An-Najah National University

Faculty of Graduate Studies

Sustainable Urban Planning for Tulkarem Governorate Using Geographic Information Systems (GIS) Applications

By

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Dedication

My lovely parents

who lightened the way for me, who catched with my hands in the first step and still catching.

My brother and sisters

(Maamoun, Maram, Mirna)

who have gone side by side since childhood.

My friend

(Heba)

Who I missed her every moment, may God have mercy on her.

My friends

who supported me with their words because of far distances.

Everyone

who stood beside me until I arrived here

Acknowledgment

Thank Allah to give me the strength and patience to complete my thesis

I would like to thank my supervisor Dr Ali Abdel Hamid for his guidance, efforts, encouragement through this work.

All my respective, thanks, and love for my lovely family for their support

Encouragement to complete this work

I would like to thank every person stood by me to complete my thesis

Manar Talal Alsaleh

الإقرار

أنا الموقعة أدناه مقدمة الرسالة التي تحمل عنوان:

Sustainable Planning and Development for Tulkarem Governorate Using Geographic Information Systems (GIS) Applications

أقر بأن ما اشتملت عليه هذه الرسالة إنما هو نتاج جهدي الخاص، باستثناء ما تمت الإشارة إليه حيثما ورد، وأن هذه الرسالة ككل أو جزء منها لم يقدم من قبل لنيل أية درجة أو بحث علمي أو بحثي لدى أية مؤسسة تعليمية أو بحثية أخرى.

Declaration

This work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

Student's Name: **اسم الطالب**:

Signature: **التوقيع:**

Date: **التاريخ:**

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Sustainable Planning and Development for Tulkarem Governorate Using Geographic Information Systems (GIS) Applications

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Abstract

The aim of this research is to achieve to the appropriate planning of Tulkarem Governorate to be in line with the global trend in sustainability, which aims to preserve the environmental resources of current and future generations, in light of the obstacles that the governorate suffers from: the rapid population growth and the shortage of space, especially the challenges of: Area C and settlements.

To achieve the objectives of the research, it was necessary to study the expansion of urban communities in the governorate, direction of its expansion, available services and places of concentration, population growth, population concentration s and environmental resources -such as: temperate, climate, soil and diversity of terrain- in order to calculate the needs of resources and services of the governorate using geographic information systems as a tool for planning through the cartographic model to link these studies spatially.

The study has reached certain results regarding the environmental, social and economic aspects. For environmental aspect it indicated that

agricultural land value and terrain have main role in determining direction of communities expansion. For the social aspect it indicated that the City of Tulkarem has the largest share of population compared to other communities in the governorate because of the concentration services. Concerning the planning aspects the study showed that the residential land use has the highest percentage among other land uses. For the economic aspect, the study determined the most appropriate alternatives for the industrial zones and area required for it.

The study recommended the need to coordinate between the planning institutions in order to preserve resources, integrate work among them, and involve inhabitants in planning and raising awareness.

Chapter One

General Introduction

1.1 Introduction

Sustainability is a lifeline that is an integrated framework of social, economic and environmental factors to form a life-style, sustainability is a practical approach that affects the single building unit, the block, the city and the state that in turn drives sustainability and recognizes it as an approach in its policies.

Dr. Serageldin defined sustainability as, providing subsequent generations by opportunities as much as or equal to those provided to current generations. " Ismail Serageldin, Report of the Dialogue on the Future of Sustainability in the Arab World, 2008"

Sustainability has become the concern axis of scientists and researchers in our time: how to create economic, cultural and social sustainable environment. This has an echo in the scientific community and even in the political arena. The planners have high resonance calls for conserving resources and sustaining cities in order to provide A decent life for present generations without compromising the resources of future generations.

As well as the rest of the world, Palestine has a remarkable urban growth due to the economic development, political and social changes and the increase in the population, which lead to an increase in the demand of land

and housing to accommodate the increase in the population and the price of land and its scarcity, causing waste of environmental resources if not urban planned, especially in light of the fierce onslaught by the Israeli occupation on razing the land, controlling the vast areas, exploiting the resources of the land, putting obstacles against Palestinian cities and towns to limit their growth and economic and urban development. These obstacles are: construction of settlements, isolation walls, buffer zones, and other policies against Palestinians.

Urban planning is a technical, engineering and scientific tool to achieve the public interest of all sectors and categories of society through drawing scientific and planning visions for future situations related to the distribution of services and multiple activities and land uses at the appropriate location and time and balance between the needs of development in the present and future on one hand and development needs for the future generations on the other hand, that is integrating the concept of sustainable development and sustainable societies into the mainstream of the overall urban planning process. (Hisham, 2014)

In order to achieve this, a scientific method must be followed by providing a database for the preparation of plans, strategies, appropriate solutions that are based on studying of growth, managing the environment and its resources and combating the problems of population congestion and urbanization at the expense of green and agricultural areas.

This study needs to study urban growth maps, population studies, environmental resources, etc… using the GIS program to link studies spatially to produce maps, to study and analyze them to achieve the desired results.

1.2 Study Problem

The study examines the current situation of Tulkarem governorate in terms of three aspects –which are principle of sustainability: environmental aspect that study what are available environmental resources and their optimal utilization to use them in sustainable urban planning, social aspect, which study demographic that study population growth rates, population characteristics, and trends of growth in the governorate and spatial aspects examines the planning situation of Tulkarem governorate in the past, present and future through studying development of built up area and current resources of Tulkarem governorate. The third aspect is economic aspect.

The study treats with these aspects and determinants that Tulkarem Governorate as Palestinian cities suffers from different determinants such as: political determinants as Israeli settlements, Area C, check points, and apartheid wall in addition to social determinants such as rapid population growth that doesn't accommodate with the existence services.

So What are future needs of population of services and the area needed for inhabitants until 2030? what are the best locations for the optimal sustainable urban planning process in light of the planning consideration? and how we can promote sustainable urban development to face rapid population?

1.3 Importance of the Study

The importance of the study can be highlighted by the absence of previous studies on the sustainable urban planning of Tulkarem governorate using geographic information systems (GIS), especially in light of the limitations that the governorate suffers from: the narrow area, The political situation, and the current, future growth and development that will have an impact on the depletion of environmental resources, if the growth of the governorate continues without a balanced planning between environmental resources and the growth of built up area.

1.4 Study Objectives:

This study aims to achieve the following objectives:

(1) Study and analyze of the characteristics of the built up area and its growth using GIS.

(2) Explore resources allocated to Tulkarem governorate.

(3) Know the characteristics of population in the governorate because of its impact in directing the growth and development of urbanization.

(4) Identification and determination of the current and future needs of sites and areas of built up area

(5) Proposal for suitable solution for the sustainable urban development of the governorate through the three axes of sustainability environmental, social and economic.

1.5 Study Plan

The study is based on the following frameworks:

1. General and Theoretical Framework

It deals with the issue of research, the problem of the study, the methodology used and the previous studies, to give an overview of the study, Also it deals with studying and reviewing the concepts related to sustainability and urban planning in general and enriching the theoretical framework with case studies, as well as highlighting the GIS and its applications in the planning and conservation of environmental resources.

2. Diagnostic Framework

It Includes data related to Tulkarem governorate in terms of sustainability: environmental aspects: (climate, Physical aspects), social aspects: (population aspects, spatial aspects) and economical aspects: (GDP, poverty, enforcement, etc…)

3. Analytical and Evaluation Framework

It includes estimates of population in order to estimate the future needs of the population of built up areas, Also it includes cartographic modeling of sub-criteria of environmental, social and economical aspects that assess suitability for sustainable future urban development.

4. Results and Recommendations

It includes results that depends on the study and recommendations for the competent authorities.

1.6 Sources of information

To achieve the objectives of the study referred to the study will be based on a number of sources, the most important:

1. Office resources: Includes books, references, studies, research, and university transcripts of the subject of the study.

2. Official sources: It includes information, data, studies, maps, charts, of the subject issued by the relevant Palestinian ministries and official institutions such as:

3. Ministries of Agriculture, Planning, Local Government and the National Economy.

4. Municipality of Tulkarem.

5. Palestinian Central Bureau of Statistics.

6. Semi-official sources: It includes information, studies and research issued by the civil institutions, including:

- Research centers such as the Applied Research Institute (ARIJ), the Arab Studies Society, and the Land Research Center (LRC).

- International organizations (UNDP, FAO).

1.9 Study Contents

This study is composed of six main chapters. The first Chapter is a general introduction that includes study problem, importance of the study, study objectives and study plan. Chapter two is dealing with the conceptual and theoretical framework of the study. The third chapter includes general background of Tulkarem Governorate such as: Loction, environmental resources and population . The fourth explains methodology followed in the research. Chapter five is about the proposed needs for sustainable development in the governorate depending of population projection until 2030. The sixth chapter is about the proposed pattern of sustainable urban development depending on criteria, Weighted overlay was used for criteria to achieve sustainability. Final chapter includes conclusions and Recommendations.

Chapter Two
Theoretical and Conceptual Frame

This chapter discusses the concepts of sustainability, sustainable planning and sustainable development because of their importance at local and national level, through preserving the resources for the current and future generations. Thus to keep up with the world in the field of planning and sustainable development.

2.1 Concept of Sustainability

In light of the blatant assaults on the environment and the unlimited depletion of the genie, Voices were raised to preserve the environment to use it in a balanced way, So the concept of sustainability appeared, and has become a global trend.

All human needs to survive depends directly or indirectly on environment this is the principle of sustainability, Sustainability takes into account how human might live in harmony with their environment , protecting it from damage and destruction. The modern way human live, This way of live impose to consume lot of natural resources every day, This affect on environment that is not only for present generation but even for future generation (EPA, 2017).

Sustainability is derived from two Latin words: ***sus*** which means up and ***tenere*** that means to hold. In the modern form the concept born out as a result humanity desire to continue to exist on planet Earth for a very long

time. Sustainability is almost literally about holding up human existence (Sustainability: A Comprehensive Foundation, 2012).

"A dynamic equilibrium in the process of interaction between a population and the carrying capacity of its environment such that the population develops to express its full potential without producing irreversible, adverse effects on the carrying capacity of the environment upon which it depends" (Ben-Eli, 2015).

"sustainability is to create and maintain the conditions under which humans and nature can exist in productive harmony to support present and future generations" (EPA, 2017).

" Brundtland defines sustainability as meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better life" (The Town and Country Planning Association, 1997).

2.1.1 History of Sustainability

Sustainability emerged as a result of social, environmental, and economic consequences of rapid population growth, economic growth, and consumption of natural resources (EPA, 2017).

This history has three overlapping story lines (EPA, 2017):

- ***The first***: Conservation movement emerged in the United States in the late nineteenth century, because taming of the wilderness was destroying much of what as part of the U.S culture.

- ***The second***: Events as the original Earth Day, the formation of EPA in 1970 and the ensuing media and pollutant-based environmental laws emerged because of industrial development which is harmful for environment and people through chemical and physical agents released in the environment.

- ***The third***: a series of international conferences and agreements such as: formal international endorsement of sustainable development occurred at the United Nations Conference on Environment and Development (UNCED or Earth Summit) in Rio de Janeiro in 1992,because of the perception that population growth and consumption are challenging the ability of Earth's ecosystems to provide for future generations conservation or the control of environmental pollutants.

2.1.2 Goals of Sustainability

The Millennium Declaration of the United Nations, defines a specific set of goals and targets for sustainability (Thomas, 2003):

- Human needs goals:

improving health, providing education and access to water and sanitation, reducing hunger poverty and providing houses.

- Environmental goal:

atmosphere/climate, oceans, fresh water, land use/land cover, terrestrial biodiversity, and toxics.

2.1.3 Sustainability Elements:

There are three elements that sustainability depends on social, environment and economic and their intersection result the sustainability to achieve bearable, equitable and viable (Development Munasinghe Institute for Sustainable, 2007).

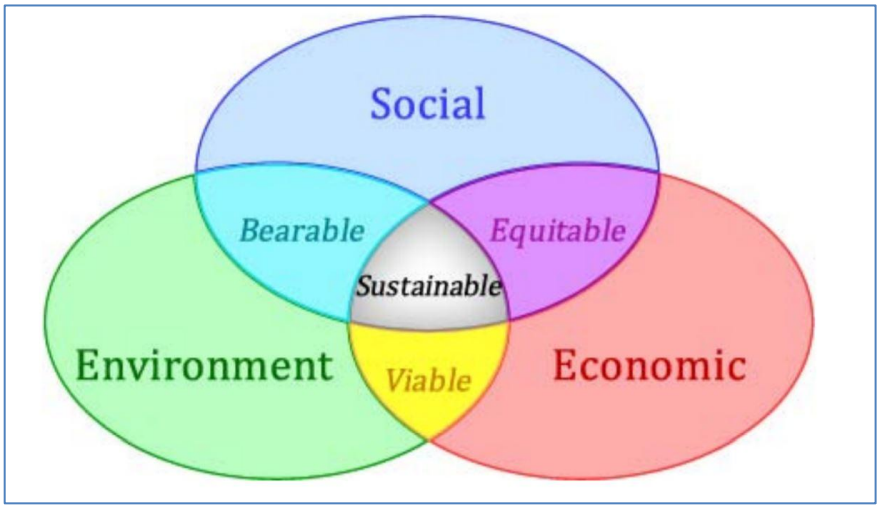


Fig 2- 1: Sustainability Elements
Source: (Sustainability: A Comprehensive Foundation, 2012)

1. Social

Social development usually refers to improvements in both individual well-being and the overall social welfare.

sustainability seeks to:

- Resilience, vigor and organization of social and cultural systems, and their ability to withstand shocks.

- Enhance human capital (through education) and strengthening social values.

- Preserve cultural capital and diversity across the globe.

- Strengthen social cohesion and networks of relationships, and reducing destructive conflicts.

- Understand the links that radiate out from poor communities, and their interface with agencies and government to:

  - build connections and channeling resources more directly to make social development more sustainable.

  - Emphasis on the formation of new community-level organizations which causing the locals to feel that they have no stake or ownership in the project.

2. Environment

Nowadays, modern economies have to wisely manage scarce natural resources because human welfare depends on ecological services, Ignoring the ecological limits will increase the risk on human life for long term development.

The environmental sustainability focuses on the overall viability and health of living systems. That apply on natural, agricultural systems, wilderness, rural and urban areas.

Natural resource degradation, pollution and loss of biodiversity are important factors of catastrophic ecosystem collapse. So the role of the sustainable development is to maintain the ecological status quo to meet demands of future generation, because economic activities affect biological diversity that affect will affect the flow of vital future ecological services.

3. Economic

Economic progress is evaluated in terms of welfare, measured as the ability to pay for a consumed goods and services. Economic policies seek to increase conventional gross national product (GNP), and ensuring optimal consumption and production which is the key role of economic efficiency.

2.2 Sustainable Planning

Before talking about sustainable development, we must point to planning in the general and spatial planning in particular.

2.2.1 Planning

“Planning as a general activity is the making of an orderly sequence of action that will lead to achievement of a stated goal or goals. Its main techniques will be written statement, supplemented as appropriate by

statistical projections, mathematical representations, quantified evaluations and diagrams illustrating relationships between different parts of the plan. It may, but need not necessarily, include exact physical blueprints of objects" (Hall & Twedwr-Jones, Urban and regional planning, 2011).

"Planning is the actual bringing about of desirable changes for an improved overall future through the medium of predetermined human action. It also involves the interpositioning of design, particularly growth pattern (regional) design and urban physical design" (Robert, 2004).

"Planning is a process to achieve the goals and objectives of national development through the rational and efficient use of available resources. Thus plans must include clear goals and adequate policies, objectives and strategies along with concrete programmes" (Nations U. N., 1976).

Planning depends on the best available information of social, economic, demographic and technological trends. Planning should be built at different scales of geographical coverage: national, regional, local, and neighborhood. Planning process is a complementary process: any decision was taken at one level must be related to those taken at other levels above and below. Planning must be flexible to adapt changes in circumstances and priorities (Nations U. N., 1976).

Planning does not depend on fixed rules, it depends on what we want to achieve, and how we want to live (Greed, 1993).

These definitions show that there are three fundamental elements of planning (Barnat, 2014):

1. ***Objectives***: are statements of future that hoped to be achieved. That characterized by: priority that means accomplishing one objective in a given time is more important than accomplishing others, and Timing where activities depends on duration of action.

2. ***Actions*:** which are specific activities that planned to achieve the objectives.

3. ***Resources***: involve budgeting, identifying the sources and levels of resources that are needed for courses of action. Implementation: involves the assignment and direction of personnel to carry out the plan. The approaches to implementation are authority, persuasion, and policy.

2.2.2 Levels of Planning

There are three levels for planning: national level, regional level, local level.

1. National planning

"National planning involves the process of setting goals, developing strategies, and outlining tasks and schedules to accomplish the national goals" (National Planning Commission Office Of The President, 2017).

2. Regional planning

“Regional planning is planning for a geographic area that transcends the boundaries of individual governmental units but that shares common social, economic, political, cultural, and natural resources, and transportation characteristics. A regional planning agency prepares plans that serve as a framework for planning by local governments and special districts (American Planning Association, 2017).

It is recognized as an important element of national, economic and social plans, and regional policies as an important instrument in the efficient implementation of national policies” (American Planning Association, 2017).

3. Urban-local planning

“Urban planning conventionally means something more limited and precise: it refers to planning with a spatial, or geographical, component, in which the general objective is to provide for a spatial structure of activities (or of land uses)which in some way is better than the pattern existing without planning” (Hall, Urban and Reginal Planning, 1975).

Urban planning emerged in the early decades of the 20th century as a response of rapidly growing cities, that affect all life fields like: sanitary, social and economic.

Architecture and civil engineering were the nuclear of urban planning . As the complexities of cities, fields as: public health, law, economic and geography(School of urban planning,2017).

Then joined by specialists, economists, sociologists, lawyers, and geographers, as the complexities of managing cities came to be more fully understood. Today, urban planning can be described as a technical and political process concerned with the welfare of people, control of the use of land, design of the urban environment including transportation and communication networks, and protection and enhancement of the natural environment(School of urban planning,2017).

Planning with this scale culminates in a spatial representation (detailed map or general diagram (Hall, Urban and Reginal Planning, 1975).

Planning process is an integrate process but some topics are more effectively in one level than the other for example: issues related for energy and water are suitable for regional level, where housing is suitable at the local level. This depends on the givens, the needs and the goals. (The Town and Country Planning Association, 1997)

2.2.3 Sustainable Planning

Sustainable planning, in this study, is related to physical and spatial planning, that aims to optimize the distribution and allocation of land and human activities, in a limited space within certain administrative boundaries (Geneletti, La Rosa, Marcin, & Cortinovis, 2017) .

Sustainable planning aims at integrating knowledge on socio-ecological contexts to take community-determined public-interest action to effect improved change

and implement principles of sustainability (Geneletti, La Rosa, Marcin, & Cortinovis, 2017).

- Nowadays there is a big movement toward sustainable planning, Global sustainable planning reports that are used in planning process in some cities. **These reports are** (Canadian International Development Agency, 2012)**:**

- **Ecological Footprint**: has emerged as the world's premier measure of humanity's demand on nature: water area, land , the ecosystems. Foot print can assess the pressure on the earth that help to conserve the nature and resources to protect human life and balance. **Global City Indicators Program (GCIP):** The Global City Indicators Program (GCIP) was established to help cities to establish database to achieve goals and monitoring performance.

- **The Human Development Index (HDI)**: measure the average achievements in a country in three basic dimensions of human development:

- healthy life (health),

- access to knowledge (education)

- a decent standard of living (income).

- **IPCC Assessment Reports*:*** The Intergovernmental Panel on Climate Change (IPCC) assesses the scientific, technical and socioeconomic information for understanding of the risk of human-induced climate change.

2.3 Sustainable Development

"Sustainable development is development that meets the needs of the present, without compromising the ability of future generations to meet their own needs" (Brundtland Commission, 1987)

This definition has three concepts (The Town and Country Planning Association, 1997):

1. **Development**: is the concept of qualitative improvements and progress cultural, social and economic systems, and not confused with growth that present physical and qualitative expansion of the economic system.

2. **Sustainable development*:*** requires a regard to regenerative capacity, the ability if its system to maintain productivity.

3. **Needs:** meets the issue of the distribution of resources.

Sustainable development has an environmental, material, ecological, social, economic, legal, cultural, political and psychological dimensions (Bossel, 1999).

"Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs" (Kates, Pariss, & Leiserowitz, 2005).

"Sustainable development recognizes that growth must be both inclusive and environmentally sound to reduce poverty and build shared prosperity for today's population and to continue to meet the needs of future generations. It is efficient with resources and carefully planned to deliver both immediate and long-term benefits for people, planet, and prosperity. The three pillars of sustainable development – economic growth, environmental stewardship, and social inclusion – carry across all sectors of development, from cities facing rapid urbanization to agriculture, infrastructure, energy development and use, water availability, and transportation" (The World Bank Group, 2017).

2.3.1 Aims and Goals of Sustainable Development

There are several aims and goals for sustainable development as follows (The National Acadimies Press, 2011):

1. To encourage the development enhancement of natural and built environment to be compatible with:

- The requirement to conserve stock of natural assests.

- The need to avoid damaging the regenerative capacity of the natural ecosystem of the world.

- The need to achieve social equality.

- The avoidance of the risks on the succeeding regeneration.

2. To ensure the supply of natural resources for succeeding generations, using land efficiently, with no wasting of nonrenewable resources, substitution renewable resources whenever possible and the insurance of biological diversity (Resources conservation).

3. To ensure that the built environment and development are compatible with natural environment with balanced relation between them (Built development).

4. To prevent processes that pollute environment, to prevent development with harmful effects on human health or diminish quality of life, to protect the regenerative capacity of ecosystems (Environmental quality).

5. To prevent development that increase the gap between poor and rich and to encourage development that reduces social inequality (Social equality).

6. To encourage participation in political decision making and in initiating environmental improvements in all planning levels (Political participation).

2.4 GIS and Urban lanning

Many fields use GIS because no limits of information can be analyzed using GIS technology as: biologists (for example use GIS to track animal migration patterns).city officials (for example use GIS to help in planning cities and to avoid natural disaster through determining best locations for shelters), Scientists (for example use GIS to compare population growth to resources, to determine future needs for public services like parking, roads, and electricity ((National geographic society, 2017).***But what is GIS???***

"A geographic information system (GIS) is a computer system for capturing, storing, checking, and displaying data related to positions on Earth's surface. GIS can show many different kinds of data on one map. This enables people to more easily see, analyze, and understand patterns and relationships" (National geographic society, 2017).

GIS use any information that includes location that is expressed in different ways as: latitude and longitude, address, or ZIP code (National geographic society, 2017).

The GIS system may include data about: people such as(population, income, or education level),land such as:(location of streams, different kinds of vegetation, and different kinds of soil), sites of factories, farms, and schools, or storm drains, roads, and electric power lines (National geographic society, 2017).

Many different forms of data can be entered into GIS such as (National geographic society, 2017):

- Maps, such as: location of rivers and roads, hills and valleys.
- Digital, or computerized: such as: data collected by satellites that show land use the location of farms, towns, or forests.
- data in table form, such as: population information.

GIS technology allows different forms of data to be overlaid on a single map.

Information from all the various maps and sources must be aligned in GIS, This is because of different scales of maps (National geographic society, 2017).

Database management, visualization, spatial analysis, and spatial modeling are the main uses of GIS in urban planning as seen in fig below. Mapping is the visualization in GIS where can planners extract information to analyze (economic, social) of cities. GIS can manipulate data, present the existing situation, identify conflict development areas. Thus help planners and decision makers to make decision depending on the best alternatives (Yeh, 2005).

The study will depend on cartographic modeling “Cartographic modeling which is a general methodology for analysis and synthesis of geographical data. It employs what amounts to algebra in which single-factor maps are

treated as variables that can be flexibly manipulated using a small but highly integrated set of cartographic functions" (Tomlin, 1991) .

The concept of cartographic modeling is Based on data layers, operations and procedures. The purpose of the method is to create new map layers using existing map layers and operations that are sequenced in procedures (Tomlin, 1991).

Chapter Three
General Background about Tulkarem Governorate

3.1 Introduction

Due to the location of the Tulkarem governorate, the challenges and obstacles facing the Governorate and of the steady increase in the population which followed by increase of resources demand.

Ever since the earth was inhabited, humans and other life forms have depended on, provisions of nature that human has no relation in existence, They are essential for human life and other living organisms, as well as to the ecosystem. These resources constitute basic material of the various production processes, which are very important for human society existence, and provision of physical and moral needs and requirements.

This led to study and analyze the current situation of Tulkarem Governorate: location, environmental resources, economic, social characteristics will be studied to save resources from waste for present and future generation.

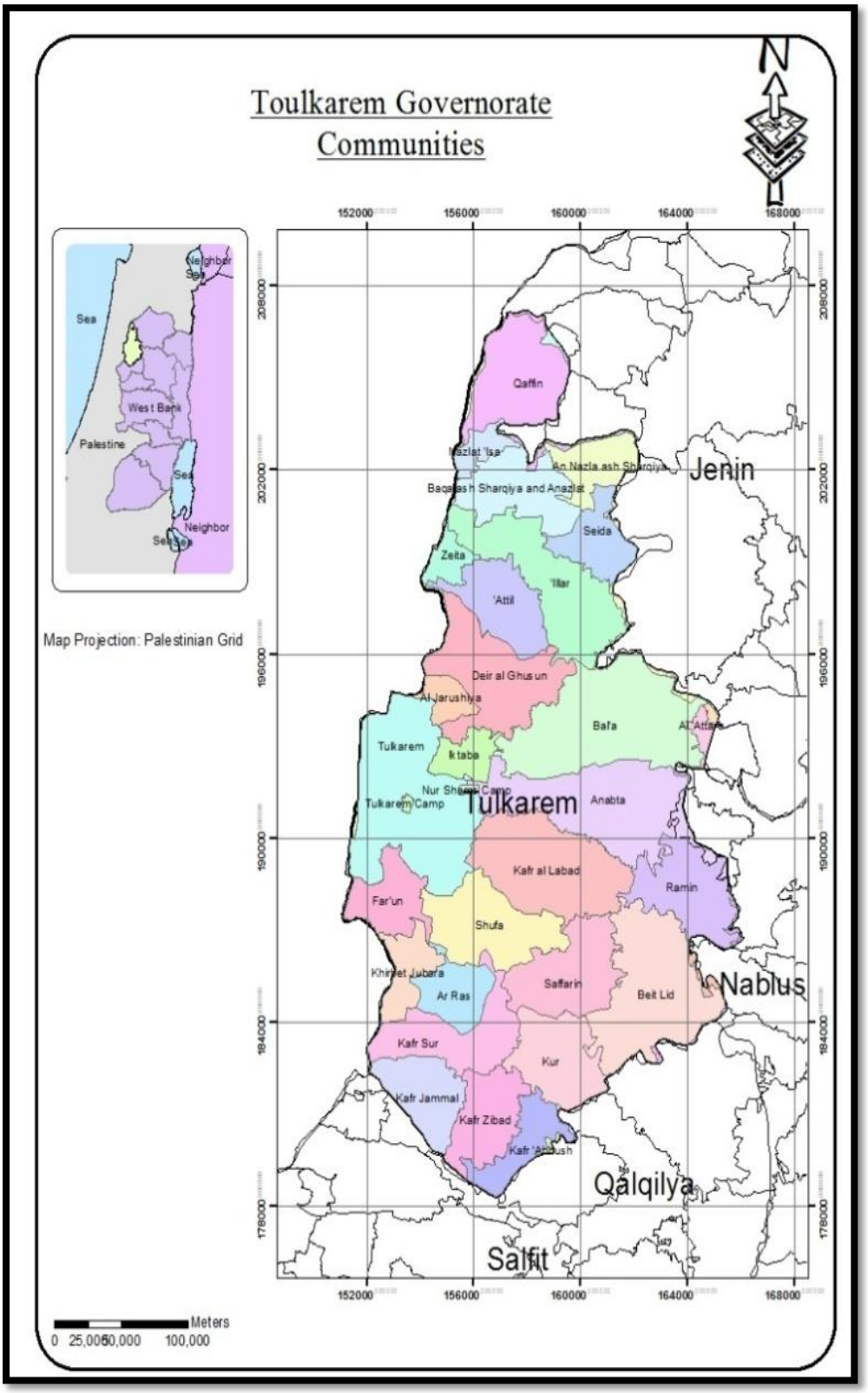
Tulkarem governorate is located in the western center of Palestine, in the northern West Bank. It is located on the borderline between the fertile coastal plain in the west of the city and the mountainous lands extending to the east of the governorate, Lands of the Tulkarem Governorate is located between the border of Palestinian National Authority and the Palestinian

territories occupied by Israel since 1948. It is 15 km from the Mediterranean coast (National Center For Sustainble Development, 2014).

Tulkarem shares a geographical boundary with Jenin to the north, Nablus to the east and Qalqilya to the south. The total area of Tulkarem is about 246km^2, which constitutes about 4.7% of the total area of the West Bank (PCBS, 2011).

The location of Tulkarem Governorate gave it commercial and military importance, because of the old city, Tulkarem city, was the junction of transportation routes. In the Ottoman and British periods, the Hijaz railway and the Egyptian railway line passed through the city. In addition to the average location of Tulkarem governorate, soil fertility and abundance of water helped to accelerate the growth and development of the province during the short period of the last century (National Center For Sustainble Development, 2014).

Tulkarem Governorate consists of 35 localities as seen in the map (3-1), 12 municipalities, 8 village councils and two camp committees (PCBS, 2011).



Maps 3- 1: **Tulkarem governorate Localities**

Source: (Ministry of Local Government, Geomolg, 2017)

3.2 Environmental Aspects

Environmental aspect of sustainability is the first aspect of the sustainability triangle which is very important. It is a gift of Allah that must be guarded and not wasted to ensure continuity of life on the surface of the earth.

3.1.1 Climate

The climate of Tulkarem is within the climate of the Mediterranean region type with moderate summer and warm winter, It has local effects due to the variation in the surface and location conditions at the local level. But does not lead to significant substantive differences (National Center For Sustainble Development, 2014).

1. Temperature

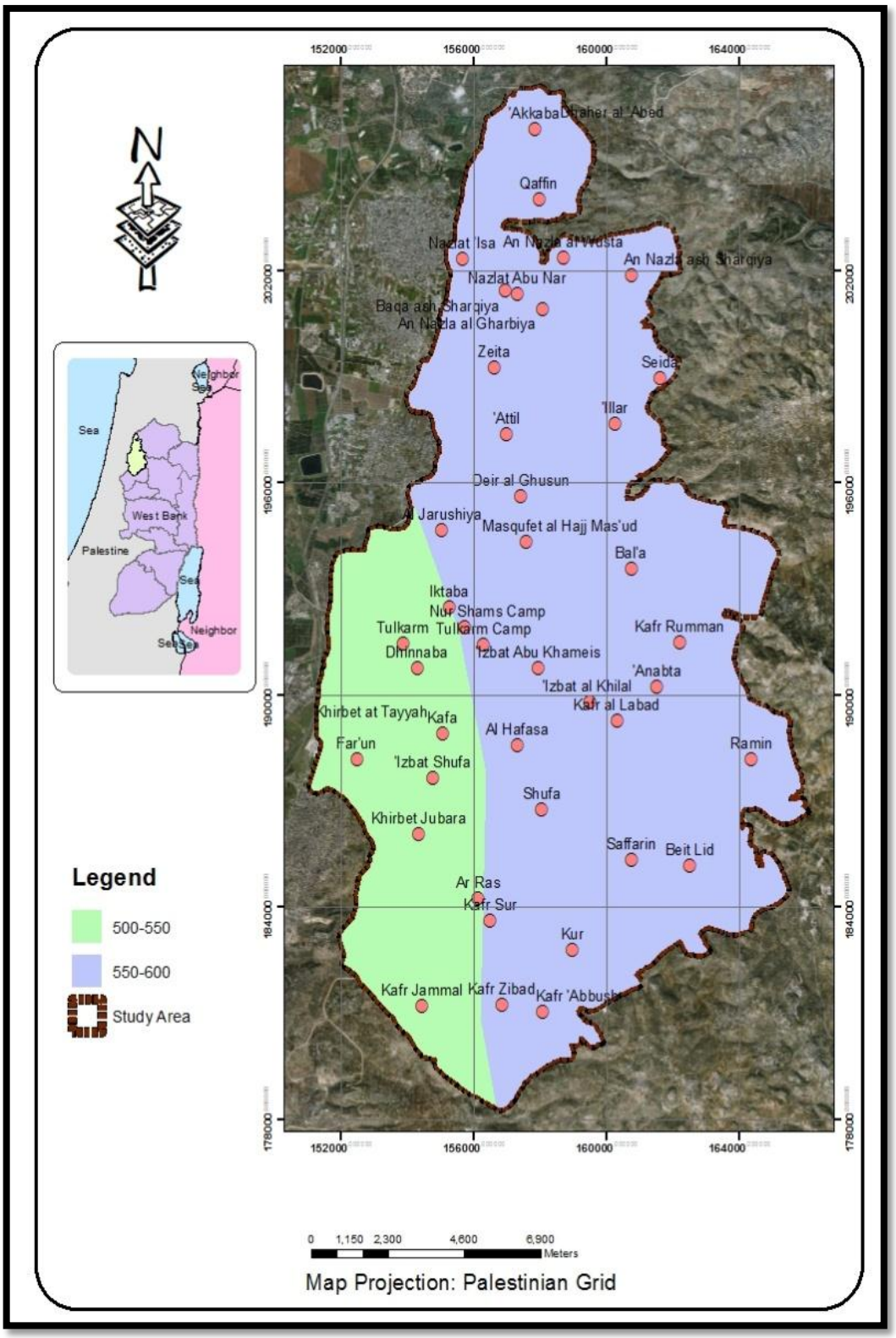
Temperature in Tulkarem governorate is moderate. The average temperature (table 3-1)in the coldest months of January does not drop from 9 ° C. The average temperature for the hotter temperatures is not more than 27 ° C, and the maximum temperature is not greater than 32 ° C (National Center For Sustainble Development, 2014).

Tulkarem Governorate climate has the characteristics of the Mediterranean climate, which is characterized by clear summer and winter (National Center For Sustainble Development, 2014).

2. Rainfall

Tulkarem area is one of the most abundant areas of rainfall in Palestine in general. Its annual rainfall exceeds 600 mm per year and in some years may reach 900 see(Map 3-2), (table 3-1). Rain falls during the winter, which runs from November to May, although the start and end of the rainy season vary from year to year. The amount, distribution and permanence of the rainfall also vary from year to year (National Center For Sustainble Development, 2014).

In general, the average annual rainfall is about 600 mm, while the annual average number of rainy days (49) days. The month of February is the most rainy months and the number of rainy days (National Center For Sustainble Development, 2014).



Maps 3- 2: Tulkarem Governorate Rainfall
Source: (Ministry of Local Government, Geomolg, 2017)

3. Wind and Humidity

The wind blows on Tulkarem Governorate is the western wind in winter, which is accompanied by generation of air depressions, resulting fall of rain and thunderstorms. The wind speed is moderate during the months of January and February see table (3-1) (ARIJ, 1996).

In summer, the effect of prevailing western wind decreases, it becomes in the form of local winds blowing from the sea to land by day and the opposite in night, thus reducing the thermal differences and tempering the internal temperatures (ARIJ, 1996).

The variation in monthly relative humidity in the governorate is clear, Winter months are more humid than summer months. Relative humidity as seen in table(3-1)ranges between 40-70% in summer and 70-85% in winter. Humidity is not less than 40% for less days of moisture and not for 58% for the least humid months (National Center For Sustainble Development, 2014).

Table 3- 1: The average annual for temperature, rainfall and humidity.

	The average temperature	The average rainfall	The average humidity
2000	22.3	784.4	67
2001	21.8	557.9	66
2002	21.2	-	-
2003	22.2	770.2	-
2004	22.8	547.3	62
2005	23.1	585.8	60
2006	-	-	-
2007	23.2	581.9	69
2008	23.6	406.9	57
2009	21.3	627.7	58
2010	22.5	391.9	55
2011	22.4	521.1	61
2012	-	-	-
2013	-	-	-
2014	-	365.5	-

Source: (PCBS, 2013; PCBS, 2015)

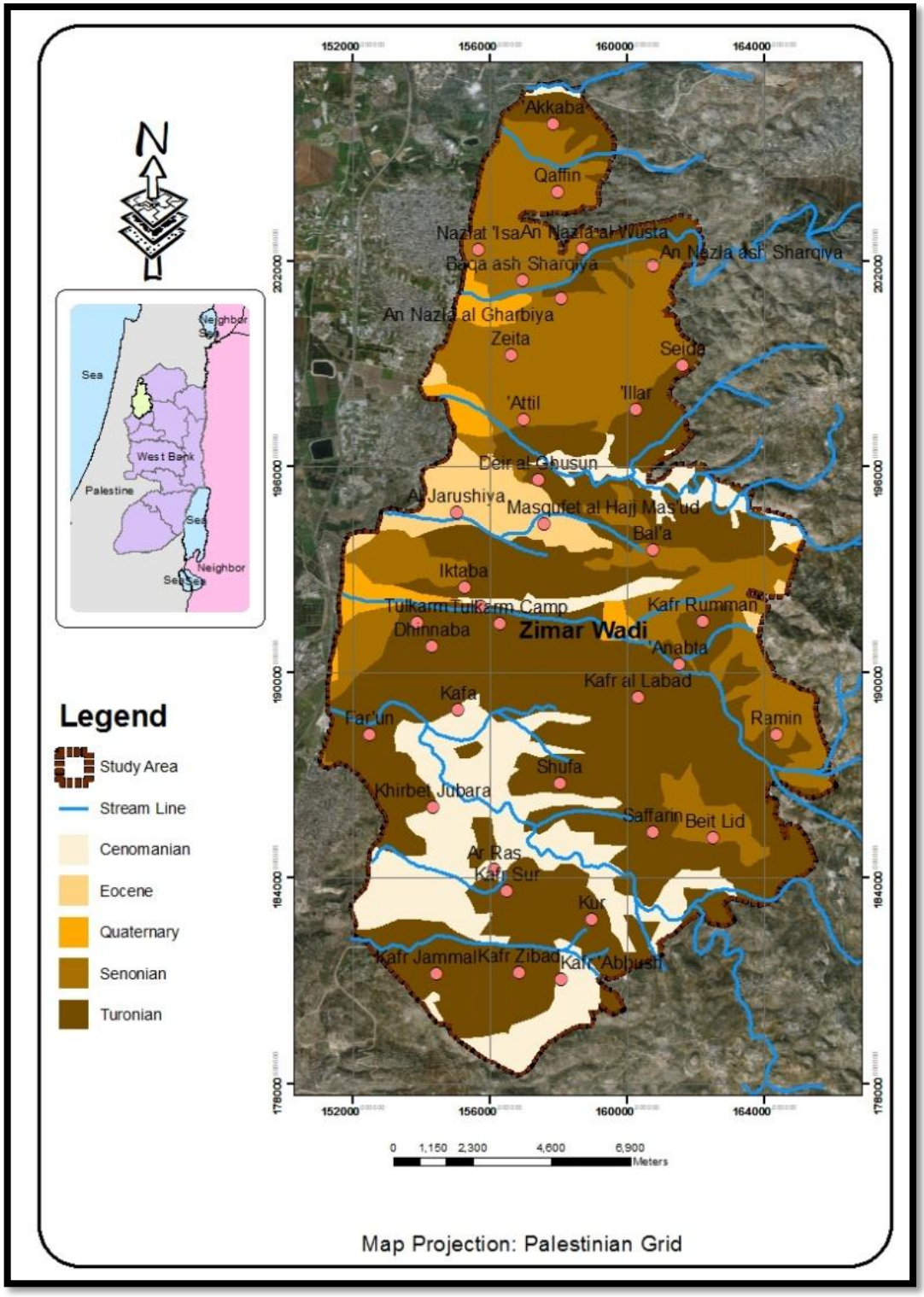
3.1.2 Physical Characteristics:

The physical Characteristics include the following:

(1) Geology

The sediments of the third and third geological stages cover the granite base in Tulkarem area, The erosion resulted removal of the components of eosin, leaving behind the silurium that appears to be visible in the lowlands. The siloric components are visible in low-lying areas. The components of the Middle Cretaceous (Jerusalem Formations) form the eastern highlands of Tulkarem. At the feet of the mountains, the calcareous components deposited by the liquid water flow, which is carried and deposited when it is weak, are located in the flatlands. Red limestone is one of the most common soils (National Center For Sustainble Development, 2014).

The geological map (3-3) shows that the Zaimar valley, which passes near Tulkarem cityis a cracked valley, later expanded because of water, which is only 200 meters wide. This valley has facilitated the linking of the coastal plain to the eastern regions, where railways and paved roads extend (National Center For Sustainble Development, 2014).



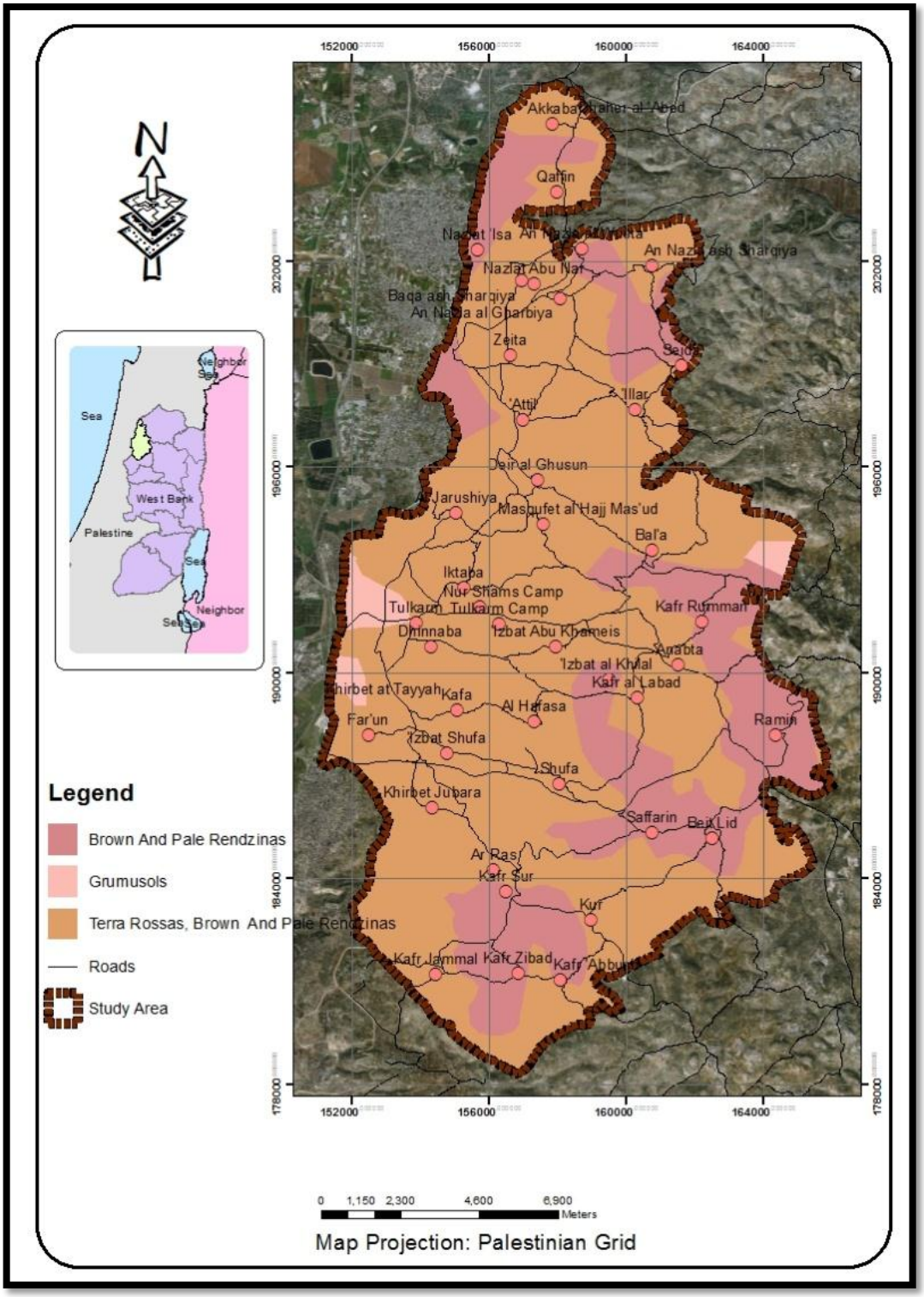
Maps 3- 3: Tulkarem Governorate Geology

Source: (Ministry of Local Government, Geomolg, 2017)

(2) Soil

Area of Tulkarem is generally covered with fertile soil whose components are dominated by lime and limestone materials. Their thickness increases in the flatlands, decreases at the slopes of the mountains and decreases at the top. The soil of the region is one of the most fertile soil of Palestine in general, the bulk of which is transferred, so the proportion of organic materials increase, which are suitable for agriculture in general (National Center For Sustainble Development, 2014).

Soil in Tulkarem Governorate as seen in map (3-4) is divided into: Brown Rendzinas and Pale Rendzinas known locally as (baiad) because of its light color. Grumusols characterized by its dark color, It is a mixture of red and yellow soil and Terra rossas, Brown Rendzinasand Pale Rendzinas known locally as (somka) as seen in the map below (Rayyan, 2014).

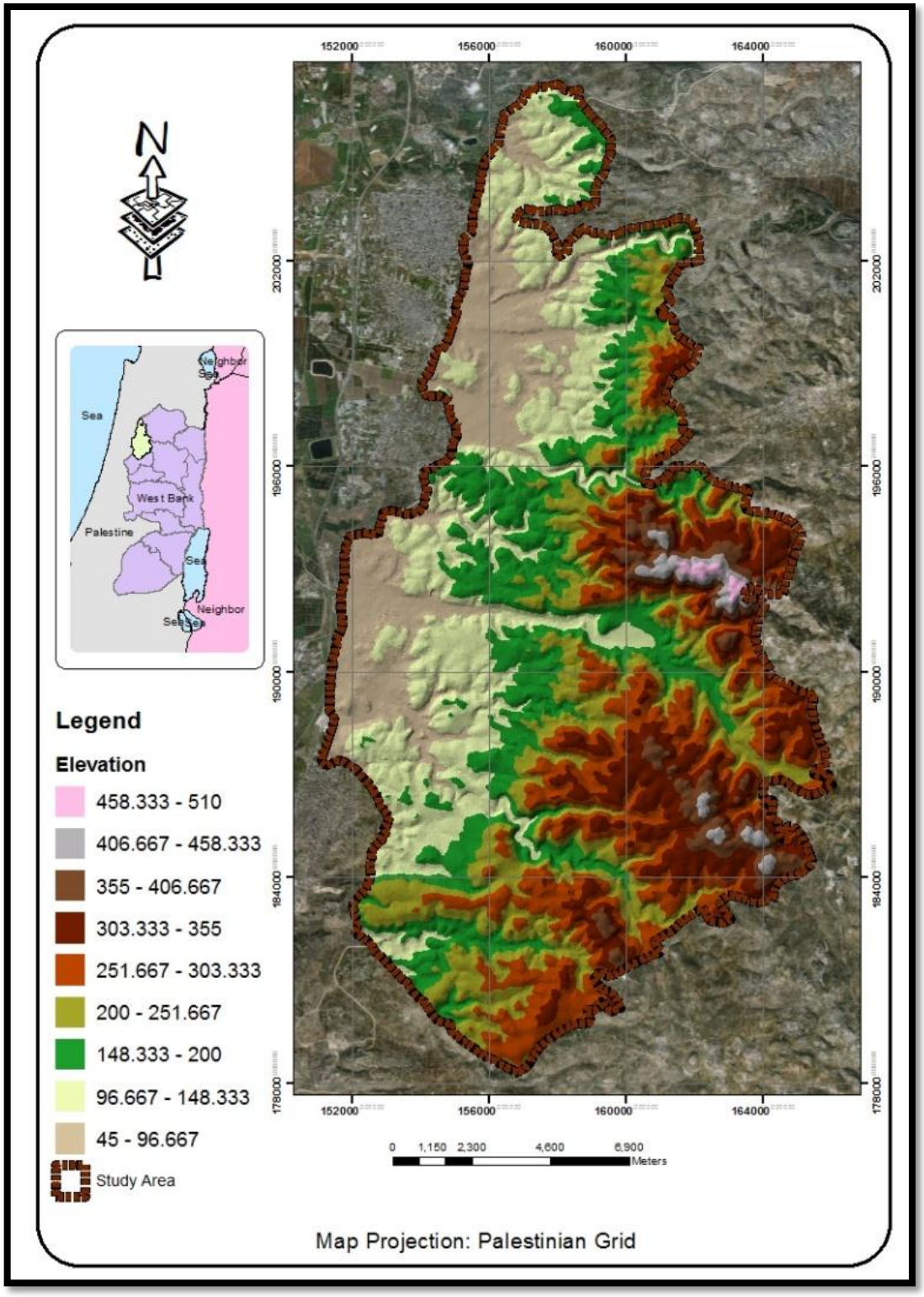


Maps 3- 4: Tulkarem Governorate Soil

Source: (Ministry of Local Government, Geomolg, 2017)

(3) Topography

Tulkarem lies on the western slopes of West bank, which are gentle slope elevation ranges as seen in Map (3-5) between 40 (in the west of the governorate on the border with the Green Line) 525 m above sea level (east of the province along the mountain range of Nablus), In the center of Tulkarem about 200 meters above sea level, Moving to the east of the governorate, the rise increases to the highest altitude in the village of Bil'a and Kafr Rumman about 500 meters. (National Center For Sustainble Development, 2014).

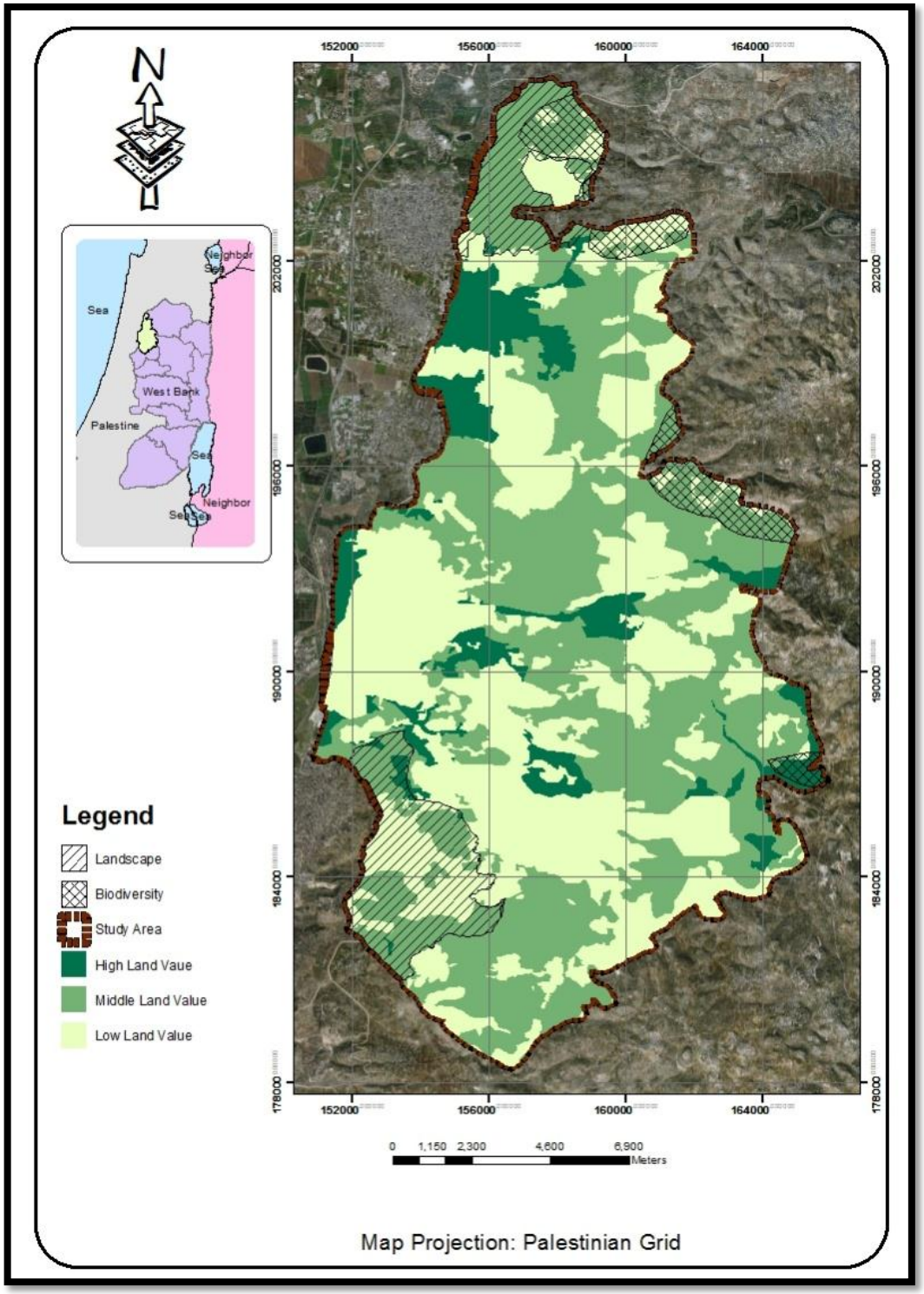


Maps 3- 5: Tulkarem Governorate Elevation

Source: (Ministry of Local Government, Geomolg, 2017)

(4) Land Value, Biodiversity, Landscape

Tulkarem governorate is characterized by diverse vegetation cover and wildlife, resulted from geographical and climatic variability and related differences in rainfall rates and distribution, and the diversity of soil and different geological composition, As well as clear differences in their natural terrain, This share in diversity of landscape, biodiversity through difference of organisms animals, plants and insects, land value that is divided into low land value that is preferable for built up areas expansion, high land value that must be protected to conserve sustainability for generations in present and future and various organisms, and middle land value that is good for agriculture see (Map 3-6).

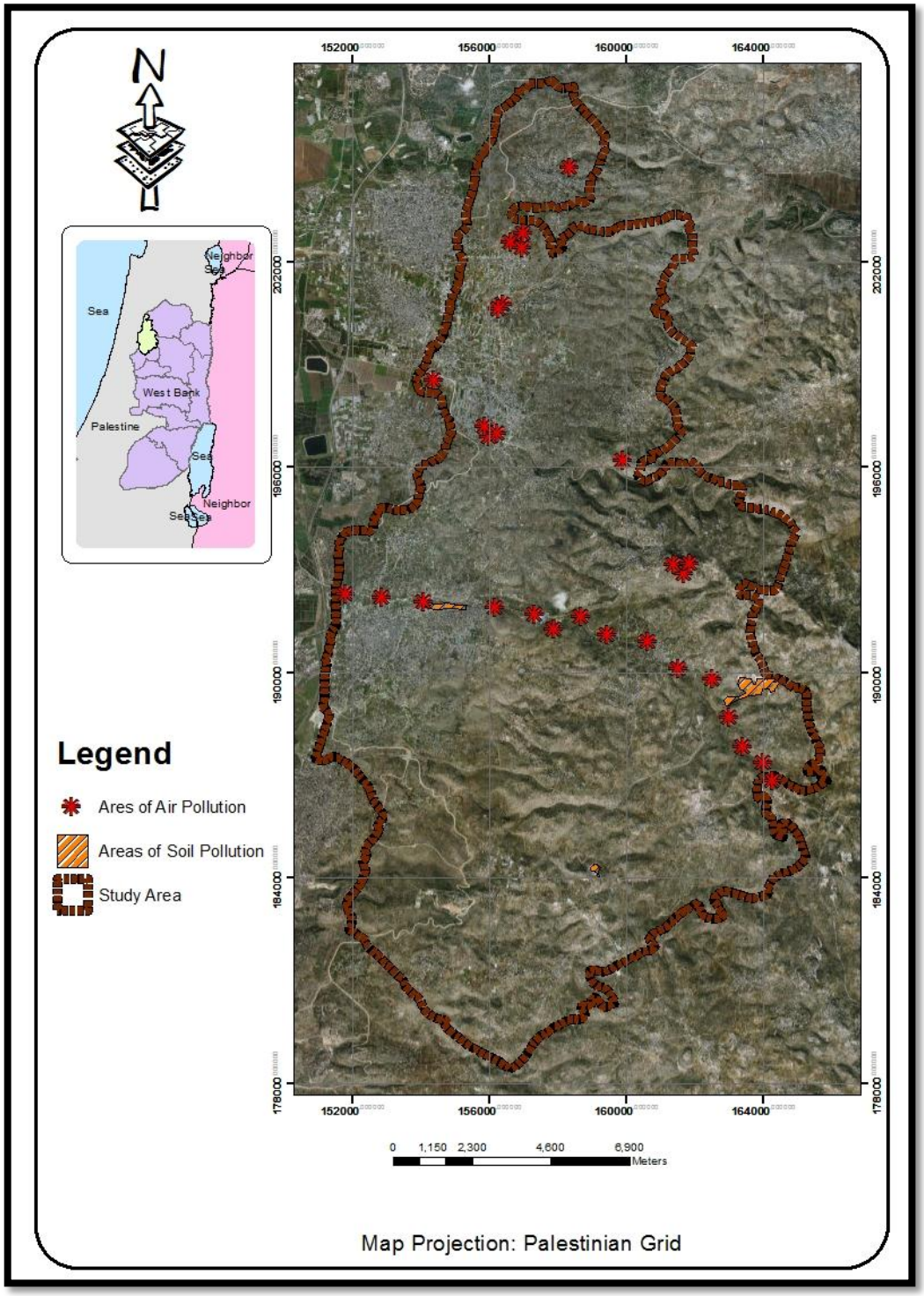


Maps 3- 6: Tulkarem Governorate Land Value, Biodiversity, Landscape.

Source: (Ministry of Local Government, Geomolg, 2017)

(5) Areas pollution

Areas the pollution resulted from Dumping sites and Swage .



Maps 3- 7: Tulkarem Governorate pollution Areas

Source: (Ministry of Local Government, Geomolg, 2017)

3.2 Social Aspects

The social aspect of sustainability is the second aspect of the sustainability triangle which is very important. It is related to the human being, It includes **Demographic** that planning is for and **Spatial** where planning is done, so this aspect has to be studied and improved.

3.2.1 Demographic Aspects

It is important to study population and population distribution to know people needs in present and future to prepare scenarios depending on population growth to estimate governorate demands.

(1) Population and Growth Rate

According to the census of 1961, the population of Tulkarem brigade, which was controlled by Nablus Governorate, was 83,600 see table (3-2), chart(3-1). The city of Tulkarem accounted for 24.7% (about 20,688 people) of the total. In 1967, the population of the brigade decline to 72,200, due to migration resulted from war of 1967. Tulkarem also had a similar decline, with a population of about 15,177. In 1987, the population of the brigade increased to 121,000, an increase of 2.6% during the period 1967-1987. The contribution of Tulkarem city was 24.9% (about 30,151 inhabitants).

In 1997, according to the Palestinian Central Bureau of Statistics (PCBS), Population of Tulkarem governorate was 128,960 with a growth rate of about 1.0% in period of (1987-1997). Contribution of Tulkarem city was 26.2% (33,799 inhabitants). According to the census 2007, Population of the governorate grew to 156,792 with a growth rate of about 2.0%, while population of the city was about 50,912 with a larger contribution (32.5%) (PCBS, 1999).

Population of Tulkarem governorate in 2016 was estimated 185,314 with growth rate of 1.79%, while population of Tulkarem city was estimated at 60,173inhabitants, or 32.47% of the population.

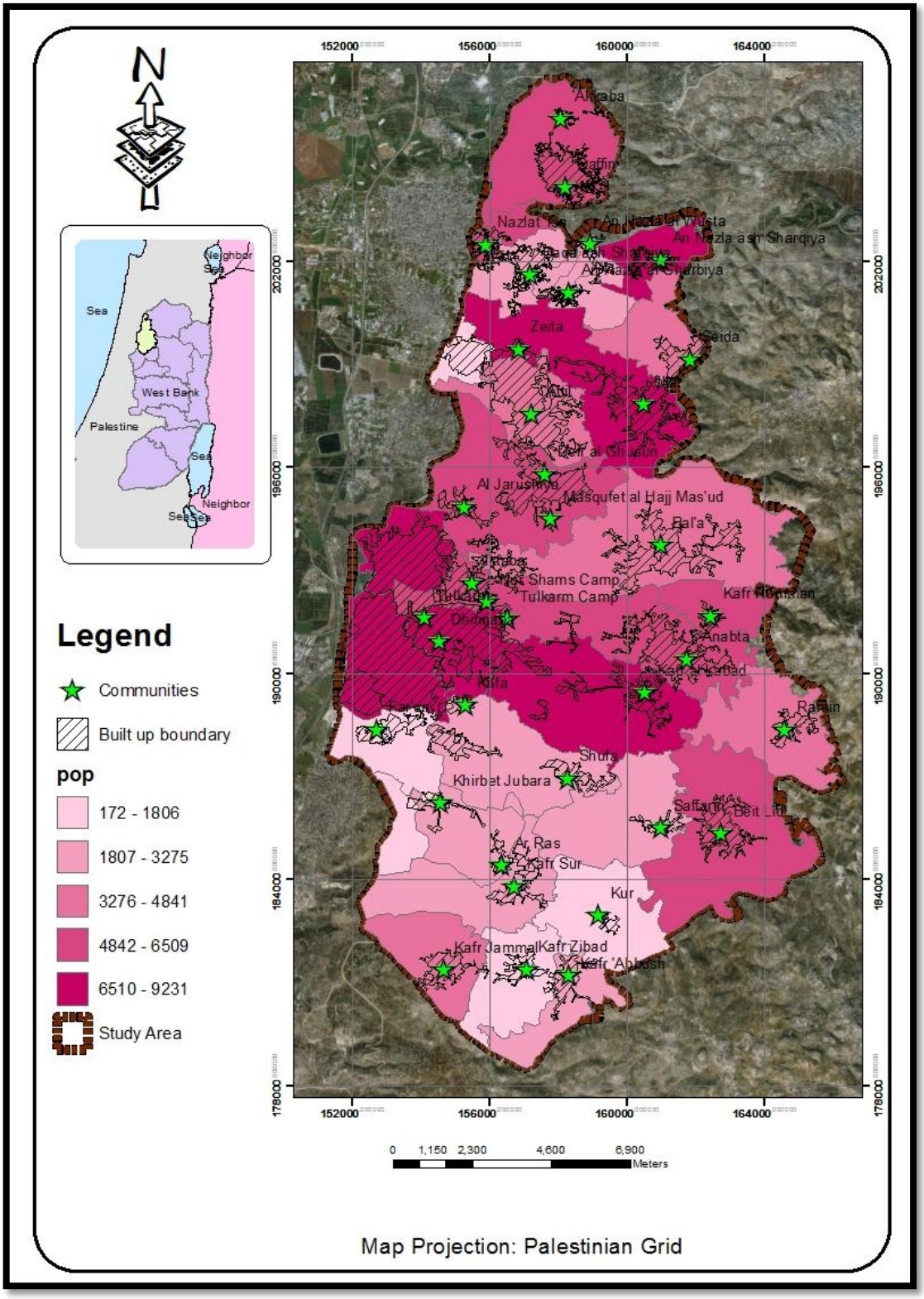
Table 3- 2: Tulkarem Governorate Population

Year	Tulkarem Governorate Population
1961	83,600
1967	72,200
1987	121,000
1997	128,960
2007	156,792
2016	185,314

Source: (PCBS, 1999), (PCBS, 2009), (PCBS, 2014), (PCBS, 2016)

(2) Population Density

As known population density is the number of people per unit of area, here density is calculated per km^2.Tulkarem city is the largest density see map (3-7).



Maps 3- 8: Tulkarem Governorate Population Density.

Source: (Ministry of Local Government, Geomolg, 2017)

(3) Population Distribution

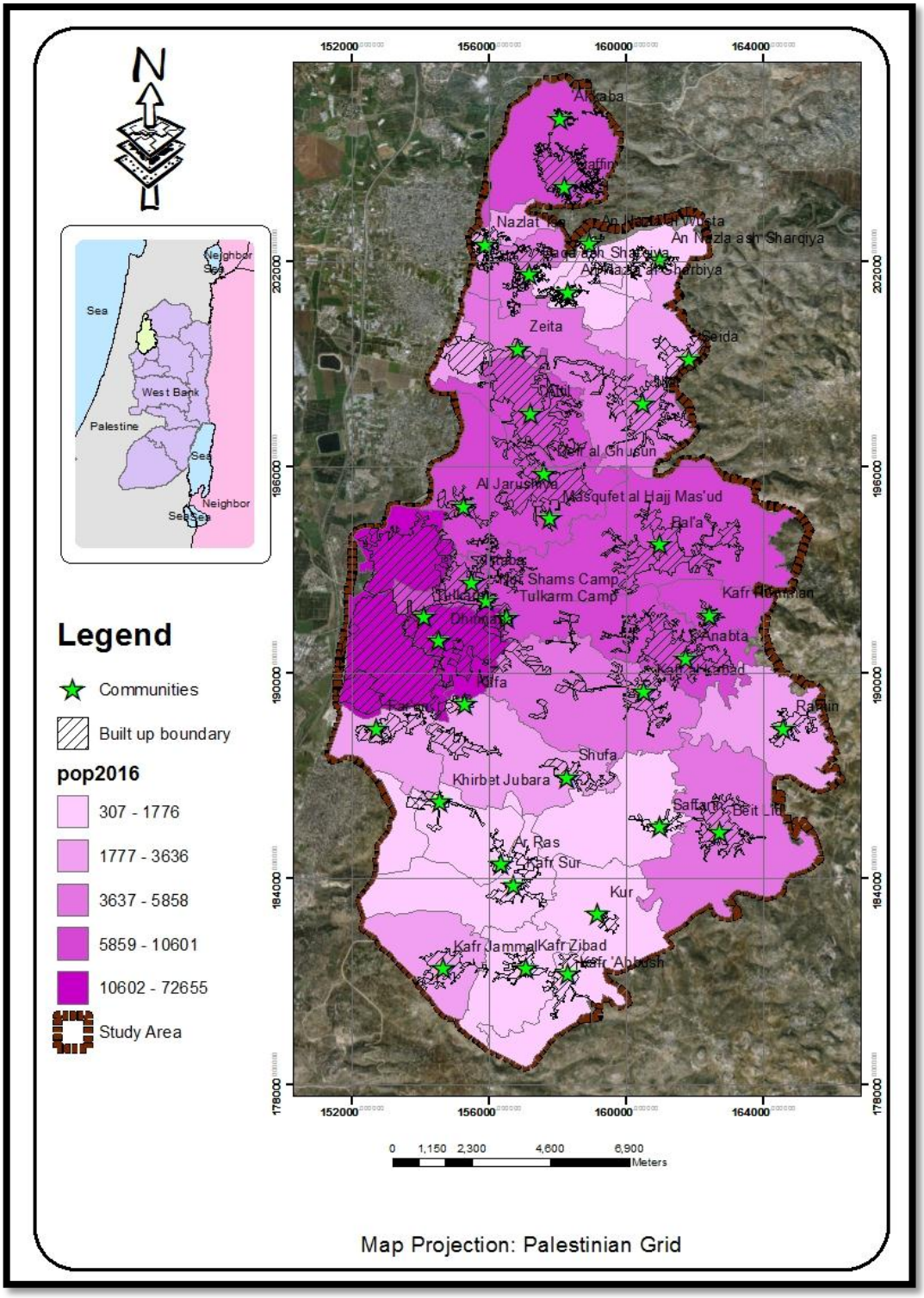
According to the population of Tulkarem governorate estimates for 2016 found that Tulkarem city has the largest population because all services concentrate in it. Then Tulkarem camp that lies in Tulkarem city boundary, The least population estimates is Al Hafasa as seen in map (3-8).

Through calculating percentage of population concentration (calculating the total relative difference between population and area).

X= Is the percentage of the population of the region to the total population of the region.

y= Is the percentage of the area of the region to the total area of the region found that Tulkarem city has the largest percent 14.08% followed by Tulkarem camp 3.33%,Attil 2.41%, Deir Alghusun 2.24%, Nur Shams 2.03%, etc… ,

The least percentage of population concentration is for Kafa 0.03% see table (3-3).



Maps 3- 9: Tulkarem Governorate Population Distribution.

Source: (Ministry of Local Government, Geomolg, 2017)

Table 3- 3: Percentage of population concentration

Community	population concentration% *
Kafr 'Abbush	0.29
KafrJammal	0.64
KafrZibad	0.19
Kur	0.04
Kafr Sur	0.27
ArRas	0.13
Beit Lid	1.39
Saffarin	0.18
Khirbet Jubara	0.05
Shufa	0.61
Far'un	0.9
Ramin	0.46
Kafa	0.03
Kafr al Labad	1.16
'Anabta	1.99
Tulkarm Camp	3.33
Tulkarm	14.08
Nur Shams Camp	2.03
Iktaba	0.58
Masqufet al Hajj Mas'ud	0.06
Al Jarushiya	0.15
Deir al Ghusun	2.24
'Attil	2.41
'Illar	1.65
Seida	0.74
Zeita	0.27
An Nazla al Gharbiya	0.21
Baqa ash Sharqiya	0.85
An Nazla ash Sharqiya	0.35
Nazlat 'Isa	0.63
An Nazla al Wusta	0.06
Qaffin	2.31
'Akkaba	0.39

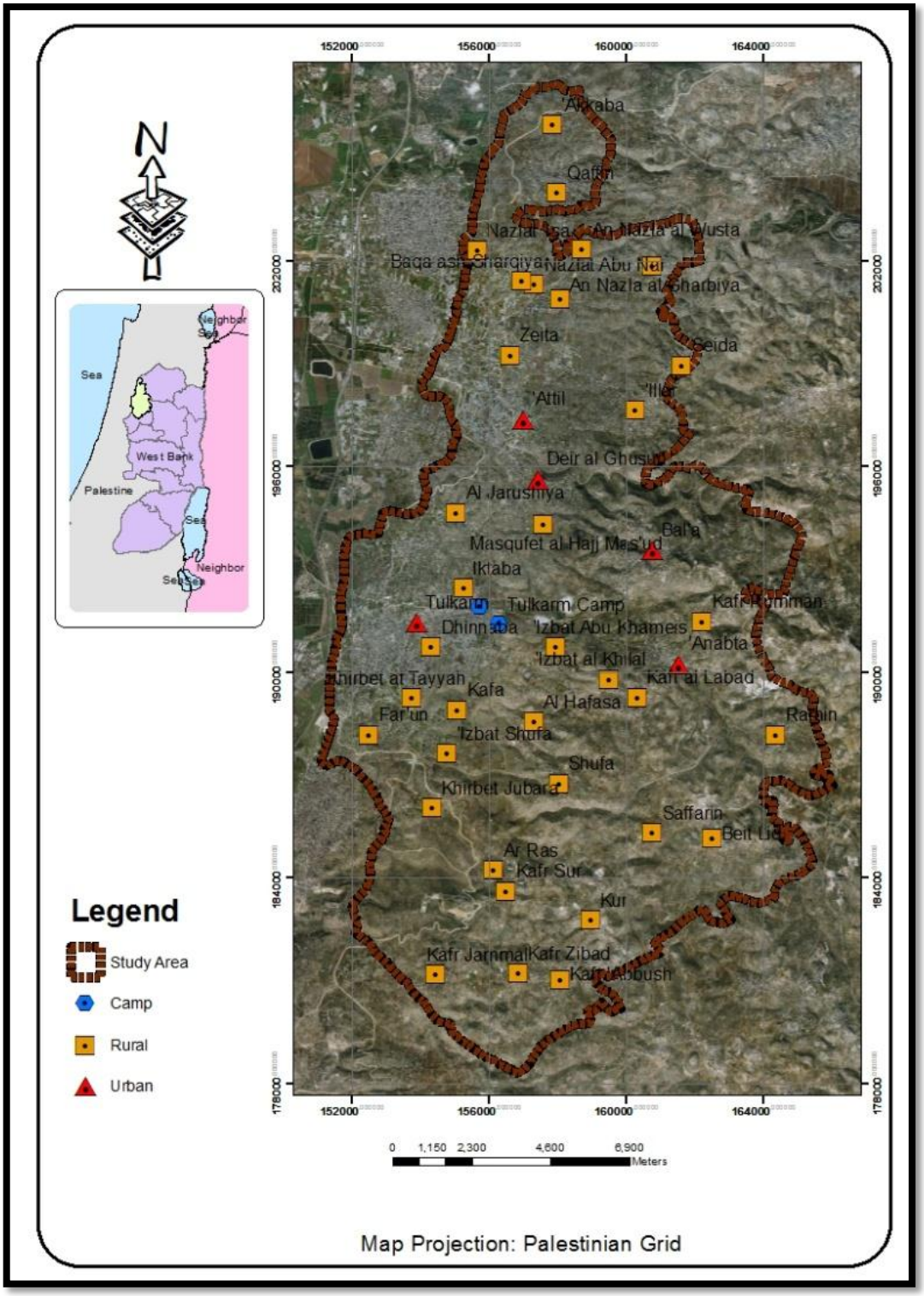
Source: based on table of population estimates of 2016 of PCBS (Palestinian Central Berau of Statistics) *$1/2\sum(x-y)$

(4) Population Characteristics

Population characteristics contains locality type, population composition and age structure of population:

- **Population by Locality Type**

There are 3 types of locality type: urban, rural and camps as seen in map below. According to the results of the 2007 census, 67.21% of the total population of Tulkarem governorate was urban dwellers, Concentration of services in urban areas gives the differential for these areas for dwellers, 21.95% were rural residents and 10.83% were camp residents see map (3-9), table (3-4), chart (3-2).



Maps 3- 10: Tulkarem Governorate Locality Type.

Source: (Ministry of Local Government, Geomolg, 2017)

Table 3- 4: Tulkarem Population Estimates By Locality Type

Year / Population	1997	2007	2014	2016
Urban	52,182	105,229	120,156	124,551
Rural	60,815	34,371	39,246	40,682
Camps	15,963	16,966	19,372	20,081
Total	128,960	156,566	178,774	185,314

Source: (PCBS, 1999) , (PCBS, 2007-2016)

- **Population composition**

Results of census indicates that Male and female in Tulkarem governorate are convergent over the years of 1997, 2007, 2014 and 2016 see table (3-5).

Table 3- 5: Tulkarem Population Estimates By Gender

Year	**1997**		**2007**		**2014**		**2016**	
Gender	**Population**	**%**	**Population**	**%**	**Population**	**%**	**Population**	**%**
Male	89,922	50.6	79,202	50.5	89,922	50.3	93,212.94	50.3
Female	88,852	49.4	77,364	49.5	88,852	49.7	92,101.06	49.7
Total	178,774	100	156,566	100	178,774	100	185,314	100

Source: (PCBS, 1999) , (PCBS, 2007-2016)

- **Age structure of population**

As the distribution of age groups, Tulkarem community is a young society see table (3-6), chart (3-3). The percentage of individuals under the age of 15 is estimated at 38% of the total population of the governorate in 2016. The percentage of economically active population aged 15-64 About 59.0%, indicating that more than half the population of the governorate within this category.

Table 3- 6: Tulkarem Population Estimates By Age 2016

Age group	Male		Female		Both	
	No people	%	No people	%	No people	%
0-4	12024	12.9	11421	12.4	23445	12.6
5-9	12118	13.0	11513	12.5	23631	12.7
10-14	12584	13.5	11973	13.0	24557	13.3
15-19	11186	12.0	11052	12.0	22238	12.1
20-24	8109	8.7	7644	8.3	15753	8.5
25-29	6898	7.4	6539	7.1	13437	7.2
30-34	6059	6.5	5894	6.4	11953	6.5
35-39	5313	5.7	5250	5.7	10563	5.7
40-44	5127	5.5	4789	5.2	9916	5.4
45-49	4194	4.5	3960	4.3	8154	4.4
50-54	2517	2.7	2671	2.9	5188	2.8
55-59	1957	2.1	2026	2.2	3983	2.1
60-64	1398	1.5	1934	2.1	3332	1.8
65-69	932	1.0	1382	1.5	2314	1.2
70-74	839	0.9	1289	1.4	2128	1.1
75-79	466	0.5	921	1.0	1387	0.8
80-84	280	0.3	553	0.6	833	0.5
+85	280	0.3	368	0.4	648	0.3
Not Indicated	932	1.0	921	1.0	1853	1.0
Total	93213	100	92094	100	185,314	100

Source: (PCBS, 2007-2016)

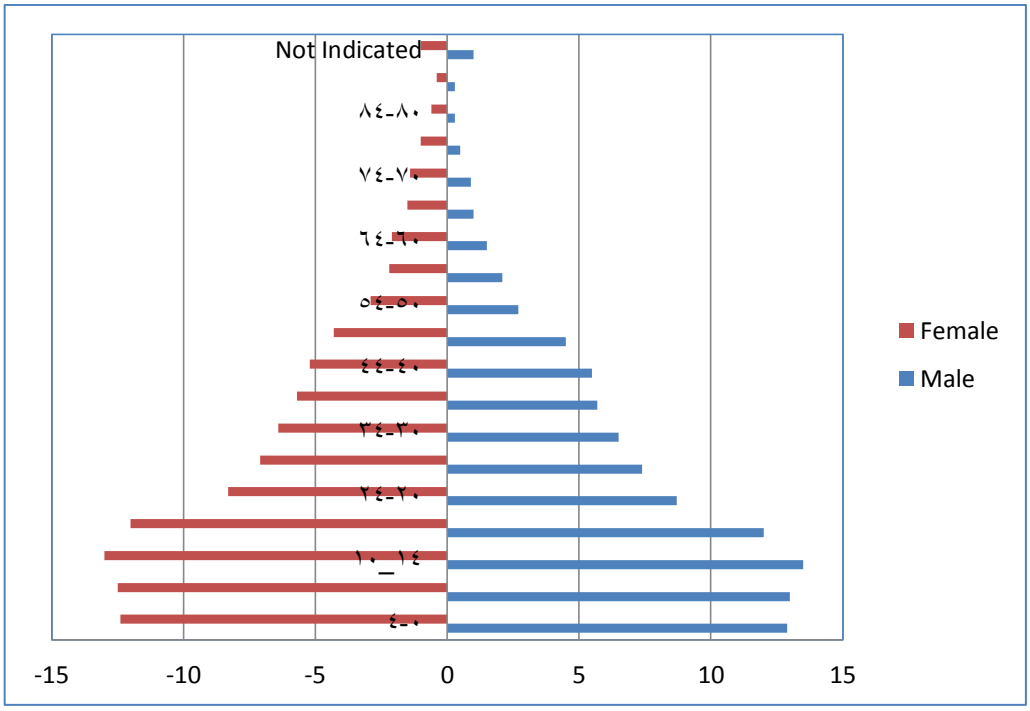


Chart 3- 1: Tulkarem Population Pyramid 2016

Source: (PCBS, 2007-2016)

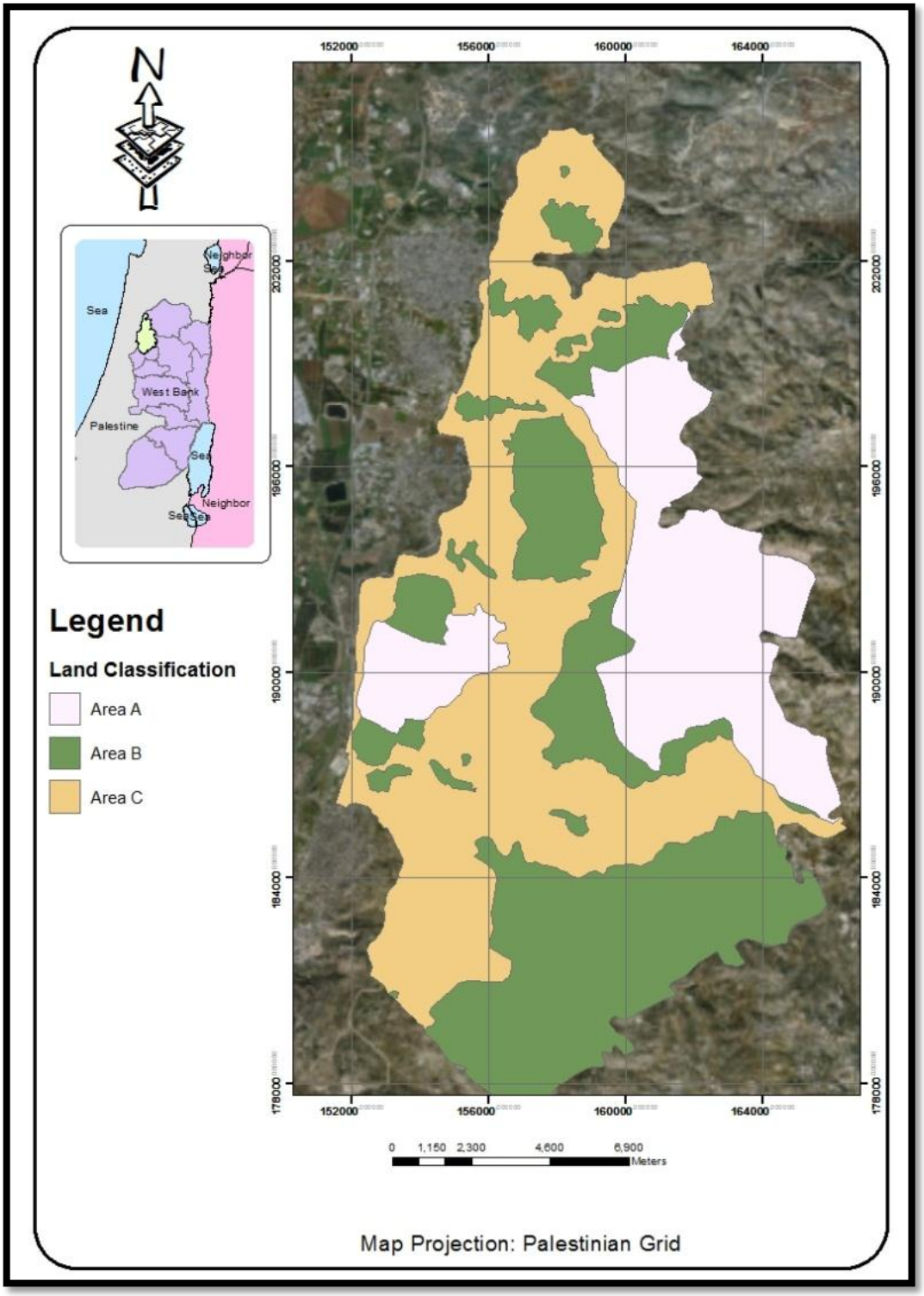
3.2.2 Spatial Aspects

Oslo classification affected clearly on Spatial aspects in Tulkarem governorate, where Tulkarem governorate was divided into 3 areas according to Oslo classification as seen in map (3-11) (WAFA INFO, 2011):

Area A: Full civilian and security control by the Palestinian Authority.

Area B: Palestinian civilian control and joint Israeli-Palestinian security control.

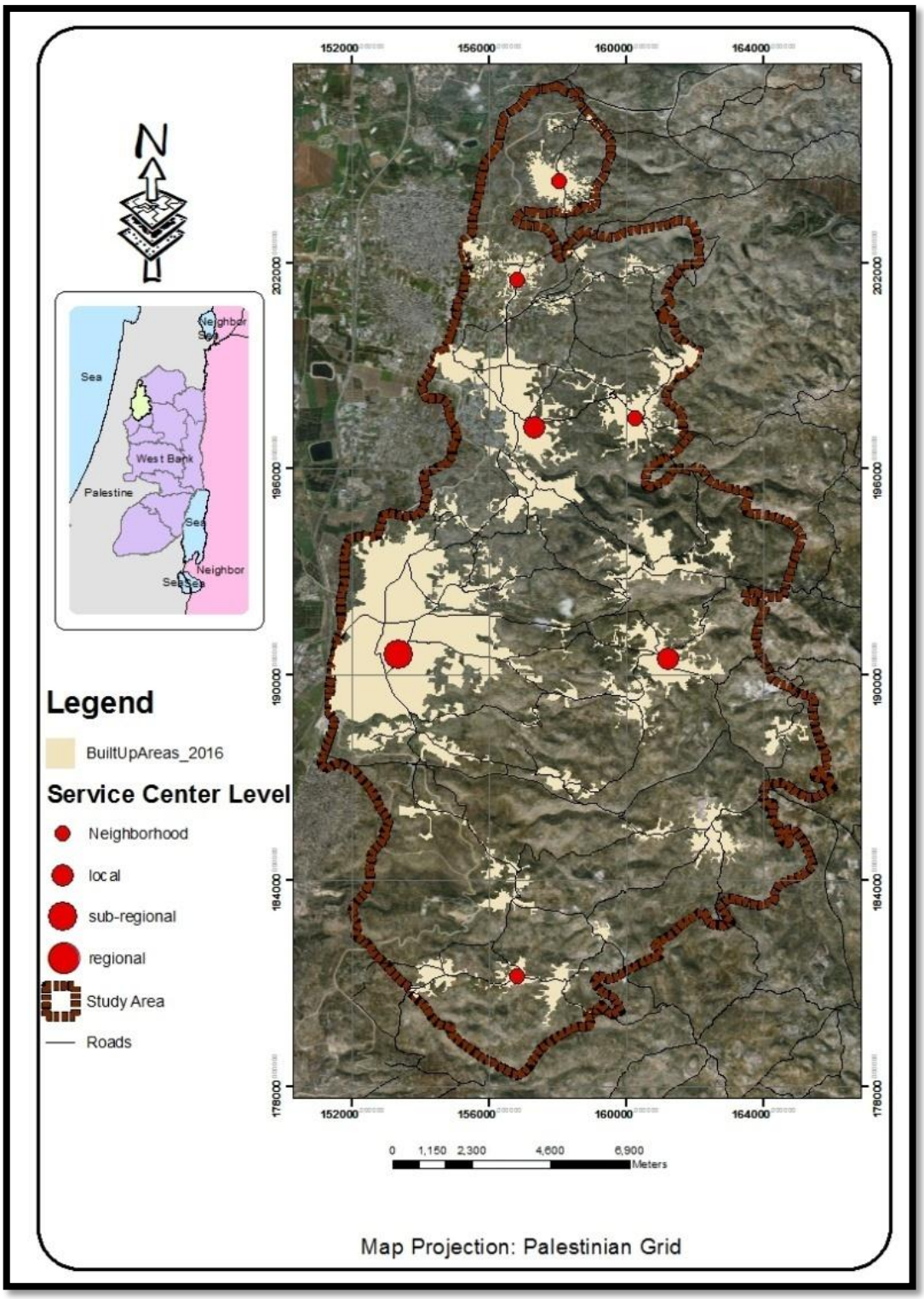
Area C: Complete Israeli civilian and security control, except for Palestinian civilians.



Maps 3- 11: Oslo classification for Tulkarem governorate.

Source: (Ministry of Local Government, Geomolg, 2017)

Tulkarem Governorate is divided into 4 levels of communities services: regional, sub-regional, Local and neighborhood see map (3-12), Tulkarem city is a sub-regional center for Tulkarem governorate, Atil and Anabta are local centers where Qaffin, Illar, Baqa Asharqiah and Kafr Zeibad are neighborhood centers, this division facilites understanding concentration of population, service and expansion.



Maps 3- 12: Tulkarem Governorate Communities Services Levels.

Source: (Ministry of Local Government, Geomolg, 2017)

(1) Development of Communities

Table (3-7) and map (3-13) show development of Urban Communities, that grew rapidly this prove that there is an active urban development.

Using GIS, Calculating Mean Center for Tulkarem Governorate and Tulkarem City during 1994, 2007, 2016 to know how development go found that mean centers for governorate are closed and to the side of Tulkarem city that has the biggest development, Mean centers for Tulkarem city are closed this gives an impression that development is going in a circular way.

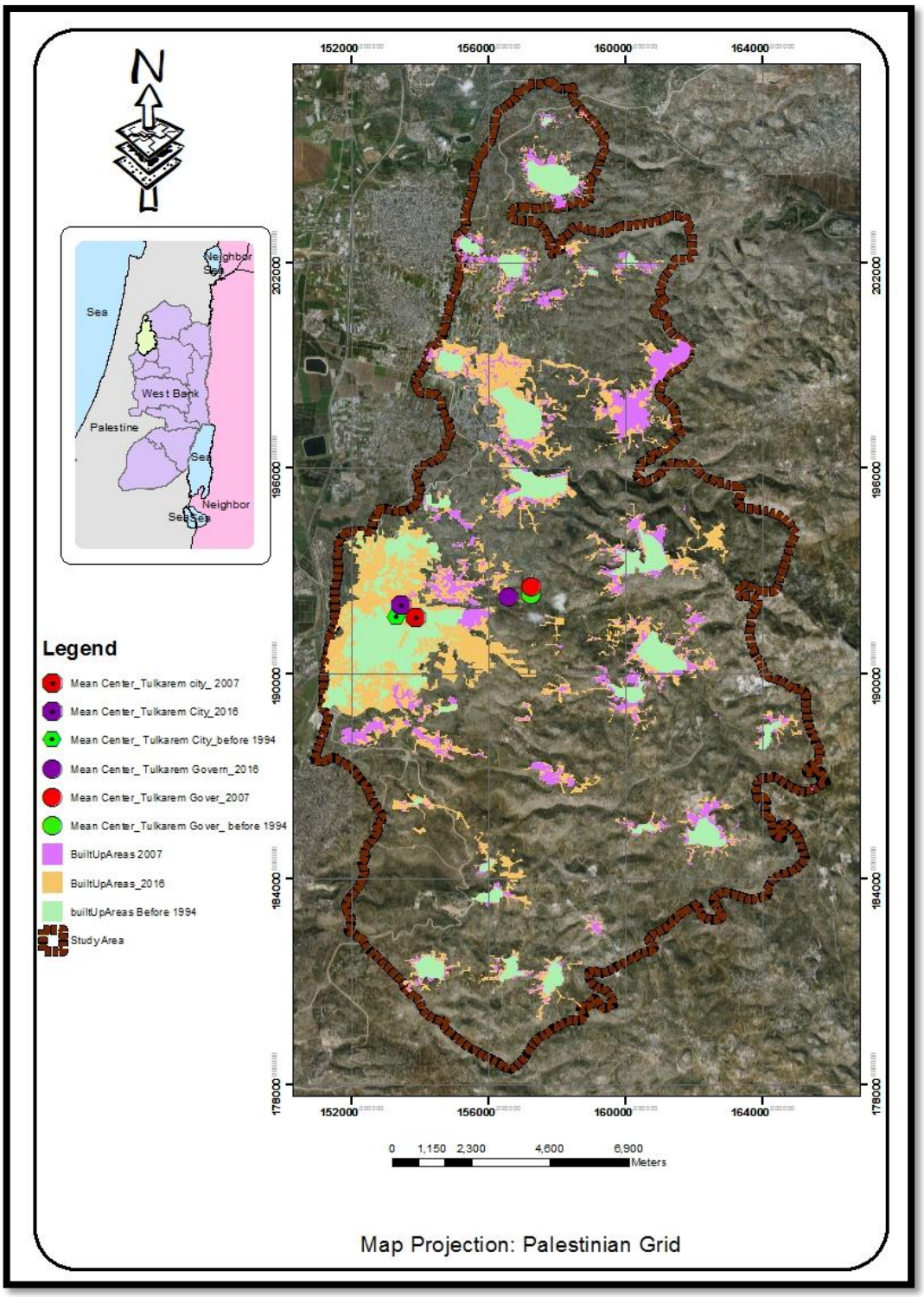
Built up area in Tulkarem Governorate is approximately 20% of total area, Where percentage of built up area in Nord-Pas de Calais in France is 26% in 2000, In 2004, Built up area in was Portugal (34%), Ireland (27%), Spain (18%) (European Enviroment Agency, 2006).

So percentage of Built up area in Tulkarem governorate is acceptable and doesn't need to be increased, so this Support vertical construction instead of horizontal expansion.

Table 3-7: Built Areas Development

Built Up Area	Area(km^2)	Increase%
Built Up Area 2016	49.08	201.31%
Built Up Area 2007	24.38	148.11%
Built Up Area Before 1994	16.46	——

Source: (Ministry of Local Government, Geomolg, 2017)



Maps 3- 13: Tulkarem Governorate Built Up Areas Development and Mean centers.

Source: (Ministry of Local Government, Geomolg, 2017)

(2) Land uses

Land uses will be divided into: uses within planning area and uses within master plan, that are classified into land uses. Areas of these land uses were calculated using GIS and Excel programs see chart (3-4) .

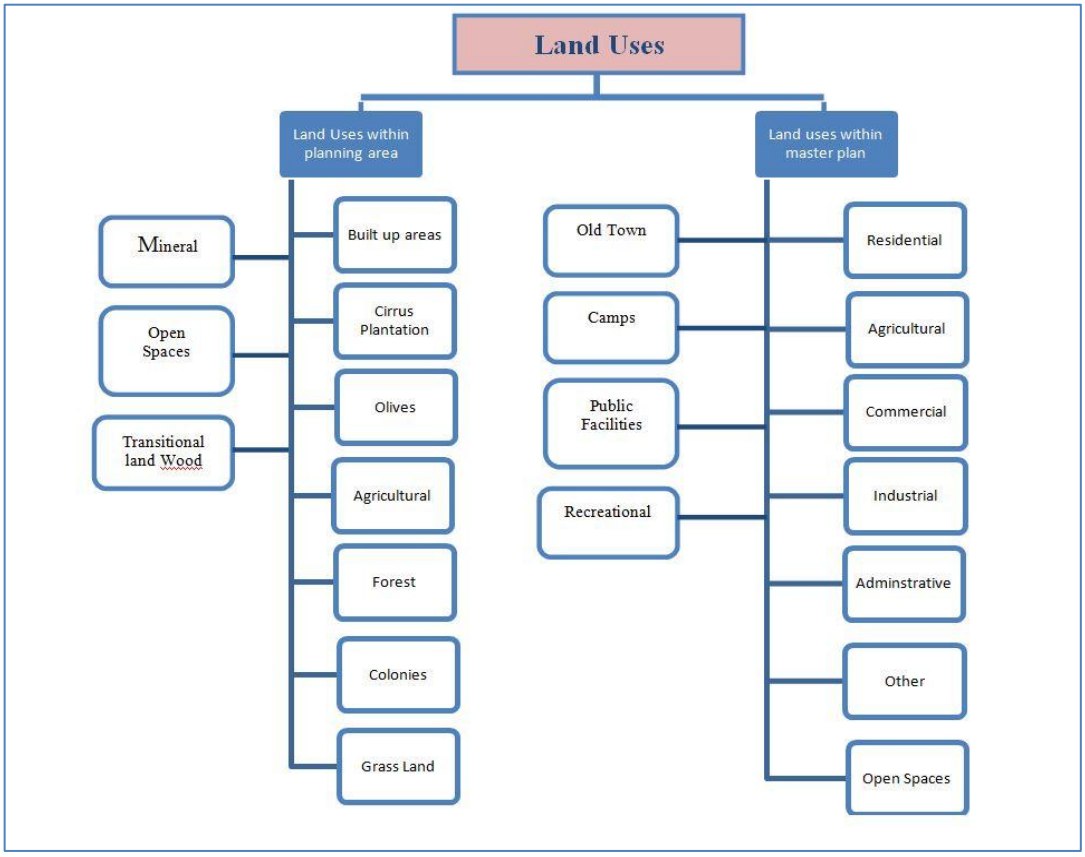
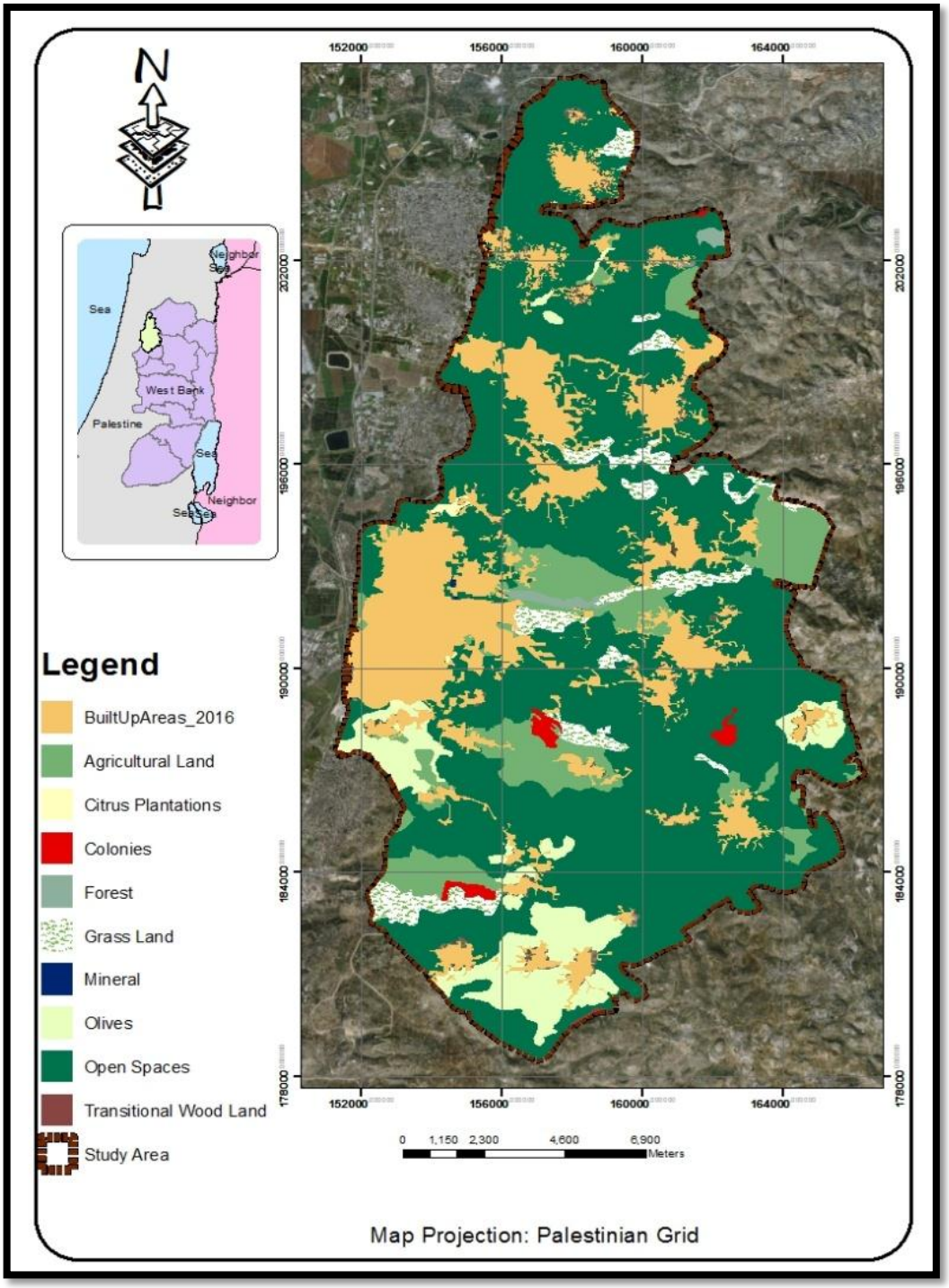


Fig 3- 1: Tulkarem governorate Land Uses Classifications.

➢ Land uses within planning area

Map (3,14), table (3.8), chart (3-5), show that area of the built up areas in the governorate constitutes 19.96%, while the agricultural use is 8.74% and open spaces area percentage is 61.38% which is equivalent approximately two-thirds of the area, but Area "c" occupies a large part of open space and agricultural lands thus impeding development.

Built-up area consume per capita 264.86m² with all uses classified, but Population is concentrated in city of Tulkarem, where services are concentrated.



Maps 3- 14: Tulkarem Governorate Land Uses Within Planning Area

Source: (Ministry of Local Government, Geomolg, 2017)

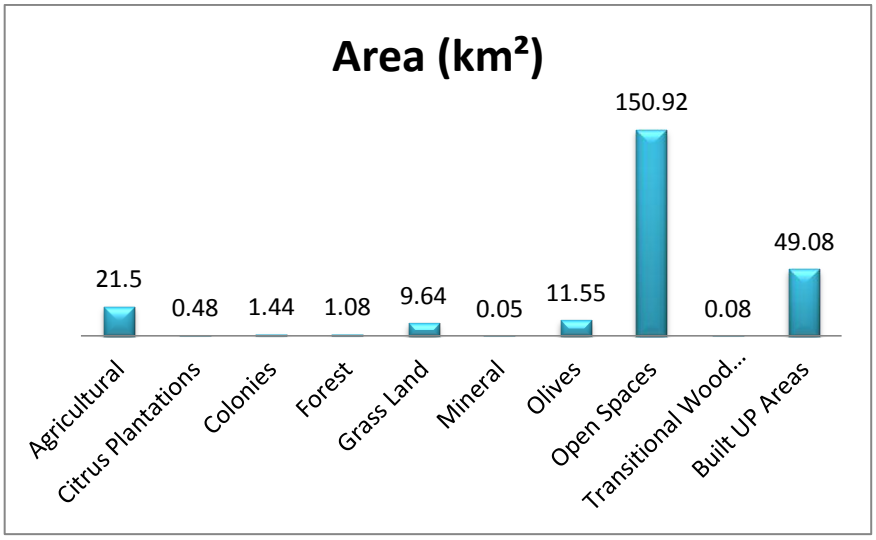


Chart 3- 2: Tulkarem Governorate Land Uses Areas within Planning Area.

➢ Land uses within master plans

Land uses as classified in Master plans in Tulkarem governorate to see map (3-15):

- Residential that mean areas that have predominantly residential character even if there is other uses that related to residential like mini markets, shops etc…Residential classification has subcategories like high buildings, residential a, residential b, residential c, residential d.

- Commercial mean areas that have commercial character like restaurants, retail and wholesale stores, etc… Commercial classification has subcategories like commercial longitudinal, local commercial, trade shows and sub-commercial center.

- Industrial means: areas used for introduction issues, its sub classification is Industrial(artificial and light) and industrial zone.

- Agricultural means: areas used for agriculture
- Public facilities means: areas used in public community like schools, hospitals, public buildings, etc….
- Recreational like: public gardens, playground.
- Old Town
- Camps
- Cemeteries
- Other

Residential use has the largest share of the area in Tulkarem Governorate equivalent to the 72.86% followed by roads and transportation 14.53% see table (3-9), chart (3-6).

As observed that capita for residential area in Tulkarem governorate is 391.77m², which is very high compared by international criteria in developed countries that is 25 for apartments and 35 for houses (Salha, 2002).

Based on Arab communities and UN estimates, the following criteria were adopted:

- Minimum standard: 14m² per capita for city, 11m² per capita for rural.
- Intermediate criterion: 18m² per capita for city, 15m²per capita for rural.

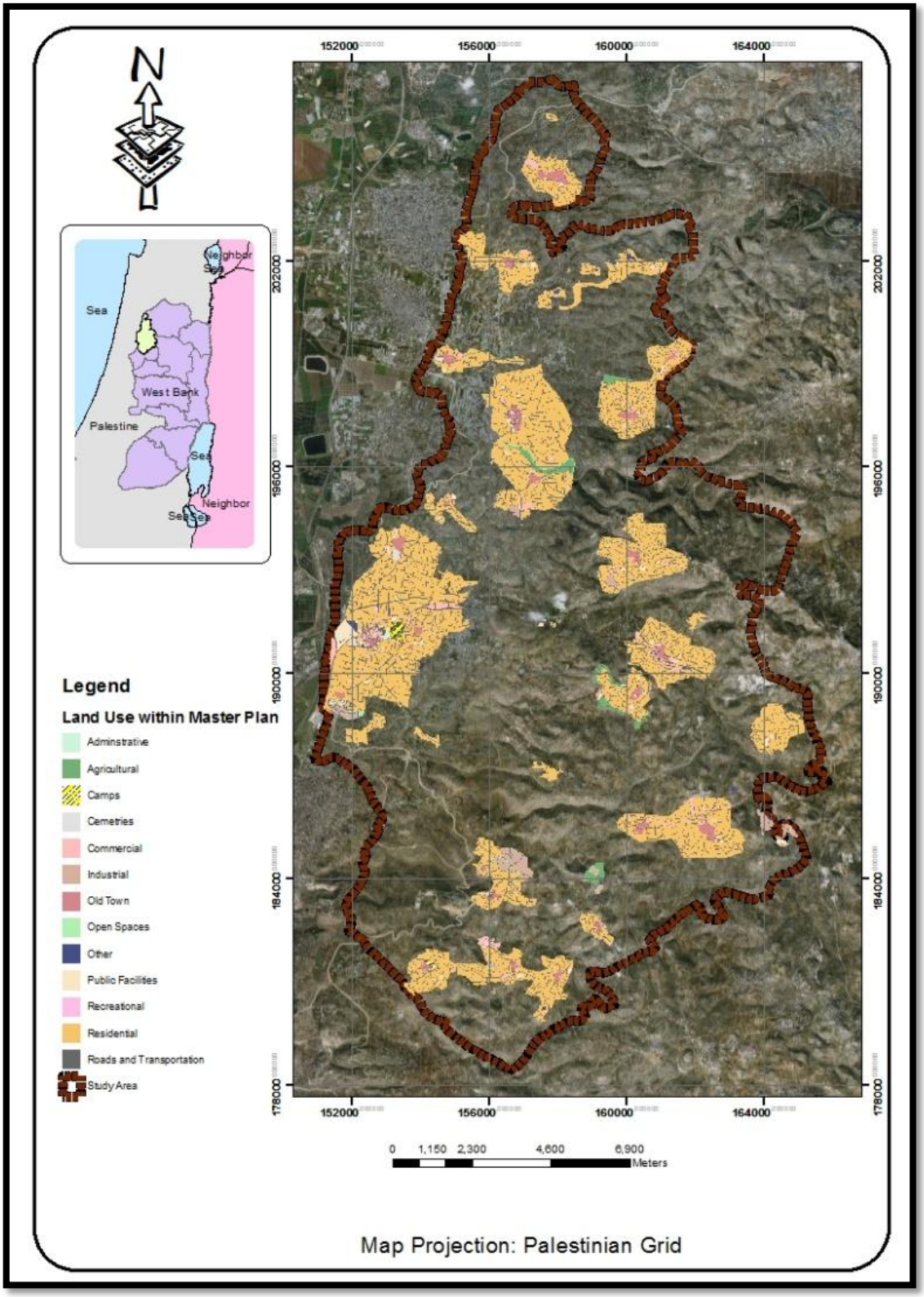
- Highest standard: 23m² per capita for city, 21m²per capita for rural.

It is noted that the minimum level in Arab countries is higher than criteria set by the United Nations, in Kuwait 36m² and in Jordan 21.9m² However, in Tulkarem governorate we find that the per capita share is very high compared by united nations criteria. Which indicates that the citizen Karmi prefer horizontal extension according to customs and traditions (Salha, 2002).

Table 3- 8: Tulkarem Governorate Land Uses Within Communities Master Plans

Land Use / Master plans	Administrativekm²	Agricultural km²	Camps km²	Cemetries km²	Commercial km²	Industrial km²	Old Town km²	Open Spaces km²	Public Facilities km²	Recreational km²	Residential km²	Roads and Transportation km²	Other km²
Illar											0.12	0.37	
Bal'a				0.007	0.06	0.06	0.09		0.04	0.01	2.8	0.46	
KufrLabad		0.33		0.01		0.03	0.06	0.02	0.04	0.01	1.08	0.24	0.001
Seida				0.008	0.02				0.02	0.003	0.76	0.12	
Akkaba											0.05	0.01	
DeirSharaf						0.15			0.03	0.003		0.05	0.009
KufrRumman											0.13	0.05	
Shufa											0.19	0.01	
Faro'n											0.39	0.04	
Ramin				0.006			0.04	0.002	0.006		1.3	0.18	
Aljarushieh							0.02		0.05		0.5	0.11	

Alkafreiat				0.03	0.13	0.54	0.31	0.06	0.13	0.02	5.11	1.08	0.13
Anabta				0.02	0.11	0.006	0.09	0.001	0.05	0.02	2.34	0.62	0.03
Attil				0.01			0.17		0.05	0.01	4.43	0.57	
BaqaSharqieh				0.009			0.07		0.02	0.004	1.49	0.25	
BeitLeid and Saffarin				0.02	0.09	0.14	0.24		0.03	0.009	3.18	0.52	0.02
DeirAlgusun		0.31	0.01	0.04	0.07	0.06	0.08		0.03	0.004	2.27	0.43	
Iktaba											0.38	0.01	
IzbetShufeh											0.14	0.05	
Kur		0.21				0.07		0.01				0.008	
Qaffin				0.003	0.01		0.22		0.02		1.26	0.18	
Tulkarem	0.13		0.16	0.15	0.47	0.18	0.29	0.07	0.43	0.01	9.72	2.25	0.06
Zeita				0.02			0.09			0.001	0.55	0.09	
Annazlat				0.005					0.03	0.009	1.41	0.23	0.06
Total	0.13	0.85	0.17	0.358	0.96	1.236	1.77	0.163	0.976	0.113	39.6	7.928	0.31



Maps 3- 15: Tulkarem Governorate Land Uses Within Master Plans.

Source: (Ministry of Local Government, Geomolg, 2017)

For Tulkarem city found that the city contain all uses for inhabitants except agricultural use depends on the governorate see table (3-10),Area of residential use is the largest one 9.72km² that equal 84.66% which is the dominant use and the largest per capita share 118.39m² where the residential use in Nablus city is 53%, Gaza city is 42.6%, Amman is 67% Damascus is 39% (Al hity, 2002).

Table 3- 9: Tulkarem City Land Uses Percentage and Per Capita Within Master Plans

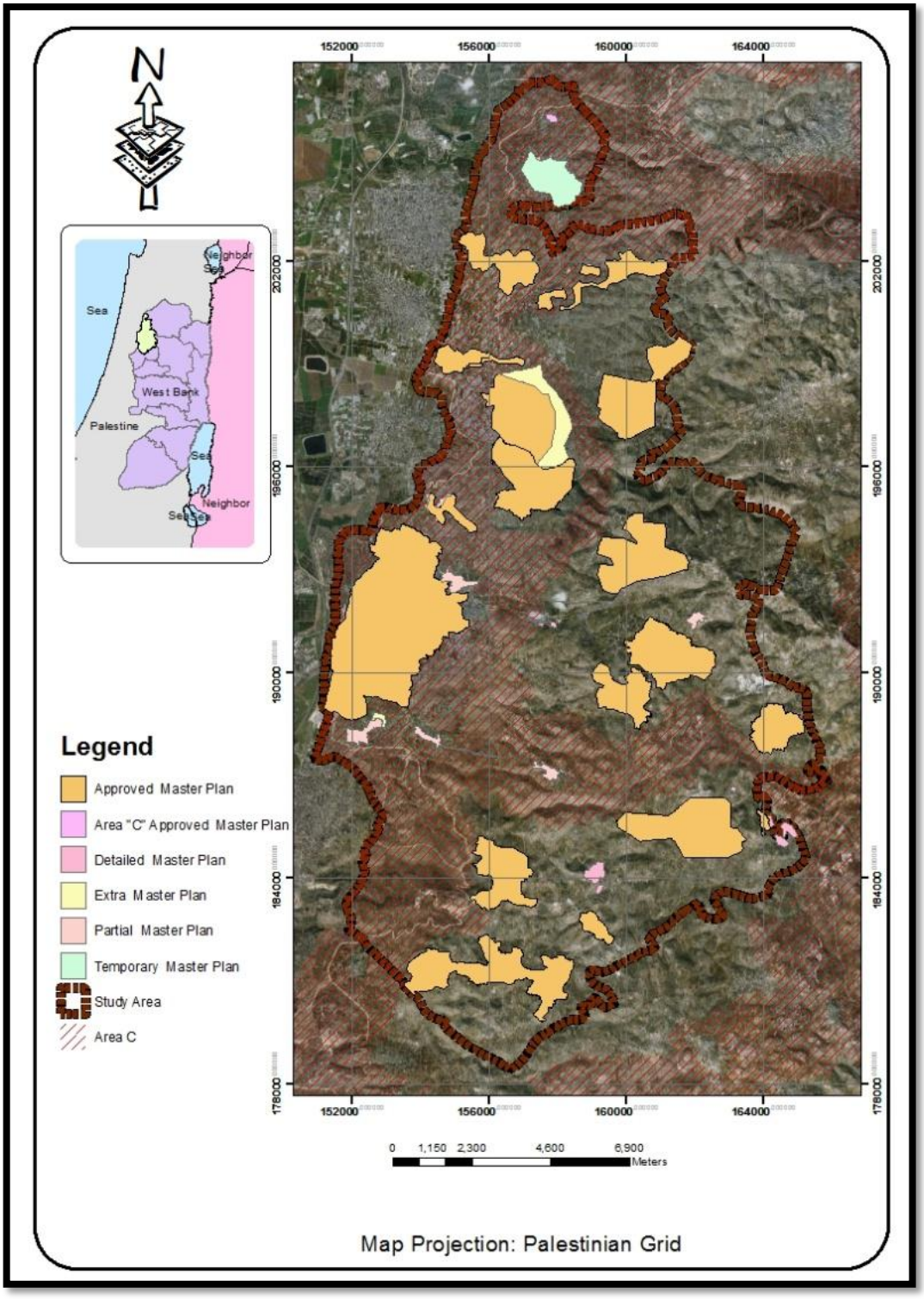
Area	Land Use (km²)	Percentage	m² /capita
Administrative	0.13	1.32	1.58
Agricultural	____	___	____
Camps	0.16	1.39	1.95
Cemeteries	0.15	1.30	0.15
Commercial	0.47	4.09	1.83
Industrial	0.18	1.56	5.72
Old Town	0.29	2.52	____
Open Spaces	0.07	0.61	3.53
Public Facilities	0.43	3.74	0.85
Recreational	0.01	0.08	5.23
Residential	9.72	84.66	118.39
Roads and Transportation	2.25	19.59	27.40
Other	0.06	0.52	0.73
Total	56.68	%100	____

Table (3-11), map (3-16) shows communities that have mater plans and their types.

Table 3- 10: Tulkarem Mater Plans Types

Community Name	Approved Master plans	Partial Master Plans
Beit lid and Saffarin	*	
BaqaAsharqeiah	*	
Iktaba		*
Zeita	*	
Tulkarem	*	
Ramin	*	*
Alkafreiat	*	
Attil	*	
Seida	*	
Illar	*	
Izbetshufeh		*
Shufeh		*
Aljarousheieh	*	
DeirAlghsoun	*	
Qaffin	Emergence	
KfrLabad	*	
Bala’	*	
Faro’n		*
Anabta	*	
KfrRomman	*	*

Source: (National Center For Sustainble Development, 2014)



Maps 3- 16: Tulkarem Governorate Master plans Types

Source: (Ministry of Local Government, Geomolg, 2017)

(3) Public Services

Infrastructure is the physical components providing commodities and services essential to sustain, or Enhancement societal living conditions such as roads, water, wastes.

i. Roads

The roads network is well distributed in Tulkarem governorate, which varies from good to bad. The percentage of good roads according to the statistics of Ministry of Public Works is estimated at 60%. The poor roads are estimated at 8% and the roads average 31% (National Center For Sustainble Development, 2014).

It is possible to say that there are three main roads in the governorate: Nablus Road, which links the city of Nablus to the city of Tulkarem, and the Kafriyat road, which runs from Tulkarem through Kafriyat to Qalqiliya. The third is the Shaarawi road connecting Tulkarem and towns and villages located see table (3-12), map (3-17) (National Center For Sustainble Development, 2014).

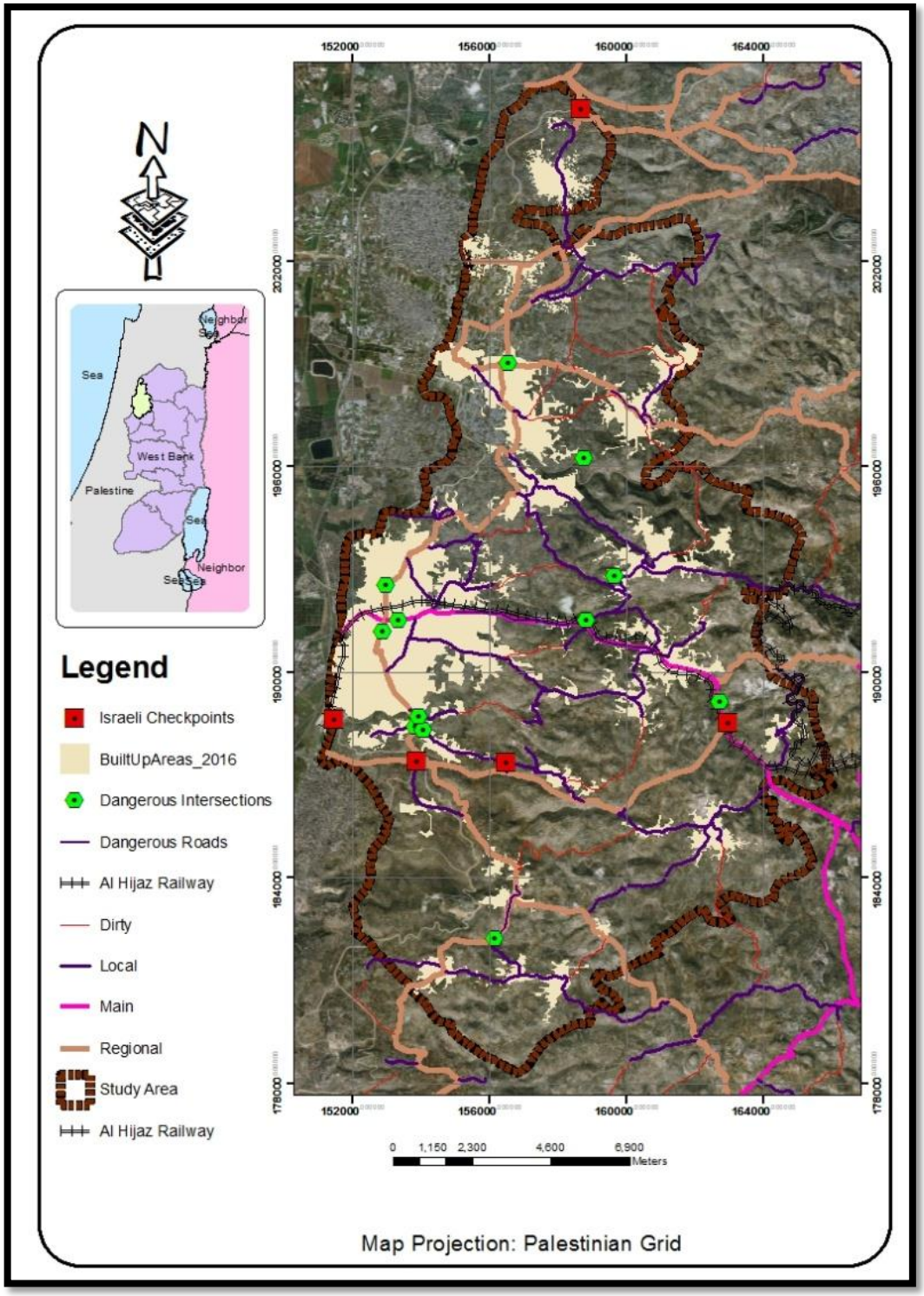
Regarding the internal roads in the towns and communities in the governorate, the situation is moderate to bad, most of them are narrow and frequent infringements of private properties because of the urban expansion and poor program of road maintenance programs in general, Many of the internal roads in the communities need to rehabilitate and maintain their internal roads, and they also suffer from the weakness of the elements of

roadways for existing roads such as sidewalks, traffic signs, pedestrian environment, water drainage system, etc (National Center For Sustainble Development, 2014).

Table 3- 11: Length and Types of Roads

Road Type	Length
Regional Road	70
Main Road	16
Local Road	70
Dirt road	50

Source: (National Center For Sustainble Development, 2014)



Maps 3- 17: Tulkarem Governorate Roads Type.

Source: (Ministry of Local Government, Geomolg, 2017)

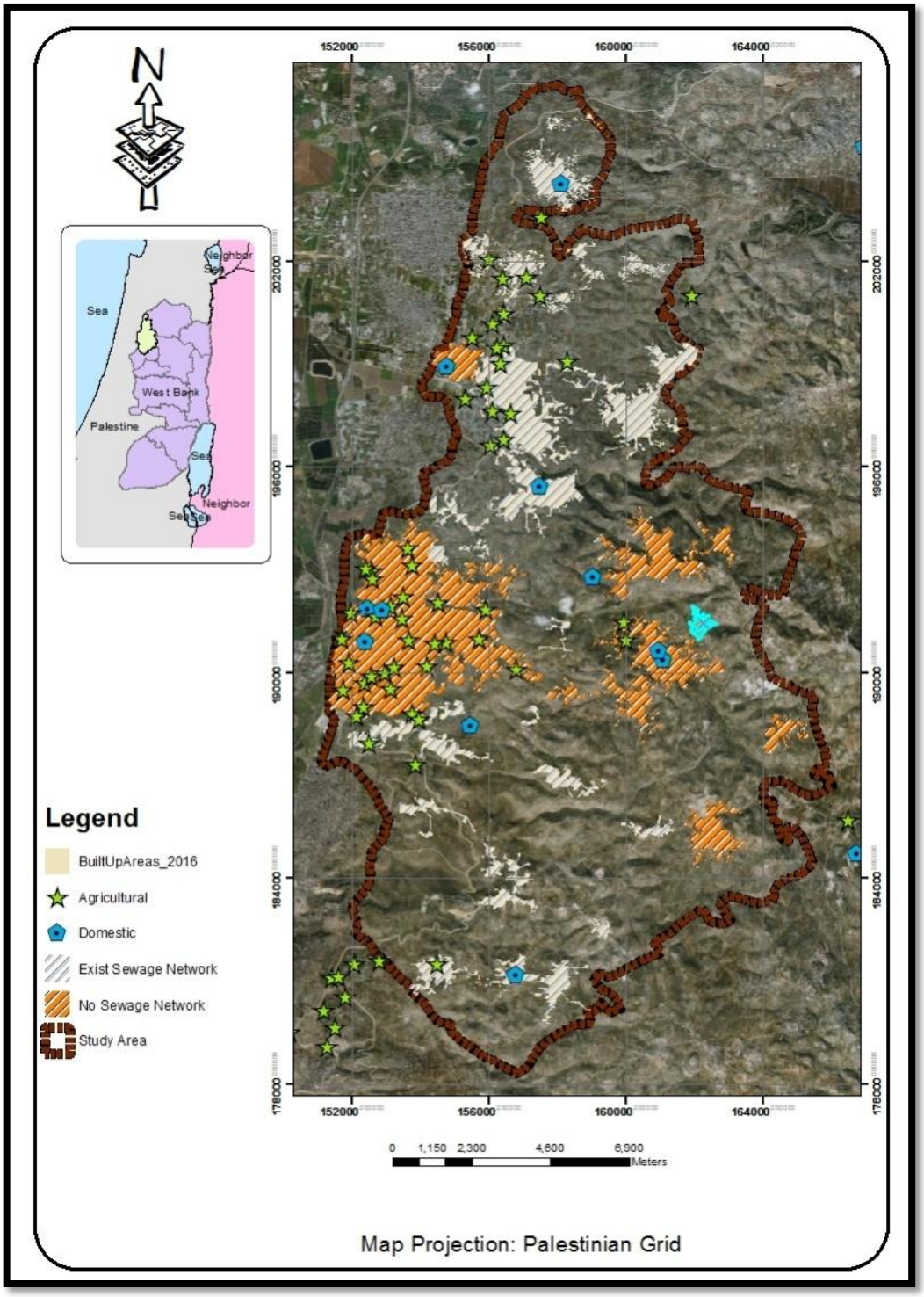
ii. Surface Water, Wells and infrastructure

Surface water resources are represented by limited amounts of winter flood water. Very limited uncalculated water quantities are being utilized from these floods through cisterns and small catchment areas to harvest water in the form of agricultural ponds (ARIJ, 1996).

Many Palestinians are using the roofs of their houses as well as plastic houses to collect water and store in small reservoir or cistern (ARIJ, 1996).

Groundwater which is located in the western basin is the main source of drinking water and irrigation in Tulkarem governorate, which is fed mainly from rainwater. This water is extracted through an artesian wells, which are running about 66 wells see map (3-18) (National Center For Sustainble Development, 2014).

For sewage in Tulkarem governorate is very similar to the situation in all Palestinian governorates, where the governorate suffer from sewage systems lack So most people use cesspits that are discharged through pumping tanks, Valleys, side roads, and sometimes in existing sewer fountains (National Center For Sustainble Development, 2014).



Maps 3- 18:Tulkarem Governorate Wells

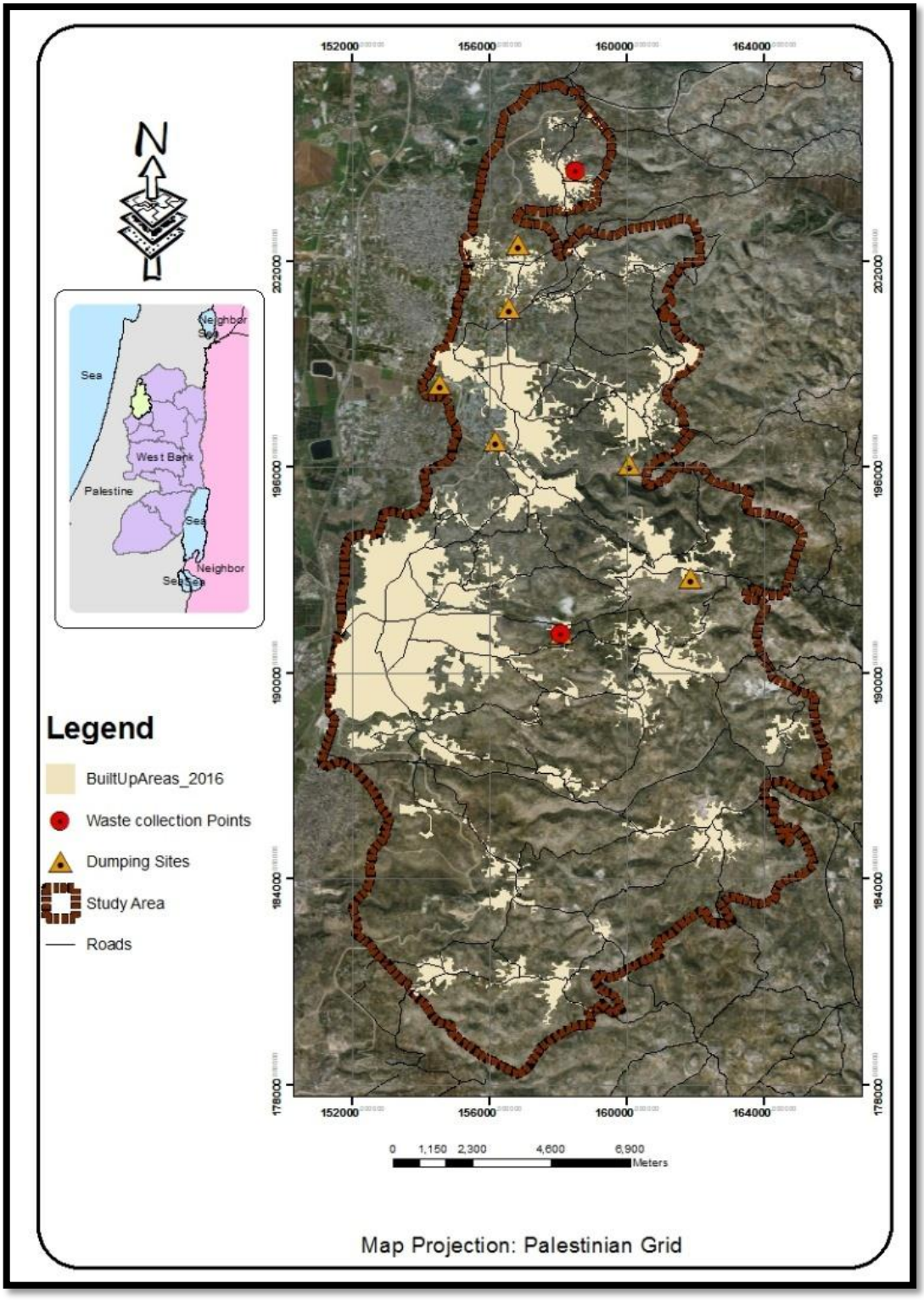
Source: (Ministry of Local Government, Geomolg, 2017)

iii. Waste

Tulkarem governorate includes 20 local councils, whether municipalities or village councils, In addition to Tulkarem and Nur Shams camps, all of them are almost covered by the solid waste service (National Center For Sustainble Development, 2014).

The amount of solid waste produced in Tulkarem Governorate is estimated at 51000 tons of municipal waste, The average daily production of solid waste is estimated at 3.5 kg. The average per capita production of waste Household solidity in Tulkarem governorate is 0.77 kg (National Center For Sustainble Development, 2014).

Waste disposal is carried out in the governorate in two ways see map (3-19): waste is collected by mechanisms and a team of the Waste Management Board through the wastewater treatment of Wadi Al-sha'er station managed by the Solid Waste Management Board to Zahra Al Finjan dump in Jenin, or collect the waste by a team of local authorities, and then travel through Wadi al-Sha'er station by the Council's Trela vehicles to the Zahra al-Fangan dump in Jenin (National Center For Sustainble Development, 2014).



Maps 3-19: Tulkarem Governorate Dumping Sites.

Source: (Ministry of Local Government, Geomolg, 2017)

3.2.3 Housing Sector

Most of the residential buildings (more than 83%) in Tulkarem are privately owned buildings, with an independent and horizontal construction structure (about 75%).The largest percentage (more than 70%) of the buildings are between 2-3 floors, except for the city of Tulkarem itself and some localities with a population of more than 5,000 people, there are some multi-storey buildings (3-5). On the level of collective housing projects is still at the beginning, for example, engineers housing still under construction.

According to the available data, the number of buildings in the Tulkarem governorate is estimated at (33,000) buildings in 2013, (23,760) are residential buildings. According to the type of housing, the largest proportion (about 80%) is distributed between villa and house.

Concerning the availability of basic services in the residential areas of the governorate, noticed that more than 99% of the houses are connected to the electricity network, more than 90% are connected to the water network and about 40% are connected to a public sewage network. This illustrates the urgent need to provide the sewage network in most Localities in the governorate.

3.2.4 Education Sector:

Education has a very important status in Tulkarem Governorate, see table (3-13), (3-14), (3,15),In 2014, number of schools was 134 with 40200 student in addition to (9) private schools, (6) UNRWA schools in the Tulkarem camp and Nur Shams camp. There is also an industrial school and the vocational training center, and there are also two legitimate schools for males and two females for the Ministry of Awqaf (PCBS, 2014).

Existence of a diverse university education and various disciplines (Al-Quds Open University, Palestine Technical University and Faculty of Agriculture and Veterinary Medicine - An-Najah University) contributed greatly to creating opportunities for higher education within the governorate for students of the governorate and helped to attract students and employees from outside the governorate see map (3-20).

Table 3- 12: Schools Distribution as Supervisor

Sector	NO Schools	NO Students
Public	134	40248
UNRWA	6	3312
Private	9	1017
Total	149	44577

Source: (National Center For Sustainble Development, 2014)

Table 3- 13: Schools Distribution as the educational level.

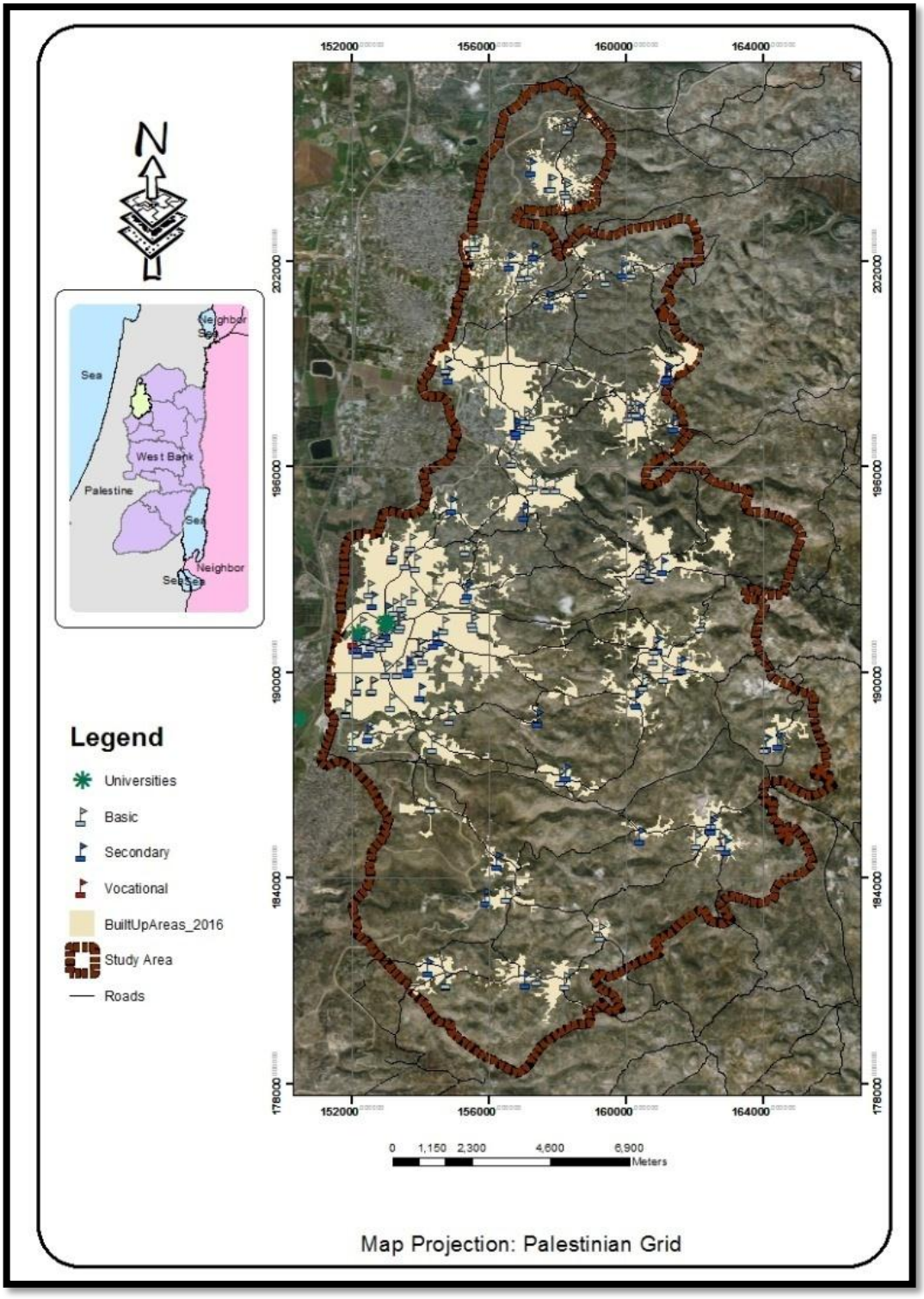
Gender	Primary (1-4)	Primary (1-10)	Secondary	Total
Male	9	27	28	64
Female	10	34	26	70
Total	19	61	54	134

Source: (National Center For Sustainble Development, 2014)

Table 3- 14: Schools Distribution as the Gender

Gender	NO Schools
Male	51
Female	52
Mixed	31
Total	134

Source: (National Center For Sustainble Development, 2014)



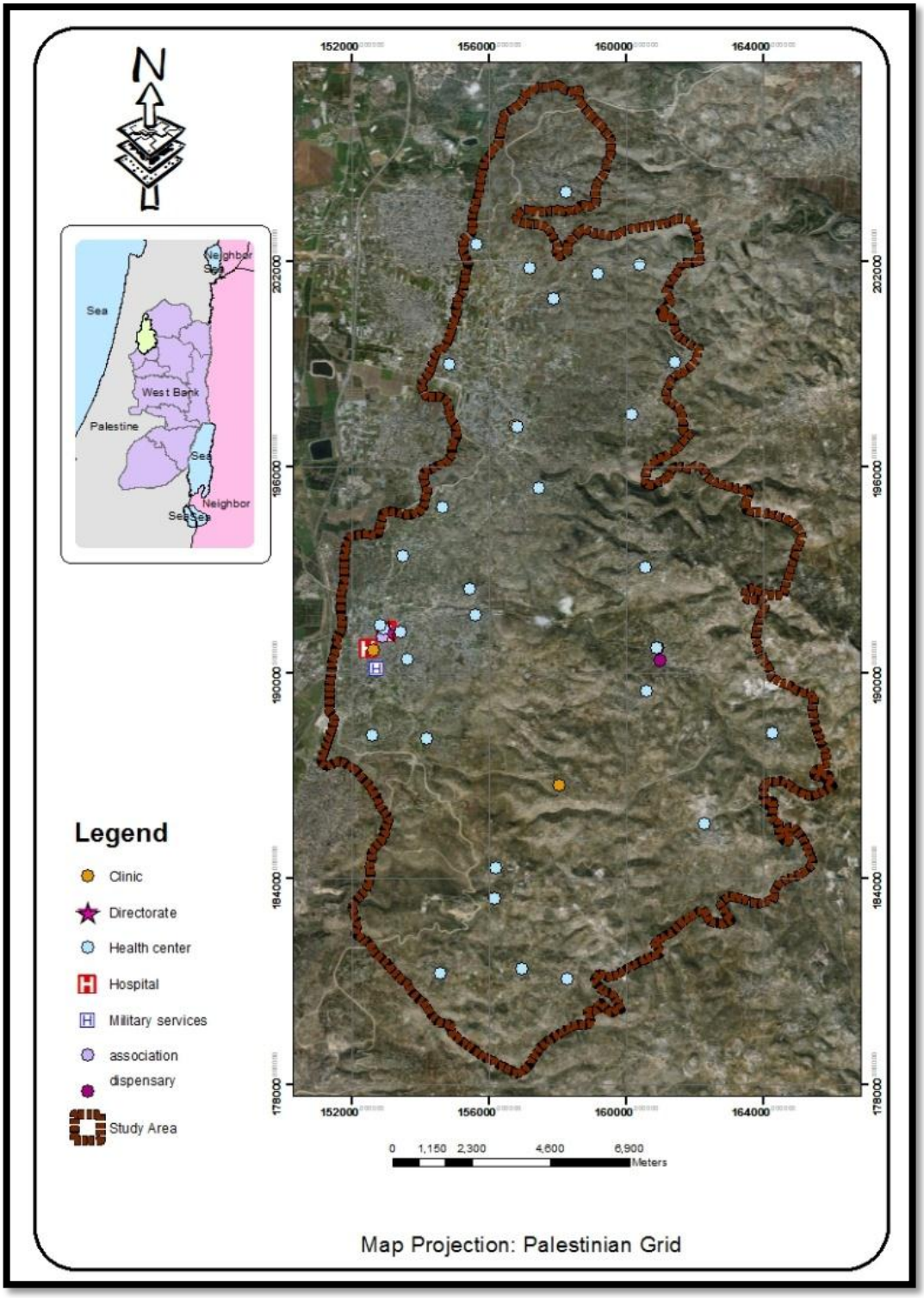
Maps 3- 20:Tulkarem Governorate Education Sector.

Source: (Ministry of Local Government, Geomolg, 2017)

3.2.5 Health sector

The health sector at the national level has witnessed a great deal of interest by government agencies in the State of Palestine as well as by the authorities operating in this field. Health sector remained one of the sectors most affected by the unstable economic situation due to the pressure and the increasing demand for health and treatment services due to the increase in the population.

There are 3 hospitals (Al-Shaheed Thabet Thabet Hospital - Tulkarem Governmental, Palestinian Red Crescent Society Hospital, Zakat Hospital) see map (3-21), also there are 31 health centers and 6 specialty clinics distributed in Tulkarem city and localities. Most of the health services in the city are concentrated in Tulkarem city, Despite existence of clinics and centers distributed in different towns and villages in the governorate, but they lack of basics and needs such as laboratories and radiation (National Center For Sustainble Development, 2014).

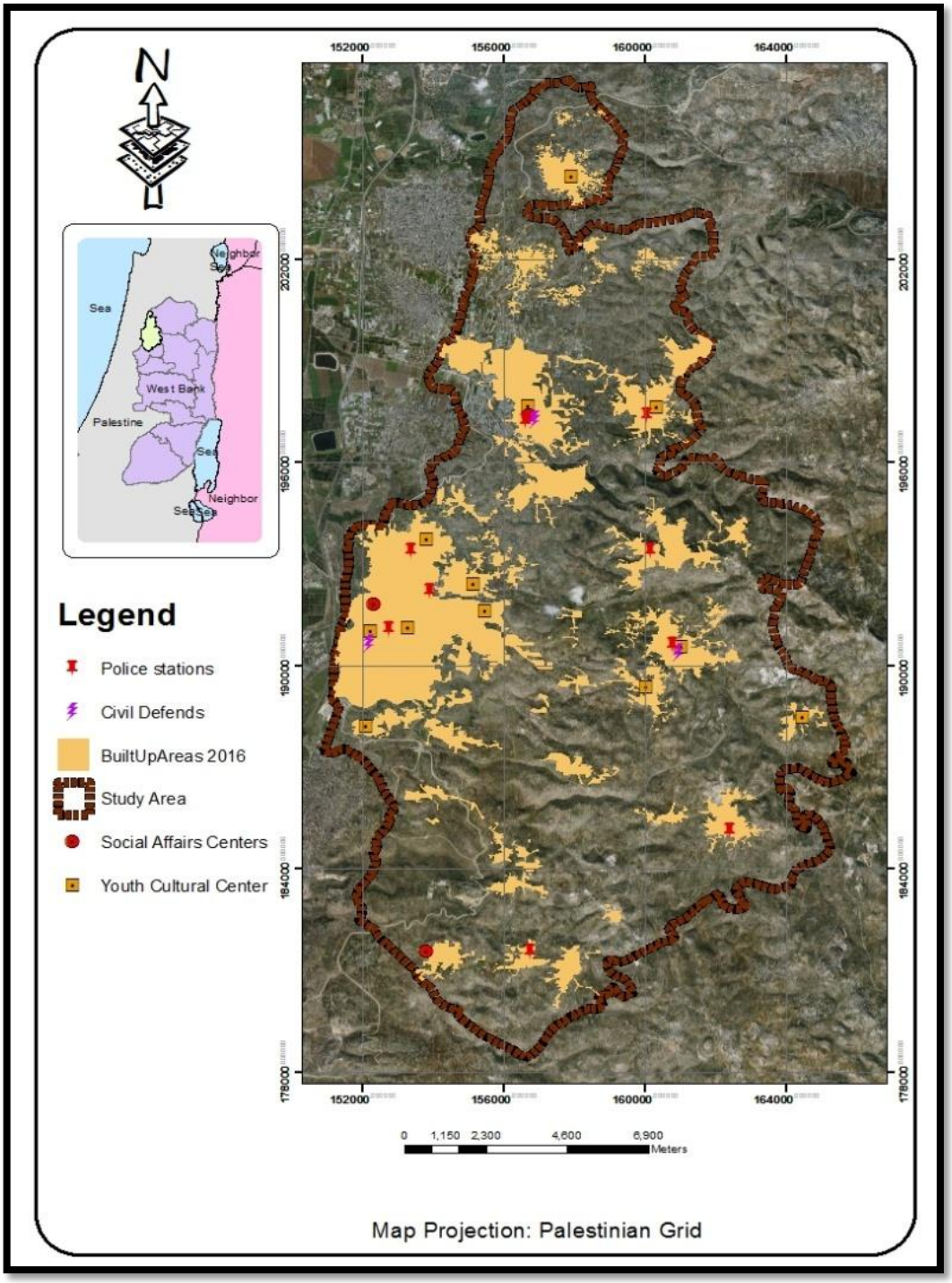


Maps 3- 21: Tulkarem Governorate Health Sector.

Source: (Ministry of Local Government, Geomolg, 2017)

3.2.6 Community Facilities

Community facilities vary in different areas of Tulkarem governorate, like: youth centers, women's centers and police stations etc…., see map (3-22)

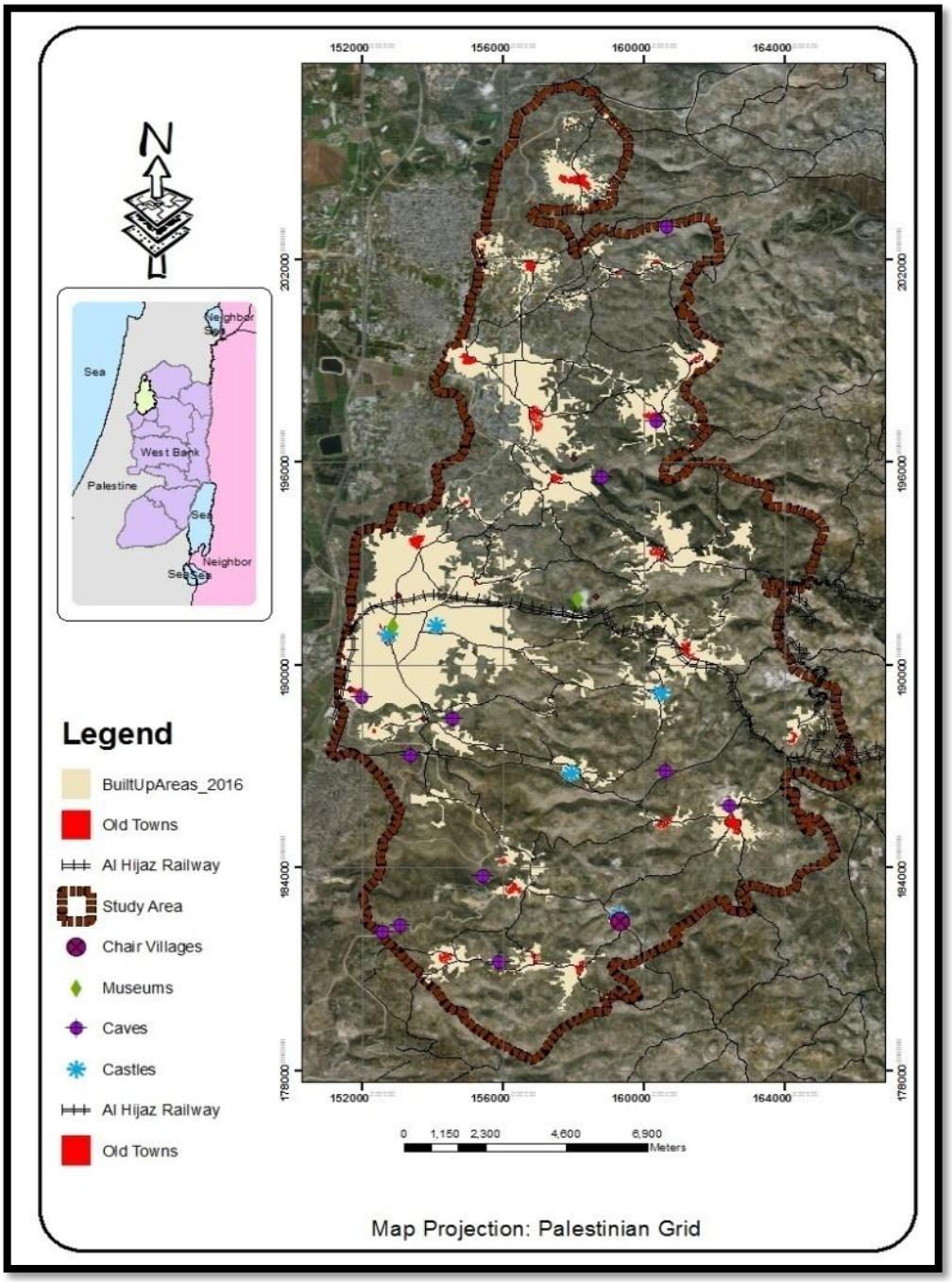


Maps 3- 22: Tulkarem Governorate Community Facilities.

Source: (Ministry of Local Government, Geomolg, 2017)

3.2.7 Cultural heritage:

Tulkarem governorate is rich in history and heritage and has been followed by several civilizations, this is reflected spatially see map (3-23) (the old cities, archaeological sites and buildings) which should be preserved.



Maps 3- 23: Tulkarem Governorate Cultural Heritage

Source: (Ministry of Local Government, Geomolg, 2017)

3.3 Economic Aspects:

Economy of Tulkarem governorate is a mixture of various activities of agricultural, commercial, industrial and tourist activities, but it is characterized by agricultural economy, especially olives, the largest volume of production in the governorate, in addition to industrial activity.

The income of workers is concentrated in government sector as a continuous income, in addition to working within the Green Line and the settlements adjacent to the governorate. Income from trade and industry is commensurate with number of workers and capital in the governorate, which is considered modest compared to other governorates, due to the small number of population and the threat of the separation wall (National Center For Sustainble Development, 2014).

3.3.1 Establishments

The number of economic establishments operating in Tulkarem governorate reached 6076 establishments, where number of employees reached 14156, majority of establishments that are wholesale and retail trade reached 3311, while the number of industrial establishments was 782, where number of agricultural establishments are 527 and establishments of service activities are 460 (PCBS, 2011).

3.3.2 Foreign Trade

Exports decreased in 2009 compared to the years 2006-2008, amounting to 8.4 million$ and concentrated on food and live animals by 65% of all exports. Where manufactured goods were 19% of all exports and the lowest share exports are tobacco and beverages by 0.4% (PCBS, 2011).

Imports of 2009 compared to 2005-2008 increased to 152.6 million$, and the balance deficit for 2009 amounted to144.2 million$ (PCBS, 2011).

3.3.3 Manpower, unemployment and poverty

The percentage of the labor force in Tulkarem governorate was 43.2% of the total manpower of the governorate in 2010. The results showed that the percentage of women participation was low. Also the results indicated that unemployment rate among the labor force was 16.5% (PCBS, 2011).

While the poverty rate reached 10.9% for 2010, while the poverty rate in the West Bank was 18.3% for the same year (PCBS, 2011).

In 2013, poverty in the governorate was 20% in the governorate and 17.8% in the West Bank (PCBS, 2015).

Employment in Tulkarem governorate increased between 2010 and 2015 as seen in table (3-16), where percentage of unemployment decreased.

Statistics of 2013 indicate that 83.9% of employees work in West bank, 58% in Tulkarem Governorate, 16.1% in occupied land and settlements.

For contribution of economical sectors as seen in table 3-17, Statistics of 2015 indicates despite of rural natural that Tulkarem governorate characterized by but agricultural and fishing sector contribute by 13.6%.

Table 3- 15: Employment Distribution Type Percentage

Employment	2010		2015	
	Male	Female	Male	Female
Full Employment	71%	64%	83.1%	65.2%
Limited Employment	8.9%	2.9%	3.5%	2.8%
Unemployment	20%	32.5%	13.4%	32%

Source: (PCBS, 2011), (Alawnah & Jaber, 2017)

Table 3- 16: Economic sector contributions to employment For 2015.

Sector	Contribution %
Agriculture and Fishing	13.6%
Mining and quarrying	13.6%
Construction	15.1%
Trade and Restaurants	23.3%
Transportaion, Storage and Communication	5.1%
Facilities and ither branches	30.3%

Source : (PCBS, 2015)

3.3.4 Poverty

Table 3-18 indicates Poverty In Tulkarem Governorate where poverty in 2009 was 19.5% but in 2010 poverty decreased to 10.9% but in 2011 increased again to 23%.

Table 3- 17: Poverty in Tulkarem Governorate

Year	Poverty %
2009	19.5%
2010	10.9%
2011	23%

Source: (PCBS, 2011)

3.3.5 Agriculture:

The area of land planted with permanent and temporary crops in Tulkarem Governorate is 77.4 km² in 2010-2011 equivalent to one third of the total area of governorate, Approximately 118000 Donum is permanent planted and the rest is temporary planted according to the seasons (PCBS (Palestinian Central Bureau of Statistics), 2013).

The number of nurseries in the governorate is 55 ones, and there are 26 cooperative societies in the governorate that practices agricultural and animal works with low efficiency (PCBS, 2011).

On the other hand number of agricultural holdings is 8147 one divided into, agricultural holdings 6711, mixture holdings 891, animal holdings 545 (Ministry of agriculture/ Directorate of Tulkarem, 2016).

3.3.6 Tourism

Tourism plays an important role in the economic sector and it is one of the largest service sectors that provide jobs. Despite the fact that Tulkarem governorate is an emergent in field of tourism, bet it ranks the first in the internal tourism, this is due to good investment in tourist areas and

recreational diversity and variety of tourism services from restaurants and workshops and shops selling antiques and frames, etc. But the governorate suffers from lackness of hotels and tourist guides workers.

Despite of lackness of tourism sector but Tulkarem governorate is the best Governorate for internal tourism of a percentage 25% of West Bank (Alawnah & Jaber, 2017).

Table 3- 18: Economic sector contributions to employment For 2015

Tourist and cultural attractions	NO
Cultural Centers	10
Public Library	9
Theaters	3
Gardens	5
Restaurants	11
Tourism Office	2
Hotels	0

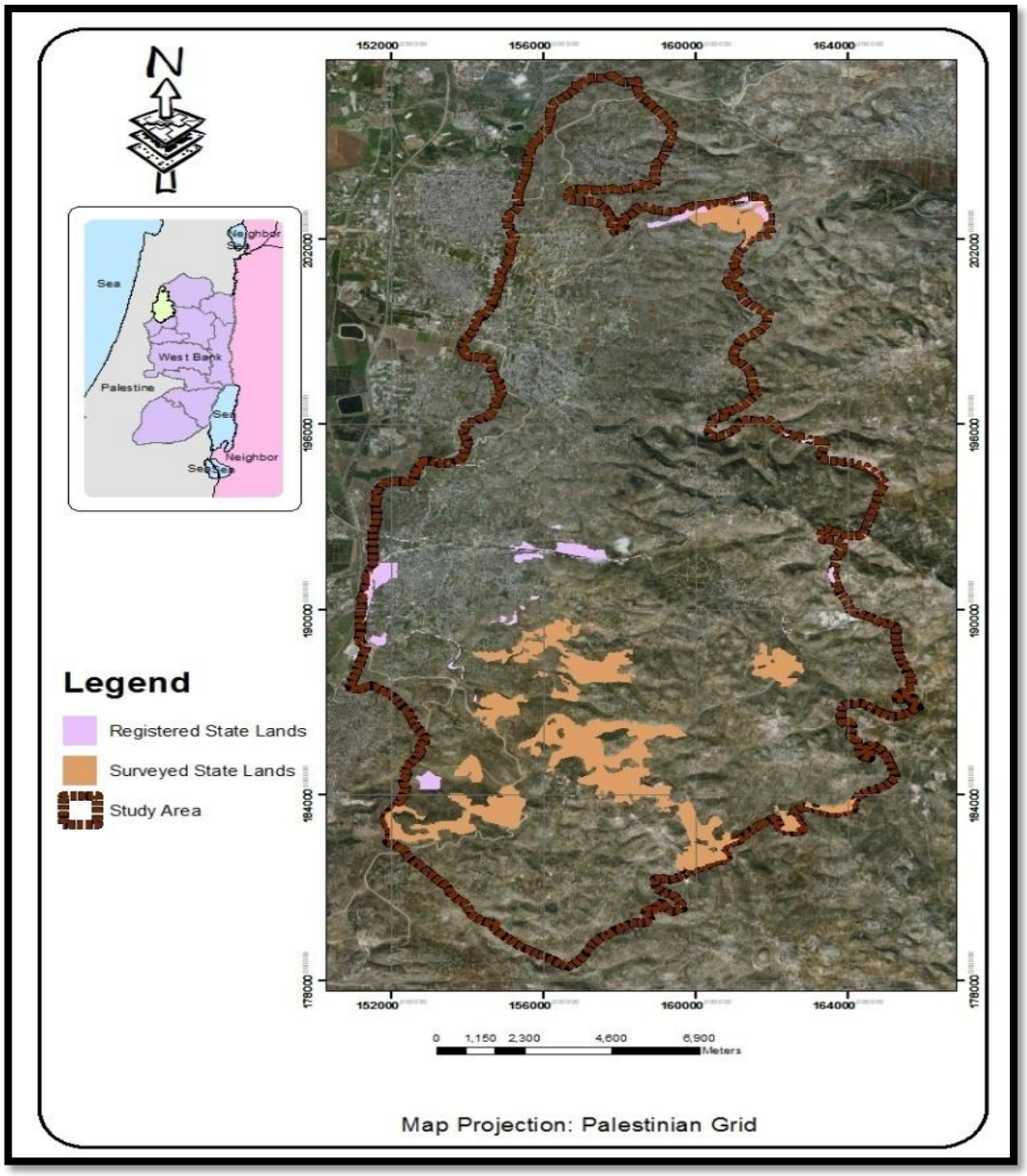
Source: (Alawnah & Jaber, 2017).

Tulkarem governorate suffers from weak infrastructure for industrial sector(such as the absence of an industrial zone, and the weakness of electricity). and lackness of tourism sector because of absence of hotels and guidance offices ... etc

Also restrictions imposed by Israel on the crossings (Taibeh crossing) to obstruct the movement of goods contribute in weakens of the economic movement of the governorate.

3.3.7 State Lands

Development is preferred on state land because of problems that happens when any development happen on inhabitants lands (time needed for inhabitants objection and financial problems comes from difficulties of inhabitants compensation see map (3-24). Development on state land save time and money.

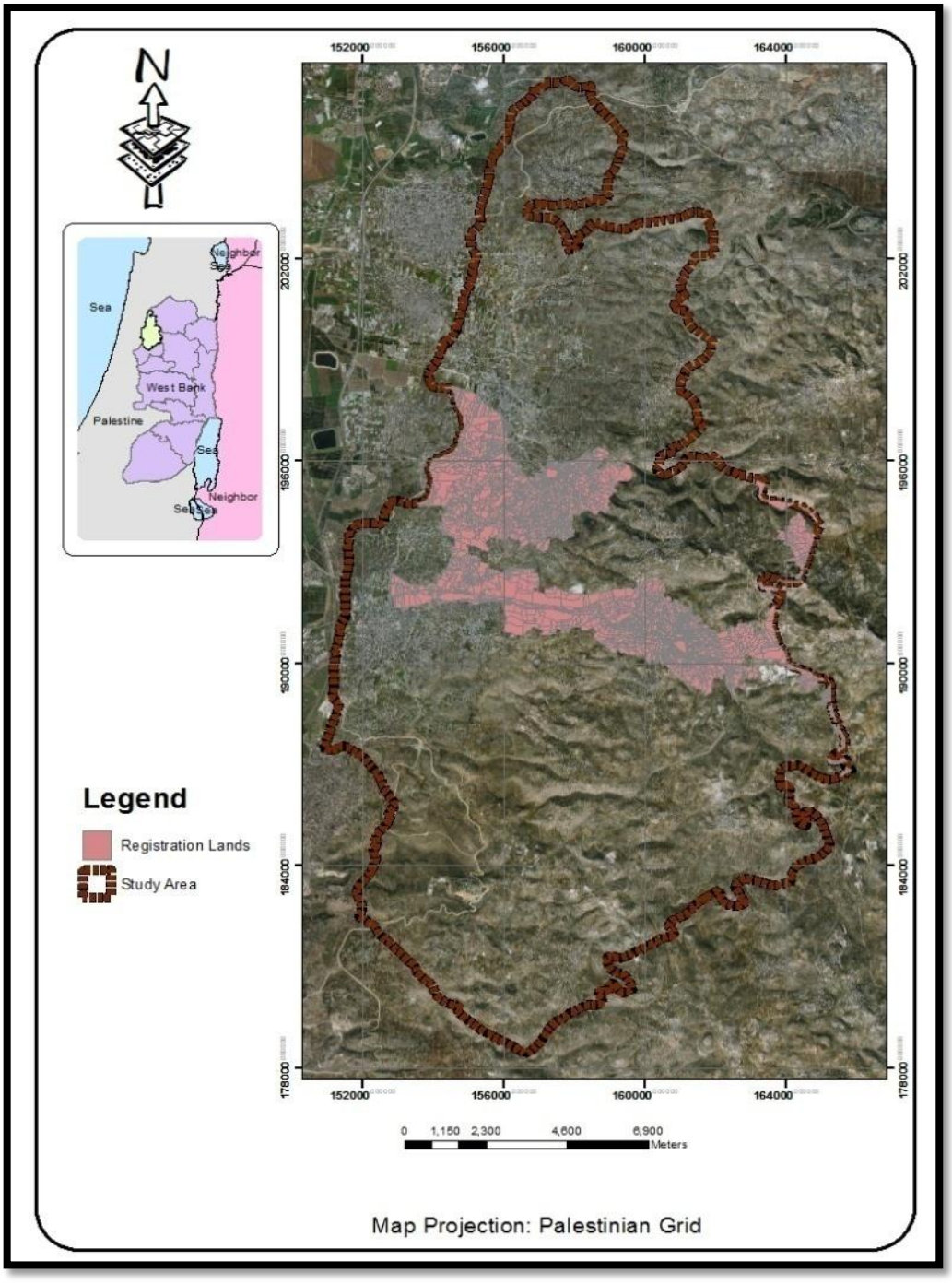


Maps 3- 24: Tulkarem Governorate State Lands

Source: (Ministry of Local Government, Geomolg, 2017)

3.3.8 Lands Registration

Lands that are ended registration is approximately 12.8% of total area of Tulkarem Governorate see map (3-25).



Maps 3- 25: Tulkarem Governorate Registration Lands

Source: (Ministry of Local Government, Geomolg, 2017)

3.4 SWOT Analysis

Studying Tulkarem Governorate shows the positive and negative aspects: Positive aspects which are divided into strength points that related to governorate characteristics and opportunities that are related to external influences, on the other side negative aspects are divided into weakness points that related to governorate characteristics and threats that are related to external influences.

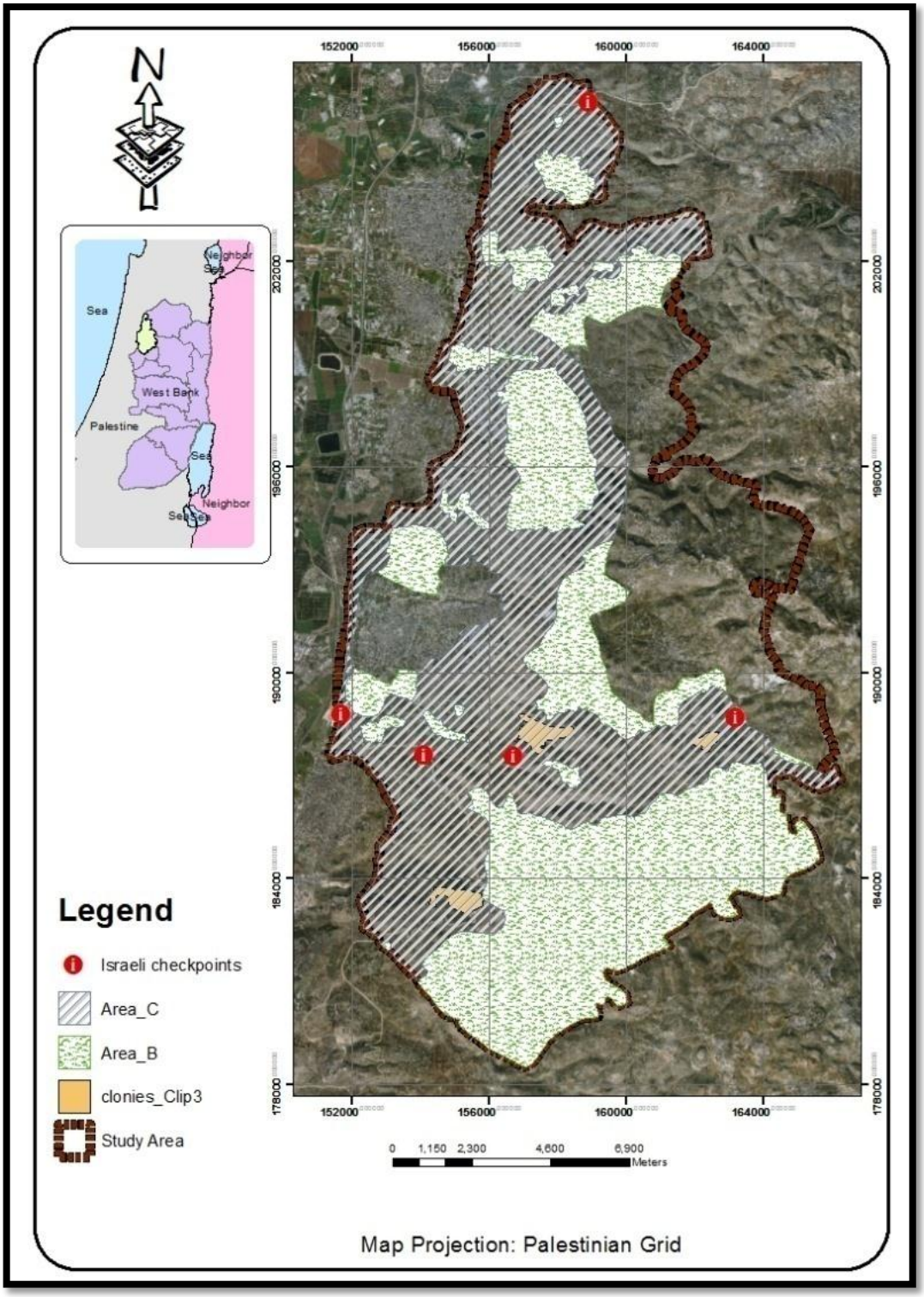
Table 3- 19: Positive Aspects of SWOT Analysis

Aspects	Positive Aspects	
	S	O
Environmental	- Diversity of land value - Diversity of Terrain - Moderate climate - Existence of an area of Forests. - Natural wealth (crushers and quarries).	
Social	- Existence of sufficient space for urban expansion. - Availability of water sources.	- Existence of strategic development plans and master plans for many communities. - Existence of health services - Existence of educational services
Economical	- Availability of agricultural Land. - Existence of archaeological sites and tourist facilities.	- Existence of some light Industries

Table 3- 20: Negative Aspects of SWOT Analysis

Aspects	Negative Aspects	
	W	T
Environmental	- Environmental pollution resulted from waste, wadis and Israeli factories.	- Non-exploitation of natural grasslands and open areas in the province.
Social		- A large area of land under Israeli control (Area C), land confined behind the Apartheid Wall, Israelian settlements, checkpoints and bypass roads as seen in map (3-26). - Assault on government land. - Violations of buildings and attacks on valleys and main streets. - Lack of awareness and community participation in urban planning. - A high rate of construction outside the boundaries of the master plans. - Insufficient services and facilities in structural schemes (eg absence of industrial zone, affordable housing projects, tourism services and facilities). - Lack of affordable housing projects and low-income housing. - Refugee camps that is uncontrolled by municipalities for planning and random construction
Economical		- Absence of tourist services (eg hotels). - Absence of Industrial zones.

After identifying the strengths, weaknesses, opportunities and determinants in Tulkarem governorate through the triangle sustainability (environmental, social and economic), to restrict resources of the governorate to construct the model for sustainable development depending on criteria that the research depend on them to give weights that suit with the nature of Tulkarem governorate, environmentally, socially and economically through negative and positive aspects. So SWOT analysis was the key to achieve research goals through the methodology used.



Maps 3- 26: Tulkarem Governorate Registration Lands

Source: (Ministry of Local Government, Geomolg, 2017)

Chapter Four
Methodology

To achieve sustainable urban development for Tulkarem governorate a clear methodology must be followed depending on criteria that is used to evalute suitability of land for development depending on sustainability.

GIS enabled the creation of digital maps that help to in making planning decisions based on understanding the reality of its various elements to solve problems in a less costs and more accurate way.

Layers varied between point (caves, castels ,historical, points, etc..) polygon as (land cover, built up area, forests, land use, etc) , line as (streams, roads), and raster (slope) as seen in fig (5-1) ,some tools of GIS as buffer, intersect, erase and union were used depending on critera and sub criteria as seen in table (5.1). layers were converted to raster. Each raster layer was assigned a weight in the suitability analysis. Values in the rasters are reclassified to a common suitability scale. Raster layers are overlayed, multiplying each raster cell's suitability value by its layer weight and totaling the values to derive a suitability value. These values are written to new cells in an output layer. The symbology in the output layer is based on these values.

Assigning a weight to each raster in the overlay process allows you to control the influence of different criteria in the suitability model.

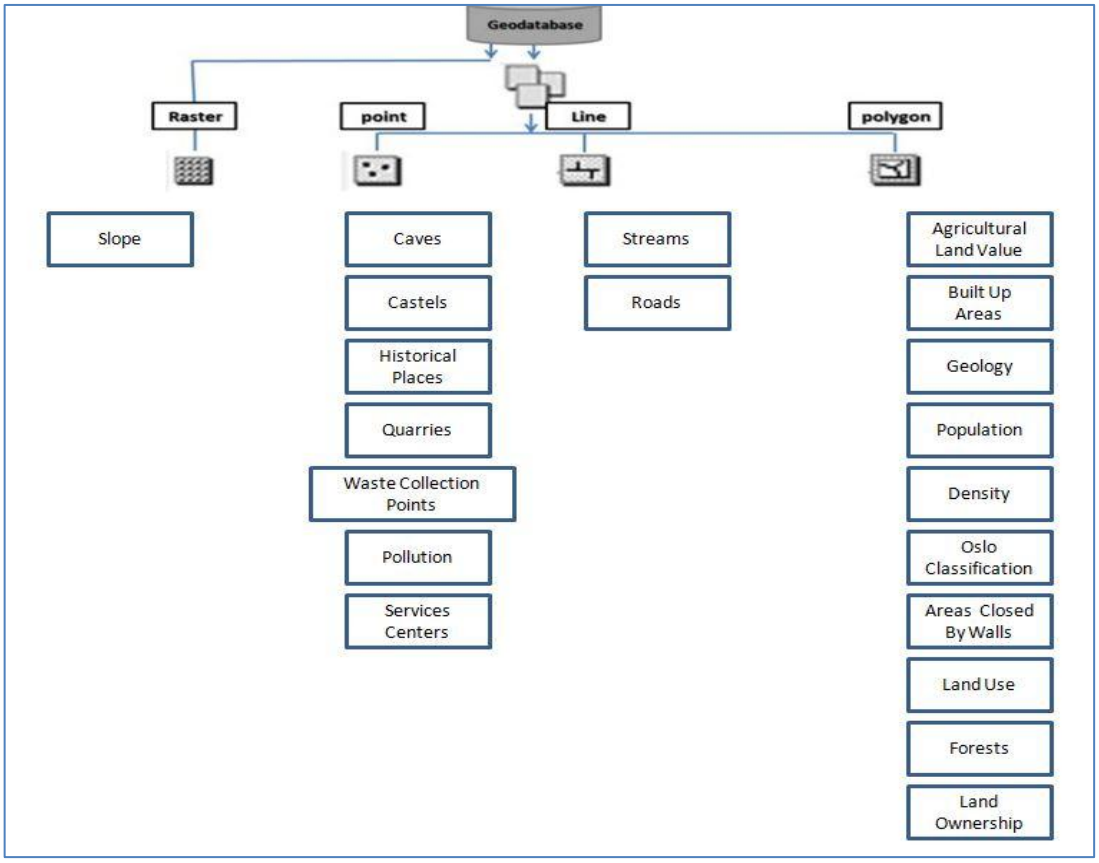


Fig 4- 1: Geodatabase for Criteria.

4.1 Criteria of evaluating suitability of land for development depending on sustainability

A number of criteria have been formulated to suit the subject of the study according to the current situation of Tulkarem governorate as seen in table (6-1). These criteria were classified into groups and levels to give each level a weight according to the degree of suitability for sustainable urban development according to the student's opinion.

Database that was used in the study is as seen in figure(5-1).

Table 4- 1: Criteria of evaluating suitability of land for development depending on sustainability.

Main Criterion	Sub-criterion	Sub-Sub-Criterion
Environmental Aspects	Geology	That Bear High Buildings
	Terrain	Suitability for slope less than 20% Lands
	Agricultural Land Value	Suitability for Low Land Value
Social Aspects (Demographic and Spatial)	Cities weight	Population Density
		Population
	Political Areas	Oslo Classification
	Land Uses	To Serve Urban development and sustainability
	Streams	Out Side Maser plan: Far from Streams 25m
	Dumping Sites,	Distance from Dumping Sites 50 m
	Waste Collection Points	Distance of Waste Collection Points 500m
	Inhabitants Desires	Closer to center of Built Up Areas
		Far From pollution Areas
Economical Aspects	Land Ownership	Development in Government Lands
	Costs of Public Facilities	Level or slope not exceed 20% slope
		Closeness to Cities
		Closeness to Main and Regional Roads

Source: The Student, (Ministry of Municipal and Rural Affairs, 1426), (Khodair & Ali, 2010), (Ghneim, 2011), (Annajah Planning Unit, 2017), (Ministry of Foreign Affairs and Planning, General Directorate of Policy and Spatial Planning, 2012),(Ministry of Municipal and Rural Affairs, 1437),(Addlaimi, 2002), (Abu jiab, 2012), (World Health Organization, 2004), (Dhawabeh, Rabaiah, & Ighbareieh),

4.2 Weights of criteria

In this section weights of criteria for effectiveness on sustainable planning of Tulkarem governorate would be determined depending on a questionnaire.

This questionnaire was divided into four parts, The first one is the part of giving weights for social, economic and environmental criterion from different directions, These weights would be affected by variety of specialists who fill the questionnaire so mean of these weights was calculated to be used it in the study through Weighted overlay. The questionnaire was filled by 8 specialists.

The second part is concerned with the environmental criteria by giving weights to the sub environmental criterion to extract the arithmetic mean for these weights adopting it in the study through Weighted overlay.

The third part is concerned with the social criteria by giving weights to the sub social criterion to extract the arithmetic mean for these weights adopting it in the study through Weighted overlay.

The fourth part is concerned with the economic criteria by giving weights to the sub economic criterion to extract the arithmetic mean for these weights adopting it in the study through Weighted overlay.

Chapter Five
Proposed Needs For Sustainable Development in Tulkarem Governorate

5.1 Introduction

Success of planning process requires estimating future population in order to calculate their need of settlements within acceptable international standards that meet the needs of the inhabitants in the governorate by calculating the area of land uses. Here goals of planning appear to provide the needs of the current and future inhabitants in light of sustainability.

In this Chapter, population in 2016- 2030 was calculated to estimate the needs of land uses of the governorate.

5.2 Environmental Aspects

This aspect is associated with social aspect through calculating future population growth and their needs from land for expansion, This expansion must take into consideration Protection plan that classify land into high land value middle land value and low land value as seen in map (3-6).

5.3 Social Aspects

Estimating population until 2030 is the first step that is based on it all estimates of all aspects such as residential, commercial, industrial, educational, lands of expansion, etc….

5.3.1 Population Projection

Population is the main objective of planning process, Planning process is to serve human, so calculation of the future population increase entails knowledge of future needs of different uses like: commercial, industrial, commercial, agricultural, residential, etc,…. in order to know the amount of pressure on environmental resources and try to achieve optimum use of these resources without wasting them.

Population projection means that estimating of total size or composition of populations in the future are constructed using certain assumptions. Two different methods are commonly used: the mathematical method and the component method. The mathematical method which is a simple one and it has errors in the far future, assumes a constant rate of growth, either the same as a past trend or with modification, to obtain future populations. The component method of population projections utilizes separate projections for each component of population change, that is, fertility, mortality and migration (Department OF International Economic And Social Affairs., 1984).

The period covered by population projections depends on the nature of the studied region, the available data and the problem studied. Short periods (5-10 years) are used by economists, The average period ranges from (10-25) years are used in some fields like: housing and health, The Long periods are used for more than 25 years in forest development studies, Water resources and food production (Abu jiab, 2012).

According to the Palestinian Urban Planning Manual for 2013 in order to develop higher level of flexibility for the plans, the planning period was set from 8-16 years (Local Government, 2013).

The study will depend 2016 as the basic year and 2030 is the year of planning goal where the period is 14 years.

During this period the population growth rate will gradual decline because many reasons some of them: education rate increase, women working, Late marriage age.

5.3.2 Population Projection until 2030

Population growth rate in Tulkarem governorate is 1.89%accorindg to the equation (Alshamry, 2006):

$$R = \sqrt[t]{(\frac{Pi}{Po} - 1)x100}$$

Where:

R: population growth rate

t : difference between census years

Pi: Subsequent population

Po: Previous population

Estimating population in 2030 according to the equation (Abu jiab, 2012):

$$P_2 = P_1 H^{rn}$$

Where:

P2: Subsequent population

P1: Previous population

H: The exponential powers that raise the rate of population growth is constant (2.71828)

r: population growth percentage

t: period between P2, P1

Applying the previous equation, the expected population of 2020, 2025, 2030 of Tulkarem governorate where considered:

P2: expected population in 2020, 2025,2030

P1: 2016 census is 185,314

H: The exponential powers that raise the rate of population growth is constant (2.71828)

r: population growth percentage 0.0189

t: period between P2, P1 (14 years)

Table 5- 1: Estimation of Population Until 2030

Period	Population growth %	Estimated population
2016-2020	0.0189	199866.89
2016-2025		219675.52
2016-2030		241447.36

This increase of population requires calculation the needs of land without wasting environmental resources.

5.3.3 Estimating the needs of Land

Based on the experiences of different countries in land use and according to the student's vision land uses areas were estimated for three period of time.

1. Residential Use

Calculating area needed for Residential use until 2030 as seen in table below:

Table 5- 2: Estimated Area For Residential Use

Period	Expected Increase of Population	m²/ capita						
		Current	Saudi	Iraq	Libya	Annajah Planning Unit	Gaza	Student vision
		118.39	10.2	50	20	100	7.82	50
2016-2020	14552.89	1722916.64	148439.47	727644.50	291057.80	1455289	113803.60	727644.50
2016-2025	34361.52	4068060.35	350487.50	1718076.00	687230.40	3436152	268707.08	1718076.00
2016-2030	56133.36	6645628.49	5840114.77	2806668	1122667.20	5613336	3432689.68	2806668.00

Source: The Student, (Ministry of Municipal and Rural Affairs, 1426), (Khodair & Ali, 2010), (Ghneim, 2011), (Annajah Planning Unit, 2017), (Ministry of Foreign Affairs and Planning, General Directorate of Policy and Spatial Planning, 2012)

To decrease per capita for residential area some strategies must be followed:

- Increase capacity for built up area through:

Support vertical orientation for what is already exist.

Control construction movement through Building legislation in expansion areas.

Exploitation Fallow lands that is already exist.

- determine border of development of built up area:

this is for preventing random expansion on areas of environmental resources,

Where development happened out of built up area can be:

- Preserve it and redetermine the built-up area, with activating strict laws that preventing any more exceeds.

- Return to agricultural areas but this causes high costs to compensate inhabitants either financially or re-providing them with other housing.

- Providing governmental housing projects that has limited area which is suitable for inhabitants.

2. Administrative Use

Calculating area needed for administrative use until 2030 as seen in table below:

Table 5- 3: Estimated Area For Administrative Use.

Period	Expected Increase of Population	m²/ capita						
		Current	Saudi	Iraq	Libya (0.2-0.35)	Annajah Planning Unit	Gaza	Student vision
		1.58	_____	_____	0.3	2	_____	1.58
2016-2020	14552.89	22993.56	_____	_____	4365.87	29105.78	_____	22993.56
2016-2025	34361.52	54291.20	_____	_____	10308.45	108582.40	_____	54291.20
2016-2030	56133.36	88690.71	_____	_____	16840.00	177381.42	_____	88690.71

Source: The Student, (Ministry of Municipal and Rural Affairs, 1426), (Khodair & Ali, 2010), (Ghneim, 2011), (Annajah Planning Unit, 2017), (Ministry of Foreign Affairs and Planning, General Directorate of Policy and Spatial Planning, 2012)

3. Cemeteries Use

Calculating area needed for cemeteries use until 2030 as seen in table below:

Table 5- 4: Estimated area for Cemeteries use

Period	Expected Increase of Population			m²/ capita				
		Current	Saudi	Iraq	Libya	Annajah Planning Unit	Gaza	Student vision
		0.15	_____	_____	0.04	1.40	-----	0.15
2016-2020	14552.89	2182.93	_____	_____	582.11	20374.046	-----	2182.93
2016-2025	34361.52	5154.23	_____	_____	1374.46	48106.13	-----	5154.23
2016-2030	56133.36	8420.00	_____	_____	2245.33	78586.70	-----	8420.00

Source: The Student, (Ministry of Municipal and Rural Affairs, 1426), (Khodair & Ali, 2010), (Ghneim, 2011), (Annajah Planning Unit, 2017), (Ministry of Foreign Affairs and Planning, General Directorate of Policy and Spatial Planning, 2012)

4. Commercial Use

Calculating area needed for Commercial use until 2030 as seen in table below:

Table 5- 5: Estimated Area For Commercial Use

Period	Expected Increase of Population	m²/ capita						
		Current	Saudi	Iraq	Libya (0.8-1.4)	Annajah Planning Unit	Gaza	Student vision
		0.47	0.2	2	1.2	2.5	0.725	1
2016-2020	14552.89	6839.85	2910.57	29105.78	17463.47	36382.22	10550.84	14552.89
2016-2025	34361.52	16149.91	6872.30	68723.04	41233.82	85903.80	24912.10	34361.52
2016-2030	56133.36	26382.67	11226.67	11266.72	67360.03	140333.40	40696.68	56133.36

Source: The Student, (Ministry of Municipal and Rural Affairs, 1426), (Khodair & Ali, 2010), (Ghneim, 2011), (Annajah Planning Unit, 2017), (Ministry of Foreign Affairs and Planning, General Directorate of Policy and Spatial Planning, 2012)

5. Industrial Use

Calculating area needed for Industrial use until 2030 as seen in table below:

Table 5- 6: Estimated Area For Industrial Use.

Period	Expected Increase of Population	m²/ capita						
		Current	Saudi	Iraqi	Libya	Annajah Planning Unit	Gaza	Student vision
		0.18	_____	8	_____	_____	_____	2
2016-2020	14552.89	2619.52	_____	116423.12	_____	_____	_____	29105.78
2016-2025	34361.52	6185.07	_____	274892.16	_____	_____	_____	68723.04
2016-2030	56133.36	10104.00	_____	449066.88	_____	_____	_____	112266.72

Source: The Student, (Ministry of Municipal and Rural Affairs, 1426), (Khodair & Ali, 2010), (Ghneim, 2011), (Annajah Planning Unit, 2017), (Ministry of Foreign Affairs and Planning, General Directorate of Policy and Spatial Planning, 2012)

6. Open Spaces Use

Calculating area needed for Industrial use until 2030 as seen in table below:

Table 5- 7: Estimated Area For Open Spaces Use

Period	Expected Increase of Population	m²/ capita						
		Current	Saudi	Iraqi	Libya	Annajah Planning Unit	Gaza	Student vision
		_____	_____	9.1	_____	5	_____	2
2016-2020	14552.89	_____	_____	132431.3	_____	72764.45	_____	29105.78
2016-2025	34361.52	_____	_____	312689.83	_____	171807.60	_____	68723.04
2016-2030	56133.36	_____	_____	510813.58	_____	280666.80	_____	112266.7

Source: The Student, (Ministry of Municipal and Rural Affairs, 1426), (Khodair & Ali, 2010), (Ghneim, 2011), (Annajah Planning Unit, 2017), (Ministry of Foreign Affairs and Planning, General Directorate of Policy and Spatial Planning, 2012)

7. Public Facilities Use

Public facilities is divided into: educational, health, police and civil defender.

- **Educational Use:**

Calculating area needed for educational use until 2030 as seen in table below:

Table 5- 8: Estimated Area For Educational Use.

Period	Expected Increase of Population	m²/ capita						
		Current	Saudi	Iraqi	Libya (6.4-9.6)	Annajah Planning Unit	Gaza	Student vision
			3.8		8	7	3.626	3.8
2016-2020	14552.89		55300.98		116423.12	101870.23	52768.77	55300.98
2016-2025	34361.52		130573.8		274892.16	240530.64	124594.87	130573.80
2016-2030	56133.36		213306.8		449066.88	392933.52	203539.56	213306.80

Source: The Student, (Ministry of Municipal and Rural Affairs, 1426), (Khodair & Ali, 2010), (Ghneim, 2011), (Annajah Planning Unit, 2017), (Ministry of Foreign Affairs and Planning, General Directorate of Policy and Spatial Planning, 2012)

- **Health Use**

Calculating area needed for health use until 2030 as seen in table below

Table 5- 9: Estimated Area For Health Use.

Period	Expected Increase of Population	m²/ capita						
		Current	Saudi	Iraqi	Libya	Annajah Planning Unit	Gaza	Student vision
		_____	0.9	_____	1.76	2	1.098	1.098
2016-2020	14552.89	_____	13097.6	_____	25613.08	29105.78	15979.07	15979.07
2016-2025	34361.52	_____	30925.37	_____	60476.27	68723.04	37728.94	37728.94
2016-2030	56133.36	_____	50520.02	_____	98794.71	112266.72	61634.49	61634.49

Source: The Student, (Ministry of Municipal and Rural Affairs, 1426), (Khodair & Ali, 2010), (Ghneim, 2011), (Annajah Planning Unit, 2017), (Ministry of Foreign Affairs and Planning, General Directorate of Policy and Spatial Planning, 2012)

- **Mosques**

Calculating area needed for health use until 2030 as seen in table below:

Table 5- 10: Estimated Area For Mosques Use

Period	Expected Increase of Population	m²/ capita						
		Current	Saudi	Iraqi	Libya	Annajah Planning Unit	Gaza	Student vision
		_____	0.7	_____	0.45	0.40	0.748	0.40
2016-2020	14552.89	_____	10187.02	_____	6548.80	5821.15	10855.56	5821.15
2016-2025	34361.52	_____	24053.06	_____	15462.68	13744.61	25702.41	13744.61
2016-2030	56133.36	_____	39293.35	_____	25260.01	22453.34	41987.75	22453.34

Source: The Student, (Ministry of Municipal and Rural Affairs, 1426), (Khodair & Ali, 2010), (Ghneim, 2011), (Annajah Planning Unit, 2017), (Ministry of Foreign Affairs and Planning, General Directorate of Policy and Spatial Planning, 2012)

- **Police and Civil Defense**

Calculating area needed for police and civil defense use until 2030 as seen in table below:

Table 5- 11: Estimated Area for Police and Civil Defense Use.

Period	Expected Increase of Population	m²/ capita						
		Current	Saudi	Iraqi	Libya (0.3-0.55)	Annajah Planning Unit	Gaza	Student vision
		_____	0.20	_____	0.4	_____	0.078	0.2
2016-2020	14552.89	_____	2910.58	_____	5821.15	_____	1135.12	2910.58
2016-2025	34361.52	_____	6872.30	_____	13744.61	_____	2680.19	6872.30
2016-2030	56133.36	_____	11226.67	_____	22453.34	_____	4378.40	11226.67

Source: The Student, (Ministry of Municipal and Rural Affairs, 1426), (Khodair & Ali, 2010), (Ghneim, 2011), (Annajah Planning Unit, 2017), (Ministry of Foreign Affairs and Planning, General Directorate of Policy and Spatial Planning, 2012)

8. Recreational Use

Calculating area needed for recreational use until 2030 as seen in table below:

Table 5- 12: Estimated Area For Recreational Use.

Period	Expected Increase of Population	m²/ capita						
		Current	Saudi	Iraqi	Libya	Annajah Planning Unit	Gaza	Student vision
		0.01	0.2	2	_____	_____	1.365	2
2016-2020	14552.89	145.53	2910.58	29105.78	_____	_____	19864.69	29105.78
2016-2025	34361.52	343.61	6872.30	68723.04	_____	_____	46903.47	68723.04
2016-2030	56133.36	561.33	11226.67	112266.70	_____	_____	76622.03	112266.70

Source: The Student, (Ministry of Municipal and Rural Affairs, 1426), (Khodair & Ali, 2010), (Ghneim, 2011), (Annajah Planning Unit, 2017), (Ministry of Foreign Affairs and Planning, General Directorate of Policy and Spatial Planning, 2012)

9. Roads and Transportation

Calculating area needed for roads and transportation area until 2030 as seen in table below:

Table 5- 13: Estimated Area For Roads and Transportation Use.

Period	Expected Increase of Population	m²/ capita						
		Current	Saudi	Iraqi	Libya	Annajah Planning Unit	Gaza	Student vision
		2.25	5.5	25	_____	28.9	19.7	15
2016-2020	14552.89	32744.00	80040.90	363822.30	_____	420578.52	286691.93	218293.40
2016-2025	34361.52	77313.42	188988.40	859038.00	_____	993047.92	676921.94	515422.80
2016-2030	56133.36	126300.06	308733.50	1403334.00	_____	1622254.10	1105827.20	842000.40

Source: The Student, (Ministry of Municipal and Rural Affairs, 1426), (Khodair & Ali, 2010), (Ghneim, 2011), (Annajah Planning Unit, 2017), (Ministry of Foreign Affairs and Planning, General Directorate of Policy and Spatial Planning, 2012)

10. Other Uses

Calculating area needed for other uses area until 2030 as seen in table below:

Table 5- 14: Estimated Area For Other Uses Area

Period	Expected Increase of Population	m²/ capita						
		Current	Saudi	Iraqi	Libya	Annajah Planning Unit	Gaza	Student vision
		0.06	_____	_____	_____	_____	_____	0.06
2016-2020	14552.89	873.17	_____	_____	_____	_____	_____	873.17
2016-2025	34361.52	2061.69	_____	_____	_____	_____	_____	2061.69
2016-2030	56133.36	3368.00	_____	_____	_____	_____	_____	3368.00

Source: The Student, (Ministry of Municipal and Rural Affairs, 1426), (Khodair & Ali, 2010), (Ghneim, 2011), (Annajah Planning Unit, 2017), (Ministry of Foreign Affairs and Planning, General Directorate of Policy and Spatial Planning, 2012)

Finally, in table below areas of land uses (km^2):

Table 5- 15: Expected Areas For All Land Uses in Tulkarem Governorate

Residential	Commercial	Industrial	Administrative	Public Facilities				Open Spaces	Recreational	Roads and Transportation	Cemeteries	Other
				Educational	Health	Mosques	Police and civil defends					
2.81	0.056	0.112	0.088	0.213	0.06	0.022	0.011	0.112	0.112	0.842	0.008	0.003

These calculations were prepared to expect number of flats and homes until 2030 needed but depending on area calculated for residential but found that there is a limitation to complete this goal because of lack of data from the Palestinian Central Bureau of Statistics regarding number of houses.

5.4 Economical Aspects:

In order to achieve economic growth and economic development, the investment map of Tulkarem Governorate 2017 had been put , These goals are (Alawnah & Jaber, 2017):

- Satisfying domestic consumption of the governorate's own product.
- Creating job opportunities, reducing unemployment rates and reducing emigration out of the governorate.
- Exploiting opportunities and increasing the productivity of the governorate.
- Increase women's involvement in economic life.
- Resistance Israeli settlement sprawl.
- Improve trade balance of the governorate, enhance the contribution of productive sectors of GDP and reduce the financial leakage of the governorate.
- Developing and improving infrastructure components as a prerequisite for all forms of development.

These goals must depend on these principles (Alawnah & Jaber, 2017):

- Rely more on natural and human resources.
- To attract effective participation in the preservation of the Diaspora.

- Develop effective participation between the three sectors: public, private Ahli

- Increasing dependence on local products and reducing consumption based on Israeli goods.

- Combine the efforts of all public and private institutions to develop mechanisms to ensure the realization of these principles.

Economic Aspects will reflect on land uses as it is calculated of economic sectors commercial and agricultural and Industrial in chapter 3.

Depending on studying of Current situation of Tulkarem governorate in Chapter 3 and the Investment of Tulkarem Governorate map 2017, there is a persistent need For industrial zone, This will be focused on in the next chapter depending on some criteria.

Chapter Six
Proposed Pattern For Sustainable Future Urban Development

Introduction

After studying Tulkarem governorate resources and expected population and expected areas of land uses needed for population, and giving weights to every criteria It's time to guide the study of urban development based on sustainability process.

Steps for preparing maps: some areas were excluded through the following steps:

- Step1as seen in map (6-1).

- Built up areas: this area already has been developed, so it was excluded

- Buffer of museums, castles, tourism places and caves 100m.

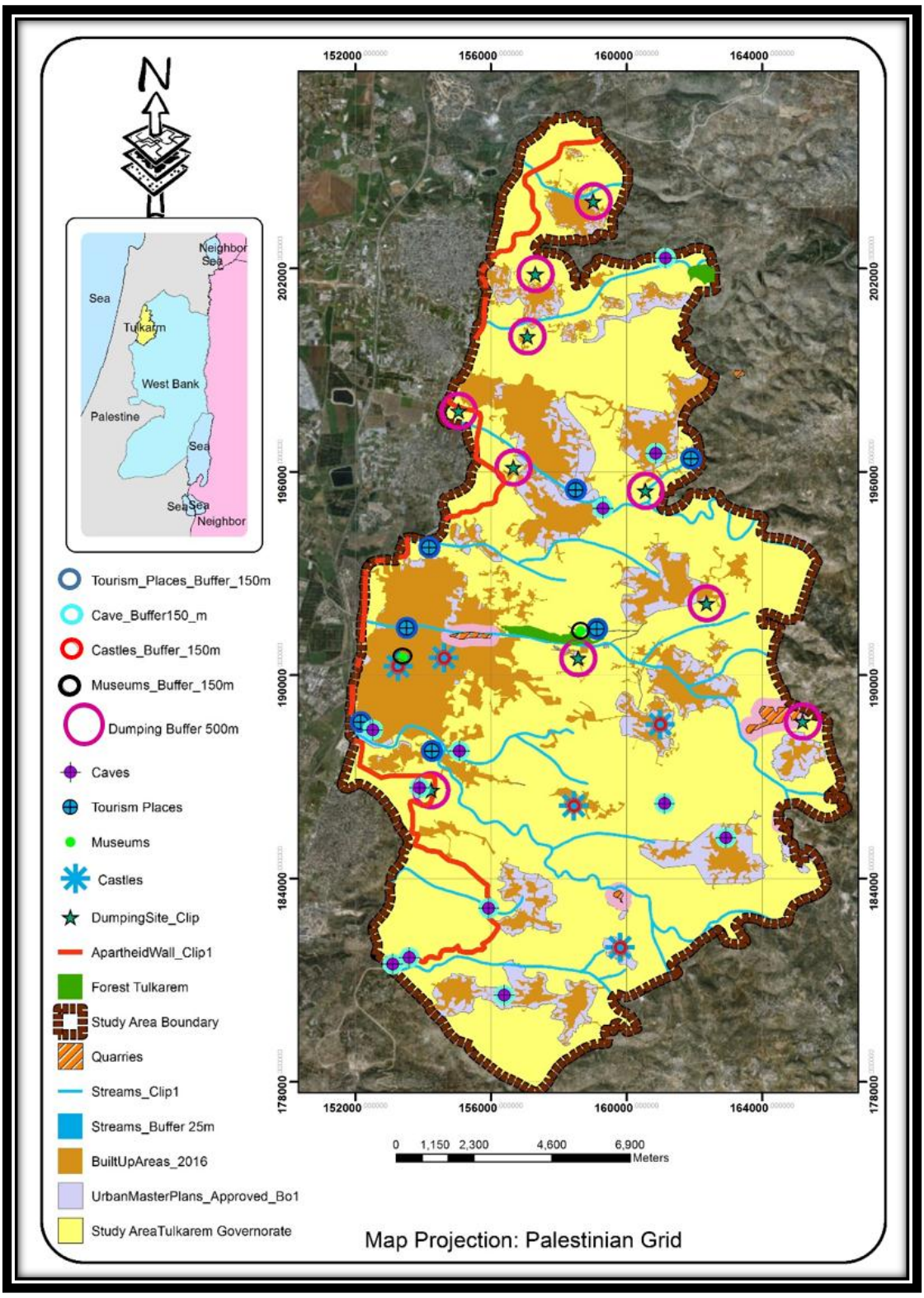
- Buffer of dumping sites 500m and waste collection areas.

- Buffer of streams 25m.

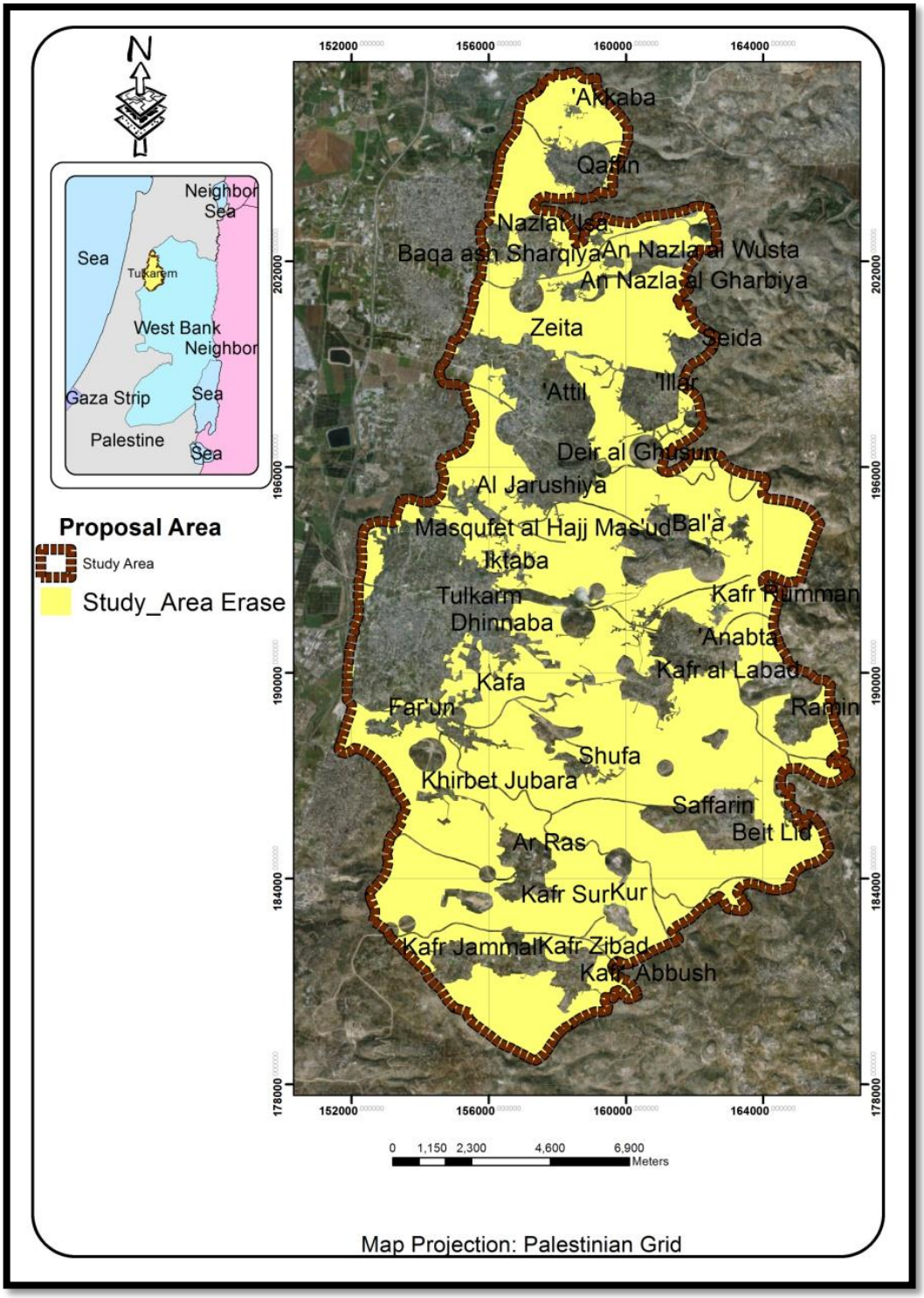
- Forests that considered as natural reserve which must be excluded from development.

- Step 2

Erase areas mentioned in step 1 as seen in map (6-2).



Maps 6- 1:Tulkarem Governorate Prepared for Excluding.



Maps 6- 2: Proposal Area for Sustainable Development.

6.1 Suitability Depending on The Three Sustainability Aspects

Suitability of aspects depend on criteria were put and weights given through the questionnaire so in this part each aspect will be overlaed by itself and finally all the three aspects would be overlayed to determine the most suitable area for development.

6.1.1 Environmental Aspects:

Environmental criteria as shown in table 6.1 is divided into:

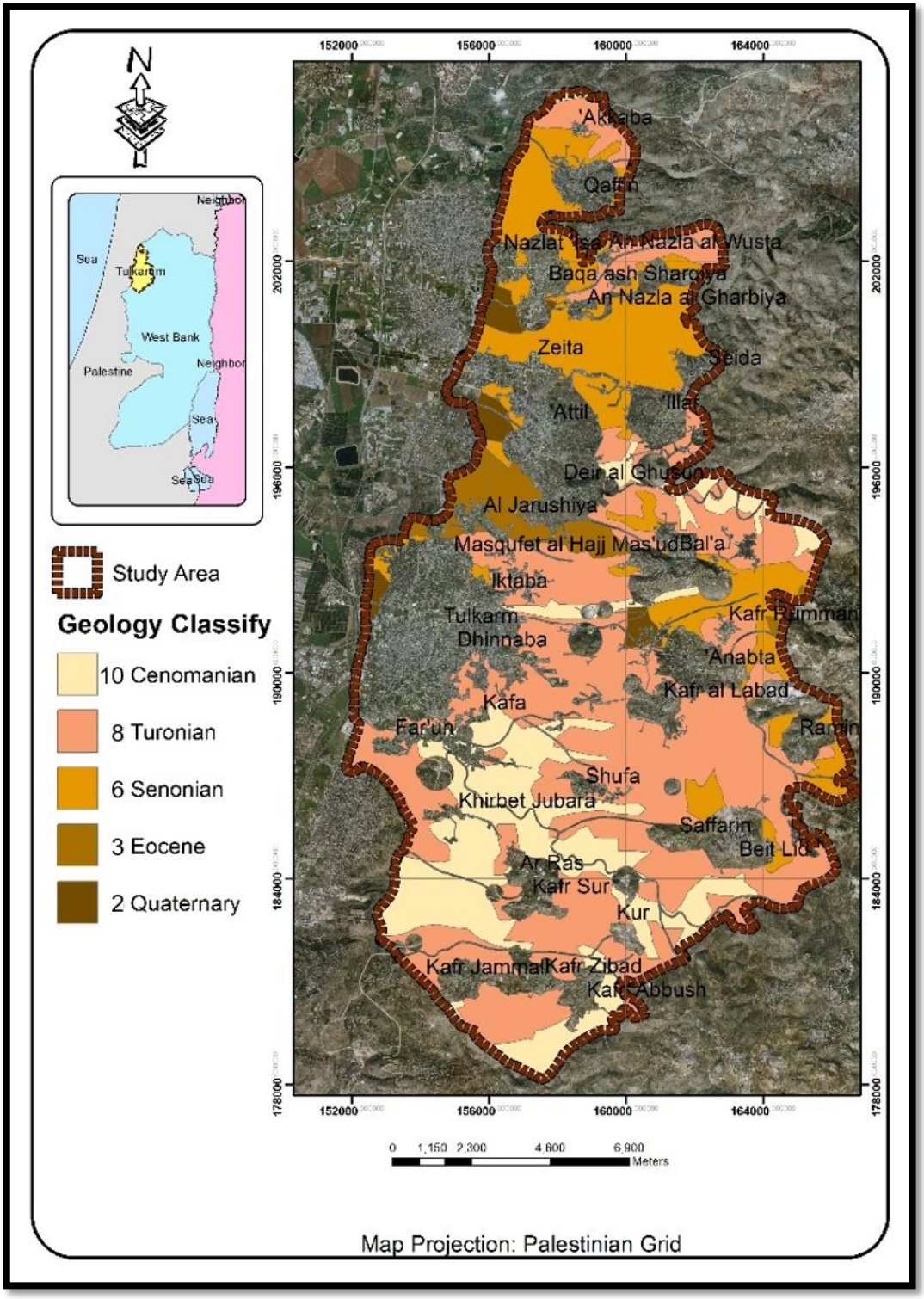
1. Geology

Suitability of Geology depends on the bear of construction of high building to limit horizontal expansion that is .

Map of Geology was reclassified according to the bear of construction as seen in map(6-3)and table (6-2).

Table 6- 1:Weights For Suitability of Geology

Type	Reclassification (from higher Suitability for sustainable development to the least)	Suitability Weights for Sustainable development
Cenomanian	1	10
Turonian	2	8
Senonian	3	6
Eocene	4	3
Quaternary	5	2
Geology Weight	24.28%	



Maps 6- 3: Reclassification of Geology Map.

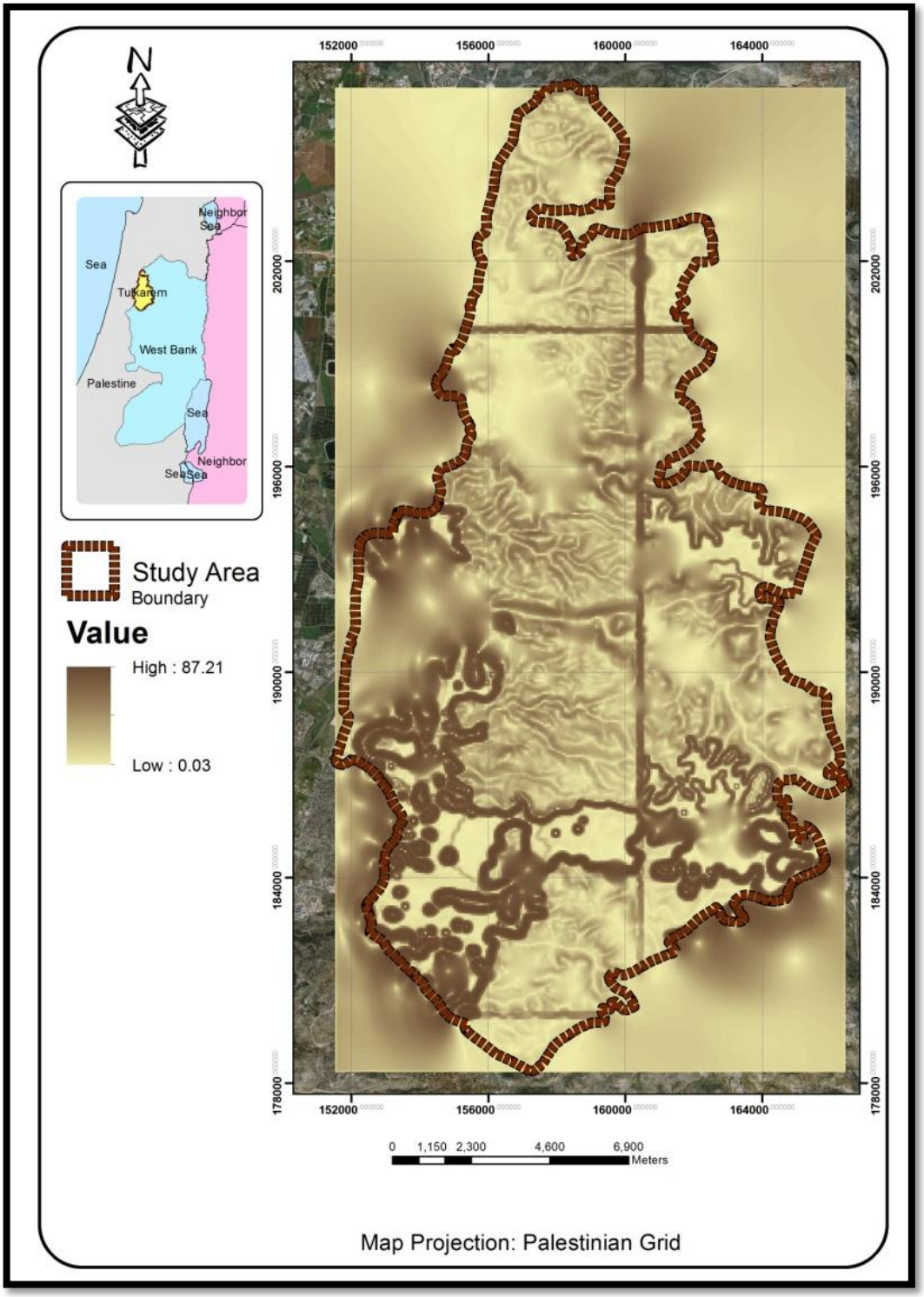
2. Terrain

Slope map was reclassified that the suitable slope for development doesn't exceed 20%,as seen in map(6-4), (6-5) and table (6-3).

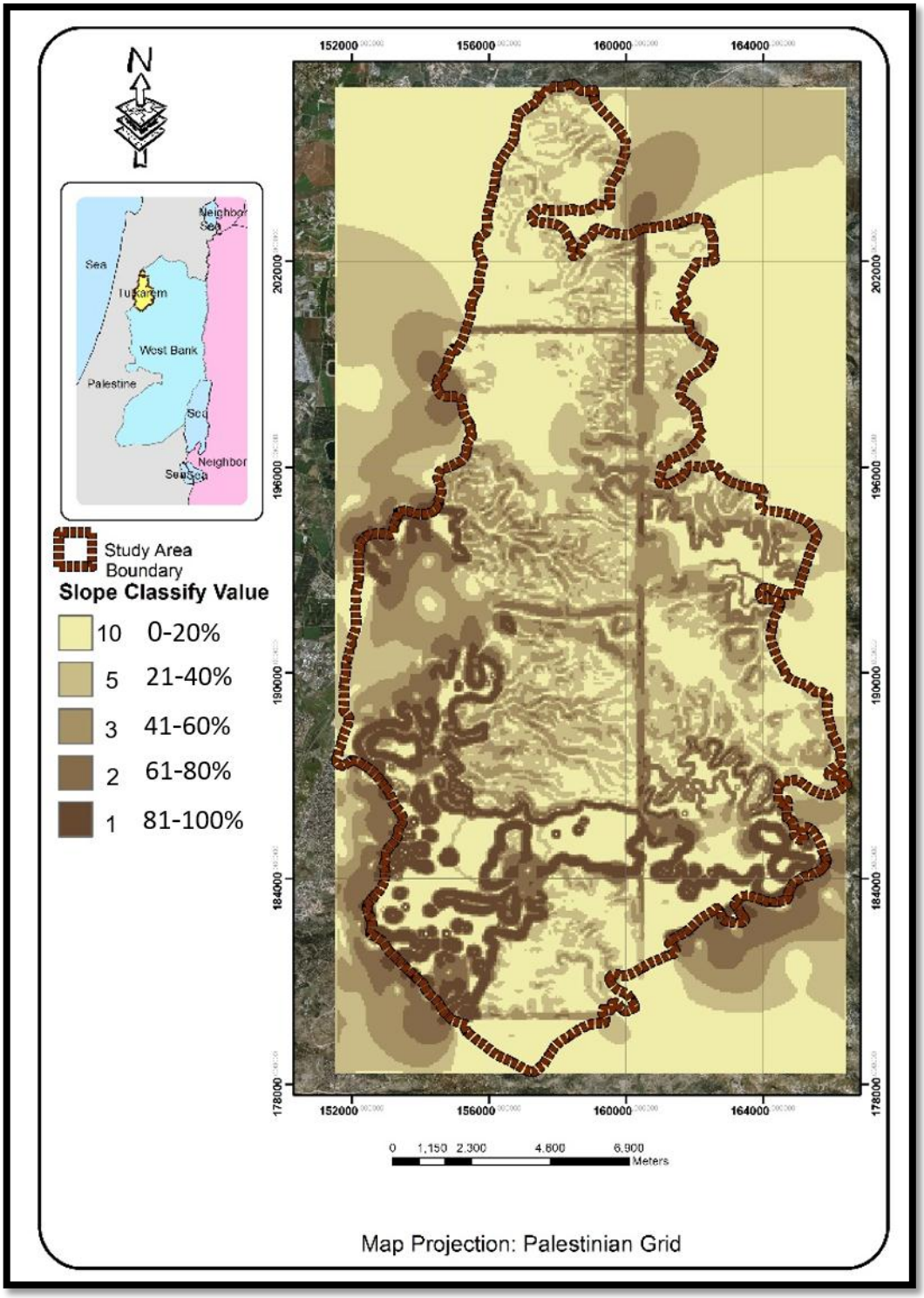
Table 6- 2:Weights For Suitability of Slope.

Slope %	Reclassification (from higher Suitability for sustainable development to the least)	Suitability Weights for Sustainable development
0-20	1	10
20-40	2	5
40-60	3	3
60-100	4	1
Slope Weight*	5.71%	

*The mean of values filled out in the questionnaire by specialists



Maps 6- 4: Slope Map.



Maps 6- 5: Slope Reclassification.

3. Agricultural Land value

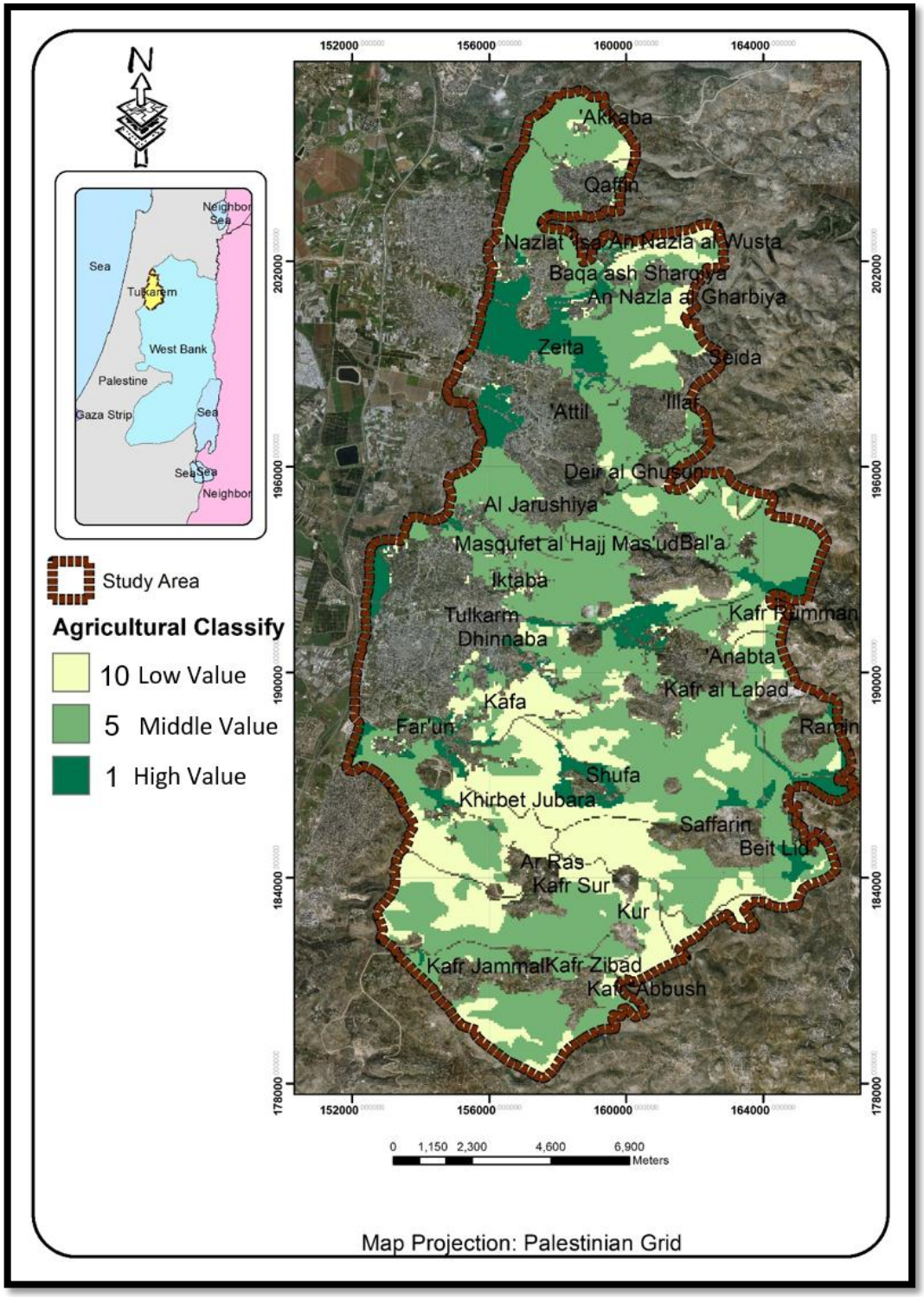
Land value map was reclassified from higher suitability for sustainable development to the lowest then given weights as seen in table(6-4) and map (6-6)

Land with low value is the most suitable for development in opposite of land with high land value that must be protected from expansion.

Table 6-3: Weights For Suitability of Land Value.

Land Value	Reclassification(from higher suitability for sustainable development to the least)	Suitability Weights for Sustainable Development
Low Land Value	1	10
Middle Land value	2	5
High Land value	3	1
Land Value Weight*	51.42%	

*The mean of values filled out in the questionnaire by specialists



Maps 6- 6: Reclassification of Land Value.

6.1.2 Social Aspects:

Social criteria as shown in table 6.1 is divided into:

1. Cities Weight

Population map for proposal sustainable development was reclassified from The highest population areas that are the most suitable for urban development to the lower population areas that are the least suitable as seen in table (6-5)and map (6-6).

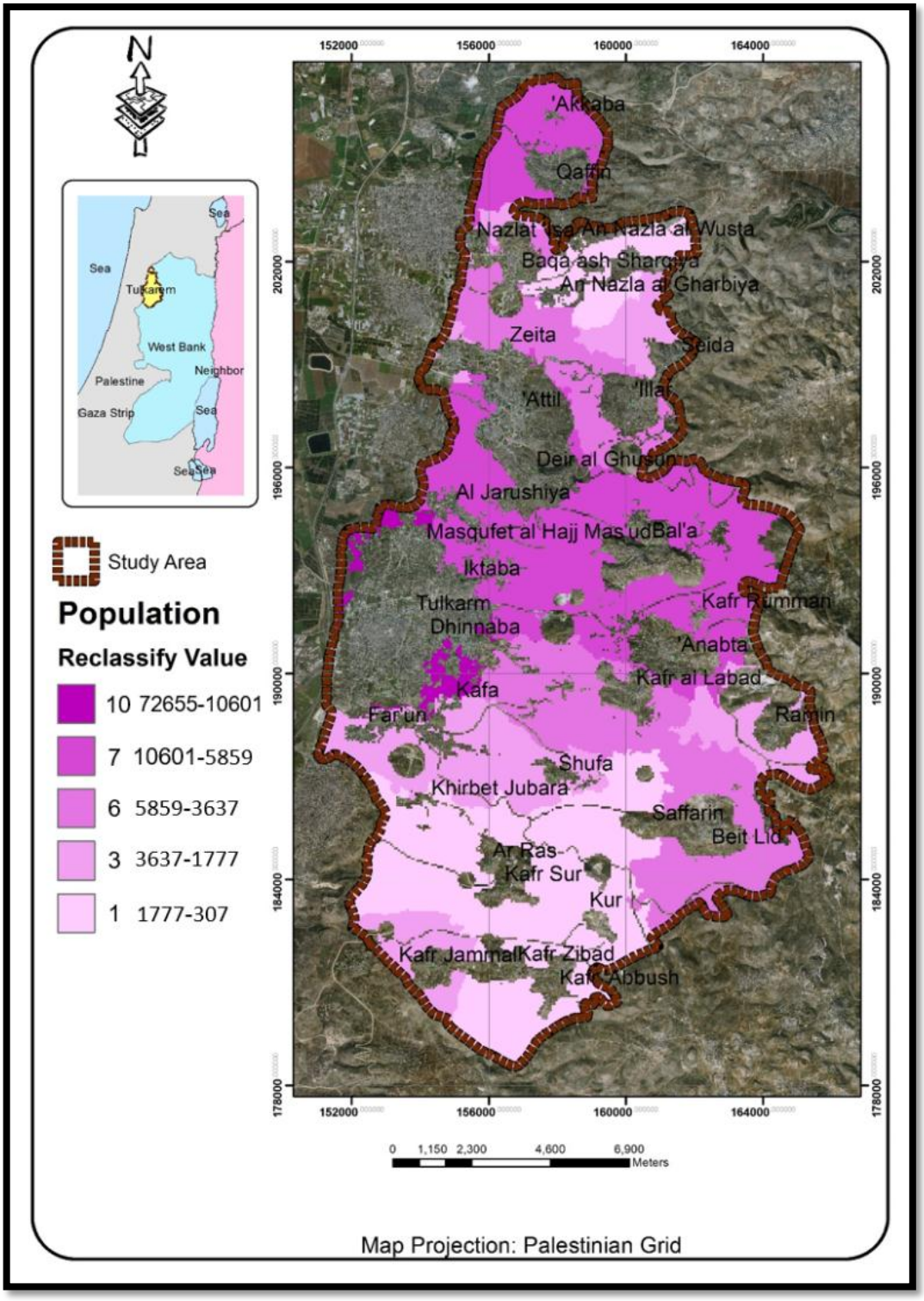
Population density map for proposal sustainable development was reclassified from The highest density areas that are the most suitable for urban development to the lower population areas that are the least suitable as seen in table (6-6) map (6-8).

Cities expansion resulted from population growth and their needs, so cities that have more density and population have higher weight of suitability than less population and density.

Table 6-4: Weights For Suitability of Population

Population	Reclassification(from higher suitability for sustainable development to the least)	Suitability Weights for Sustainable Development
10602 – 72655	1	10
5859 -10601	2	8
3637 – 5858	3	7
1777 – 3636	4	5
307 – 1776	5	3
Population Weight*	22.28%	

*The mean of values filled out in the questionnaire by specialists

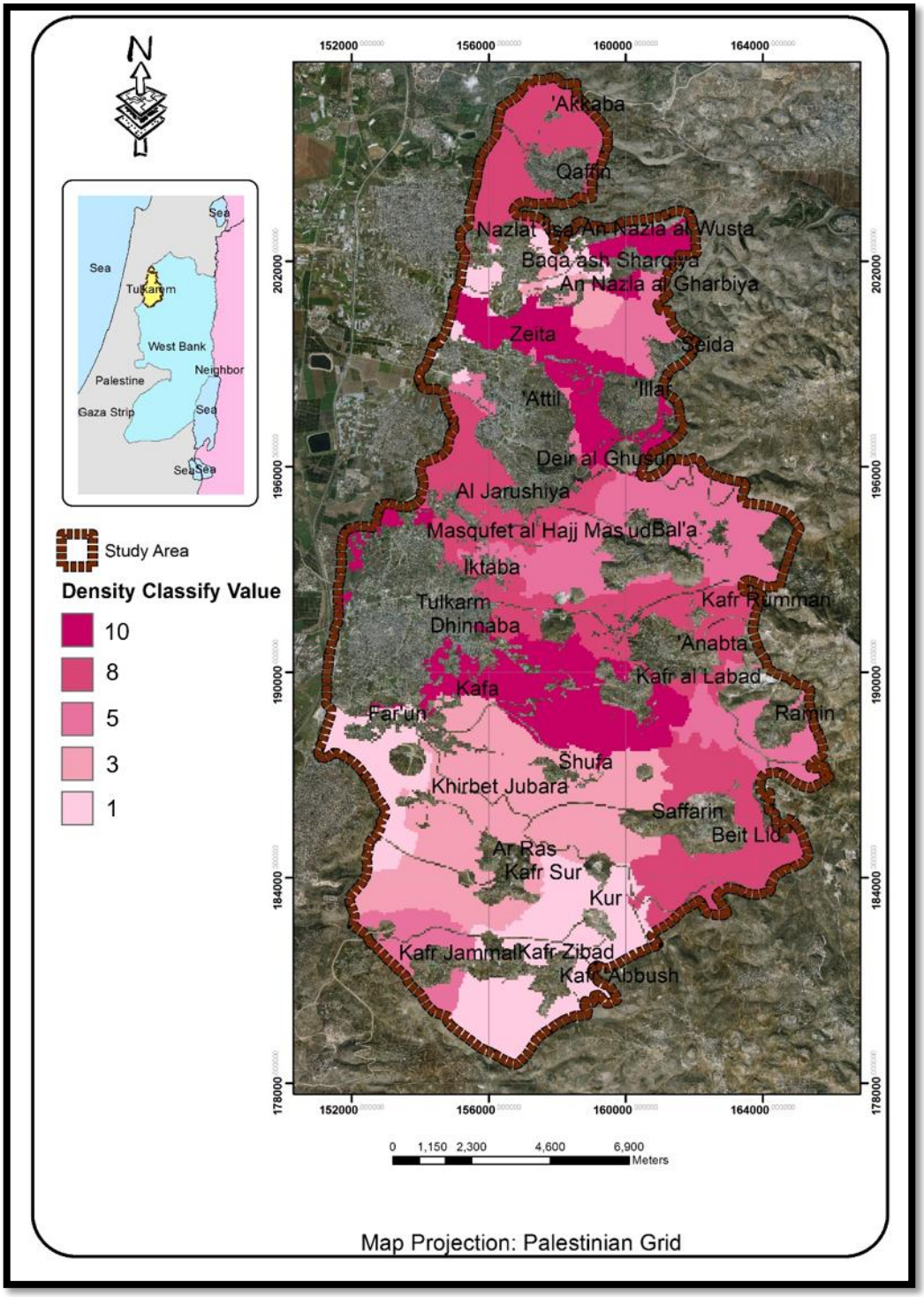


Maps 6- 7: Reclassifying of Population.

Table 6-5: Weights For Suitability of Density

Density (person/ km²)	Reclassification(from higher suitability for sustainable development to the least)	Suitability Weights for Sustainable Development
6510 – 9231	1	10
4842 – 6509	2	8
3276 – 4841	3	6
1807 – 3275	4	4
172 – 1804	5	2
Density Weight*	14.85%	

*The mean of values filled out in the questionnaire by specialists



Maps 6- 8: Reclassifying of Density.

2. Political Areas

Political areas is divided into areas authorities depending on Oslo classification

and areas closed by Separation Wall.

- **Areas authorities depending on Oslo classification**

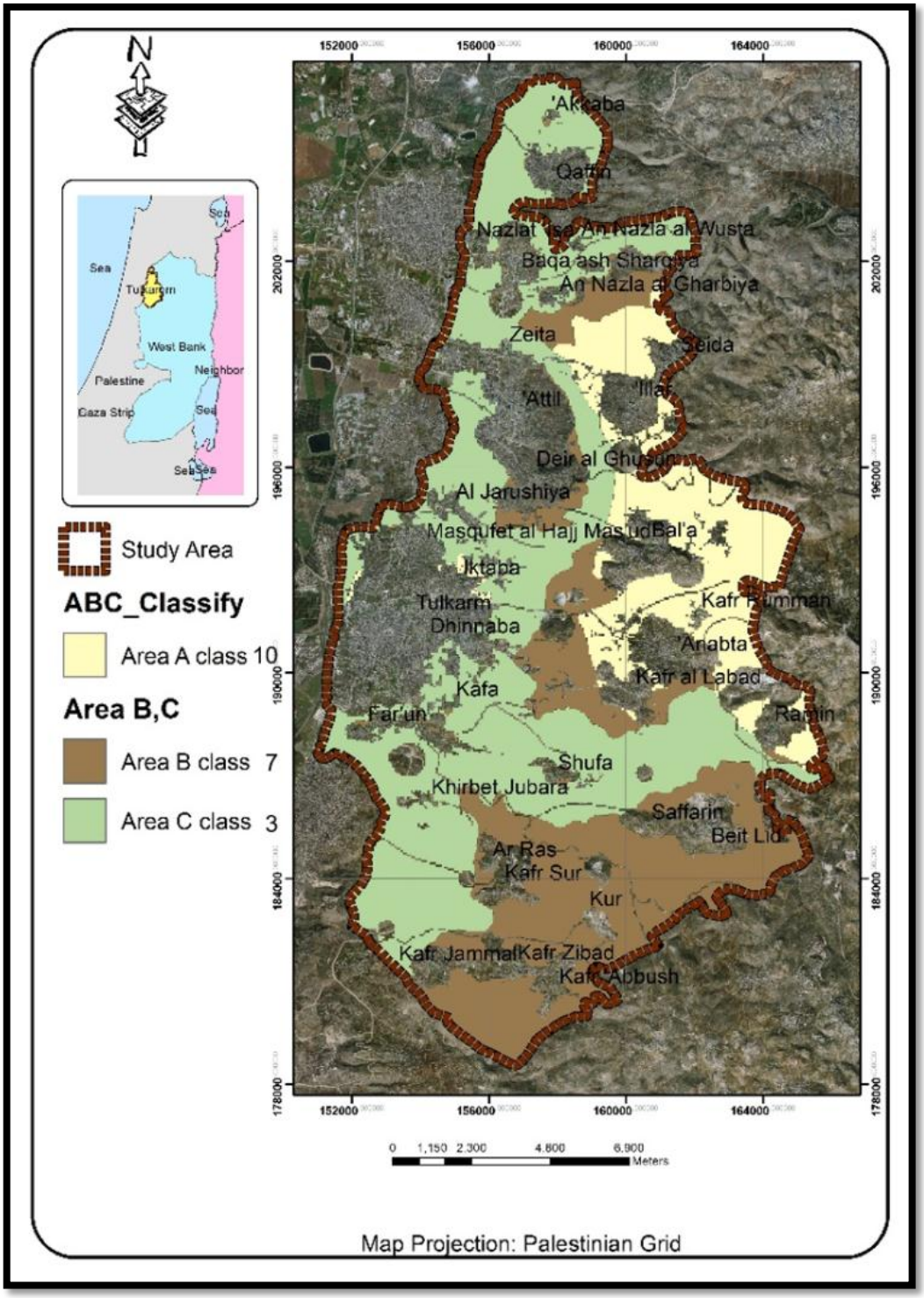
Oslo classification map for proposal sustainable development was reclassified from the highest suitability for sustainable development to the lowest as seen in table(6-6) map(6-9).

Developing is easier in lands that controlled by Palestinian authority than area C that controlled by Israeli occupation because of difficulties of licensing procedures.

Table 6-6: Weights For Suitability of Oslo Classifications.

Oslo Classification	Reclassification(from higher suitability for sustainable development to the least)	Suitability Weights for Sustainable Development
Area A	1	10
Area B	2	5
Area C	3	3
Oslo Classification Weight*	15%	

*The mean of values filled out in the questionnaire by specialists



Maps 6- 9: Reclassifying of Oslo Classification Areas.

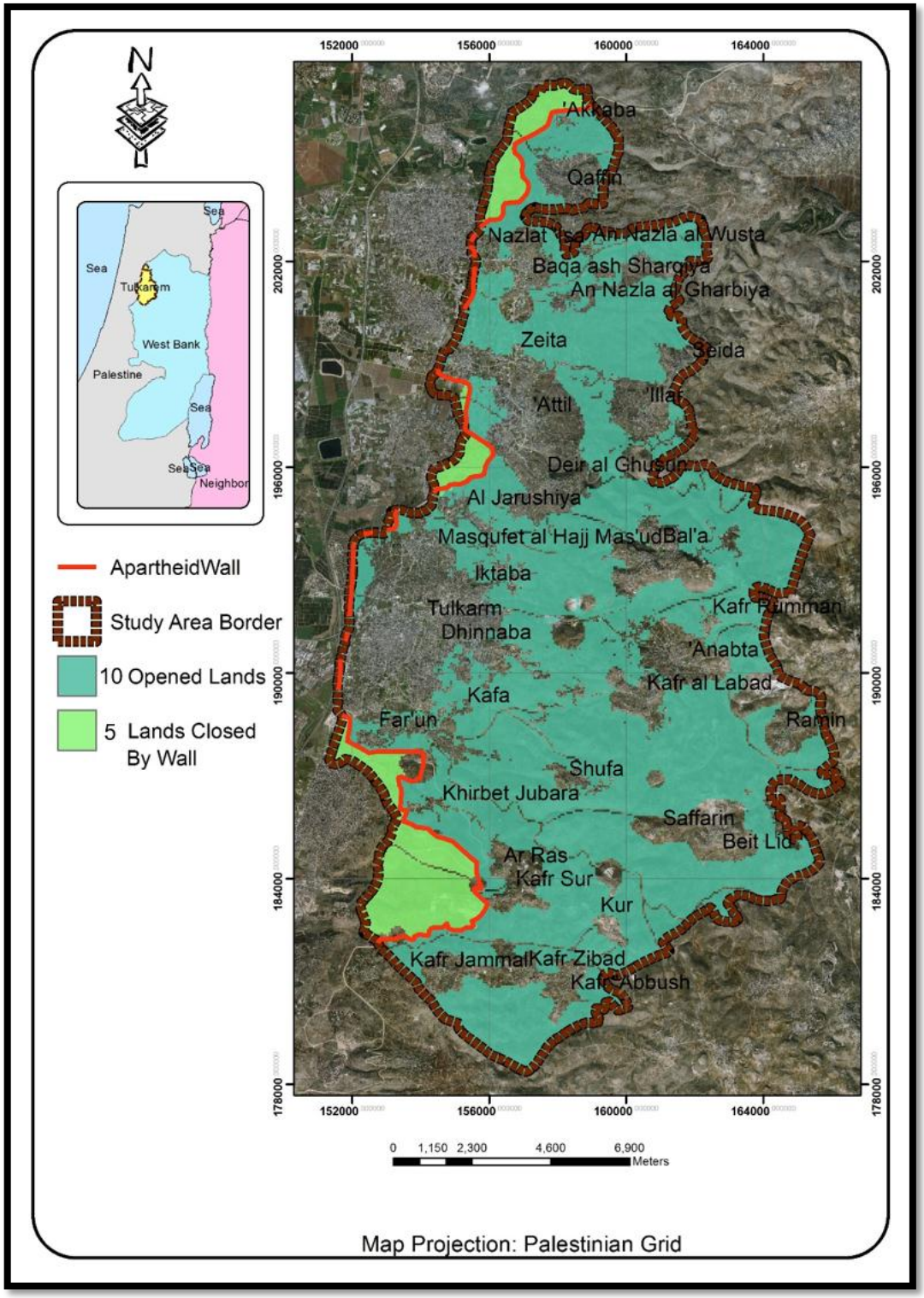
- **Areas Closed by Separation Wall**

Areas closed by the wall map was reclassified as the lowest suitable for development are areas closed by the wall in opposite for areas not closed by the wall are the highest suitable for development as seen in table (6-8) map(6-10).

Table 6-7: Weights For Suitability of Land According to the Wall.

Lands	Reclassification(from higher suitability for sustainable development to the least)	Suitability Weights for Sustainable Development
Lands Opened	1	10
Lands Closed By Wall	2	3
Weight*	15.71%	

*The mean of values filled out in the questionnaire by specialists



Maps 6- 10: Reclassifying Areas closed by the Wall.

- **Land Use**

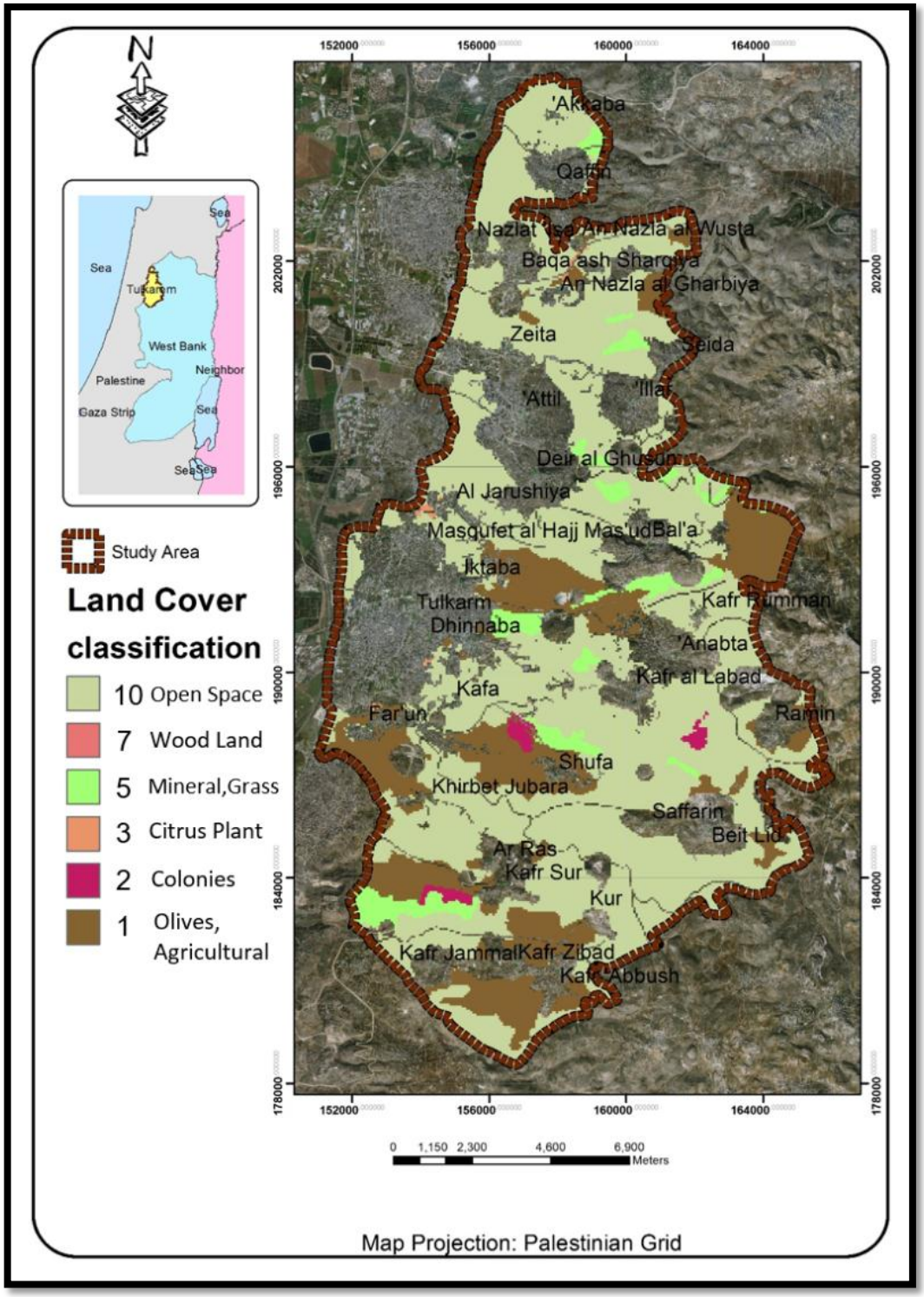
Land uses map for proposal sustainable development was reclassified from the highest suitability for sustainable development to the lowest as seen in table (6-9) and map(6-11).

Land uses identify the productivity of land so every land use weighed for suitability for development as:

Table 6-8: Weights For Suitability of Land Use

Land Use	Reclassification (from higher suitability for sustainable development to the least)	Suitability Weights for Sustainable Development
Open Spaces	1	10
Transitional Wood Land	2	7
Grass Land	3	5
Mineral	3	5
Citrus Plantations	4	3
Colonies	4	3
Agricultural	5	1
Olives	5	1
Forest	5	1
Built UP Areas		Excluded
Land Use Weight*	15.42%	

*The mean of values filled out in the questionnaire by specialists



Maps 6- 11: Reclassifying of Land Cover.

3. Streams

Distance 25 m from streams is excluded from development out of the structural plan.

4. Dumping Sites

Development is excluded for a distance of 500m from dumping sites.

5. Wastes Collection Points

Development is out from waste collection points of 500m.

6. Inhabitants Desires

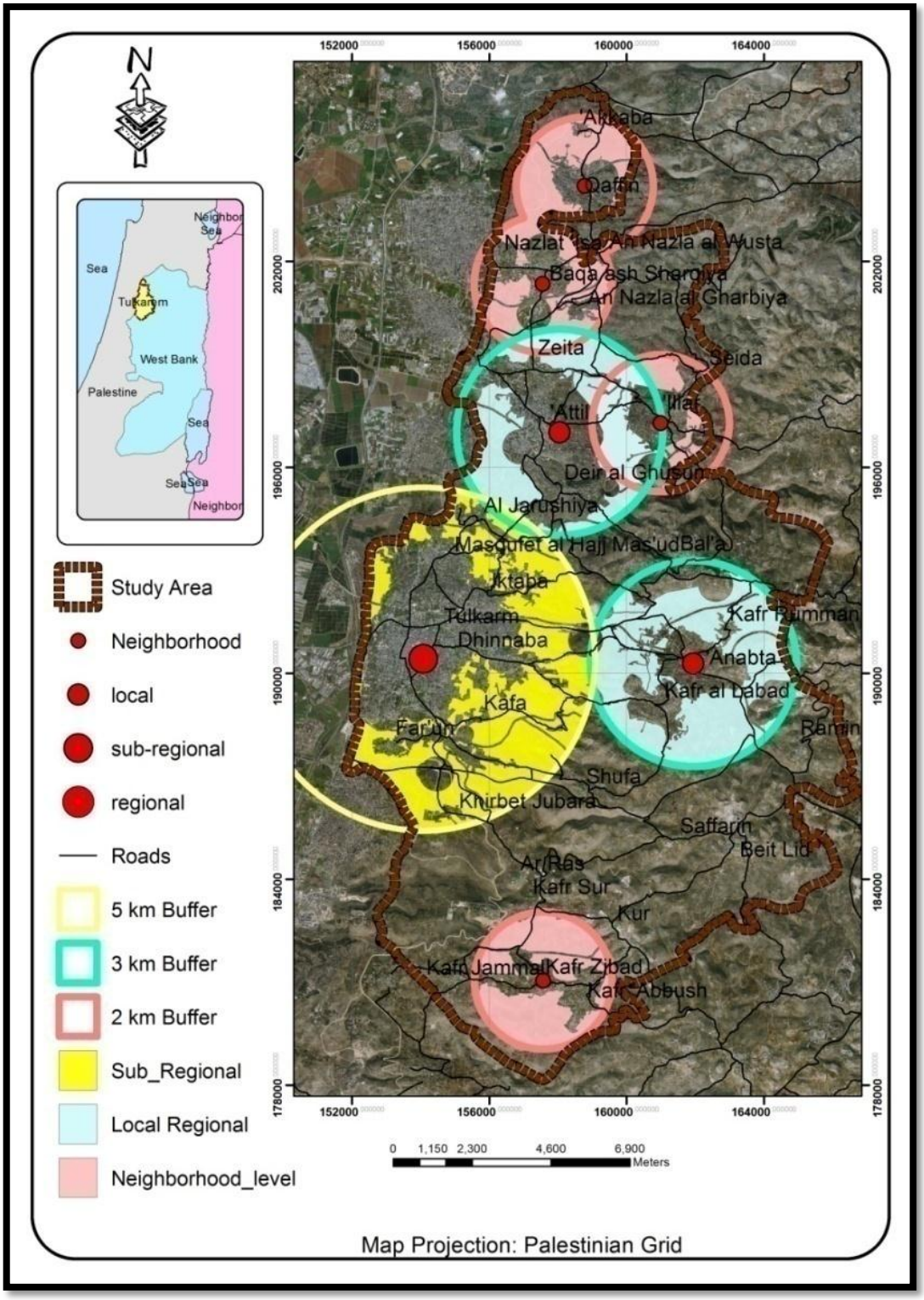
Inhabitants prefer to live close to built up areas where facilities, markets and governmental institutions are available, so closeness to built up areas weighed 10 then rank as far as seen in table (6-10) and map (6-12),(56-13).

Pollution areas are unpreferable for inhabitants so far from pollution weighed 10, then rank to 1 as close to pollution areas, but from map (5-14)found that pollution areas are already from excluded areas.

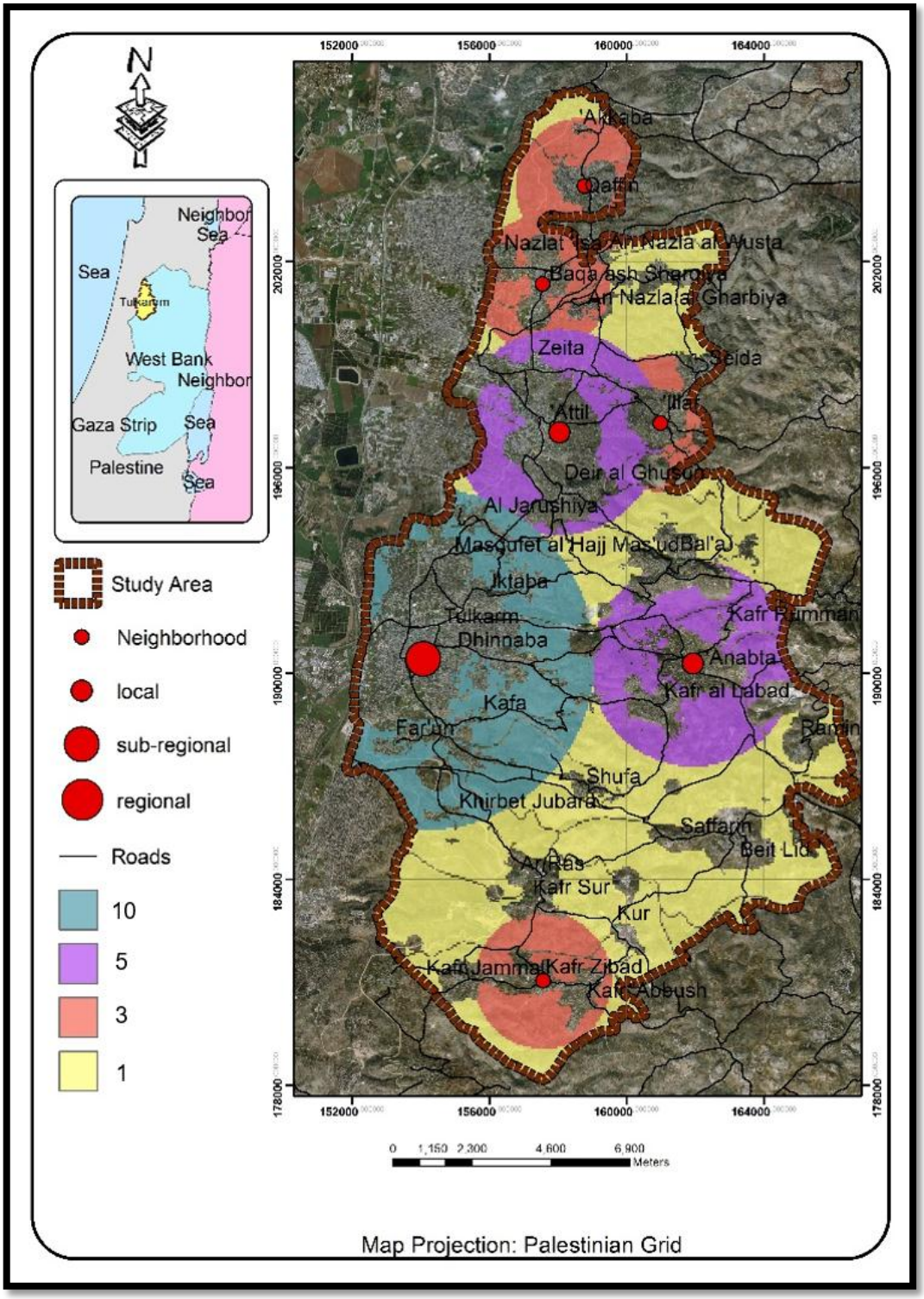
Table 6- 9: Weights For Suitability of Closeness to Cities

Closeness to centers	Reclassification(from higher suitability for sustainable development to the least)	Suitability Weights for Sustainable Development
Sub regional	1	10
Local	2	5
Neighborhood	3	3
Other	4	1
Closeness to centers Weight*	18.14%	

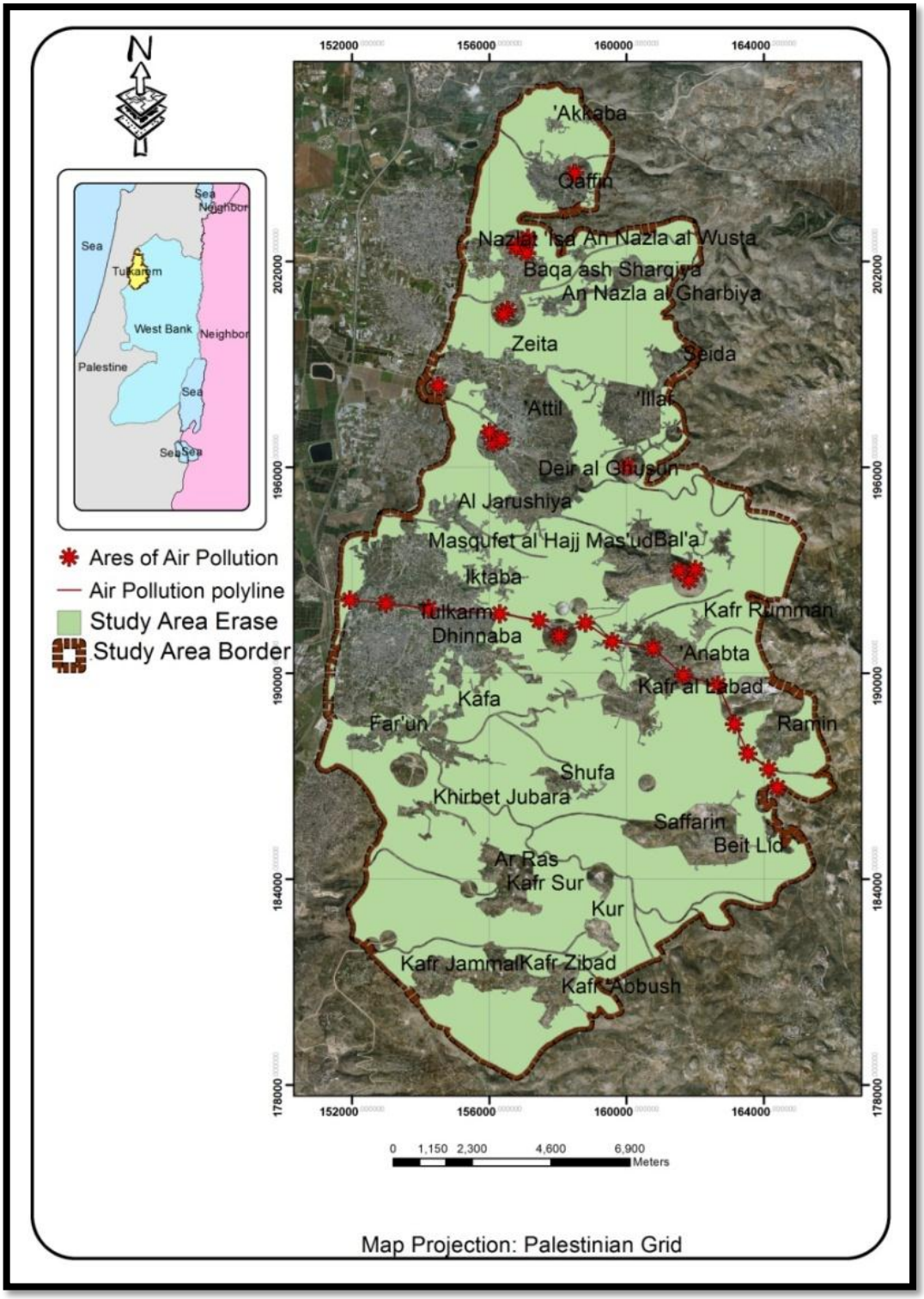
*The mean of values filled out in the questionnaire by specialists



Maps 6- 12: Buffer of Services Centers.



Maps 6- 13: Reclassifying of Services Centers.



Maps 6- 14: Pollution Map.

6.1.3 Economical Aspects

Economical criteria as shown in table 6.1 is divided into:

Slope

1. Land ownership

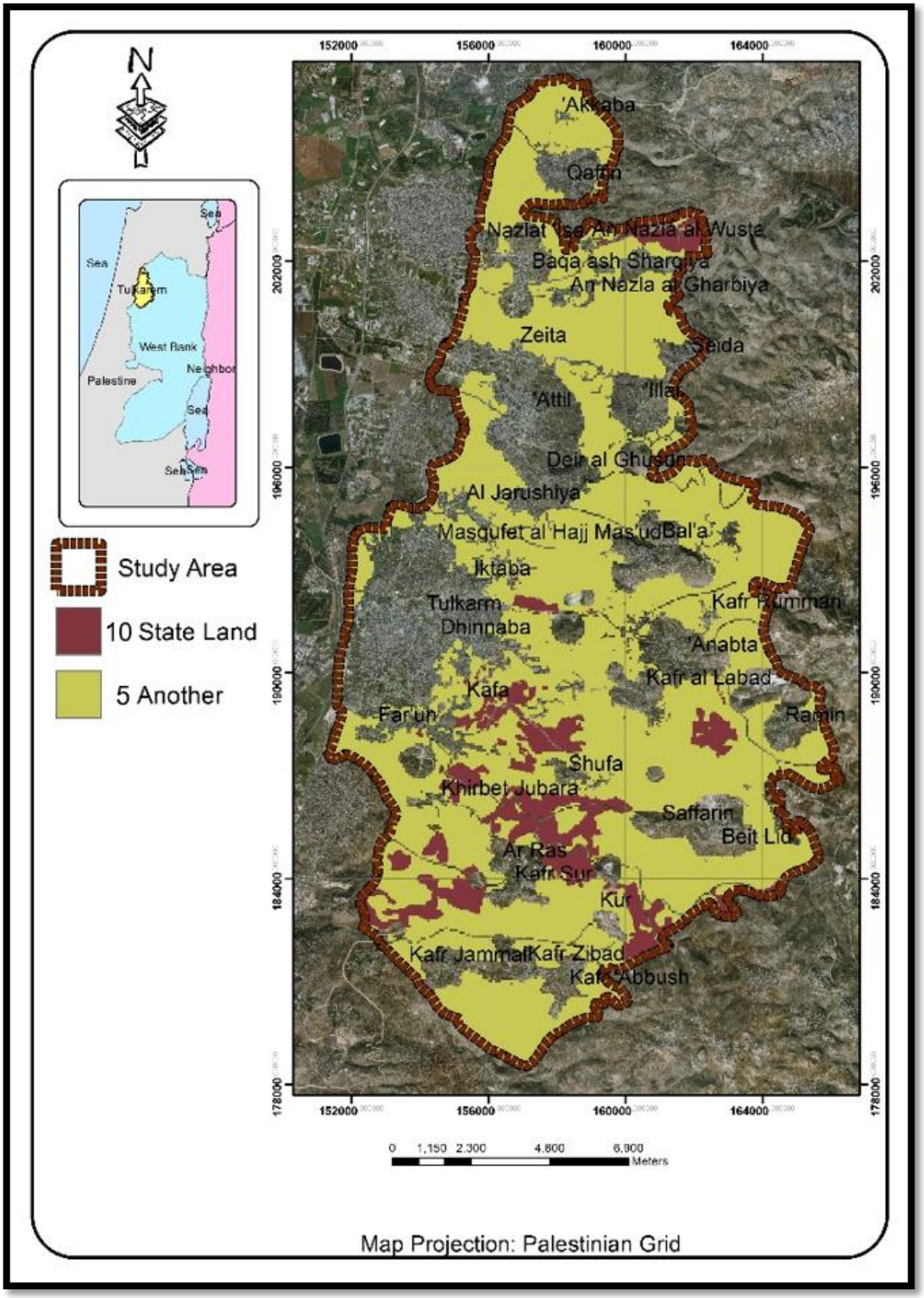
Land ownership map for proposal sustainable development was reclassified from the highest suitability for sustainable development to the lowest as seen in table (6-11) map(6-15).

It is preferable and more easier to develop in state properties because of people desire as known " not in my backyard" and compensation costs when developing in other (inhabitants, occupied lands) properties.

Table 6- 10: Weights For Suitability of Land Ownership

Land Ownership	Reclassification(from higher suitability for sustainable development to the least)	Suitability Weights for Sustainable Development
State Ownership	1	10
(Inhabitants – Occupied) Ownership	2	1
Closeness to centers Weight*	32.85%	

*The mean of values filled out in the questionnaire by specialists



Maps 6- 15: Reclassifying of Land Ownership.

2. Cost of Public Utilities

Costs of Public utilities is less when expansion is near current development, For subregional service center buffer of 5km was taken, where for local service center a buffer of 3km was taken and for neighborhood service center a buffer of 2km was taken as seen in map (6-12),

Services centers map for proposal sustainable development was reclassified from the highest suitability for sustainable development to the lowest as seen in table (6-10) and map (6-13).

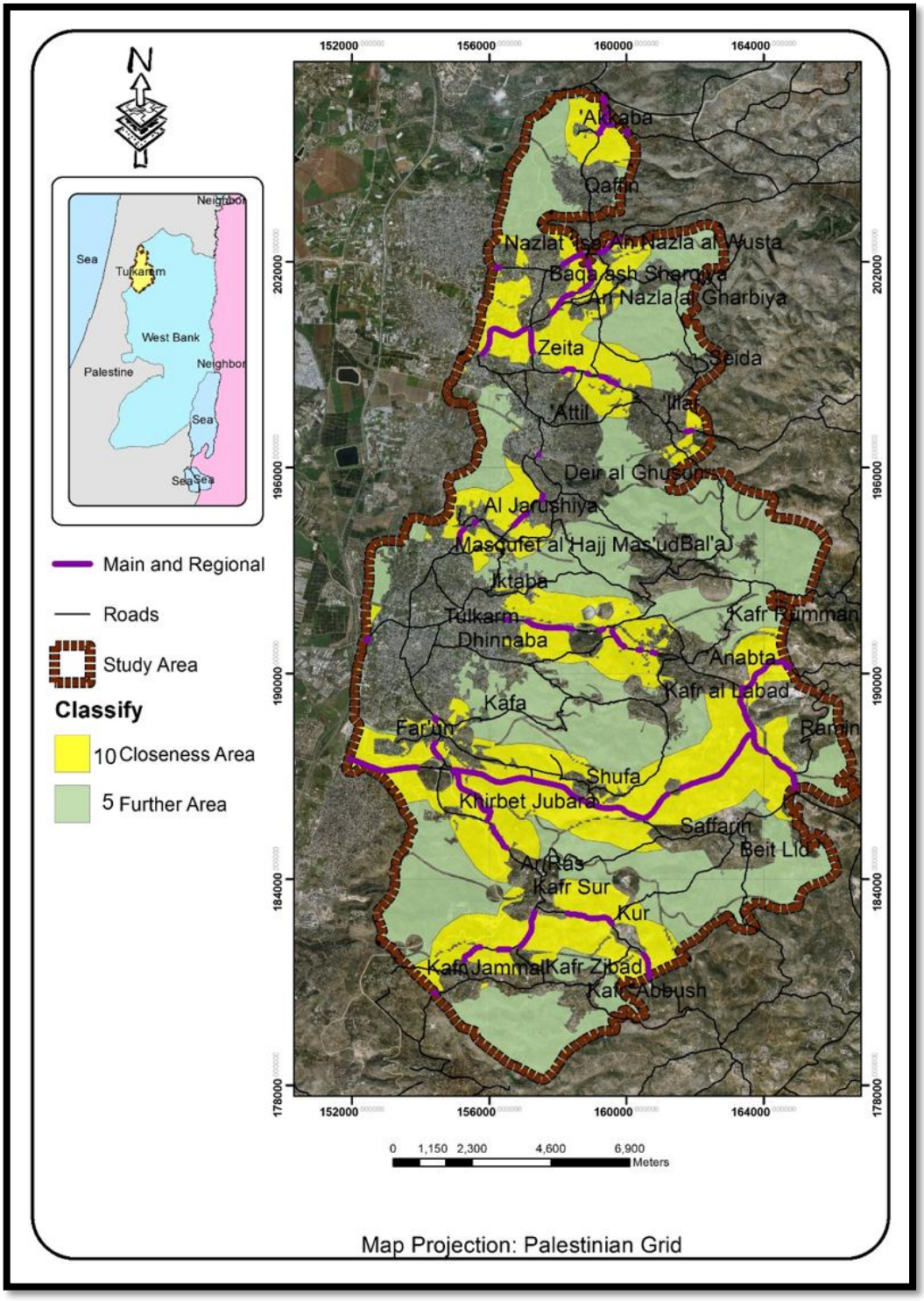
Street Buffer map was made as seen in map (6-18), then it was reclassified from the highest suitable for sustainable development to the lowest as seen in table (6-12) and map (6-16).

Slope as mention previously in social aspects should not exceed 20% as seen in map(6-4), (6-5) and table (6-3)because slope affect in costs of construction and services where less slope less cost, more slope more costs.

Table 6-11: Weights For Suitability of Street Buffer

Closness to Streets	Reclassification (from higher suitability for sustainable development to the least)	Suitability Weights for Sustainable Development
0 – 1000	1	10
Other	2	5
Closness to streets Weight*	26.4%	

*The mean of values filled out in the questionnaire by specialists



Maps 6- 16: Reclassifying of Buffer of Streets.

6.2 Weighted Overlay for Environmental, Social and Economical Aspects

Through criteria that were studied in this chapter and weights were given for each one three weighted overlay maps would be resulted for environmental, social and economical aspects.

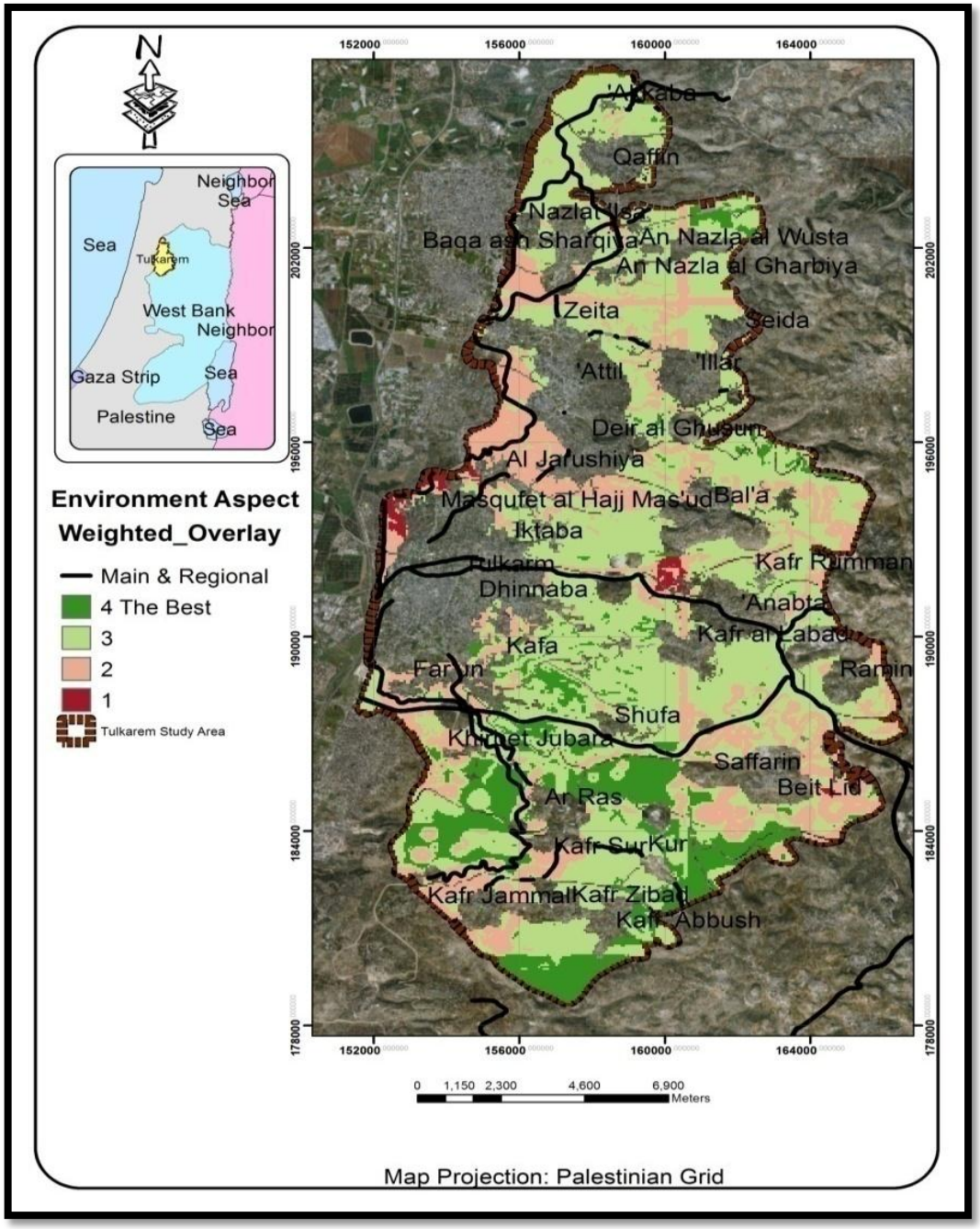
6.2.1 Weighted Overlay for Environmental Aspect

Depending on the sub criteria of environmental aspects, found that the most suitable areas for development is in the south of Tulkarem Governorate as seen in table(6-13) and map (6-117).

Table 6-12: Weights For Suitability of Enviromental Subcriteria

Sub criteria	Weight
Agricultural Land Value*	51.24%
Geology*	24.28%
Terrain*	25.71%
Total	100%

*The mean of values filled out in the questionnaire by specialists



Maps 6- 17: Weighted Overlay for Environmental Aspects.

6.2.2 Weighted Overlay for Social Aspect

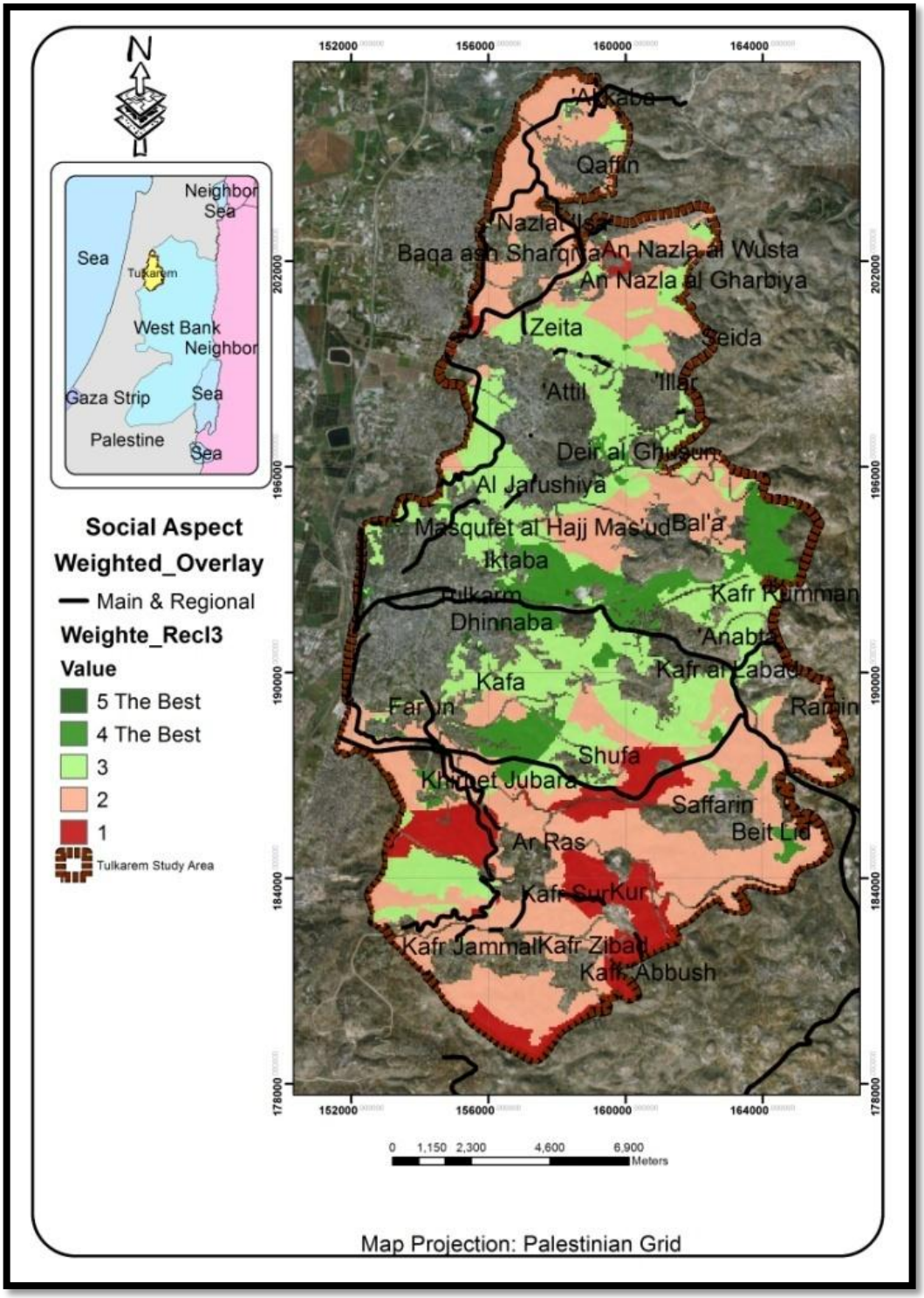
Depending on the subcriteria of social aspects weights were given as seen in table (6-14):

Table 6-13: Weights For Suitability of Social Subcriteria.

Sub criteria	Weight
Population density*	22.28%
Population*	14.85%
Political areas*	15%
Areas closed by wall*	15.71%
Closness to city*	18.14%
Land cover*	15.42%
Total	100%

*The mean of values filled out in the questionnaire by specialists

The most suitable areas for development according to social aspect are in the middle of governorate and close to Tulkarem city as seen in map (6-18).



Maps 6- 18: Weighted Overlay for Social Aspect.

6.2.3 Weighted Overlay for Economical Aspect

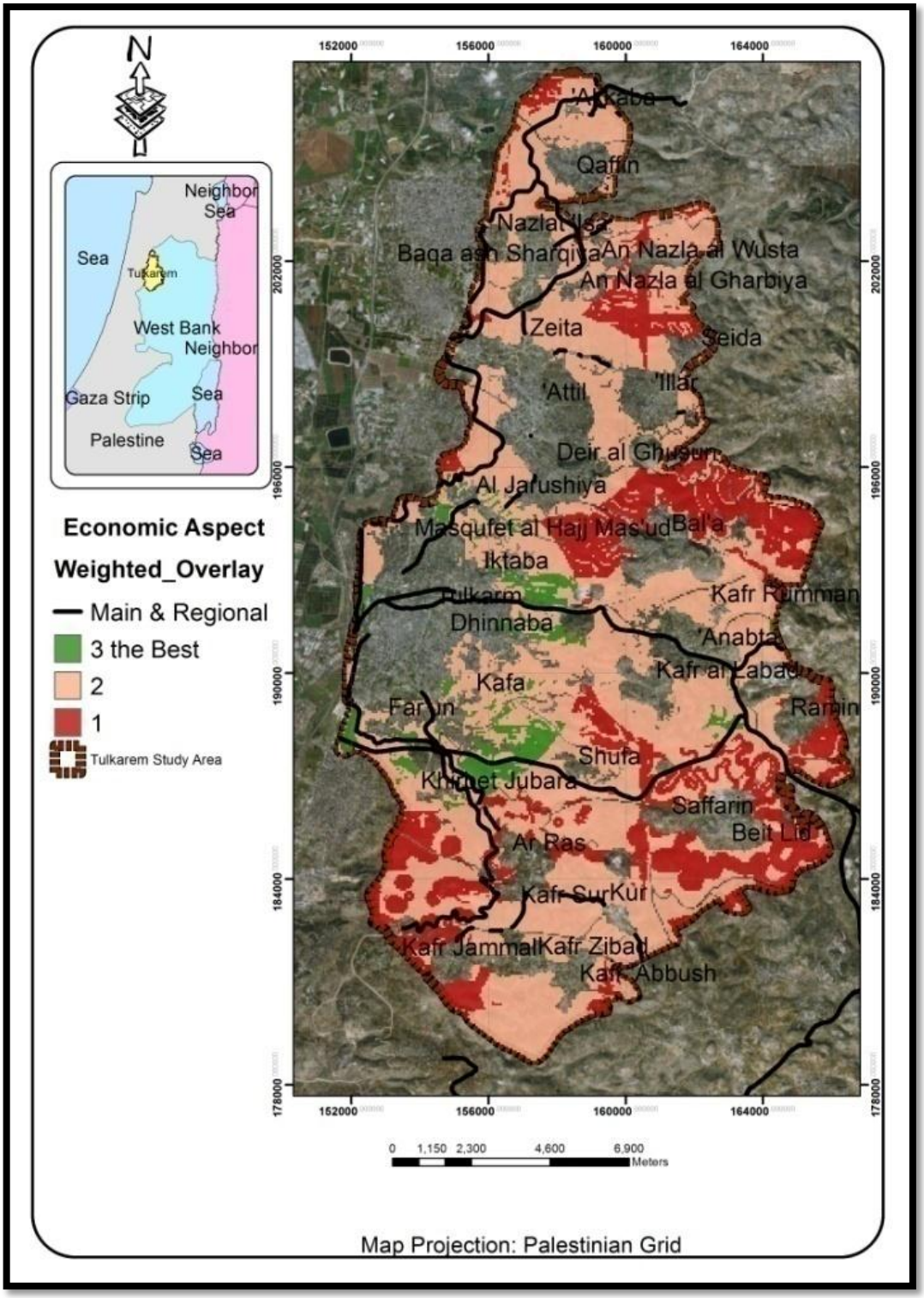
Depending on the subcriteria of economical aspects with site is level, or slope of 15%, weights were given as seen in table (6-15):

Table 6-14: Weights For Suitability of Economic Subcriteria.

Sub criteria	Weight
Land Ownership*	32.85%
Slope*	18.57%
Closness to Cities*	22.14%
Closness to Main and Regional Roads*	26.42%
Total	100%

*The mean of values filled out in the questionnaire by specialists

The most suitable areas for development according to economical aspect are in the middle of governorate and close to Tulkarem city as seen in map (6-19).



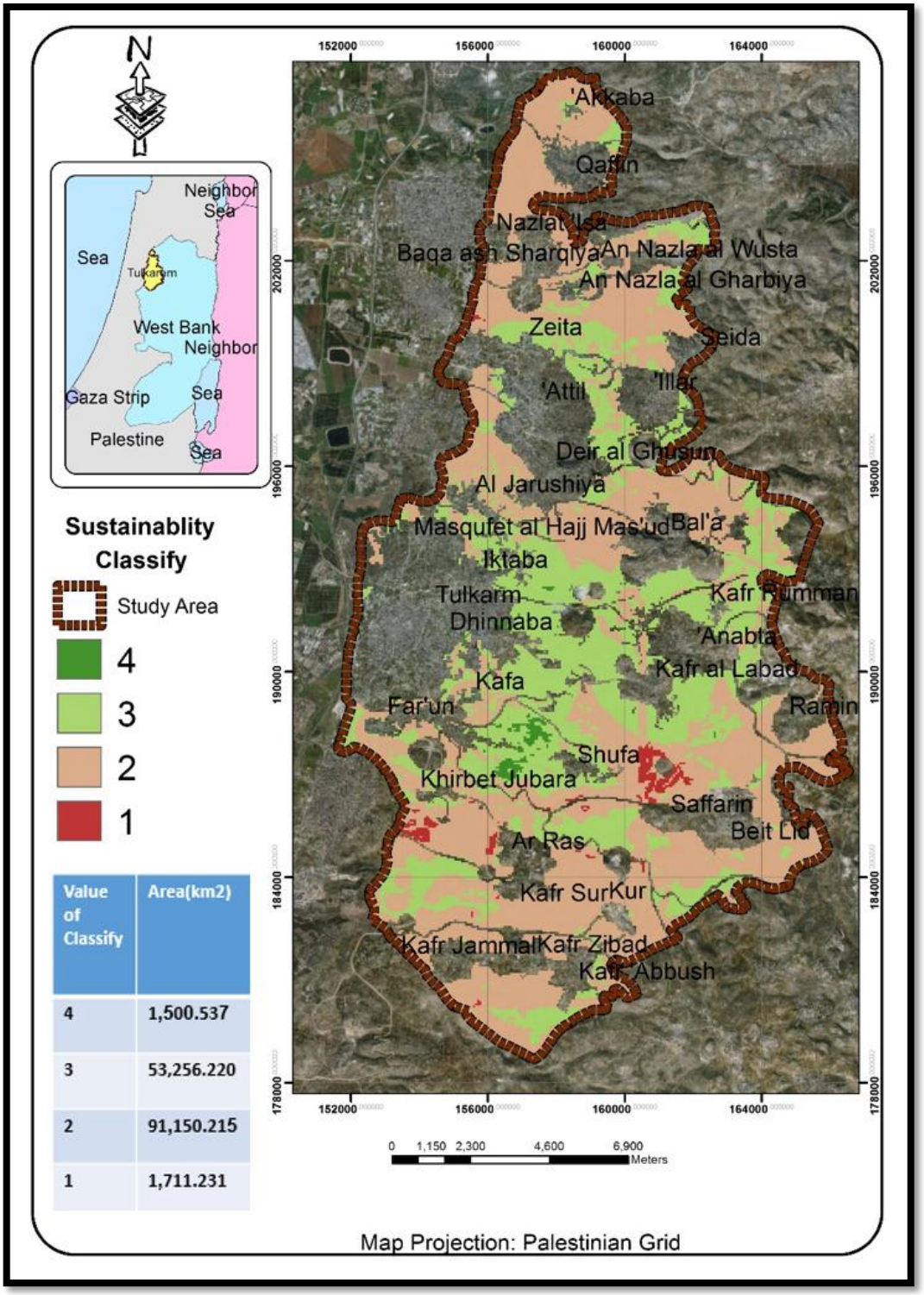
Maps 6- 19: Weighted Overlay for Economical Aspect.

6.3 Final Weighted Overlay

Weighting criteria as mentioned in table (6-16) results that the most suitable lands for sustainable development until 2030 is closed to Tulkarem city, So the governorate can be expanded according to the calculated areas according to the suitability map (6-20).

Table 6-15: Weights For Suitability for sustainable development land.

Criteria	Weight
Environmental	34.76%
Social	31.90%
Economical	33.33%
Total	100%



Maps 6-20: Weighted Overlay of sustainable Development Lands in Tulkarem Governorate

Found that, areas which are the best area for sustainable Tulkarem development (that are colored by dark green) is to the south east of Tulkarem city with an area of 15 dunum approximately In Izbet Shufeh and Alhafasi. Followed by areas that are couloured by light green of area 53.25 dunum approximately in around Anabta, Kufrlabad, Tulkarem city and Dhinabeh. Followed by areas colored of orange of an area of 91.15 dunum in around An Nazleh Gharbeieh, An Nazleh Asharqeieh, Baqa Asharqeieh, Kufr Sur, Kur, Kufr Kibad , Akaba then the area coloured by red which is the less suitable for Sustainable Tulkarem development whith an area of 1.71dunum in around Saffarin and Khirbet Jubara.

3. Identifying Industrial Zone:

Tulkarem Governorate suffer from no existence of Industrial Zone, especially that Tulkarem governorate has rural characteristic, this support Towards food processing depending on its resources.

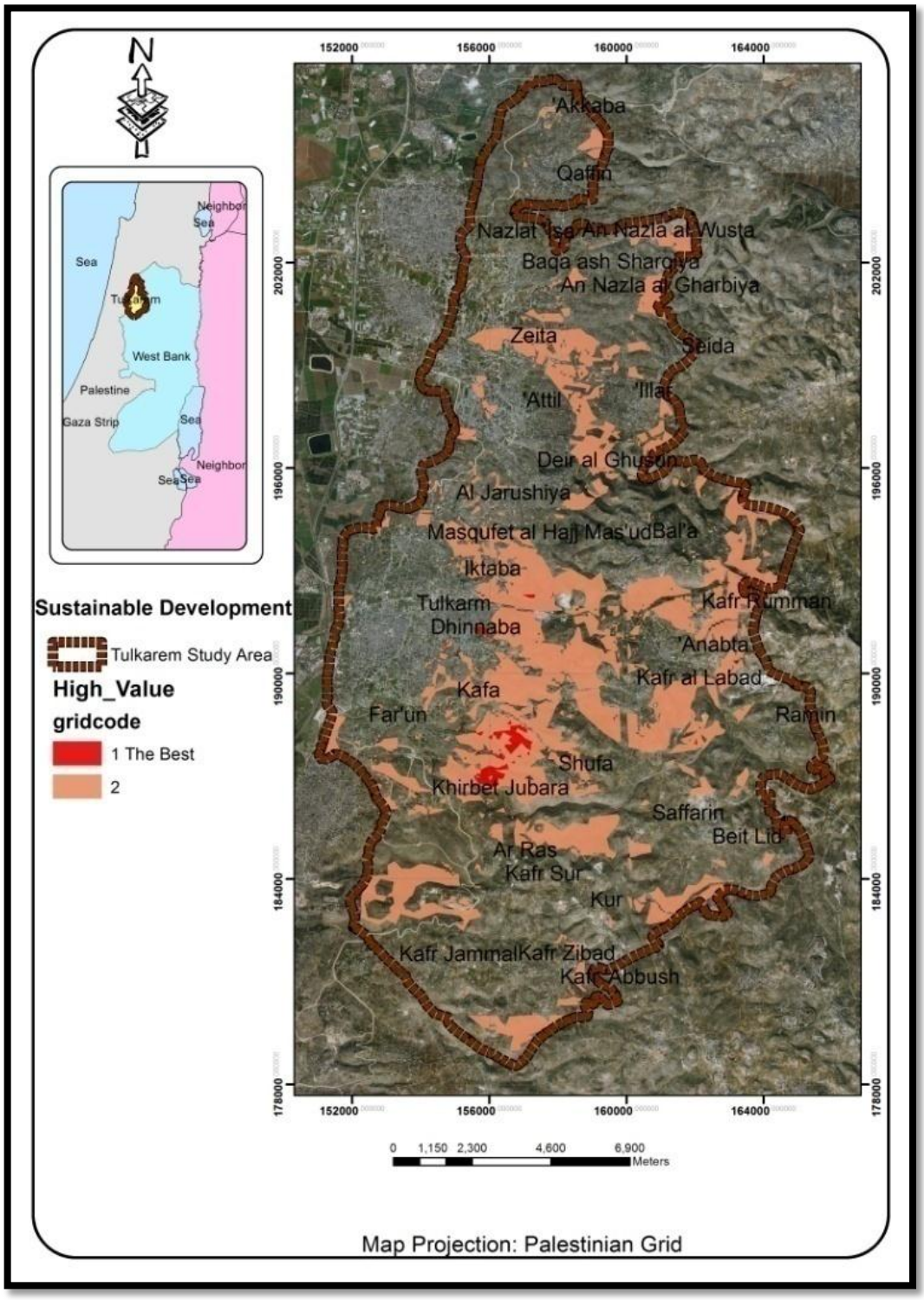
After identifying Direction of sustainable development Industrial zone should be identified to support economical Aspects with criteria in table (6-17).

Table 6-16: Criteria for Identifying Industrial Zone.

Industrial Zone	Site With no Forests, Natural Reserves (already excluded)
	Land of low agricultural value
	Away From Communities More Than 250m
	Site is level, or slope Doesn't Exceed 5-7%
	Area more than 100 dunom
	Closer to Commercial Borders

Source :(Hasan, 2005), (Industrial Authority, 2017)

Depending on weighted overlay for best sites for sustainable development two classifications were taken as seen in map (6-21).

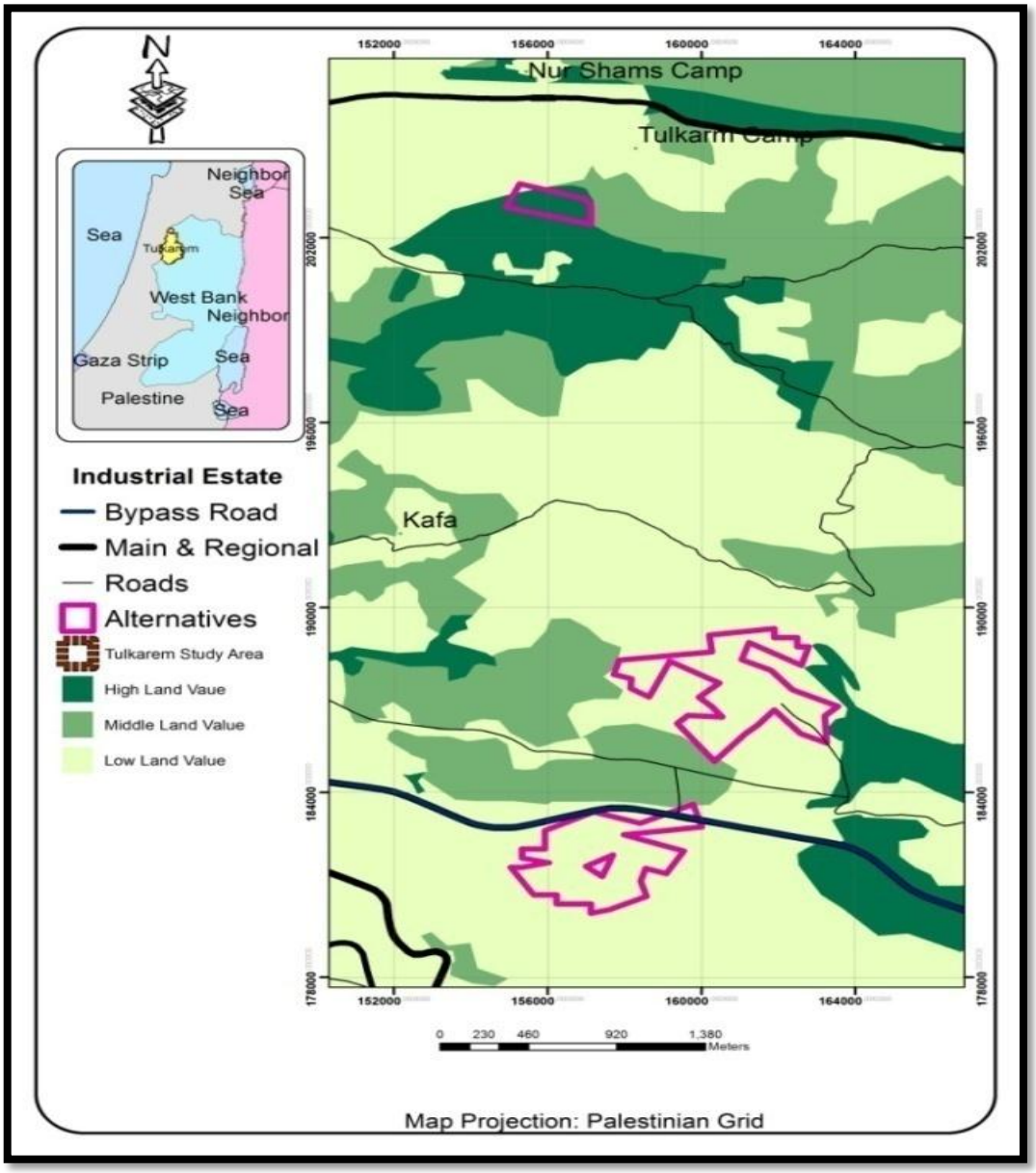


Maps 6- 21: Sites for Identifying Industrial Zones.

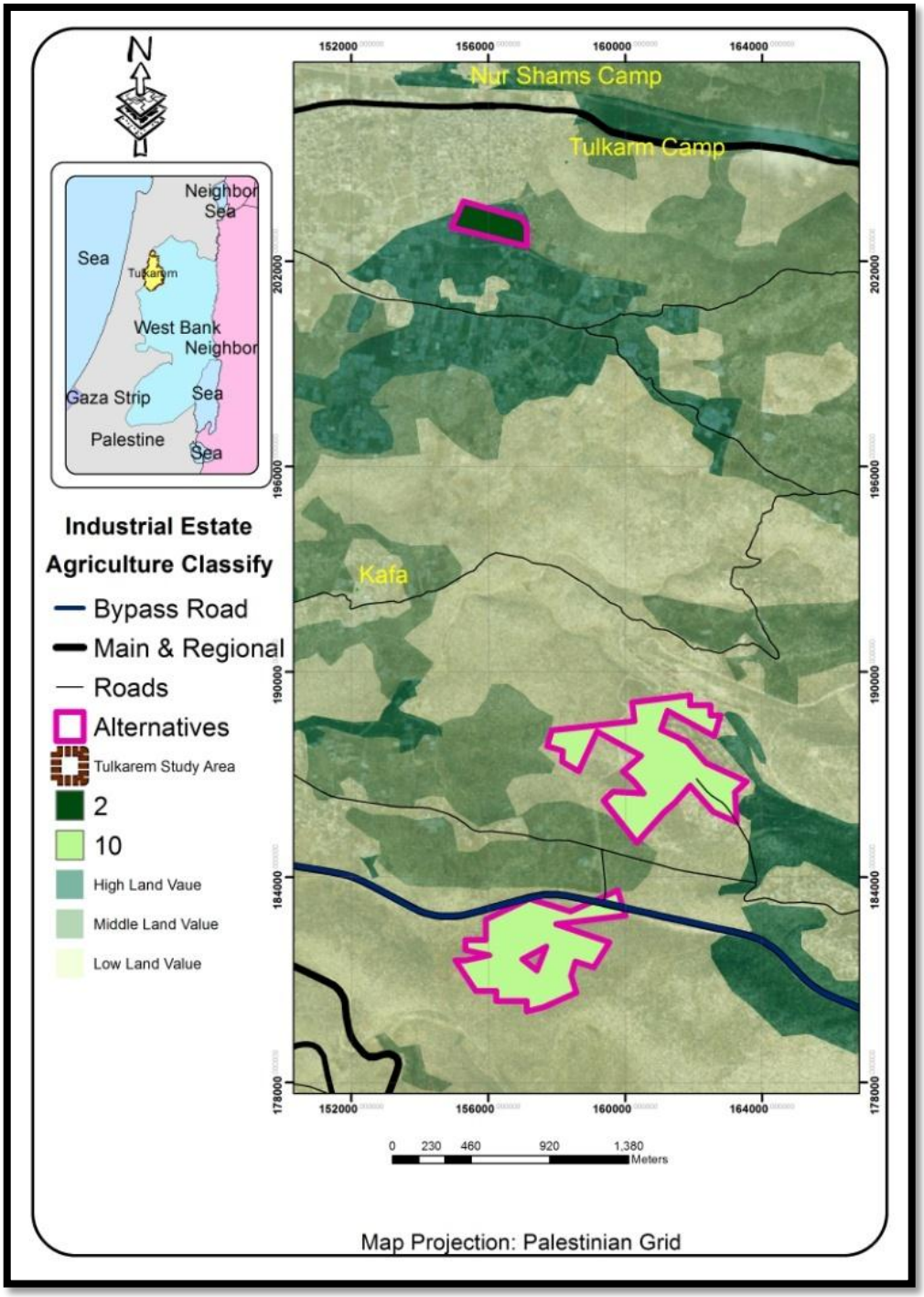
- Site With no Forests, Natural Reserves (already excluded).

- Land of low agricultural value:

Two areas take the weight of 10 because they are in low land value which is one of criteria for identifying Industrial Zone as seen in map (6-22) and (6-23).



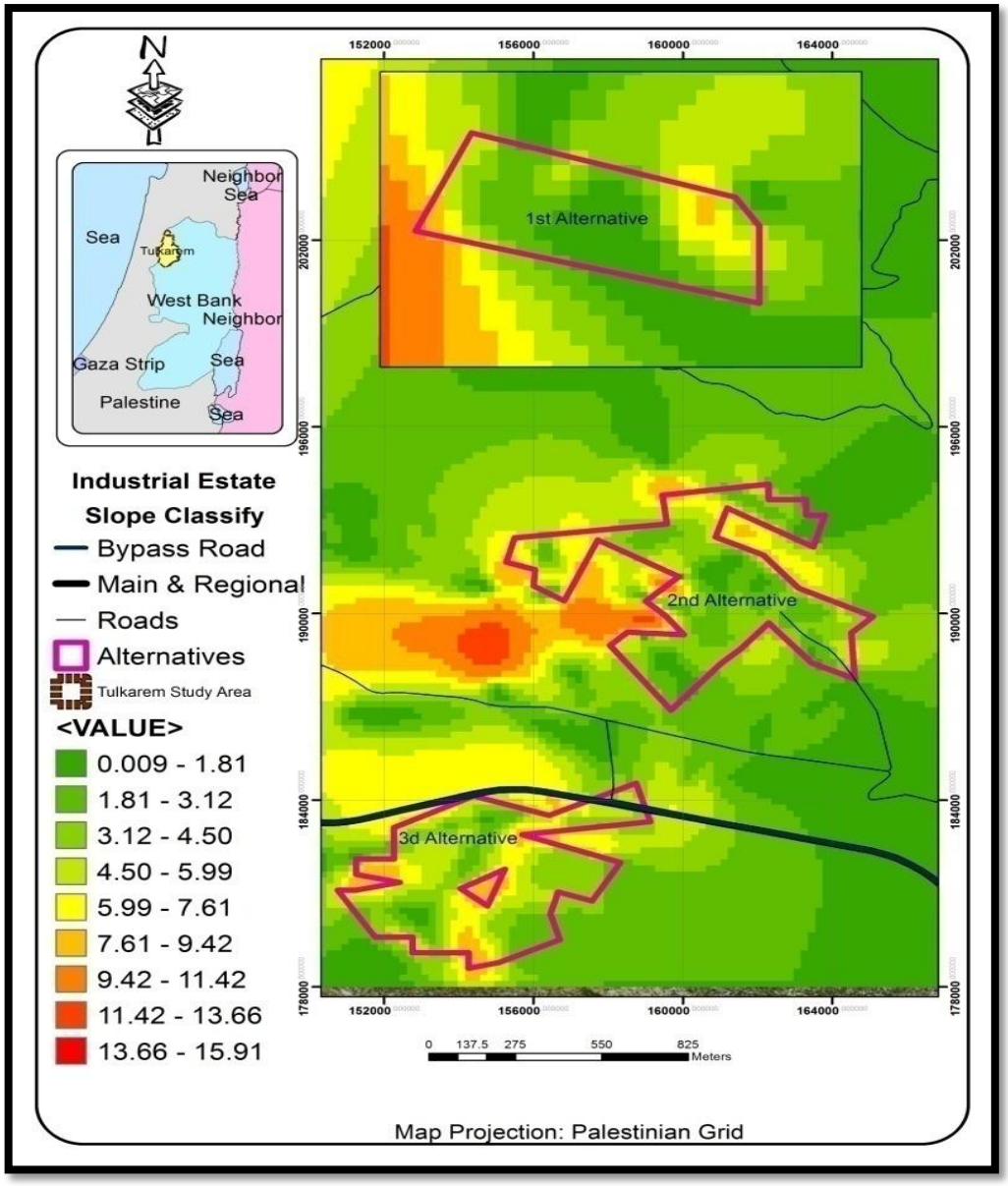
Maps 6- 22: Alternatives of Industrial area depending on Agricultural Land Value.



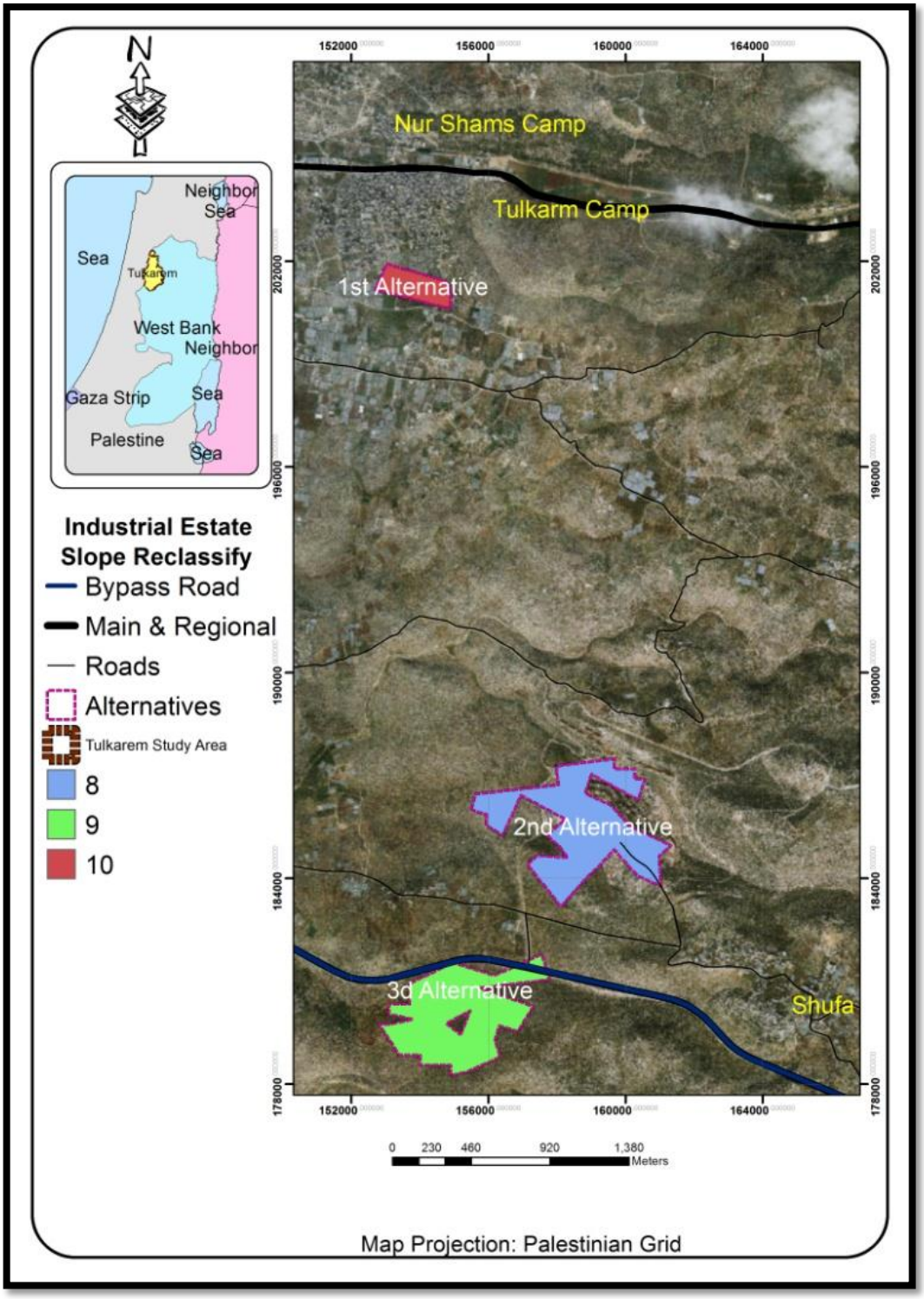
Maps 6- 23: Reclassification of Alternatives of Industrial area depending on Agricultural Land Value.

- Site is level, or slope Doesn't Exceed 5-7%

The three alternatives depending on Slope that doesn't exceed 5-7%, given 3 reclassifications for them depending on slope and contour line and topo to raster so the first alternative was reclassified by 10, the second one was reclassified by 8, and the third was reclassified by 9 as seen in map (6-24) (6-25).



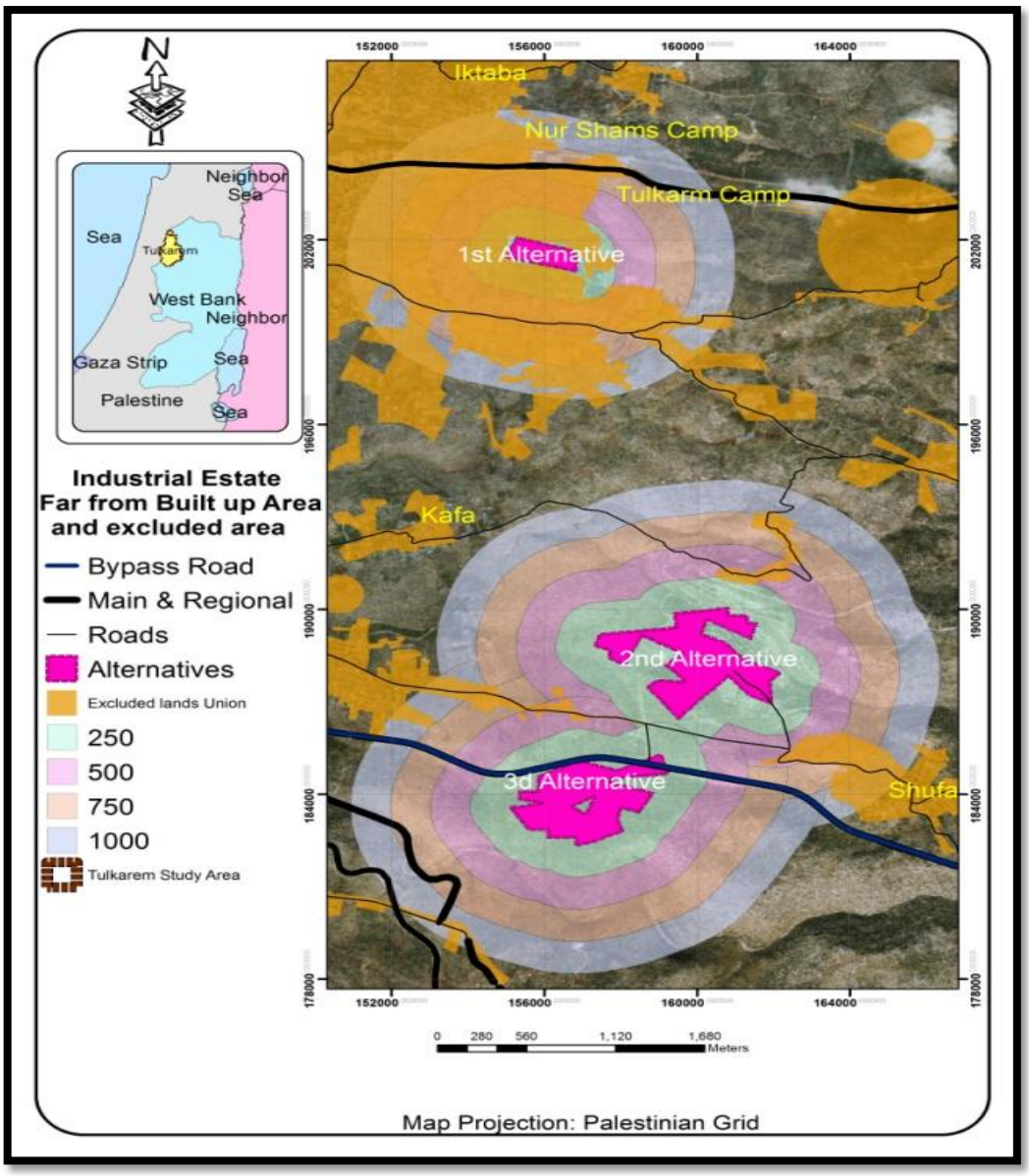
Maps 6- 24: Alternatives of Industrial area depending on Slope.



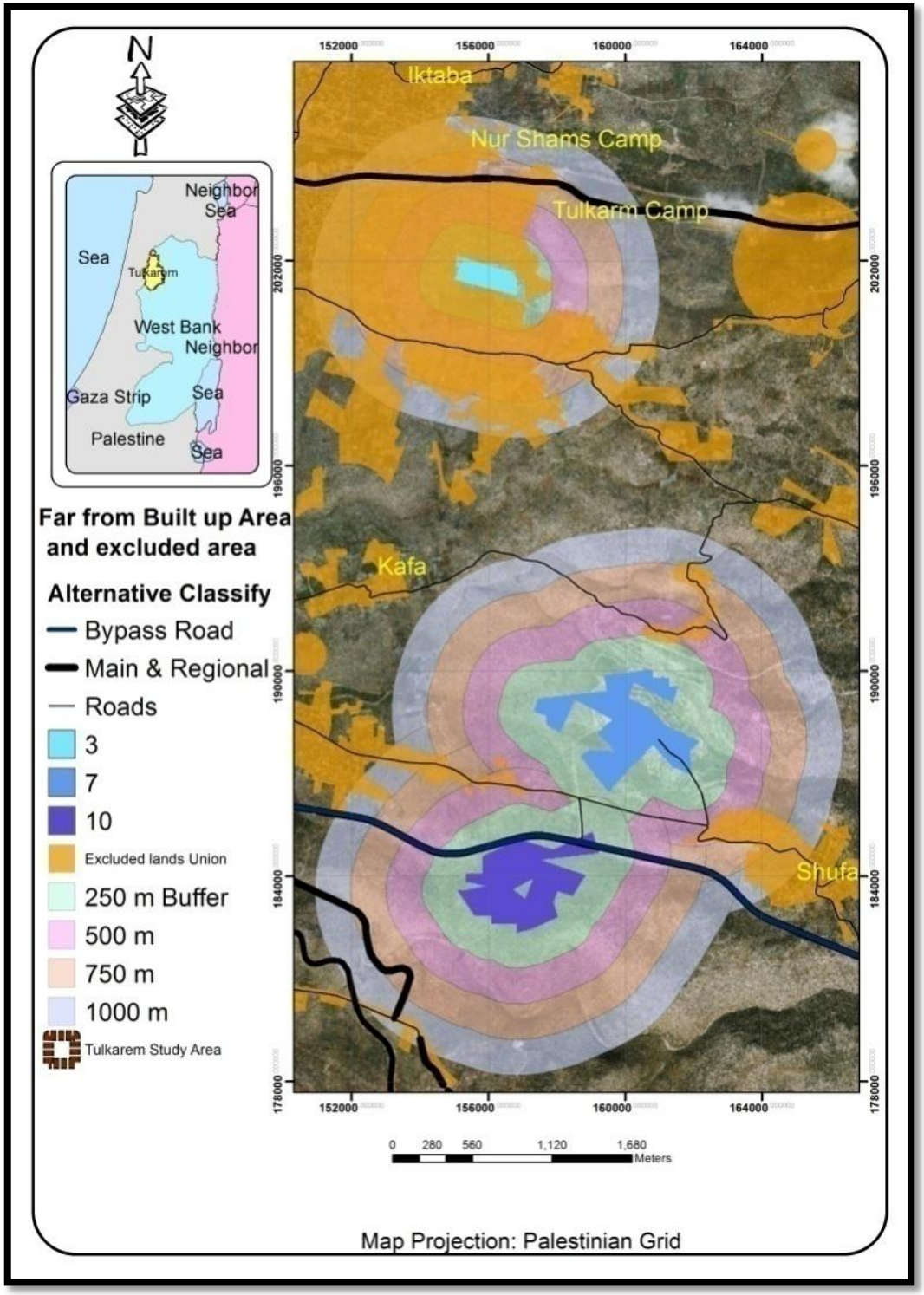
Maps 6- 25: Reclassification of Alternatives of Industrial area depending on Slope.

- Away From Communities More Than 250m.

Multiple ring buffer was done for each alternative 250m,500m, 750m and 100, found that excluded lands were within buffer of the first alternative, in the second alternative, excluded lands were within buffer of 250m are more that in the third one, so given 10 for the third one, 7 for the third one and 3 for the third as seen in map (6-26) and (6-27).



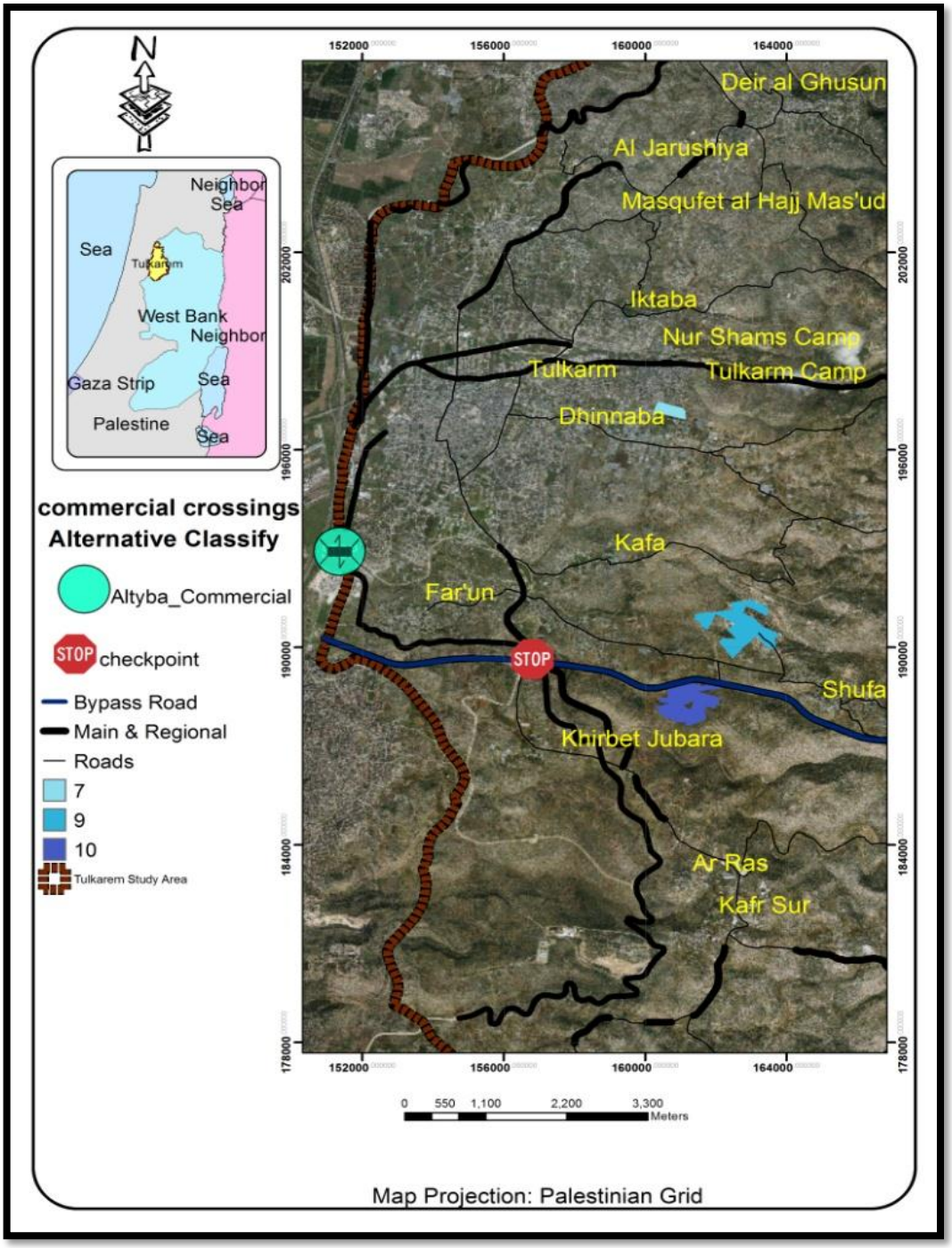
Maps 6- 26: Alternatives of Industrial area depending on Slope.



Maps 6- 27: Reclassification of Alternatives of Industrial area depending on Slope.

- Closness to commercial border:

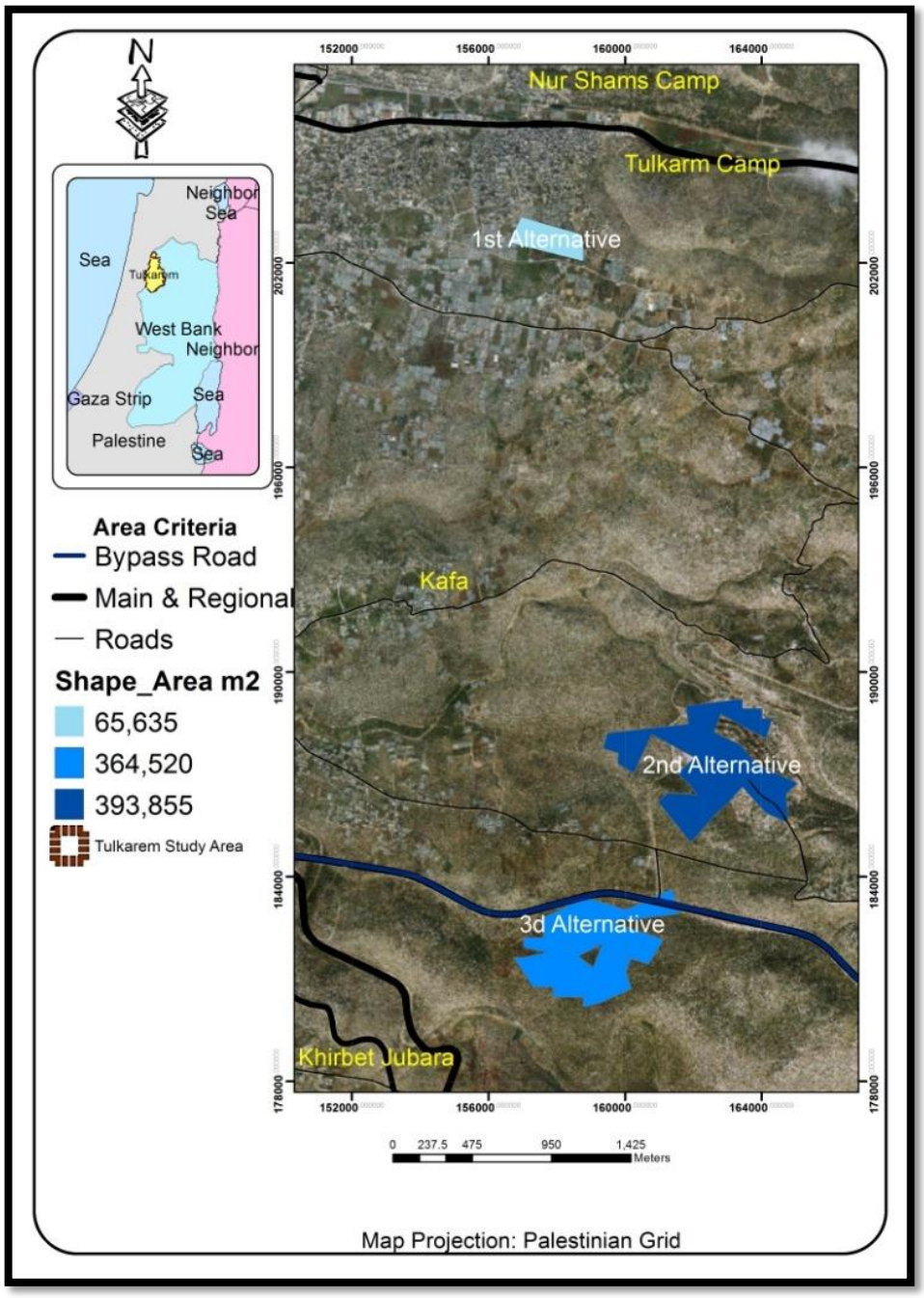
Three alternatives were reclassified 10 for the third alternative, 9 for the second one and 8 for the first one as seen in map (6-28).



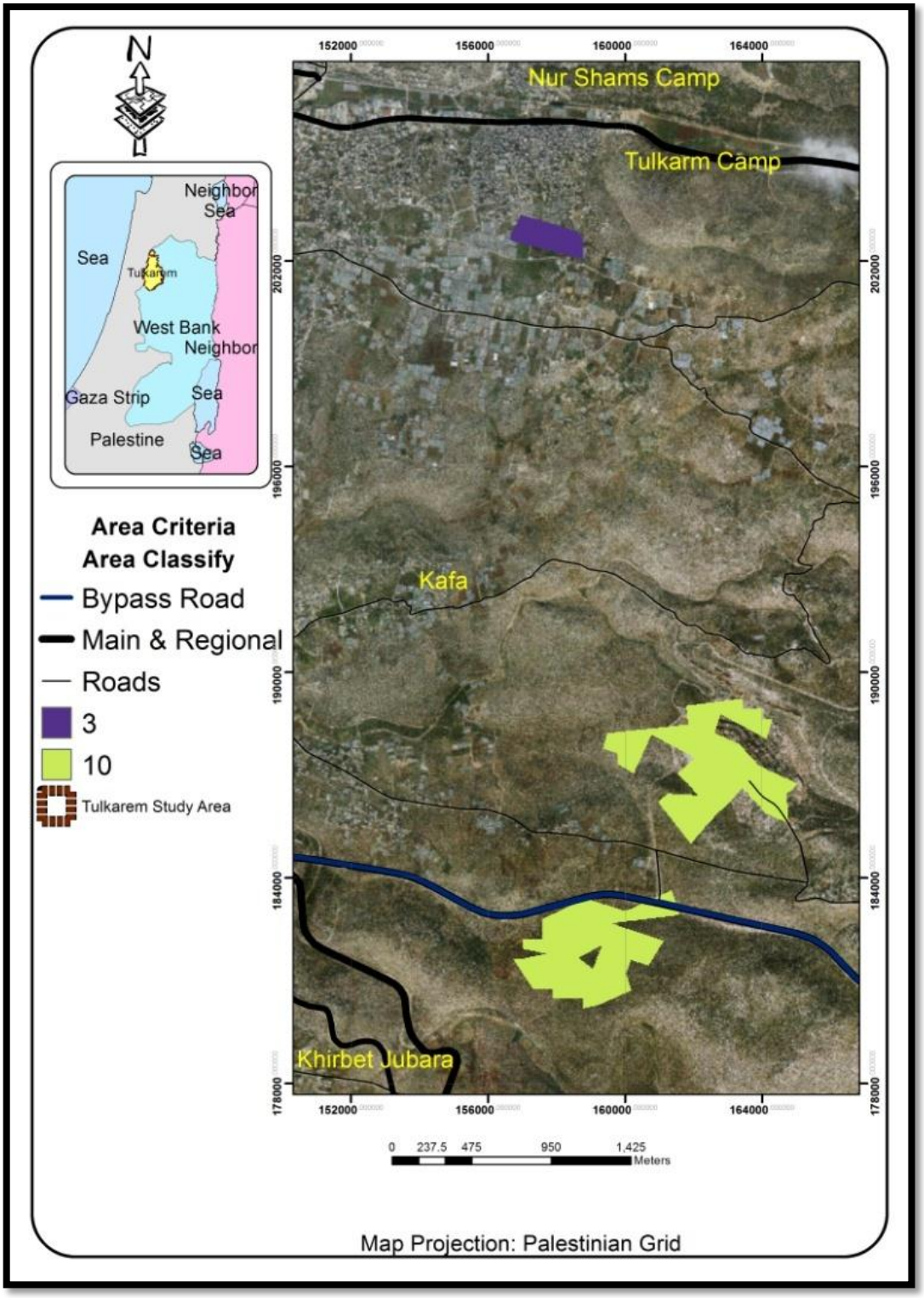
Maps 6- 28: Reclassification of Alternatives of Industrial area depending on closness to commercial border

- Area more than 100 dunom and ability to expansion:

Three alternatives were reclassified, 10 for the third and second alternatives, 3 for the first one because it is less than adopted criteria as seen in map (6-29) and (6-30).



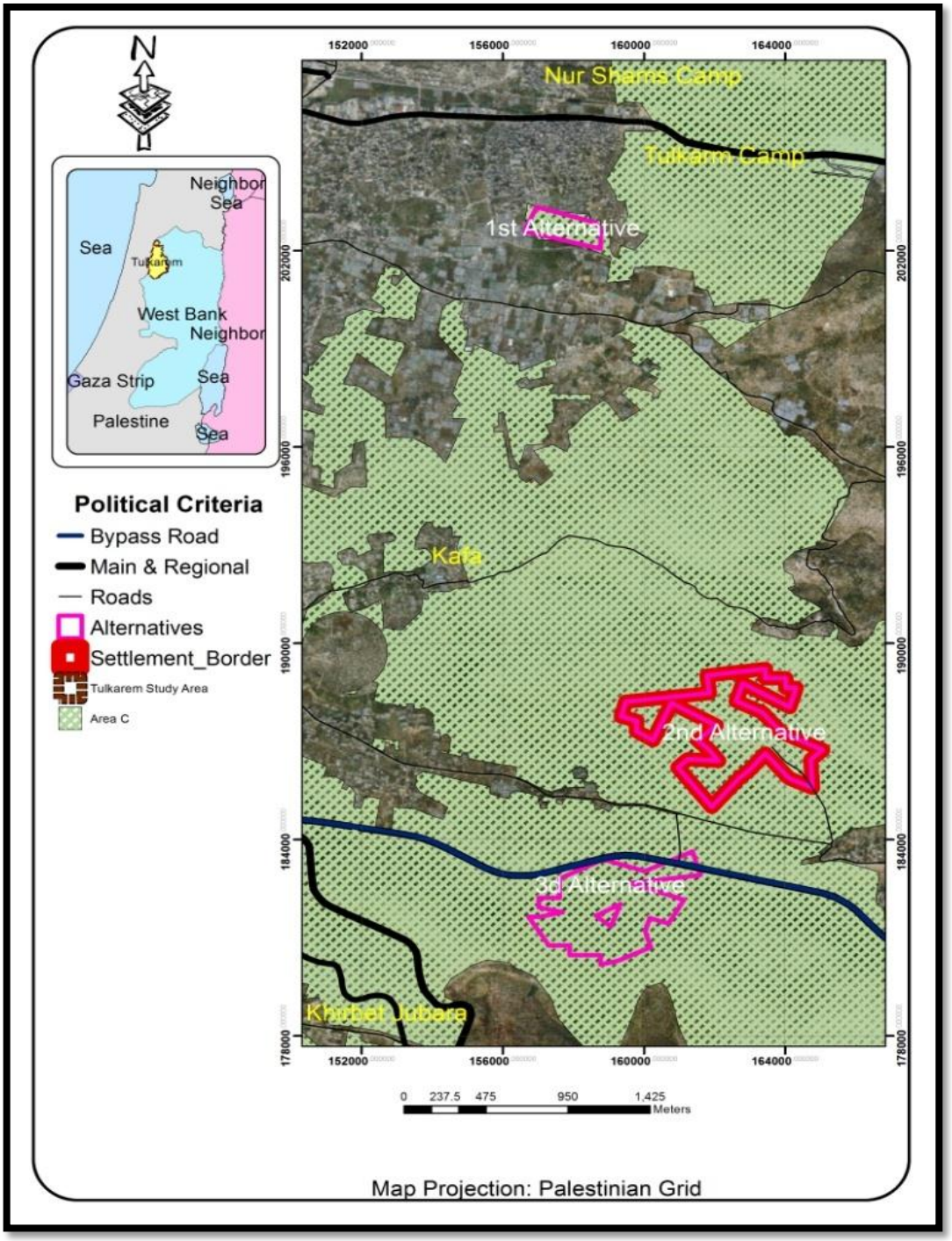
Maps 6- 29: Areas Alternatives of Industrial area.



Maps 6- 30: Areas Alternatives of Industrial area.

- Political Area

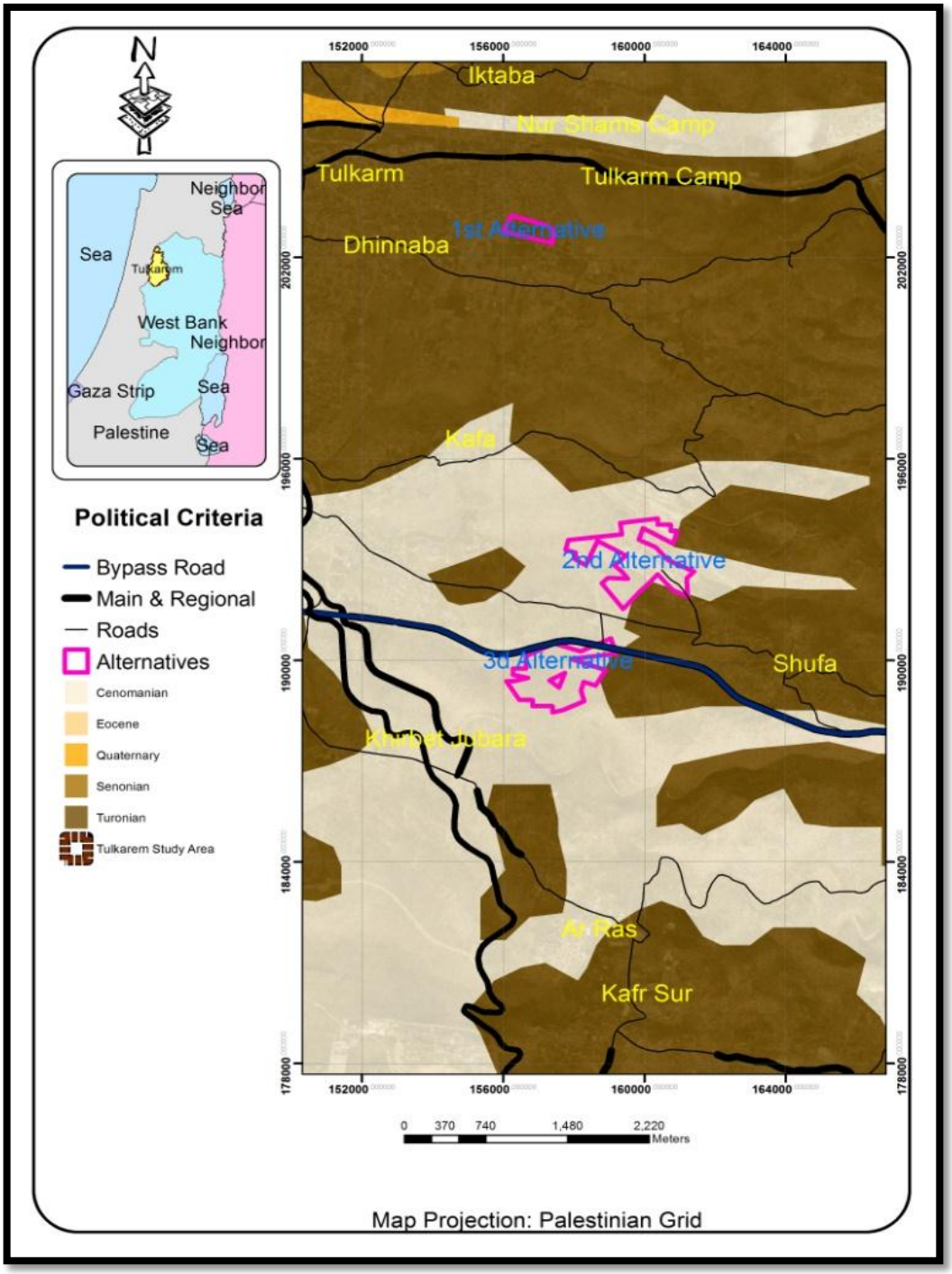
Even if alternatives located in area C that is a challenge for Palestinian to prevent expansion of settlements as seen in map (6-31).



Maps 6- 31: Alternatives location

- Geology

The same of classifications of geology studied before as seen in map (6-32).



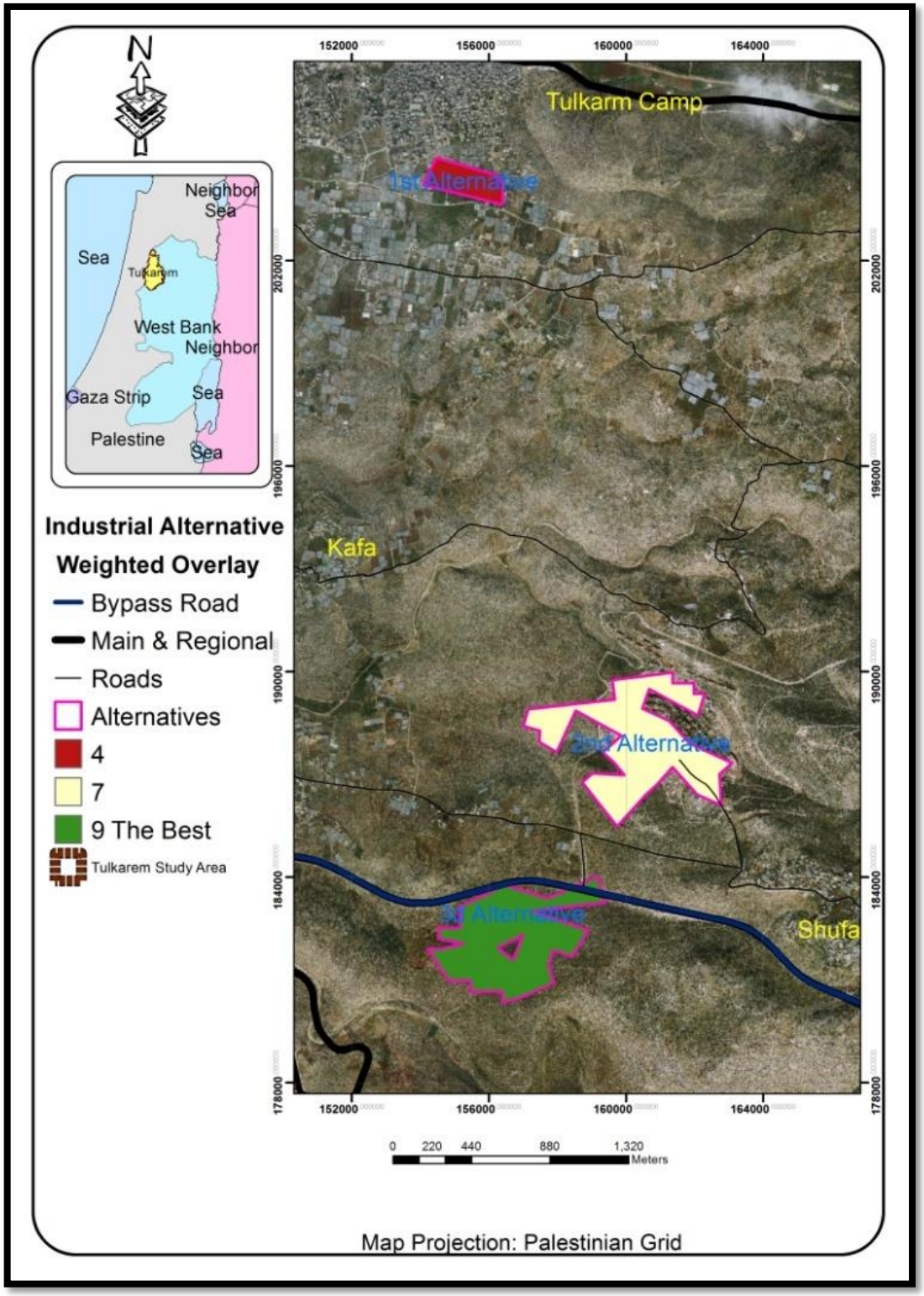
Maps 6-32: Alternatives location

Weighted overlay for Identifying Industrial Zone:

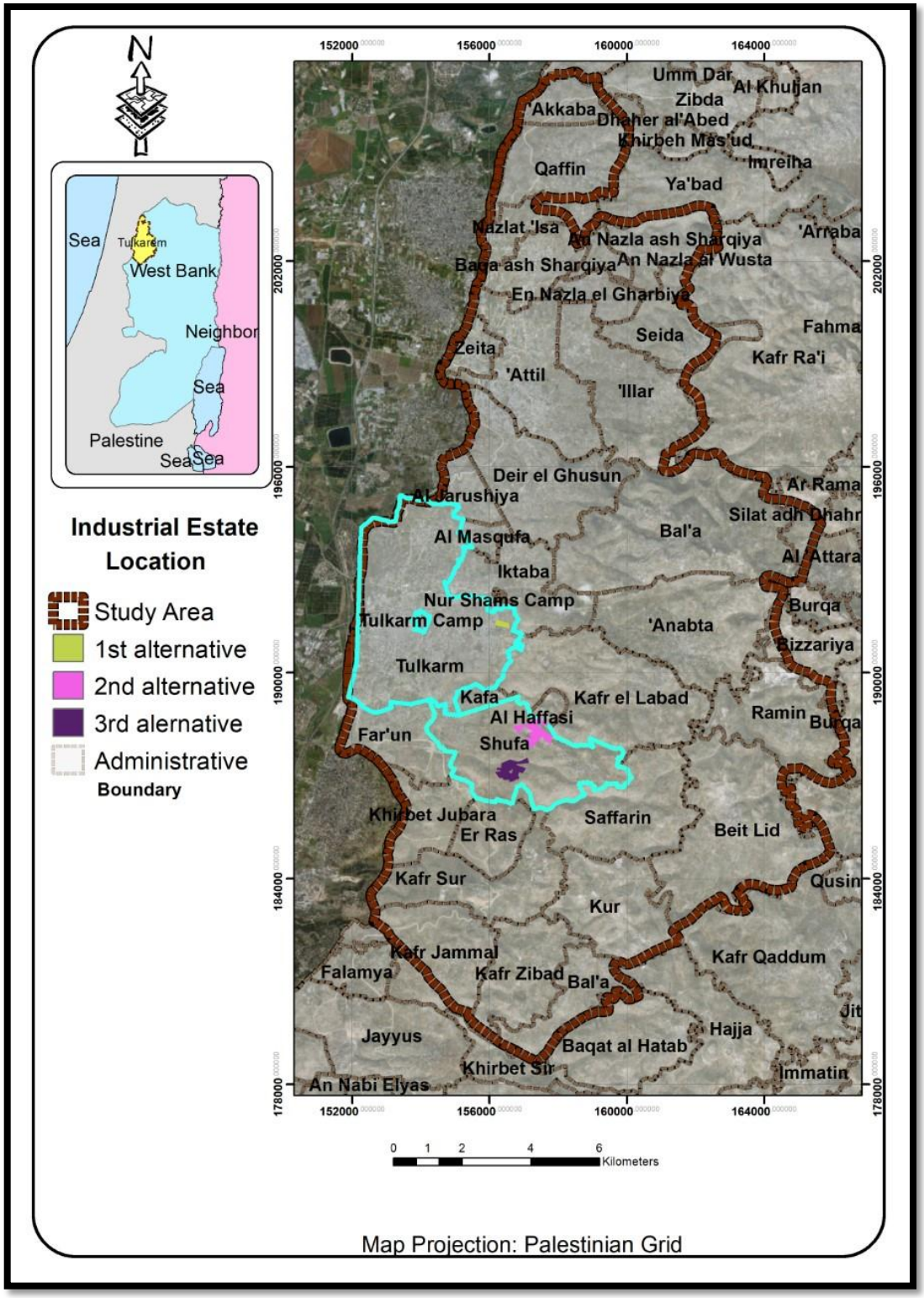
Given weights as seen in table(6-18), the most suitable zone for industrial zone is the second alternative as seen in map(6-33), (6-34).

Table 6-17: Weights of Criteria of Identifying Industrial Zone

Criteria	Weight
Slope	20
Closness to Commercial Border	20
Area	10
Buffer of communities	20
Geology	15
Land Value	15
Total	100



Maps 6- 33: Alternatives location.



Maps 6- 34: Alternatives location.

Depending on criteria of identifying industrial zone, Found that the most suitable areas for industrial zone in the east of Tulkarem city, Shufa and Alhafasi.

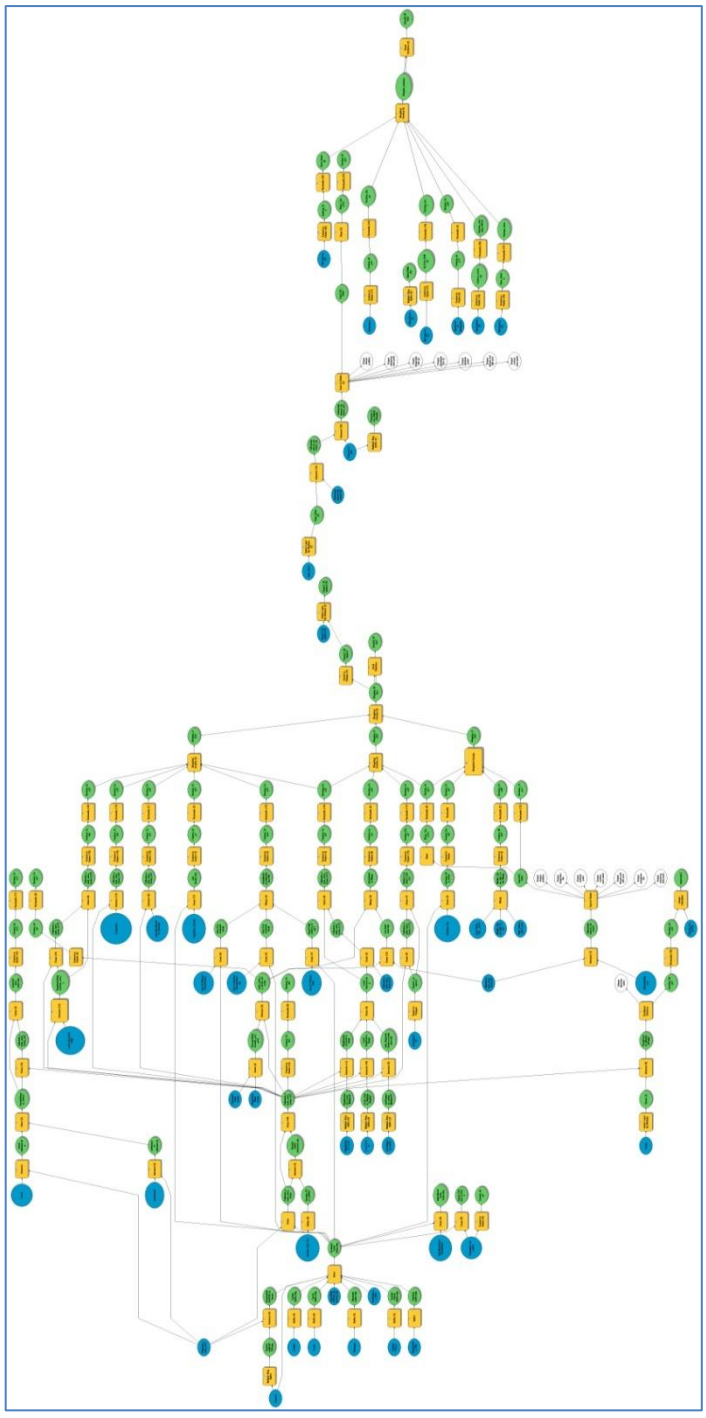


Fig 6- 1: The Model**.**

Chapter Seven
Conclusions And Recommendations

All the study of Tulkarem Governorate resources and putting some criteria for sustainable development depending on Geographic information system (GIS) through cartographic modeling is to achieve best solution for sustainable urban development, So in this section results and conclusion would be mentioned.

7.1 Conclusions

Based on the previous analysis the following conclusions could be mentioned:

1. Environmental

- Tulkarem governorate has several environmental resources blessed by God, good climate, diversity of soil and terrain, and its proximity to the coast, but the Israeli occupation has been an obstacle of benefiting from the sea lava

- The agricultural value of the land has a role in determining the direction of urban development. The lowest value is the most suitable for development. In opposite the higher value is the least suitable. The preservation of agricultural land from depletion, where agricultural land is an economic wealth of the governorate.

- The terrain of land has a role in determining the direction of urban development, where slope should not exceed 20%.

2. Social

- Population growth in the Palestinian society has passed through different periods. The natural increase is somewhat high due to the culture of society and the love of procreation. There have been periods due to forced migration due to the Israeli occupation.

- Percentage of increase of population growth in Tulkarem between 2016 and 2007 was 1.79%.

- Population is the intended target of the planning process, Population expected to reach 241447.36 in 2030.

- City of Tulkarem has the largest share of the population because of the concentration services in it.

- The population concentration in Tulkarem city was 14.08%, which is a high percentage compared to other urban communities in the governorate.

- There is a similarity of the percentage of males and females in the Tulkarem governorate, where the percentage of males is 50.3% and females 49.7% in 2016.

- Pyramid population show that Tulkarem society is a young society, Where the proportion of the population under 15 years is 38% and the percentage of active group between 15-64 is 59% , where youth are a wealth for society.

- The percentage of built-up areas in Tulkarem governorate from 1994 to 2016 increased from 148.11% to 201.31%.

- The proportion of built-up areas for 2016 is 19.96%, while the percentage of agricultural land is 8.74% and open areas is 61.38% where area C occupied a large percentage of open areas.

- The individual's per capita of built-up area is much higher than some Arab Countries like Saudi Arabia, Libya, etc….

- Residential use in the city of Tulkarem constitutes 72.86%. This percentage is high, while the percentage of streets is 14.53%. The rest is distributed among the other uses.

- There is a strong correlation between population increase and built up area expansion.

- Oslo classification has a significant role in determining the direction of urban development in Tulkarem governorate, as development is limited in the area of Palestinian state lands.

- Tulkarem is characterized by its rural character.

- Tulkarem city contains various land uses while the other communities depend on the city of Tulkarem in many uses.

- Lack of structural plans for infrastructure facilities.

- Weakness of sewer network.

- Insufficient green areas and gardens.

- Lack of tourism awareness and lack of conservation plan for archeological sites.

- The study showed that the expansion of the built up area comes at the expense of environmental resources and agricultural areas.

- Roads network needs to be developed like: sidewalks, asphalt and traffic lights, etc….

- Roads network in Tulkarem governorate is well distributed.

- Tulkarem governorate suffer of lack housing projects for low-income people.

- The education sector is one of the priorities of the governorate because of the culture of the inhabitants who encourage education. The governorate contains 134 governmental schools, 6 UNRWA schools and 9 private schools, but the schools are overcrowded.

- Universities in Tulkarem attract a large number of students from different governorates in the West Bank.

- Tulkarem governorate has a deep history and heritage, the archaeological sites in the governorate are considered an economic wealth that have to be exploited.

- There is a lack of coordination between the governmental agencies related to urban planning such as the municipalities, ministries of planning, local government.

3. Economical

- Economy of Tulkarem governorate varies between several sectors that contribute in economist by: the agriculture sector contributes 13.6%. ,Construction sector contributes 15.10%, while the services sector contributes 30.3%., transportation sector contributes 5.1%, trade sector contributes 23.3%, while the mining sector contributes 13.6%.

- The proportion of workers in the governorate 43 and the unemployment rate in the province of 16 years in 2010 and the poverty rate 10, while increased to 20 in 2013.

- Tourism sector plays an important role for the governorate where it is on the top of the rest of West Bank governorates in internal tourism although it suffers from lack of tourist facilities.

- Registration land project should be completed.

- The low share of the agricultural sector in the budget and subject to taxation.

- absence of industrial zone and weak industrial infrastructure.

- The most suitable areas for industrial zone in the east of Tulkarem city, Shufa and Alhafasi.

General Conclusions

- The ability of geographic information systems GIS to study urban planning to produce accurate maps and to assist in critical decision making.

- Cartographic modeling is one of the most efficient methods for preparing urban plans.

Results related to the suitability of land for sustainable development

- The best area for sustainable Tulkarem development is to the south east of Tulkarem city with an area of 15 dunum approximately In Izbet Shufeh and Alhafasi. Followed by areas of area 53.25 dunum approximately in around Anabta, Kufrlabad, Tulkarem city and Dhinabeh. Followed by areas area of 91.15 dunum in around An Nazleh Gharbeieh, An Nazleh Asharqeieh, Baqa Asharqeieh, Kufr Sur, Kur, Kufr Kibad , Akaba then

- The less suitable areas for Sustainable Tulkarem development with an area of 1.71dunum in around Saffarin and Khirbet Jubara.

7.2 Recommendations

Based on the above conclusions the following recommendations are drawn:

- For Land Authority should support complete the registration of land and public property project.
- For housing ministry should work on provision of housing for people with limited income.
- For local Government and municipalities should work on construction of sewerage networks in Shaarawya, Kafriyat and Wadi El Zimar.
- For local Government and municipalities should work on updating and expanding structural plans in the Governorate.
- For The Ministry of Tourism and Antiquities should work on developing of tourist facilities.
- Activating the laws for protection of environment so as not to repeat the urban encroachment and punishing for violators.
- Involve the local community in the planning process.
- The elimination of favoritism in planning process and reducing the importance of private property in exchange for the public interest.
- For Ministry of Education and Ministry of Health should and raise the potential of the education sector and the health sector.
- Providing an industrial zone to attract factories.

- For Economical Ministry should reduce taxes in order to increase agricultural production.

- For Local Government and municipalities should improve street quality and provide pedestrian areas and encourage.

- Provide tourism projects around archeological sites and forests to exploit them in supporting economics of the governorate.

- Restore Ministry of Planning and activate its role rather than abolished.

- Develop alternative plans in the event of an exit of the occupation

- Working out of the narrow planning level, that means to work at all local and national levels.

- Planning should precede implementation, not vice versa, by imposing a de facto policy.

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Appendix

Questionaire for Weighted Overlay

- What do you think as (Palestinian Planner, Economist, Specialist of environmental Studies, Specialist of social studies) of what weights can be given for environmental, social and economic aspects depending on effectiveness on sustainable planning of Tulkarem governorate ?

Aspect	Weight given	Reason
Environmental		
Social		
Economic		
Total	100%	

- What do you think as (Palestinian Planner, Economist, Specialist of environmental Studies, Specialist of social studies) of what weights can be given for sub criteria of Environmental criteria in the table below depending on effectiveness on sustainable planning of Tulkarem governorate?

Sub criteria	Weight	Reason
Agricultural Land Value		
Geology		
Terrain		
Total	100%	

- What do you think as (Palestinian Planner, Economist, Specialist of environmental Studies, Specialist of social studies) of what weights can be given for sub criteria of social aspect in the table below depending on effectiveness on sustainable planning of Tulkarem governorate?

Sub criteria	Weight	Reason
Population density		
Population		
Political areas		
Areas closed by wall		
Closness to city		
Land cover		
Total	100%	

- What do you think as (Palestinian Planner, Economist, Especialist of environmental Studies, Specialist of social studies) of what weights can be given for subcriteria of economic aspect in the table below depending on effectiveness on sustainable planning of Tulkarem governorate?

Sub criteria	Weight	Reason
Land Ownership		
Slope		
Closness to Cities		
Closness to Main and Regional Roads		
Total	100%	

The above questionnaire was answered by the following specialists:

Secialist Name	Institution	Area of Specialization
Dr. Samer Raddad	Al-Quds University/Abu-Dis	Cities studies Department
Dr. Khaled Al sahli	An-Najah National University	Traspottaion Department
Dr. Ahmad Ra'afat	An-Najah National University	Geographic Department
Dr. Islam bdel Jawwad	An-Najah National University	Economic Department
Dr. Ahmad Alatrash	United Nations program for Human Settlement (UN_Habitat)	
Dr.Imad Dawwas	An-Najah National University	Urban and Regional Planning
Dr. Ali Abdelhamid	An-Najah National University	Urban and Regional Planning
Dr. Eehab Hijazi	An-Najah National University	Urban and Regional Planning
Dr,Farid Alqiq	Islamic University/ Gaza	Urban and Regional Planning

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كلية الدراسات العليا

التخطيط العمراني المستدام لمحافظة طولكرم باستخدام نظم المعلومات الجغرافية GIS

اعداد

منار طلال الصالح

إشراف

د. علي عبد الحميد

قدمت هذه الأطروحة استكمالاً لمتطلبات الحصول على الماجستير في هندسة التخطيط الحضري والاقليمي، بكلية الدراسات العليا، في جامعة النجاح الوطنية، نابلس- فلسطين.

2018

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اعداد

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إشراف

د. علي عبد الحميد

الملخص

يهدف هذا البحث للوصول بمحافظة طولكرم الى التخطيط الأنسب الذي يتماشى مع التوجه العالمي في الاستدامة التي تهدف إلى المحافظة على الموارد البيئية للأجيال الحالية والمستقبلية وذلك في ظل المعيقات التي تعاني منها المحافظة، والمتمثلة في الزيادة السكانية المتسارعة وضيق المساحة المتاحة للتوسع العمراني وخاصة في ظل ما يفرضه الاحتلال من تحديات.

ولتحقيق أهداف الرسالة تم دراسة توسع التجمعات الحضرية في المحافظة واتجاه توسعها والخدمات المتوفرة وأماكن تركزها والنمو السكاني وتركز السكان في بعض التجمعات، إضافة إلى دراسة الموارد البيئية من حيث المناخ والتربة وذلك باستخدام نظم المعلومات الجغرافية كأداة للتخطيط من خلال النموذج الكارتوجرافي لربط هذه الدراسات مكانيا.

وقد توصلت الدراسة لبعض النتائج المتعلقة بالجوانب البيئية والاجتماعية والاقتصادية. فيما يخص الجانب البيئي أظهرت الدراسة أن التضاريس والقيمة الزراعية تؤثر في تحديد اتجاه التوسع الحضري. وعلى الجانب الاجتماعي أشارت الدراسة أن مدينة طولكرم تحظى بالنصيب الأكبر من السكان على حساب التجمعات الحضرية في المحافظة وذلك بسبب تركز الخدمات فيها. ومن الناحية التخطيطية وجد أن الاستخدام السكني هو المسيطر على باقي الاستخدامات الأخرى. وعلى الجانب الاقتصادي تم تحديد أنسب المواقع لمنطقة صناعية والمساحة المطلوبة لها خصوصا وأن المحافظة تفتقر لمنطقة صناعية.

وقد أوصت الدراسة بضرورة التنسيق بين المؤسسات التخطيطية من أجل الحفاظ على الموارد وتكامل العمل فيما بينها وإشراك سكان المحافظة في التخطيط ونشر الوعي بين المواطنين.