standard, followed by left setback with 53% violations. About 51.1% and 47% housing units on medium density residential parcels violated rear and right setback standards respectively. Most of the occupants had extra buildings erected in their parcels to accommodate more household sizes. Bribery and corruption and Inadequate field-based Supervision are some of the factors responsible for the violations according to the residents. This is similar to the finding of Amedu (2017) which revealed that front setback was the highest form of violation (73%) in medium density area in Badawa layout, Kano metropolis. Figures 4.14 to 4.17 shows the structures that violated setback standards on medium density parcels.

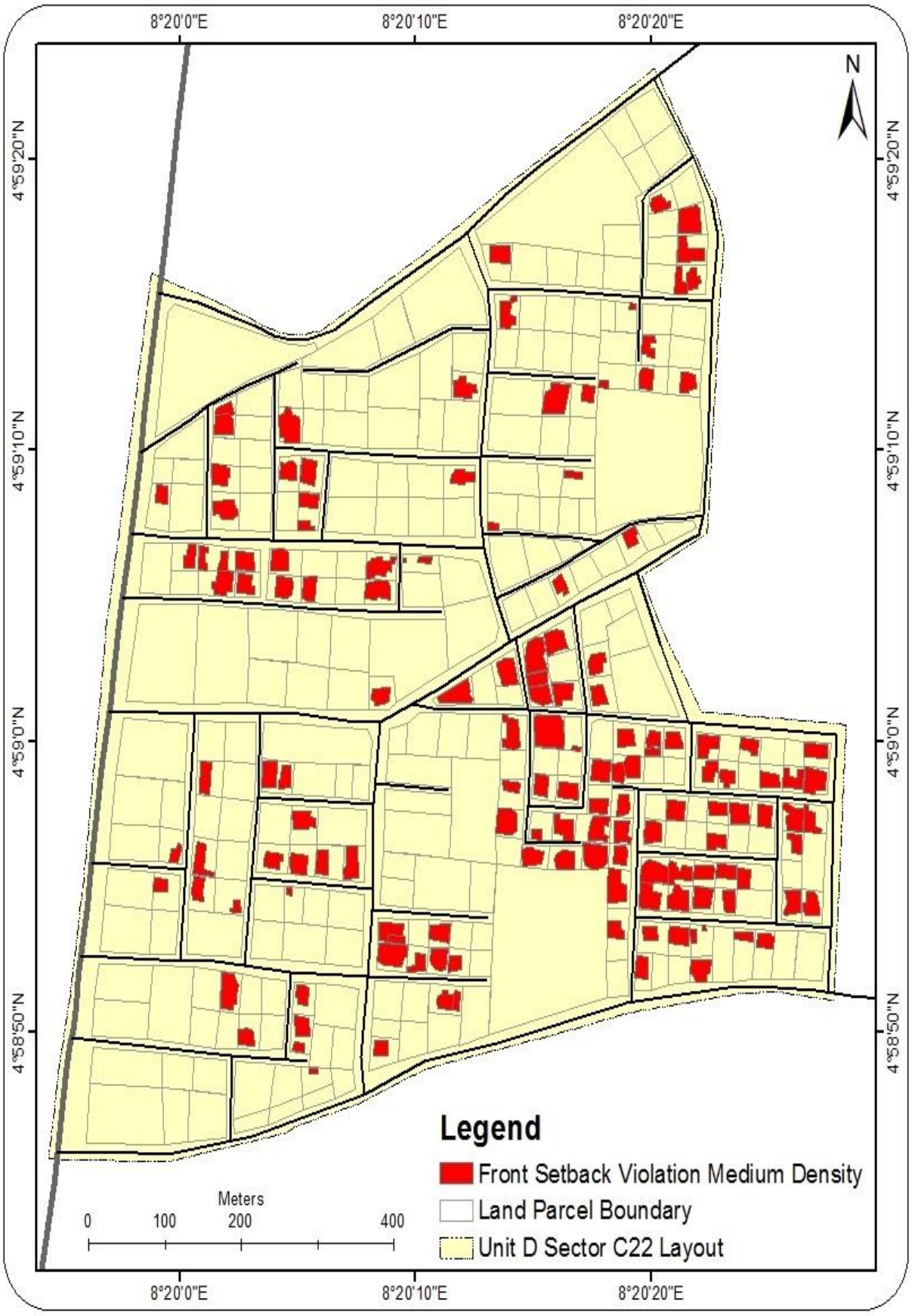

8°20'0"E
8°20'10"E
8°20'20"E
4°59'20"N
4°59'10"N
4°59'0"N
4°58'50"N
N
Legend
Front Setback Violation Medium Density
Land Parcel Boundary
Unit D Sector C22 Layout
Meters
0
100
200
400

Figure 4.14: Front setback violations of medium density parcels
Source: Author's Analysis (2019)

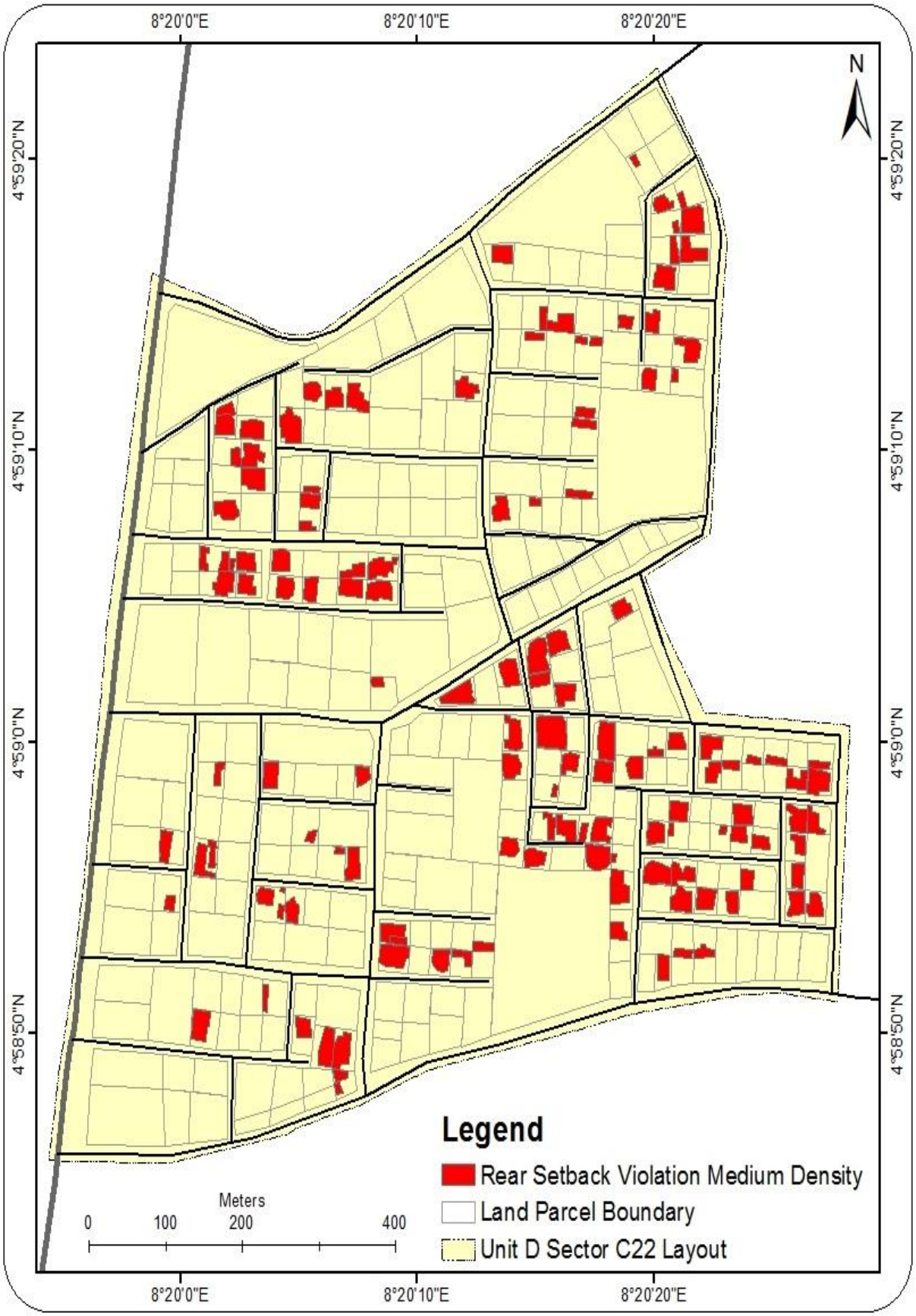

8°20'0"E
8°20'10"E
8°20'20"E
4°59'20"N
4°59'10"N
4°59'0"N
4°58'50"N
N
Legend
Rear Setback Violation Medium Density
Land Parcel Boundary
Unit D Sector C22 Layout
Meters
0
100
200
400

Figure 4.15: Rear setback violations of medium density parcels
Source: Author's Analysis (2019)

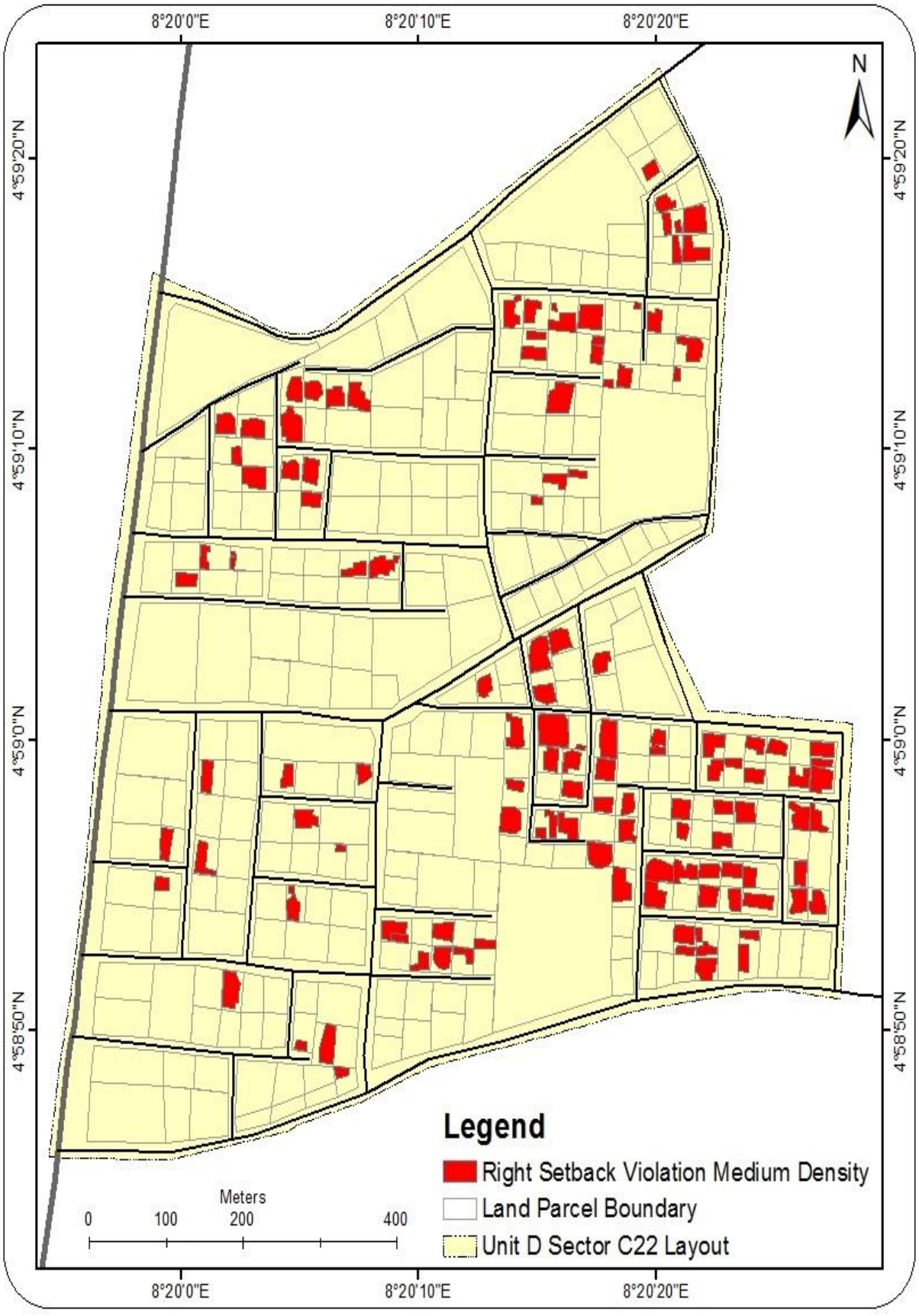

8°20'0"E
8°20'10"E
8°20'20"E
4°59'20"N
4°59'10"N
4°59'0"N
4°58'50"N
N
Legend
Right Setback Violation Medium Density
Land Parcel Boundary
Unit D Sector C22 Layout
Meters
0
100
200
400

Figure 4.16: Right setback violations of medium density parcels
Source: Author's Analysis (2019)

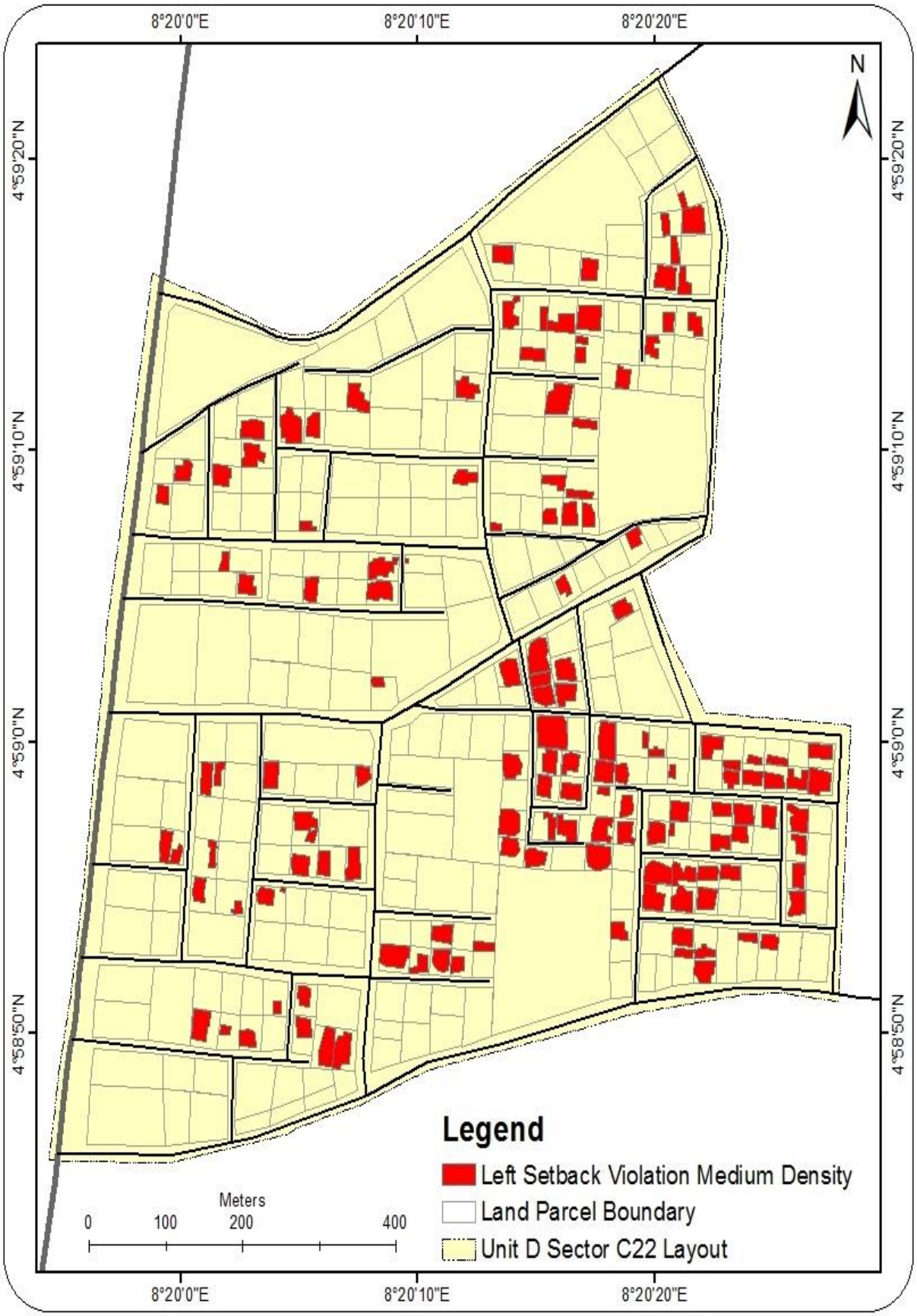

8°20'0"E
8°20'10"E
8°20'20"E
4°59'20"N
4°59'10"N
4°59'0"N
4°58'50"N
N
Legend
Left Setback Violation Medium Density
Land Parcel Boundary
Unit D Sector C22 Layout
Meters
0
100
200
400

Figure 4.17: Left setback violations of medium density parcels
Source: Author's Analysis (2019)

4.4.5 Setback violations of low-density parcels

These are various development control standards that are meant to establish, control and maintain the building structures in low density parcels. For low density parcels, development control standard stipulates that front and rear setbacks should not be less than 6m and 3m respectively while the minimum distance from the boundary line from the right and left is 3.5m (Table 3.1). Query operation was carried out in ArcGIS 10.5 to obtain information about the number of building units on low density parcels that violated setback development control standards in the study area. Table 4.7 shows that building density violation was 33.3% in medium density parcels. The results are given in Table 4.10.

Table 4.10: Setback Violations of Low-Density Parcels

Standard	**<6m**	**<3m**	**<3.5m**	**<3.5m**
Type of Violation	Front Setback	Rear Setback	Right Setback	Left Setback
Total	113	113	113	113
Total Violation	38	43	31	41
Percentage	33.63	38.05	27.43	36.28

Source: Author's Analysis (2019)

Table 4.10 shows that rear setback was the highest form of violation in low density parcels with 38.1% of building units contravening the stipulated setback standard while right setback had the least violation (27.4%). About 36.3% and 33.6% of the housing units on low density residential parcels violated front and right setbacks standards respectively. This is as a result of building modifications made to accommodate car parks and for animal housing. The residents admit that bribery and corruption and Inadequate field-based Supervision are some of the factors responsible for the violations in the study area. This finding is similar to that of Amedu (2017) which revealed that back setback had the highest form of violations (78%) on low density parcels in Badawa layout, Kano metropolis. Figures 4.18 to 4.21 shows the structures that violated setback standards on low density Parcels.

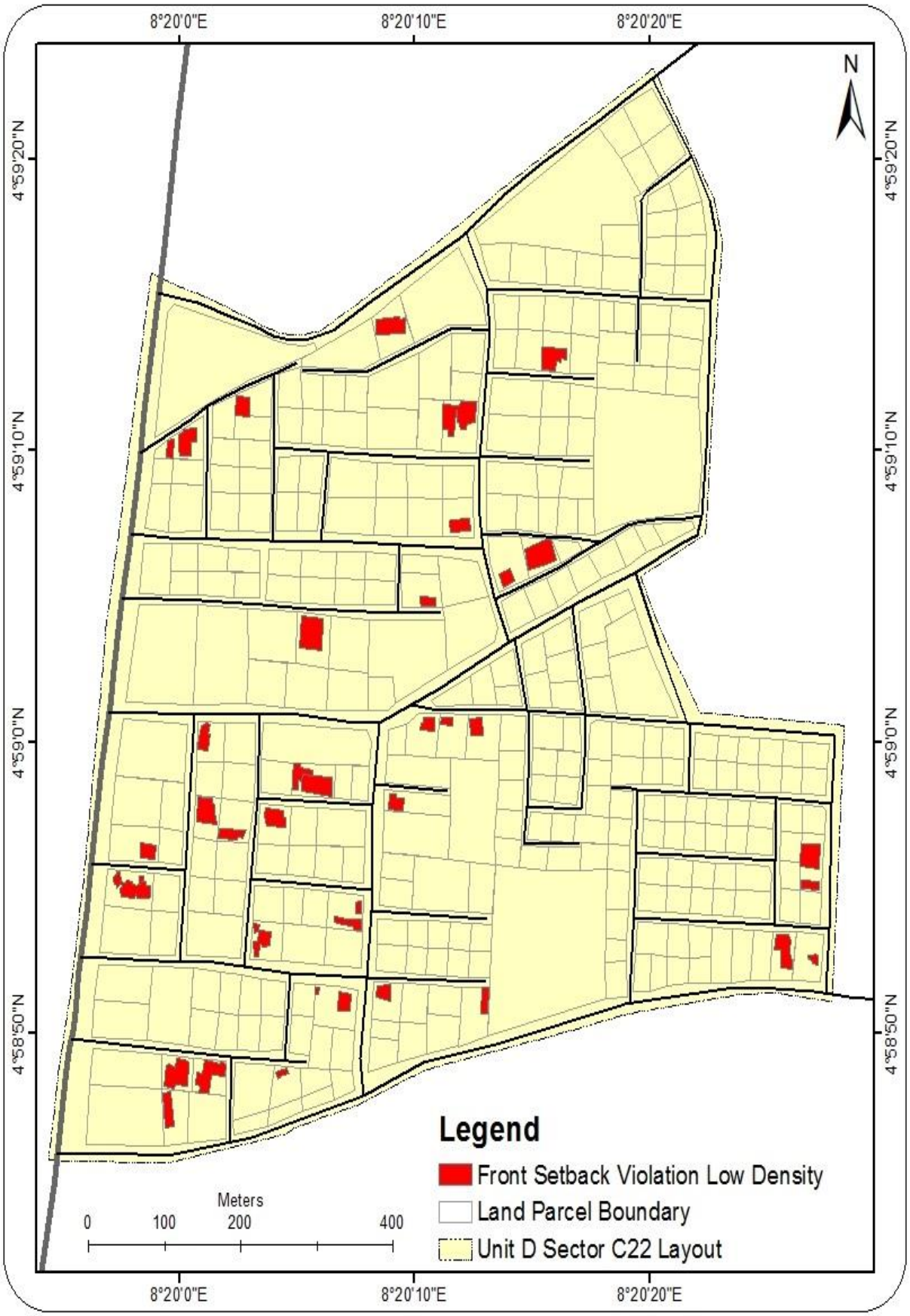

8°20'0"E
8°20'10"E
8°20'20"E
4°59'20"N
4°59'10"N
4°59'0"N
4°58'50"N
N
Legend
Front Setback Violation Low Density
Land Parcel Boundary
Unit D Sector C22 Layout
Meters
0
100
200
400

Figure 4.18: Front setback violations of low-density parcels
Source: Author's Analysis (2019)

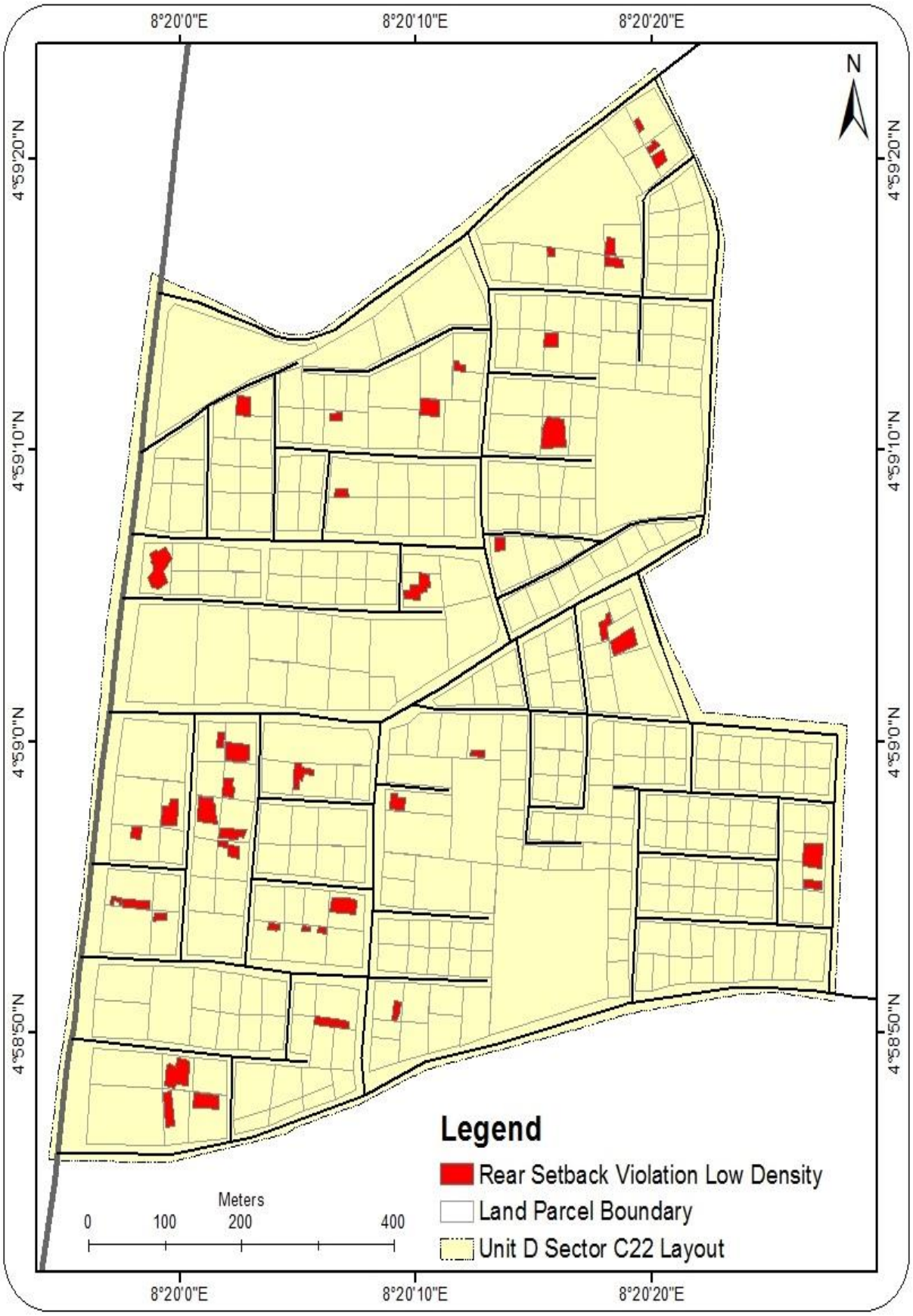

8°20'0"E
8°20'10"E
8°20'20"E
4°59'20"N
4°59'10"N
4°59'0"N
4°58'50"N
N
Legend
Rear Setback Violation Low Density
Land Parcel Boundary
Unit D Sector C22 Layout
Meters
0
100
200
400

Figure 4.19: Rear setback violations of low-density parcels
Source: Author's Analysis (2019)

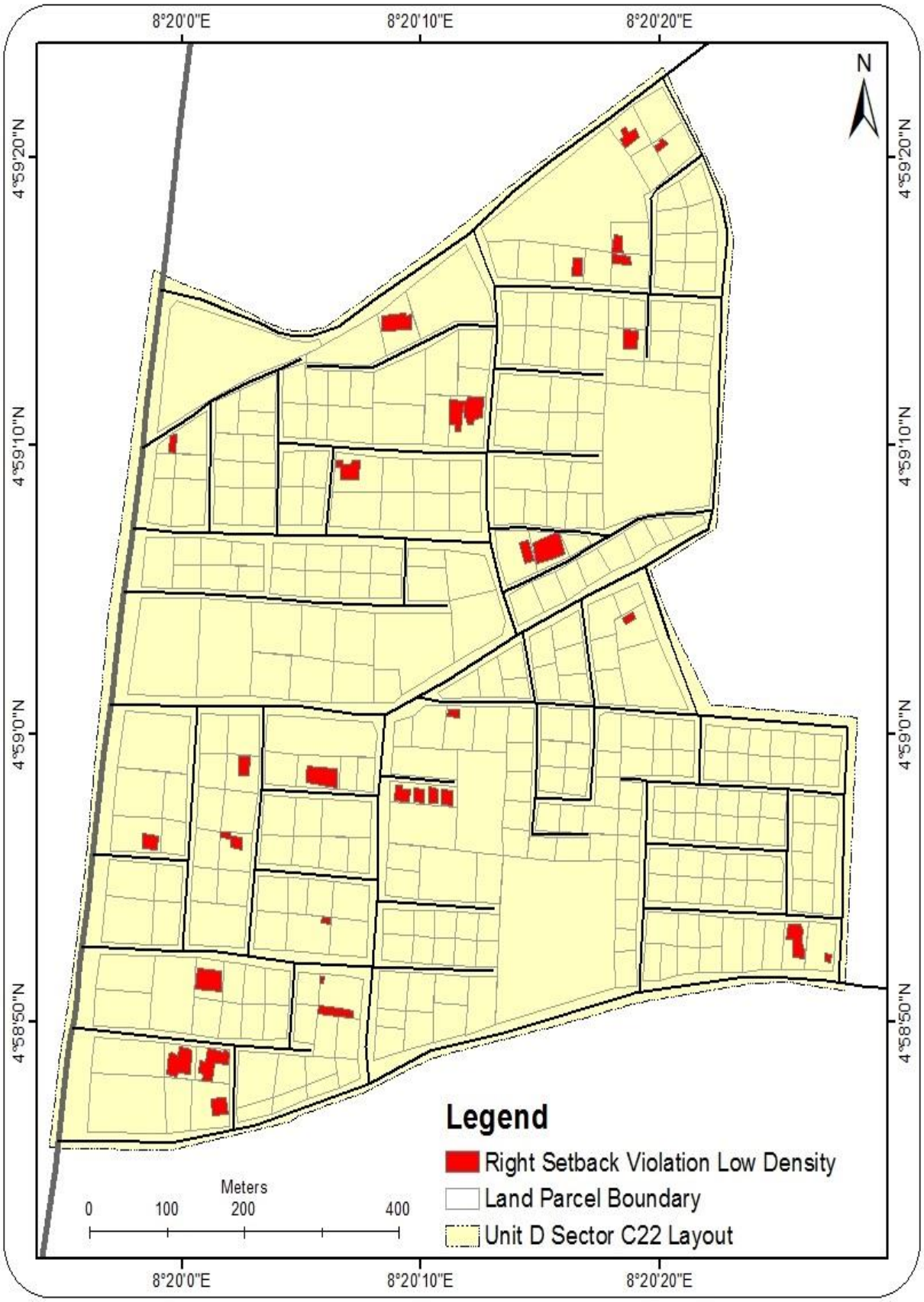
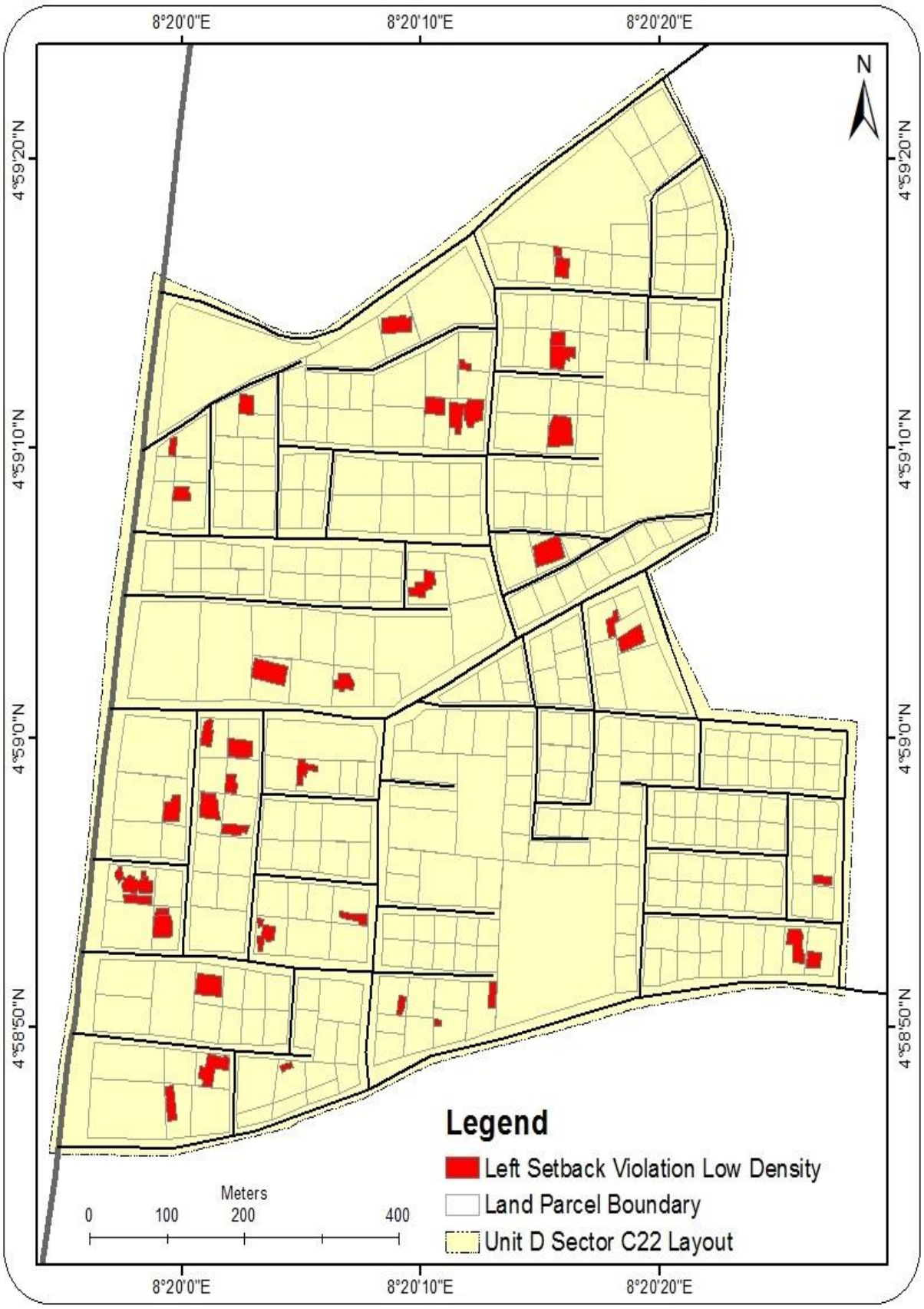

8°20'0"E
8°20'10"E
8°20'20"E
4°59'20"N
4°59'10"N
4°59'0"N
4°58'50"N
N
Legend
Right Setback Violation Low Density
Land Parcel Boundary
Unit D Sector C22 Layout
Meters
0
100
200
400

Figure 4.20: Right setback violations of low-density parcels
Source: Author's Analysis (2019)


8°20'0"E
8°20'10"E
8°20'20"E
4°59'20"N
4°59'10"N
4°59'0"N
4°58'50"N
N
Legend
Left Setback Violation Low Density
Land Parcel Boundary
Unit D Sector C22 Layout
Meters
0
100
200
400

xxx

Figure 4.21: Left setback violations of low density parcels
Source: Author's Analysis (2019)

4.4.6 Setback violations of special residential density parcels

These are various development control standards that are meant to regulate and control development in special residential density parcels. For special residential density parcels, development control standard stipulates that front setback should not be less than 6m while rear, right and left setbacks should not be less than 4m each (Table 3.1). Table 4.7 shows that building density violation was 32.4% in special residential density parcels. Table 4.11 shows the results of query operations carried out based on the stipulated development control standards for special residential parcels to ascertain the number of building units that violated the setback standards in the study area.

Table 4.11: Setback Violations of Special Residential Density Parcels

Standard	**<6m**	**<4m**	**<4m**	**<4m**
Type of Violation	Front Setback	Rear Setback	Right Setback	Left Setback
Total	91	91	91	91
Total Violation	45	36	39	46
Percentage	**49.45**	**39.56**	**42.86**	**50.55**

Source: Author's Analysis (2019)

The results in Table 4.11 shows that left setback was the highest form of violation with 50.6% of building units did not meet the stipulated requirements on setback. About 49.5% structures on special residential density parcels did not observe the requirements of front setback while 42.9% and 39.6% of the housing units violated right and rear setback standards respectively. Majority of the resident revealed that extra rooms were attached for visitors and to accommodate the growing house hold sizes. The violations were blamed on bribery and corruption, Nonchalant and Lack of coordination between the agencies and Lack of appropriate public awareness. See Figures 4.22 to 4.25 for the spatial representation of the structures that violated setback standards on special residential density parcels.

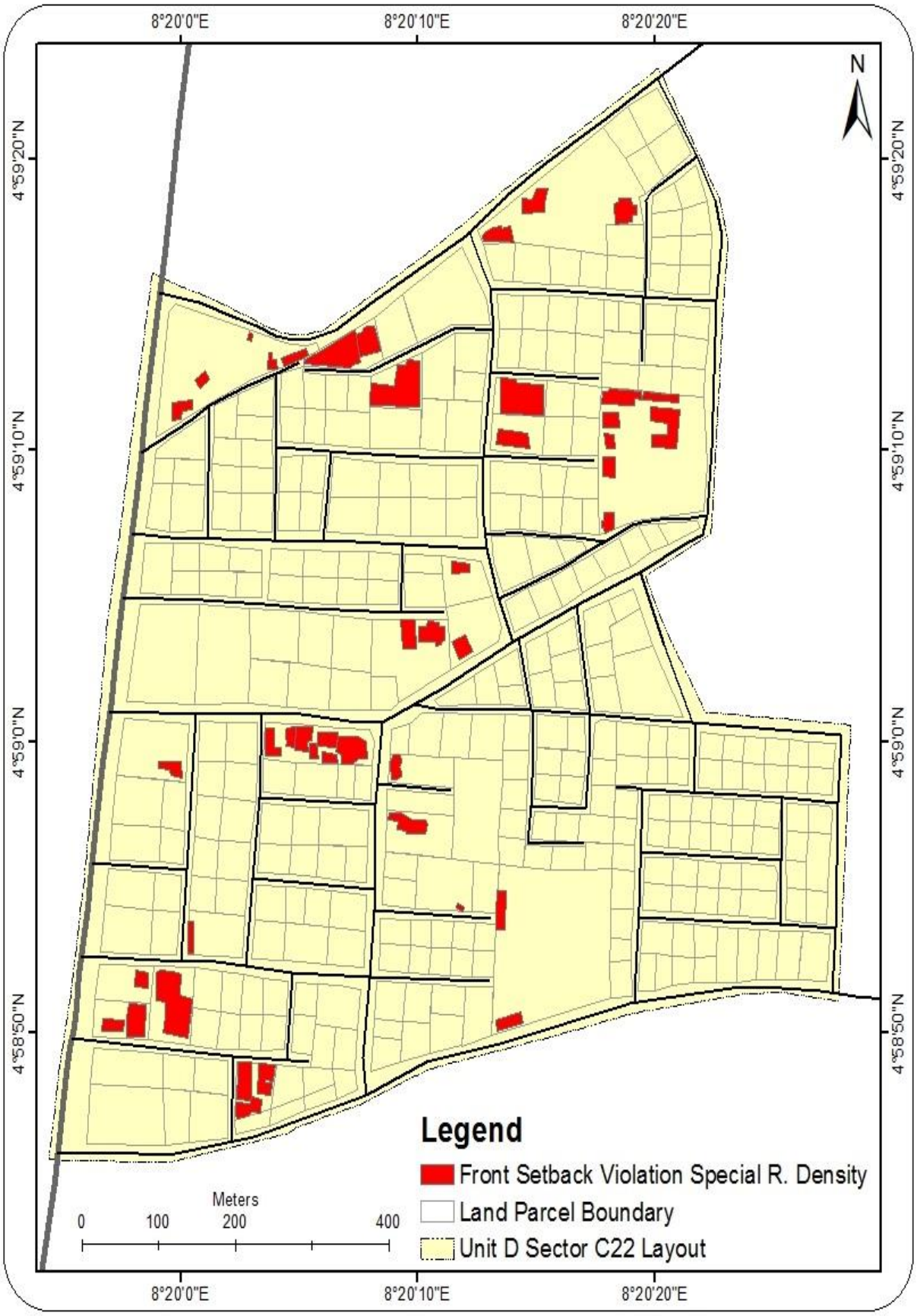

8°20'0"E
8°20'10"E
8°20'20"E
4°59'20"N
4°59'10"N
4°59'0"N
4°58'50"N
N
Legend
Front Setback Violation Special R. Density
Land Parcel Boundary
Unit D Sector C22 Layout
Meters
0
100
200
400

Figure 4.22: Front Setback Violations of Special Residential Density Parcels
Source: Author's Analysis (2019)

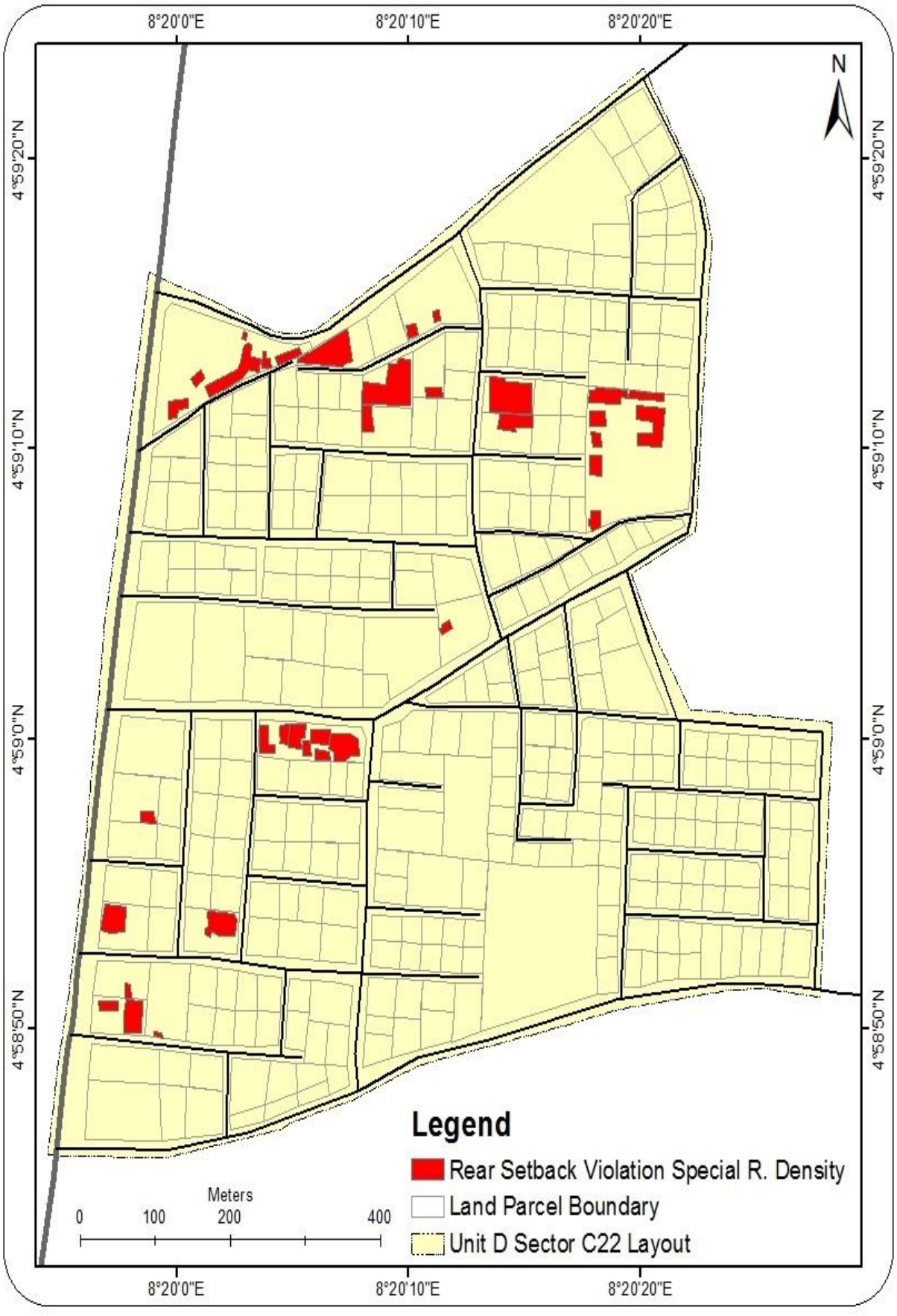

8°20'0"E
8°20'10"E
8°20'20"E
4°59'20"N
4°59'10"N
4°59'0"N
4°58'50"N
N
Legend
Rear Setback Violation Special R. Density
Land Parcel Boundary
Unit D Sector C22 Layout
Meters
0
100
200
400

Figure 4.23: Rear Setback Violations of Special Residential Density Parcels
Source: Author's Analysis (2019)

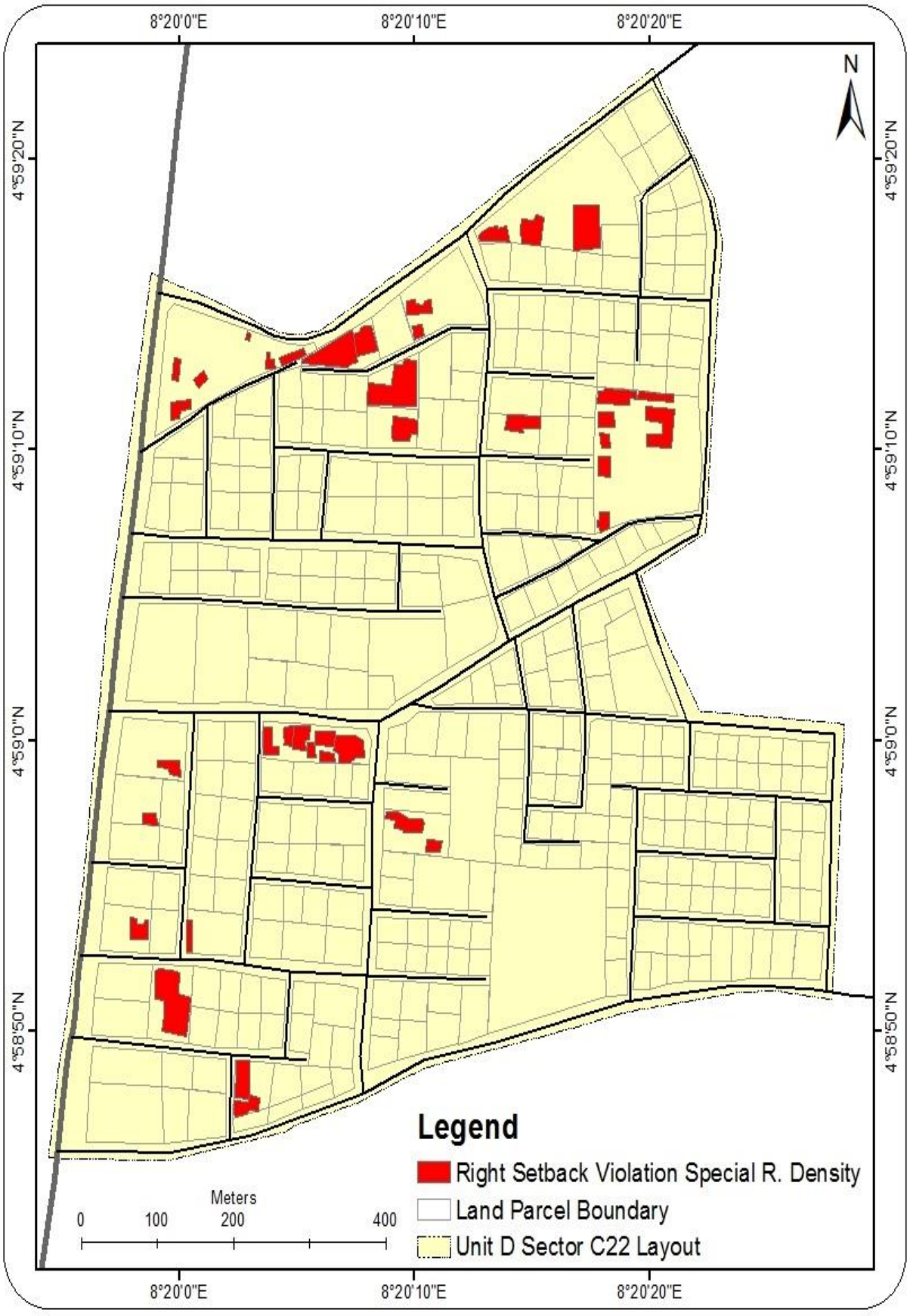

8°20'0"E
8°20'10"E
8°20'20"E
4°59'20"N
4°59'10"N
4°59'0"N
4°58'50"N
N
Legend
Right Setback Violation Special R. Density
Land Parcel Boundary
Unit D Sector C22 Layout
Meters
0
100
200
400

Figure 4.24: Right Setback Violations of Special Residential Density Parcels
Source: Author's Analysis (2019)

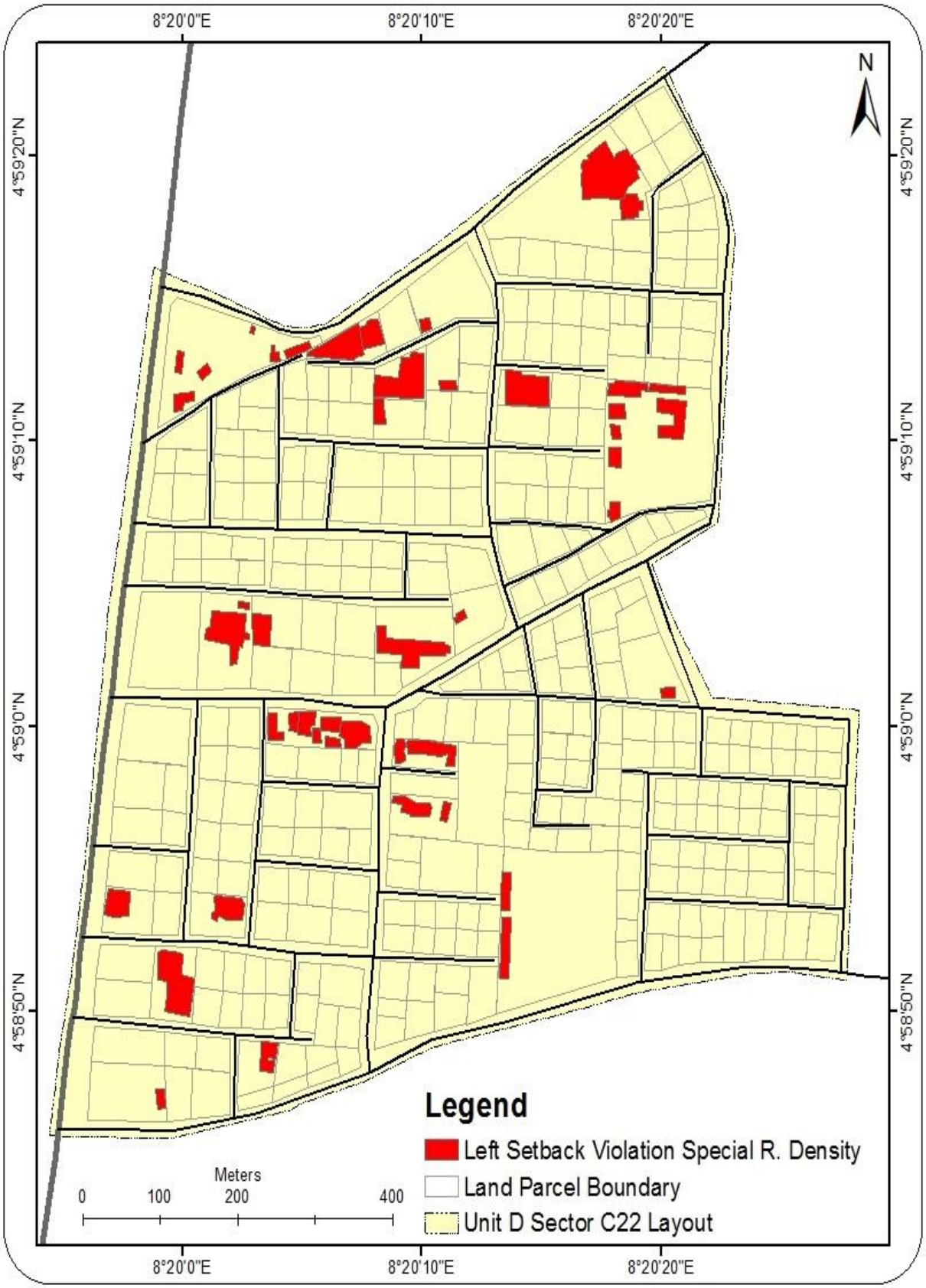

8°20'0"E
8°20'10"E
8°20'20"E
4°59'20"N
4°59'10"N
4°59'0"N
4°58'50"N
N
Legend
Left Setback Violation Special R. Density
Land Parcel Boundary
Unit D Sector C22 Layout
Meters
0
100
200
400

Figure 4.25: Left Setback Violations of Special Residential Density Parcels
Source: Author's Analysis (2019)

4.5 Factors Responsible for Development Control Violations in the Study Area

Development control violations observed in the study area include front set back, left set back, right setback, back or rear set back, and building density in a low, medium, high and special residential areas. There are many factors that affect compliance to development control standards but this study considered only four factors, namely: lack of public awareness; corrupt practices; administrative bottlenecks and cost of processing building permit. The opinion of the respondents is presented in Table 4.12.

4.5.1 Lack of public awareness

Lack of public awareness on the implications of violating development control is one of the major factors affecting compliance to development control standards in the study area. The procedures that guide development control have not been adequately shared with the public as some of the developers get to know of the existence of the development control regulations during the submission of the development proposals. This shows failure of government and the relevant agencies to inform developers and the public about the implications of non-compliance with development control regulations like setbacks (front, rear, right and left), building density, change of land use and so on. It is expedient to feed the public with valuable information on preparation and implementation of plans. When this is done, it will help the public to participate in decision-making processes and also make plan implementation easier.

4.5.2 Corrupt practices

Corruption is one of the factors influencing conformity to development control regulations in the study area. Some of the house owners were interviewed and their responses indicated that corruption among development control officials and developers contributes significantly to violation of development control regulations' compliance. This could be instigated by either the developers or the development control officials, but in most cases, it is the development control officials who ask for the money to approve development proposals which are non-compliant.

4.5.3 Administrative bottlenecks

Most of the respondents are of the view that there are administrative bottlenecks in obtaining building permit and change of land use for any proposed development in the study area. Consequently, developers refrain from going through the cumbersome process of seeking approval and undertake unguided development. Discussions with some of the technical staff in the development control unit reveal that many developers do not affect corrections on their proposed buildings plans as at when due to allow for fast approval of building permit. In addition, the time taken for the evaluation of the development proposals in all the development control departments is deemed to discourage developers to submit development proposals for evaluation. The inter-departmental movement of development proposals is tiresome, costly and time consuming for developers. The average time for evaluation of development applications usually takes more than a year even when applicants have fulfilled all the requirements. This delay results in various illegal practices as desperate developers are not patient to wait for the long

bureaucratic process. Generally, bureaucratic delays in building permit procurement lead to increased cost of construction and loss of value.

4.5.4 Cost of processing building permit

Another opinion of the respondents is that building permits are not obtained for free. It involves some financial commitments on the part of the prospective developer. Cost of processing building permit has also appeared as an area of concern for most of the respondents, who believe that it is important to bring down the cost of processing building permit in the study area. In addition to the cost of architectural drawings and various documents like site plan and a good title that tends to make the process more expensive, the developer has to obtain a building permit form. These fees incurred by developers at each stage of the permit acquisition process appears to be more expensive for developers. Table 4.12 presents the opinion of respondents on the factors responsible for development control violations in the study area.

Table 4.12 Factors Responsible for Development Control Violations in the Study Area

		Response								
	Factors	SA	A	UD	D	SD	Mean	Std. Dev	Decision Rule	**Decision**
1	Inadequate field-based Supervision	58	200	0	29	0	4.00	0.78	4.00>3.00	**Agree**
2	Lack of qualified professionals	0	105	107	62	13	3.10	0.87	3.1054z>3.00	**Agree**
3	Lack of public awareness and education	33	148	29	51	26	3.40	1.71	3.40>3.00	**Agree**
4	Poor and inadequate funding	91	84	99	13	0	3.90	0.91	3.90>3.00	**Agree**
5	Bribery and corruption	125	162	0	0	0	4.40	0.50	4.40>3.00	**Agree**
6	Processing of Building Permit	31	173	83	0	0	3.80	0.61	3.80>3.00	**Agree**
	Cumulative	**338**	**872**	**318**	**155**	**39**	**3.80**	**0.81**		

Decision Mean: If Mean is ≥3.00, Agree otherwise Disagree
Source; Author's Analysis (2016)

Location, socialization, globalization, culture, environmental condition among others influences the way of life of people in goelocality. The factors responsible for development control violation in this study area was found to be unique as compared with that of the review literatures therefor the need for presurvey to identify these factors before determining the weight of each of the effects. The Table 4.12 reveals that the cumulative mean responses of all the factors was 3.80 which is higher than the decision mean of 3.0 with the standard deviation value of 0.81 implying

that the responses were significant. Majority of the opinion points bribery and corruption as factor responsible for violations with the highest mean response of 4.40. This was closely followed by Inadequate field-based Supervision of developing projects by the supervision team from Urban planning Department (4.00) while Lack of qualified professionals (3.10) was the least factor responsible for violations in the area. This finding is in line with that of Amedu (2017) which showed that corrupt practice and Inadequate Supervision were the major factors responsible for noncompliance to development control in Badawa Layout, Kano metropolis.

4.6 Effects of Development Control Violations in the Area

The effects of development control violation in the study area include Population and Inflation, Poor Ventilation, water logging, building collapse, pollution, traffic and accident and right of way depletion among others. The effects of uncontrolled development cannot be underestimated because of the negative implications it is posing to residents and the environment.

4.6.1 Traffic congestion

Most of the respondents believe that traffic congestion is one of the effects of noncompliance to development control standards in the study area. This means that the width of some of the access roads in the study area have been reduced due to unwarranted extensions and alterations of already existing buildings causing difficulty in movement of goods and services by residents. It was observed also in the study area that violation of land uses (residential to commercial) is responsible for traffic congestion in the study area. It was further observed that due to street parking resulting from inadequate parking facilities and violation of building setbacks and land use conversions, a high traffic congestion was established.

4.6.2 Pollution and disease

Most of the respondents claimed that pollution is a problem in the study area. Residents are charged for the disposal of refuse in the containers provided by Niger Delta Development Commission (NDDC). Some of the refuse containers are located a distance away from the residents and as such the residents travel a long way in other to dispose of their refuse. Residents in the attempt of avoiding such fees and the long distance to be travelled end up disposing refuse into gutters and nearby bushes. This has led to some of the gutters being choked serving as breeding grounds for mosquitoes spreading malaria in the community. The study area was also faced by the problem of foul smell. Bad odour emanating from gutters made breathing in some places in the study area very unpleasant which will encourage disease propagation and easy transfer from one person to another.

4.6.3 Poor quality and Collapse of buildings

The lack of enforcement of development control has resulted in the violation of building standards with regard to the site of buildings and the structural requirements. This has led to the constructions of buildings with sub-standard materials. While building collapse is a situation where building which has been completed but not occupied, completed and occupied and under construction, tears apart without the influence of any party or agent. building collapses were due to substandard building materials, bad design, wrong foundation, wrong site, bad usage of the

structure, poor technology and inexperienced contractor. In most cases, the buildings do not have approved building plans. The result of the field survey reveals that poor building quality and collapse of building were the major effects of noncompliance to development control standards in the study area.

4.6.4 Poor Ventilation

The result of the survey reveals that poor air circulation within building is a result of noncompliance to building codes and planning standards. This is because it brings about environmental management problems especially in waste management and control of congestion-related diseases. It was revealed also that poor ventilation is a problem in the study area. They complained of excessive heat in the area due to the compact nature of the houses even though there are some pockets of green areas within the study area. Field survey revealed that there was not enough space in between houses and rooms to allow for proper ventilation. Poor ventilation may promote the spread of certain communicable diseases like Cerebrospinal Meningitis, Tuberculosis and so on.

4.6.5 Population growth and inflation

Urban development is connected to population increase, this is linked to many environmental problems, including air pollution, water pollution, and loss of wildlife habitat. Urban runoff often contains nutrients, sediment and toxic contaminants, and can cause not only water pollution but also large variation in stream flow and temperatures. Population growth on the other hand increases demand for goods and services leading to increase in price of goods and services and also perception of the marketers on the status of the resident of the area.

4.6.6 Erosion and environmental degradation

The effects of soil erosion go beyond the loss of fertile land. It has led to increased pollution and sedimentation in streams and rivers, clogging these waterways and causing declines in fish and other species as revealed by some respondents from the study area. And degraded lands are also often less able to hold onto water, which can worsen flooding. Sustainable land use can help to reduce the impacts of agriculture and livestock, preventing soil degradation and erosion and the loss of valuable land to desertification. Table 4.13 presents the respondents' Opinion on the Effects of development control violations in the study area.

4.6.7 Environmental hazard

Environmental hazard can be biological, chemical, social, cultural and physical. Physical hazards are those substances or conditions that threaten our physical safety. Fires, explosive materials, temperature (hot or cold), noise, radiation, spills on floors and unguarded machines are some examples of physical hazards. Biological hazard includes those substances released or conditions which may include animal waste, human body fluids, microbiological waste, pathological and sharp waste casing biohazardous infections which is common in the study area. Short-term exposure in badly designed work may result in muscle fatigue or tiredness, but long-term exposure can result in serious long-term injuries of the musculo-skeletal system.

Table 4.13: Effects of Development Control Violations in the Study Area

Factors		Responses								
		SA	A	UD	D	SD	Mean	Std. Dev	Decision Rule	Decision
1	Population growth and Inflation	164	123	0	0	0	4.60	0.50	4.60>3.00	**Agree**
2	Erosion and Environmental Degradation	79	157	15	7	29	3.90	1.15	3.9>3.00	**Agree**
3	Poor Ventilation	13	193	52	29	0	3.70	0.72	3.70>3.00	**Agree**
4	Right of Way Depletion and Traffic	93	96	52	26	20	3.80	1.20	3.80>3.00	**Agree**
5	Poor Building and Collapse	29	186	39	7	26	3.60	1.01	3.6>3.00	**Agree**
6	Environmental Hazard	61	115	53	58	0	3.60	1.03	3.6>3.00	**Agree**
7	Pollution and Disease	158	68	28	26	7	4.20	1.09	4.20>3.00	**Agree**
	Cumulative	**597**	**938**	**239**	**153**	**83**	**3.91**	**0.96**		

Decision mean: If mean is ≥3.00, Agree otherwise Disagree
Sources: Authors analysis (2016)

The effects in Table 4.13 were obtained through presurvey and were found to be peculiar in the study area. The table revealed that the cumulative mean responses of all the factors is 3.91 which is higher than the decision mean of 3.00 with the standard deviation value of 0.96. Most of the respondents were of the opinion that Population and Inflation is the major effect of development control violation in the study area as this item attracted the highest mean response of 4.60 which is closely followed by 4.20 and 3.90 for pollution/disease outbreak and Erosion/ Water logging respectively. This finding is in line with Dawaba (2016) which revealed that overdevelopment was one of the major effects of noncompliance and enforcement of development control in Minna metropolis.

CHAPTER FIVE
SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter brings the work to an end and its divided into summary of the research work, conclusion and recommendations based on the findings of this work.

5.2 Summary of Findings

This research work used geospatial techniques to create a cadastral information system of state housing Corporation Calabar, Cross River State, Nigeria. Findings from characteristics of parcels and parcel owners revealed that the parcels were owned by predominantly males (85.4%) and civil servants were the dominant category of occupation type with 61% in the study area. Most (94.6) of the parcels are developed and the study area is majorly (63.4%) a medium density layout.

This study revealed that several land uses existed in the area, these include, residential, public, commercial and mixed lands use, 79.8% out of the 92.6% of the parcels proposed for residential purpose were used for that purpose. This change in land use resulted to mixed land use and increase in commercial land use.

The finding further revealed that 2.7% of the structures encroached upon the right of way of the express way while 45.2% encroached on the right of way of access roads in the area. Right setback was the highest (76.5%) form of violation in high density parcels while front setback was the most common (54.1%) on medium density parcels. Left setback was the highest form of violation on low density (38.1) and special residential parcels (50.6) in the area.

Majority of the opinions of respondents' points to bribery and corruption (4.4) as responsible for the violations, this was closely followed by Inadequate field-based Supervision (4.00) of developing projects by the supervisory team of Urban planning and Department while Lack of qualified professionals (3.10) was the least factor responsible for violations in the area. Most of the respondents were also of the opinion that Population and Inflation (4.60) is the major effect of development control violation in the study area. Which is closely followed by 4.20 and 3.60 for pollution and Traffic and Accident among water Logging and Erosion (3.90) and Right of way depletion (3.80) respectively.

5.3 Conclusion

This research has shown that geospatial techniques can be used for digital mapping, parcel use study and analysis of the level of compliance to development control standards. From the findings of this research, it can be concluded that most of the parcel owners are males and civil servants respectively. Most of the parcels in the area are developed and are mainly medium residential density parcels. Similarly, from the results of this study, conversion of residential building to commercial and other uses constitutes the highest form of violation in the study area. Based on the findings from analysis of development control, it can also be concluded that there is jlow level of compliance to development control standards. Based on the foregoing, it is safe to conclude that development control in state housing Corporation Calabar is not effective and this can lead to over exploitation of natural resources, increase in crime rate, increase in accident rate among others.

5.4 Recommendations

The findings from this research have compelled the need to make the following recommendations.

i. Parcels in the study area are owned predominantly by males, in that event, Females should be encouraged to own more parcels as this will go a long way to address gender inequality in land ownership and development in the area.

ii. In the study area, 79.8% out of the 92.6% of the parcels proposed for residential purpose were converted into mostly commercial and mixed used. On this note, Government should conduct an effective sensitization to educate the residents on the dangers of illegal land use change and violations should be treated as a very serious crime as will be stipulated by an enacted law to guide land use in the area.

iii. Due to mass violation in encroachment of right of way and setback violations in the study area, it is recommended that strict enforcement of the rule of law should be applied disregarding social ranking to ensure total compliance with development control standards to ensure sustainable development in the study area.

iv. Majority of the opinions of respondents' points to bribery and corruption and Inadequate field-based Supervision. On this note, they should be adequate qualified office and field based supervisors to process and monitor developmental projects in intervals across various involved departments in a way that will control bribery and corruption in the area considering the effects of development control violations in the area.

v. Researchers could perform the same study in other localities in the Local Government Areas, the State, and Country or in any parts of the world in general.

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APPENDIX: I

Adjudication Form (AF)

Digital Mapping and Creation of Cadastral Information System of State Housing Corporation Calabar, Cross River State, Nigeria

I am a Postgraduate student of Ahmadu Bello University, Zaria carrying out a research project. It will be appreciated if you would kindly provide the required information contained in this form, this information will not be used for reasons other than academic purpose and will be treated with utmost confidentiality.

Section A: Parcel User's Data

1. Surname ……
2. First Name ……Other Names ……
3. User Identification Number: ☐☐☐☐☐☐☐☐
4. Sex: a. Male ☐ b. Female ☐
5. Occupation: a. Farming ☐ b. Civil Service ☐ c. Business ☐ d. mix ☐ ☐

Section B: Parcel Data

6. Parcel Identification Number: ☐☐☐☐☐☐☐
7. Parcel Density: a. High Density ☐ b. Medium Density ☐ c. Low Density ☐ d. Special Residential Density ☐
8. Proposed parcel use: a. Residential ☐ b. Commercial ☐ c. Public ☐
9. Existing Parcel use: a. Residential ☐ b. Commercial ☐ c. Public ☐ d. Mix ☐ ☐
10. Parcel allocation status: a. Allocated ☐ b. Not allocated ☐
11. Parcel development status: a. Developed ☐ b. Not Developed ☐
12. how did you acquire the parcel of land in the estate? A. gift ☐ b. Inheritance ☐ c. bought from third party ☐ d. occupier-owned agreement with Government ☐ ☐

Section C: Development Control Violations, Factors Responsible and Effects

12. Are you aware of the planning standards enforced in this estate? Yes ☐ No ☐ ☐
13. If yes, how did you get to know about the standards A. a. Television ☐ B. Radio ☐ C. print media ☐ D. Public enlightenment through any other means ☐

14. Factors responsible for Development Control Violations

	Item	SA	A	UD	D	SD
1.	Inadequate field-based Supervision					
2.	Lack of qualified professionals					
3.	Lack of public awareness and education					
4.	Poor and inadequate funding					
5.	Bribery and corruption					
6.	Processing of Building Permit					

15. Effect of Development Control Violation

	Item	SA	A	UD	D	SD
1	Population growth and Inflation					
2	Erosion and Environmental Degradation					
3	Poor Ventilation					
4	Right of Way Depletion and Traffic					
5	Poor Building and Collapse					
6	Biochemical Hazard					
7	Pollution and Disease					

Thank you

APPENDIX: II

Satellite (Google Earth) Imagery of the Study Area



Source: Adapted from Satellite (Google Earth) Imagery of the Study Area (2020)