



Sustainable Housing Planning

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Dedication

I dedicate this success to my Parents, friends and colleagues and for every person supported me along the five years of study.

Acknowledgement

I would like to give special thank for my parents for their great effort to give the opportunity to be a student in the university and to complete this research, I also give a special thanks for my colleague Reevan for her great advices and notes.

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Abstract

This project came as a solution for the housing problem in Palestine, by taking the outlines of the Palestinian housing policies and the casted solutions by them, the sustainable housing was the best choice to solve the shortage of resources problem, the unaffordability in housing and the social problems in many areas. So this project aims to set up a new affordable and planned housing areas, to apply the principles and reach the goals of sustainability in the distribution of housing units, planning the spaces and locating the services, To make an attractive, efficient and successful housing project and to move the planning in Palestine to the next level and bring in new ideas and concepts instead of keeping the old planning methods and principles. After making weighted overlay for the entire west bank, the project site was chosen to be in Arraba Town, 11 km for Jenin city. The housing area should include sufficient open and green spaces, use local building materials, to integrate with the surrounding environment and to achieve as much as possible of sustainability.

ملخص البحث

جاء هذا البحث وفكرة الاستدامة كحل لمشكلة الاسكان في فلسطين والتي تم طرحها بشكل واضح في مسودة سياسات الاسكان الفلسطينية والتي قدمت الاستدامة في السكن كحل لمشاكل عديدة منها، محدودية الموارد والمصادر الطبيعية في الضفة الغربية نتيجة للسياسات الاسرائيلية وكذلك ارتفاع اسعار السكن بشكل ملحوظ في العديد من المناطق الفلسطينية بالاضافة الى وجود بعد المشاكل الاجتماعية نتيجة لعدم التكامل الصحيح بين السكان في المنطقة او الحي الواحد. ويهدف هذا المشروع إلى انشاء مناطق سكنية ومخططة و ميسرة بسعر مقبول كما يهدف للوصول إلى اهداف ومادئ الاستدامة في توزيع الوحدات السكنية و توزيع الفراغات و المناطق الخضراء و توزيع الخدمات بالشكل الذي يحقق سهولة الوصول من جميع مناطق الحي السكني وبالتالي انشاء اسكان فعال و جاذب و ناجح مما سينقل تخطيط الاسكان في فلسطين الى المرحلة التالية وطرح افكار و توجهات جديدة في انشاء الاسكانات بدل التوجهات القديمة والتقليدية القائمة حاليا والتي تهدف فقط إلى تحقيق الربح. وبعد عمل تحليل لجميع المناطق الضفة الغربية بناء على معايير الاستدامة واهم مقوماتها، تم تحديد موقع الاسكان ليكون في بلدة عرابة والتي تبعد 11 كم عن مدينة جنين. ويجب ان يحتوي الاسكان على نسبة كافية من المناطق المفتوحة والمساحات الخضراء واستخدام مواد بناء محلية والتكامل مع البيئة المحيطة بشكل يحقق الاستدامة البيئية بأقصى درجة ممكنة.

Chapter 1

General Introduction

1-1 Introduction

Many areas around the world are facing problems regarding the shortage in resources and inefficient exploitation for the existing ones. This problem is related mainly to the non-renewable resources such as lands. These issues and other ones pushed the concept of sustainability to come to existence (UNHABITAT, 2012).

Sustainability appeared at the end of the twentieth centuries as a result for some social movements that emphasize the principles of justice, conservationism and internationalism. It is considered one of the important elements related to the people way of living and their daily attitudes since sustainability consists mainly from social, environmental and economic pillars and generally it is defined as “meeting our own needs without compromising the ability of future generations to meet their own needs”⁽¹⁾.

People use nature and environmental resources to extract raw materials to build their cities and houses, this work needs economic fund to be made, then they live together in cities and villages which leads to social interaction between them which makes the three pillars of sustainability become the center of a human life (UNIVERSITY OF ALBERTA, 2010).

Housing is a main part in the social and environmental interaction. The environmental process starts from cutting trees and using wide areas of land to construct housing projects in addition to the needed energy and water to do that. After the houses are constructed, each unit will produce waste water and garbage

which will make pollution if didn't treated in the right way, all of these aspects made the housing as a vital part in the sustainability approach. The meaning of housing can be formed by two perspectives, the first one is a physical structure made from specific materials with a desired shape in a way that make integration with the surrounding physical environment and the second one is a social structure that enhance the social life and social interaction with the surrounding community and the wider society (GOVERNMENT OF IRELAND, 2009).

In most cases, the sustainable housing restricted by the (green) perspective and self-sufficiency while neglecting the other important functions as a social enhancer and environmentally-friendly issues (GOING GREEN, 2012).

1-2 Problem statement:

Housing problems varies from one country to another due to the different economic resources for each country at the first place and also the population number and density concentration in some cities. The problem of housing increased dramatically around the world, especially in the developing countries caused by the high costs and unaffordable houses in addition to the desire of people to live in the big cities where the jobs are located, which as a result made the shortage of lands in these areas and formed slums in some cases.

The Palestinian case is not far from these problems. The political situation caused unplanned urban expansion in the period when the Palestinian authority was weak, and made limitation in lands, increased the land prices significantly and the construction materials are expensive. As a result the houses become unaffordable compared with the people's income. These points carried some investor to

reduce the services in their housing projects in order to reduce the costs or use poor building materials which leads to other physical and social problems in the long term. This research is made as an attempt to solve these housing problems by importing a relatively new concept for the Palestinian approaches which is the sustainable housing which can be a very efficient solution for the current and the future housing trammels in the area.

Other side of the problem in Palestine is the weakness of the governmental support for housing projects. As a result, most of the housing projects are planned and constructed by the private sector which put the maximum profit as a main goal and so it became unaffordable houses directed for high-income people. This fact made the problem of housing significant. With high demand and low supply for housing, the need for sustainable housing appears.

1-3 Importance and justification for research

Sustainability is an important approach and global concept which many countries seeks to apply on a wide range. For this research, the importance and justifications can be summarized in the following points:

- 1- Lack of sustainable communities and residential areas in Palestine due to the existence of more important concerns and urban problems which take the priority to find solutions for it before thinking in any new approaches like sustainability. Also most of the Palestinian communities appeared spontaneously and after that the plans were made to organize the expansion.
- 2- Lack of Palestinian researches about sustainability in housing and the absence of existing sustainable housing projects.

- 3- The need for a study that makes a relation between sustainability and housing from a Planning perspective and not architecture perspective.
- 4- the problems of the existing housing projects like high costs , dependence on private cars due to the inefficiency of public transportation , the lack of green areas and sometime the absence of sewage networks and other problems.
- 5- The rapid expansion for the Palestinian communities calls for new approaches to solve the housing problems for the future generations.

1-4 Objectives

Housing sector in Palestine suffered from dangerous threats along the history due to the British mandate and Israeli occupation laws and policies in demolishing many villages and houses for security reasons or even without any reason. Nowadays the housing sector face many problems which some of them are mentioned in the following points:

- 1- The significant surge in the price of lands inside city's boundaries because of the limited expansion areas around these cities which can be C areas.
- 2- Israeli practices of demolishing houses, especially in Jerusalem.
- 3- The continuous increase in the gap between people's income and construction materials prices which prevented many people from constructing their own houses (Yousef, 2012).
- 4- The absence of professional specialized Palestinian institutions to address housing issues and find solutions for the increased demand.

This research aims to establish a new housing project, depends mainly on the principles of sustainability to solve as much as possible of the existing housing problems in the Palestinian context. In particular, the research aims to achieve following objectives:

- 1- Setting up a new affordable and planned housing area.
- 2- Apply the principles and reach the goals of sustainability in the distribution of housing units, planning the spaces and locating the services.
- 3- To make an attractive, efficient and successful housing project.
- 4- Move the planning in Palestine to the next level and bring in new ideas and concepts instead of keeping the old planning methods and principles.

1-5 Methodology

The research methodology based on the following three frameworks:

- 1- General and theoretical framework: contains the introduction, research objectives and importance in addition to general information about sustainability and housing issues.
- 2- Informational framework: include all the information regarding the concept of sustainability and the principles of applying sustainability in housing projects and the housing projects planning methods (plans, photos, maps...).
- 3- Analytical and deductive framework: analyses the collected information about housing and how to apply on the project in a proper way then to make recommendations and conclusion about the result.

The study relied mainly on the following research methods:

- 1- Historical method: viewing previous researches, theories and models about the sustainability and housing.
- 2- Descriptive method: used to examine and describe the housing situation in Palestine and to describe the sustainable housing principles.
- 3- Analytical method: this method used to analyze the collected information about sustainable housing to find the best way to apply it on the project.

Interviews, surveys and questionnaires can be used in addition to computer software (AutoCAD, GIS ...)

1-6 Data sources

To find the best models and information about the research subject, these sources were used.

- 1) Library sources: which include books, thesis and researches about housing and sustainability.
- 2) Official sources: governments, ministries and official institutions.
- 3) Semi-official sources: like the international institutions and organizations such as UNHABITAT and municipalities in England and Ireland.
- 4) Personal sources
- 5) Internet sources

Chapter 2

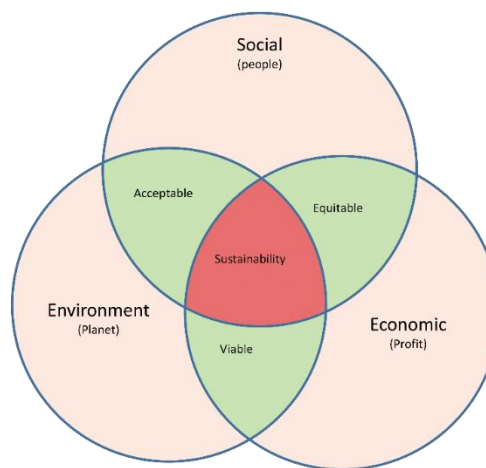
Conceptual & Theoretical Background

2-1 Introduction

After introducing the idea and the problem of the research, this section comes to talk about the main concepts, theories, models and elements that form the base for sustainable housing. These concepts will be the gateway to analyze the case studies after.

2-2 Sustainability & Sustainable development

Sustainability consists mainly of three pillars as seen in Figure1, economic, environmental and social (Brundtland, 1987). The main idea is that we reach sustainability as much as we achieve equal harmony between these three pillars which are defined as following:



Source: Office of Sustainability- Univ. of Alberta, 2010

Figure 1 elements of sustainability

1- Environmental Sustainability: Environmental sustainability means that we are living within the means of our natural resources. To live in true environmental sustainability we need to ensure that we are consuming our natural resources, such as materials, energy fuels, land, water...etc, at a sustainable rate. Some resources are more abundant than others and therefore we need to consider material scarcity, the damage to environment from extraction of these materials and if the resource can be kept within Circular Economy principles. Environmental sustainability should not be confused with full sustainability, which also need to balance economic and social factors (Djalali & Vollaard, 2007).

2- Economic Sustainability: Economic sustainability requires that a business or country uses its resources efficiently and responsibly so that it can operate in a sustainable manner to consistently produce an operational profit. Without an operational profit a business cannot sustain its activities. Without acting responsibly and using its resources efficiently a company will not be able to sustain its activities in the long term (Djalali & Vollaard, 2007).

3- Social Sustainability: Social sustainability is the ability of society, or any social system, to persistently achieve a good social well-being. Achieving social sustainability ensures that the social well-being of a country, an organization, or a community can be maintained in the long term (Djalali & Vollaard, 2007).

From these components, the concept of sustainable development appeared, so what is sustainable development?

There are many definitions about sustainable development, but the most famous one was written by Brundtland (1987) which is “Sustainable Development is a

development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs”.

This implies that we need to look after our planet, our resources and our people to ensure that we can live in a sustainable manner and that we can hand down our planet to our children and our grandchildren to live in true sustainability (Djalali & Vollaard, 2007).

2-3 Concept of housing development

Housing can be generally defined as the place which provide a shelter for people and also the housing production market including the wishes and requirements for people regarding their houses and the problems they face to get an appropriate house which will affect them psychologically, socially and culturally (Al-Sa`ed, 2006).

The type of housing chosen by the residence is affected by many factors like family resources, decisions, culture, regulations in the area and the family knowledge about the available houses in the market. And many other political, social and economic factors. The social system also affects directly the housing system. The transformation in social order in the community like the type of family that changed from extended to nuclear family and the stability of the new households in independent houses after it was inhabited in big common dwelling and one consisting of several floors or on horizontal extension and some housing units has a kitchen or sitting area used by all of the people in the building, all this has changed the system of housing policy in many countries of the world. Also technological development in housing construction methods and materials used in the interior and exterior design of the buildings in general and housing in

particular. Moreover, housing can be defined from academic aspect as a field of integrated systems that requires the application of Sociology, home economics, architecture, interior design, and political science, economics, psychology, and the science of law (Al-Sa`ed, 2006). And so it seems that it is necessary to know all these systems and ways to solve housing problems, or to choose a specific dwelling.

There are many different approaches for housing development issue, each of them focuses on different sides and goals for housing. Socio-ecological housing development is one of these approaches which is a process that involves the transformation of natural resources, via labor power, into livable spaces. Subsequently the aim of the housing unit is to provide a shelter for the people, but we shouldn't forget that each housing unit use and reproduce energy, and also produce wastes which will be delivered to the environment. It was noticed that the global warming, ozone depletion, exhaustion of non-renewable resources, as well as human health and wellbeing are affected by the process of production, management and consumption of housing.

The creation of a healthy built environment and its adequate management was defined as wider definition of sustainable construction based on effective resource utilization and ecological principles. To achieve building Sustainability, and emphasize the energy related design concepts in addition to the Technical issues such as materials, building components, construction technologies.

Nowadays the importance of the non-technical issues including economic, social, and cultural aspects has been emphasized and considered very important.

2-4 Housing Rights

The housing right had already been on the agenda; since included in Article 25 of the 1948 Universal Declaration of Human Rights. During the late 1980s, it appeared again in the United Nations General Assembly, As in United Nations human settlements program, (2005) It was also mentioned in the Vienna Declaration on Human rights, which emphasizes: the right of everyone to a standard of living adequate for their health and Well-being including food and medical care, housing and the necessary social services, As in United Nations human settlements program (2005).

As in United Nations human settlements program, (2005) AGENDA 21, of the UNCED (Earth Summit), with the title, “Promoting Sustainable Human Settlement Development” identifies the following 8 areas to be the program areas:

- Providing adequate shelter for all.
- Improving human settlement management.
- Promoting sustainable land-use planning and management.
- Promoting the integrated provision of environmental infrastructure (water, sanitation, and drainage, hazardous and solid waste management).
- Promoting sustainable energy and transport systems in human settlements.
- Promoting human settlement planning and management in disaster- prone areas.
- Promoting sustainable construction industry activities.
- Promoting human resource development and capacity building.

From all of the United Nations resolutions protect to all people to have the adequate housing, in Palestine the Israeli occupation regulations and the practical

policies controls on sustainable housing development, and we can see that the Israeli government doesn't comply with the United Nations resolution.

2-5 Concepts of sustainable housing development

2.5.1 Environmental Planning

Housing is embedded in a set of natural systems that provide key eco-system services. It is imperative that the relationship between housing and natural systems is understood and taken into account when planning and building houses and settlements. (Daly, 1996), for example, emphasizes the difference between growth, defined as an increase in size or quantity (e.g. of populations or resource throughput) and development, defined as qualitative improvement. Growth will ultimately run up against finite limits, since we only have one Earth. William Rees (1996) introduced the notion of humanity's Ecological Footprint, the total land and water area needed to support the global population. Currently, our collective footprint is calculated as nearly 25 per cent greater than the capacity of the biosphere to support us (Heinberg. 2007). Environmental economist Herman Daly has suggested three conditions for sustainability, focusing on the resource base (Meadows & Randers. 2004):

- 1- The rate of use of renewable resources must be less than or equal to their rate of regeneration.
- 2- The rate of use of non-renewable resources must be less than or equal to the rate at which they can be replaced by sustainable renewable resources
- 3- The rate of pollution emissions must be less than or equal to the rate at which they can be absorbed and processed by the environment.

In terms of the above definition, housing will stand in a sustainable relationship to the natural systems within which they are embedded if their rate of usage of

both renewable and non-renewable resources, as well as their rate of waste output, is as expressed above.

Five principles of an environmental planning and design

- Healthful exterior environment: The measurements are to be taken that ensure building materials and building system does not emit toxic substances and gasses into the interior atmosphere. Like asbestos that causes cancer diseases and the fiber by using planning methods that encourage the use of eco-friendly materials.
- Energy Efficiency: The measurements are to be taken that ensure housing project use of energy is minimal, and benefit from the renewable energy like solar panels, wind power or any other available methods in Palestine.
- Ecologically being materials: The measurements are to be taken that ensure for housing, infrastructure and facilities to use materials and products that minimize destruction of the global environment, using much as possible the recycling materials.
- Environmental form; the measurements are to be taken that ensure that housing harmonious relationship between the inhabitants and nature, accommodations are to be made for recycling and energy efficiency. And to be manages with community.
- Good design: The measurements are to be taken that ensure that housing project achieve an efficient, long lasting and elegant relationship of use areas, circulation, building form, mechanical system appropriate history and construction technology.

2.5.2 Green housing

A green advance to the built environment involves a holistic advance to the design of housing. All the resources that go into a building are they materials, fuels or the contribution of the users need to be considered if a sustainable housing is to be produced. Producing green housing involves resolving many conflicting issues and requirements. Each design decision has environmental implications. Measures for green housing can be divided into four areas:

- reducing energy in use
- minimizing external pollution and environmental damage
- reducing embodied energy and resource depletion
- minimizing internal pollution and damage to health

What Makes a housing Green?

A “green” housing places a high priority on health, environmental and resource conservation performance over its life-cycle. These new priorities expand and complement the classical housing planning concerns: economy, utility, durability, and delight. Green design emphasizes a number of new environmental, resource and occupant health concerns:

- Reduce human exposure to Toxious materials.
- Conserve non-renewable energy and scarce materials.
- Minimize life-cycle ecological impact of energy and materials used.
- Use renewable energy and materials that are sustainably harvested.
- Protect and restore local air, water, soils, flora and fauna.
- Support pedestrians, bicycles, mass transit and other alternatives to fossil-fueled vehicles.

2.5.3 Affordability

Affordability is one of the main principles for a sustainable housing project, affordability refers to people's ability to purchase basic (or essential) goods and services such as healthcare, food and shelter. Affordable housing is traditionally defined as housing costs (including rents, mortgages, property taxes and insurance, maintenance and basic utilities) that costs less than 30% of household income or budgets. This threshold is called "affordable rent burden." But 30% of \$1 million is very different from 30% of \$20,000. So when we hear "affordable housing," it means affordable for families in the middle or at the lower end of the income scale so when we hear the term "affordable housing," it's important to ask: "Affordable to whom?" The term doesn't mean much unless it is explained precisely, Middle income families? Moderate income families? Low income families? Very low income families? Extremely low income families? In fact each affordable housing program uses these categories to determine which families qualify and what the rents can be.

But some experts recommend including other costs in affordable housing definition since households often face tradeoffs between housing and transport costs, many experts now define affordability as households being able to spend less than 45% of budgets on housing and transport combined. This recognizes that an inexpensive house is not truly affordable if it has high transport costs, and it is often rational to spend more to live in an accessible location if that reduces transport costs.

2.5.4 Sustainable housing planning

Sustainable house was defined as “Building in indigenous styles, constructed from locally available materials, following traditional building practice and Patterns, and not architect-designed, fully integrated with the environment and suitable for all society income levels” (VASSA. 2008).

If a new housing project will be constructed, especially with a large scale, it may be appropriate to start not so much with the architecture and design, but with planning principles starting from choosing the best location to maximize sustainability. This is to recognize that people live not simply in a house, but in a neighborhood and a settlement or a city. Sustainable development is seriously compromised by organizing cities around “urban sprawl” and private car mobility. Transport is a main energy user and producer of CO₂, as well as other pollutants. More expanded residential suburbs require more land, resources and infrastructure (water, gas, electricity, roads) and lead to a disintegration of the city space, including between socially segregated areas. Relatively compact and mixed-use mixed-income areas, which integrate housing, work, facilities and entertainment in close proximity, are believed to constitute an important strategy for reducing these negative footprints. A more compact city also allows easier, more affordable access by low-income residents to urban services and employment opportunities and a better sense of community integration and unity.

In large urban areas, an extension to the compact city approach – polycentricity or decentralized concentration can move or redirect development pressures to new urban centers. For this, planners can imagine new housing developments to be of a substantial size and located within or near existing settlements, so that

new car travel distances are minimized. Development should ideally be located near to a regional or metropolitan public transportation system, so that high levels of public transport accessibility can be provided. However, building free flowing highway networks is likely to encourage the sprawl of development and a strung-out community (Banister and Anable, 2009). However, it is not always that densification programs are accepted or accepted in a given social context. In already low density areas such programs can meet residents' protests and sabotage from powerful landowners. It is, therefore, important to prevent the strong connection with the low



density high-carbon lifestyles from the very beginning by using the instruments of urban planning and building control effectively for newly built areas.

There are many different types for sustainable houses which are used worldwide and the following types are the most common:

1- Cob homes: Cob homes have been around for centuries. Their low-cost, combined with the fact that they can be easily molded into any shape and space makes them a great choice for sustainability on a budget. Cob is a natural material that is resistant to fire and earthquakes, in addition to being able to naturally regulate interior

temperatures. Because of the substance's initial malleability, many cob homes feature beautiful sculpted designs and unique aesthetics (Walker, 2012).

2- Hemp Homes: Also a natural material, hemp shares many of the benefits of cob. Hemp homes are mold, fire, termite, and rot resistant, as well as non-toxic. They are also more sound-proof than traditional homes. Hemp homes are very energy efficient, meaning that residents can expect big savings on their heating and air bills (Walker, 2012).



3- Passive Homes: Passive homes are built to work with their environment to provide the highest degree of energy efficiency. By situating windows in a way that takes advantage of light and heat, using innovative ventilation methods, and leveraging effective insulation, passive homes eliminate the majority of the average Homeowner's energy costs (Walker, 2012).



4- Solar Homes: Solar homes use cutting edge technologies to provide their own source of energy. Some homes are completely self-sustainable thanks to their optimal solar panels, while others use the solar energy as a supplemental resource (Walker, 2012).



5- Earthship Homes

This up-and-coming home type uses recycled and organic materials from the local area. They also feature self-sustainable utilities such as solar panels, rainwater recycling systems, and crop gardens. Earthships have a unique look that varies with each construction. Official Earthships are currently only being constructed by Earthship Biotecture, but many architects are getting inspired by the company's innovative sustainability solutions and designs.

Good environmental approaches suggest moderately high densities for compact neighborhoods. However, the actual density needs to be in a specific context. There is a level beyond which density creates social, economic and environmental congestion and cause weakness of sustainability. In some developing regions, many denser residential areas are associated with poverty and overcrowding (Walker, 2012).

It is important in such cases to actually reduce densities and introduce new public, open and green spaces for recreation and leisure. However, good urban design creates attractive living environment by balancing variously dense developments with access to green space, adequate infrastructure and good transport. Many European towns and cities show that the best solution lies in a compact green city combination, where a relatively compact built environment includes a diversity of densities and designs and maintains a good coherence with the landscape and green environment. Related tasks include encouraging walking, cycling and public transport (from, to, and between residential areas). Public transport is a main



Image4: Earthship homes

Source: Normal-UK.org

element that controls the reduction of emissions from travel. For example, Mumbai with a higher share of public bus transport and suburban rail has experienced a 60% reduction in energy and emissions compared to Delhi (Das and Parikh, 2004). There is an interesting trend of adopting “non-traditional” approaches of public transport, such as aerial ropeways – which can also make remote residential areas more accessible. Examples include metrocables in Medellin, Colombia and Caracas, Venezuela, as well as Algeria’s aerial ropeway serving the cities of Skikda and Tlecern (UN-Habitat, 2010a). Similar infrastructure is being built to provide urban access from some of the favelas in Rio de Janeiro, Brazil. Such means of transportation use less material and energy, relatively cost-effective to install and don’t make pollution.

After all, a series of important aims for successful and sustainable Planning Guidelines housing development in urban areas can be listed. Housing developers, their design teams, the planning system, and the community they serve, share a common goal to create high quality places which:

- Priorities walking, cycling and public transport, and minimize the need to use cars.
- Deliver a quality of life which residents and visitors are entitled to expect, in terms of amenity, safety and convenience.
- Provide a good range of community and support facilities, where and when they are needed and that are easily accessible.
- Present an attractive, well-maintained appearance, with a distinct sense of place and a quality public realm that is easily maintained.
- Are easy to access for all and to find one’s way around.

- Promote the efficient use of land and of energy, and minimize greenhouse gas emissions.
- Provide a mix of land uses to minimize transport demand.
- Promote social integration and provide accommodation for a diverse range of household types and age groups.
- Enhance and protect the green infrastructure and biodiversity.
- Enhance and protect the built and natural heritage.

Planning for sustainable housing is not limited on the physical environment, in fact it also includes the principles of stable and integrated communities which has to be planned by providing enough community facilities, efficient use of resources, emphasis the quality of life issues and conservation of the national and built environment.

Sustainable housing area requires many community facilities which should be integrated with the surrounding residential areas as some facilities may be available in the wider area while others will need to be provided locally. A special attention should be given to the vital and most used facilities like the schools, childcare and health clinics or health center (depending on the size of the area) and community centers.

2.5.4.1 Universal design

Developing sustainable neighborhoods should be guided by the principle of universal design. Universal design is the design of an environment so that it can be accessed, understood and used to the greatest extent possible by all people regardless of their age, size, ability or disability. By considering people's diverse needs and abilities throughout the design process, which reflects the life cycle

approach, environments that meet the needs of all can be achieved. In this way, sustainable design and universal design are strongly linked and sustainable design when incorporated from the early stage of planning integrated neighborhoods, will reduce the need for costly and wasteful retrofits over the medium to long term.

2.5.4.2 Design process

The design process contains many standards and guidelines which can't be counted in this research but the most significant design guideline is the general layout of the streets and movement axis inside the residential area which will be explained in this part.

The design of street layouts must start by considering people movement rather than vehicle movement. This approach ensures greater consideration of pedestrians, cycling and public transport users. In many instances, all users can comfortably share the same street network. When designing a street layout for a new housing area, designers should consider the need for:

- (a) Links to the overall road network in the district or town, including bus services, based on an analysis of the need for such linkages.
- (b) Access to bus-based and rail-based public transport (where relevant).
- (c) Direct walking and cycling routes to local facilities such as shops, schools, public transport, and open spaces, together with lighting and landscaping of such routes.
- (d) Access for people with disabilities.
- (e) Maximum permeability for pedestrians and cyclists.

(f) Circulation routes for public service (buses, waste collection) and delivery vehicles within the area.

(g) Residential streets with limited through motorized traffic.

(h) Consideration of provision for low design speeds (such as 30 kph) and facilities for pedestrians and cyclists.

(i) The location and amount of parking for cars and cycles.

(j) The planting of appropriate street trees (with taking in consideration the location of underground services).

Some streets will have important movement functions whereas for others, considerations of place will be more important. The balance between the various functions of a street will help determine appropriate design speeds, road geometry and the level of adjacent development. It should be acknowledged, however, that the character of streets can change over time and that design has to allow for the capacity to respond to changing circumstances.

The definition of sustainable development includes “maximizing access to and encouraging use of public transport, cycling and walking.” According to UN-Habitat, the majority (55%) of primary schoolchildren were driven to school by car, compared with 28% in 1991. away from the energy and climate change implications of the increasing use of the car for journeys to work and school, cycling and walking have a role in achieving healthier lifestyles. A significant minority of children aged 5-17 have been found to be overweight. Good pedestrian and cycle facilities within residential areas (including adequate public lighting) can facilitate higher levels of physical activity among young people, particularly in relation to school trips, where ideas and thoughts about traffic safety among parents and children are a key factor. Higher residential densities

within walking distance of public transport facilities can help to sustain the use of such transport.

2-6 The Concept of zero emission technology

Zero emission technology aims at 100% reuse of all materials; this concept has been introduced for industrial production. The concept entails a practical approach to satisfying humanity's needs for water, food, energy, jobs, in an environmentally sustainable manner, by applying science, urban design and technology. From an environmental perspective, waste minimization and reuse of stabilized biosolids and treated effluent represent the ultimate solution to pollution problems that threaten public health and ecosystems at both local and regional levels.

Environmental planning must be adapted in designing our housing project or built up areas, to study the impact of these housing projects on natural resources, to use the potential natural resources in order to keep it and not to deplete it in the future. The environmental planning deals with health, energy, transportation, water, materials, land use ecology and pollution. The housing rights for each person to have an adequate home with standard of living has been adapted in the united nation resolutions; the policy of publishing and clearing these resolution in schools and universities will improve the awareness of Palestinian people for their rights.

2-7 Theories and Models

Review of sustainable development models:

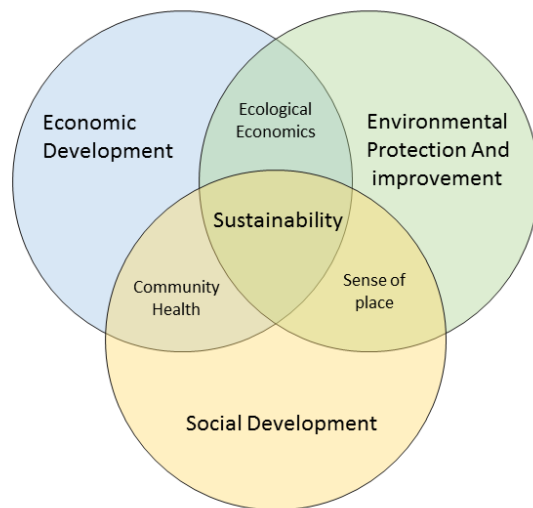
There have been numerous ways of representing sustainable development in a model that captures this extremely complex concept and a new way of thinking.

2.7.1 Pictorial Visualization Models:

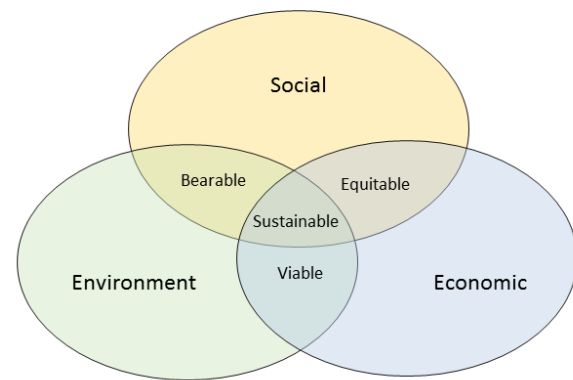
According to the World Conservation Union (IUCN, 2006), the three dimensions of sustainability (economic, social and environmental) are represented either as pillars, embedded circles or in the popular Venn diagram of three overlapping circles. The latter model stresses the importance of the intersection between the three areas (see Figure 2). These models clearly emphasize the need for interdisciplinary and transdisciplinary (Marinova and McGrath, 2005) approach to Understand sustainability. Generally, these are popular static models with limited informative value but powerful in terms of reaching a broad audience.

2.7.2 Quantitative Models:

From a policy-making perspective, describe six types of quantitative models, namely “macro-econometric models, computable general equilibrium models,



Source: Kenworthy, 1999



Source: IUCN, 2006

Figure 2: example for Venn diagram

optimization models, system dynamics models, probabilistic or Bayesian network models (this category also includes risk assessment models based on influence diagrams) and multi-agent simulation models” (Boulanger & Bréchet, 2005). Economic models represent a special sub-class of the quantitative models. In fact, this area has been extremely active in academic pursuit generating models representing various economic concepts, ranging from neo-classical, evolutionary, ecological economics to neo-Ricardian (Faucheux, 1996). These models have attempted to find ways of embracing uncertainty and dealing to a various degree of success with long range perspectives. Despite this, they have been poorly equipped to accommodate a holistic perspective, address the local or global perspective or acknowledge the need for stakeholders’ participation. A common

characteristic of the quantitative models is the fact that they remain dominated by the discipline from where they have originated, like environmental science, engineering or economics.

2.7.3 Physical Models:

The use of physical models for sustainability has been restricted mainly to its environmental component. They have been applied for water (Hellstrom, 2000), energy, buildings, in urban design, for recreation of habitat, for handling of pollution, CO₂ and toxicity in implementing industrial ecology (Levings, 2004), to mention a few examples. Physical models are very specific and predominantly local. The purpose of their construction is to reduce the uncertainty, however their time range is very restricted. They allow for a participatory approach and interdisciplinary perspectives, but by nature are only a small part of the global sustainability system and can rarely serve to main purpose of modelling for sustainability.

2.7.4 Conceptual Models:

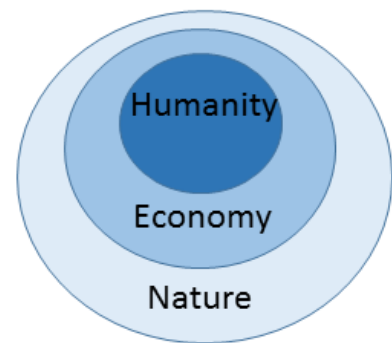
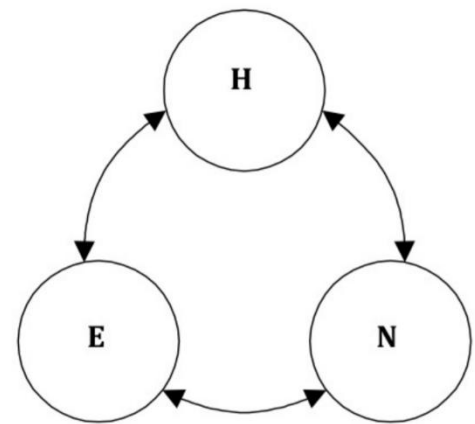
This category of models is very broad and is linked to humanity's waking up to the limits of its natural environment and the negative impacts that population and population development having on it. They started with the work of the Club of Rome (Meadows, 1971), went through the conceptualisation of the implications from the use of nuclear weapon and from ozone depletion and the ozone hole (Litfin, 1994) to go through the various futurist scenarios such as the ones developed by the World Business Council for Sustainable Development (Speth, 2004), to the work on global warming and climate change. Another example of a

powerful theoretical idea that crossed the borders of many disciplines and is also contributing to understanding sustainability is the evolutionary concept.

Based on the co-evolutionary paradigm, it is possible to model the interactions within the global “humanity–global economy–nature” system. The important point is that all three should be modelled and analyzed simultaneously in terms of their global interactions (Norgaard, 1997).

An adequate model of sustainable development cannot build on the existing understanding of society and nature. Humans have also created what can be described as “second nature”, the human-made material world which by size and importance has become similar to the global natural systems.

It not only acts as a buffer between humans and nature (see Figure 2) but has also become the main objective of human development. Following its own developmental logic and laws, this second nature is now threatening the planet's nature. Since the 20th century, globalization has become a distinctive feature of development affecting the economy (and making it global), society (with emerging global consciousness and shared global problems) and the environment (with the effects of pollution, for example, becoming of global importance). In fact, sustainable development is becoming a globalizing development which does not contravene but reinforces and goes along with these processes. The planet



Source: Giannetti, 1993

Earth can only support such development. A model of this global sustainable development is shown with a state of dynamic balance $\oplus$:

$$GS = H \oplus E \oplus N$$

Where H is humanity; E –global economy and N – the global natural environment (see Figure 3).

The following three characteristics, informed by the co-evolution principles, are important for this model

1- Heterogeneity:

At the local scale, heterogeneity is expressed in specific socio-ecological systems in which ecological, social and cultural elements are represented as a whole through the complex and complicated interactions of geographic, biological and anthropomorphic factors (Marinova, 2009). Therefore the global system is not just a complex of global phenomena of a different nature, but complex and alternately dependent arranged in pace separate socio-natural agglomerates (Marinova, 2009).

2- Equality:

Need to holistically integrate different priorities. It emphasized the deep connection and direct and multilateral interaction between each of the components and the rest. Examples of this are any of the global problems that society currently faces like climate change.

3- Human stewardship:

The leading role that humanity has in transforming, maintaining and/or sustaining the planet Earth (Marinova, 2009). According to Costanza (1993), “models are similar to maps, they have many possible purposes and uses, and no one map or model is right for the entire range of uses”. The previously mentioned models are just a brief view for a longer analysis of this subject and it is clearly seen that the need for new models to clarify more phenomena are needed.

2.7.5 Theories review:

The appearance of sustainability in development science has led planners to apply advanced concepts of sustainability to the modern discussions over how cities and regions should be renovated, redeveloped, and reformed. Sustainability is regarded alternatively as either the proper means or the proper end of urban development (BASIAGO, 1999). Nowadays, it is common in planning circles for urban planners to describe efforts to reverse problems of urban sprawl, congestion, and decline as a search for urban sustainability. This is the case even though in urban theory no consensus exists as to which human settlements embody sustainability (Ewers & kamp, 1990).

As mentioned in section 2-2, Sustainability consists from the three pillars, environmental, social and economic. Each of these pillars has its own use and practices in the urban planning which will be clarified in the following points:

1- Economic sustainability in development theory

Economic sustainability implies a system of production that satisfies present consumption levels without compromising future needs. The sustainability that

economic sustainability works for is the sustainability of the economic system itself. The concept of economic sustainability was originated by a researcher called Hicks in 1939, Hicks defined income as the amount one can consume during a period and still be as well off at the end of the period. Traditionally, economists, assuming that the supply of natural resources was unlimited, placed excessive emphasis on the capacity of the market to allocate resources efficiently. They also believed that economic growth would bring the technological capacity to replenish natural resources destroyed in the production process. But nowadays, a realization has come that natural resources are not infinite.

2- Social sustainability in development theory

In the most basic meaning, social sustainability offer a system of social organization that relieve poverty. In a more substantial meaning, social sustainability establishes the connection between social conditions -such as poverty- and environmental dissolution (Ruttan, 1991). This theory of social organization identifies a negative linkage between sustained settlements, sustained poverty levels, and sustained natural resource exploitation. There is a divergence of opinion in development theory whether environmental sustainability is a necessary condition of economic growth and poverty reduction, or economic growth and poverty reduction are needed before environmental sustainability can even be addressed.

Very poor countries should accept temporary environmental degradation in order to meet immediate needs of food and shelter before they can have permanent economic and environmental improvements. Some view was that developing countries simply cannot afford to put environmental protection before economic

development. In contrast to this view, the theory of social sustainability suggest that the reduction of poverty need not entail environmental decline. It aims to reduce poverty within the existing resource base of a society (BASIAGO 1999).

3- Environmental sustainability in development theory

Environmental sustainability requires maintaining natural capital as both a provider of economic inputs called sources. And an absorber called sinks of economic outputs called wastes (Daly, 1986). At the source site, harvest rates of resources must be kept within regeneration rates. At the sink site, waste emissions from industrial production must be controlled so it does not exceed the capacity of the environment to assimilate them without impairment (Goodland, 1995). It has become familiar for sustainable development or sustainability to be defined strictly in terms of environmental sustainability. This misconception holds that what is wrong with the contemporary pattern of international development is simply that it is destroying the environment. This view is too much simple, however, for it ignores the market forces and social inequalities that are driving environmental degradation (Alexander, 1994).

Chapter 3

Case Studies:

3-1 International scale - Village Homes, Davis, California

When Village Homes was built in the 1970s, the local investors refused to show anyone the 70 acre, 240 home development because they didn't think anyone would want to live there. There were no front roads, no storm drains, and the houses all faced the same way (for solar gain). Today, it is one of the most sought-

after subdivisions in Davis, and Coldwell Banker Residential identified Village Homes as "Davis's most desirable subdivision". The crime rate is 10th that of Davis as whole, and in 1995 the homes sold for 13% more than the equivalent sized homes in a traditional post WWII subdivision located across the road.

3.1.1 Design Features:

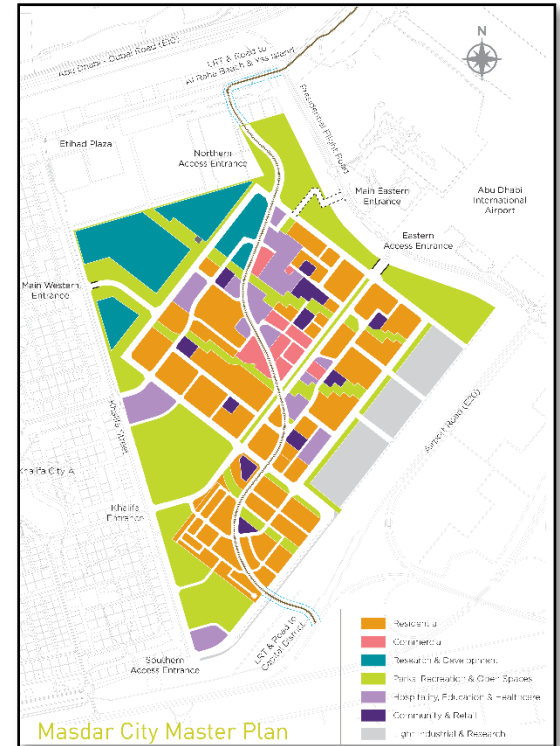
- 1- Ecological protection:** 12 acres of greenbelt and open space, 12 acres of common agricultural land.
- 2- Density and urban design:** A whole systems approach to design. The houses are clustered into groups of 8 and are surrounded by mutual space. The early residents were responsible for the landscaping and design of the green space in front of their housing clusters. 25% of the areas are open spaces (agricultural and recreational).
- 3- Local economy:** 4000 square feet of commercial office space. Due to the agricultural space, by 1989, much of the Village Homes residents' food was being grown in the neighborhoods. The agricultural areas include commercial fruit and nut orchards, a commercial organic produce farm, home-scale garden plots and eatable landscaping along pathways and roads.
- 4- TRANSPORTATION:** Vehicle access is by the back lanes only, with pedestrian lanes for walking and cycling. The front streets are designed by the residents as grassy areas and gardens with trees. Pedestrian paths and traffic calming designs with narrow streets encourage a strong sense of community and high property values. The compact design encourages residents to walk rather than drive for their daily needs. The grocery store is 10 minutes walking, and the largest employer - the university is nearby.

- 5- **AFFORDABLE HOUSING:** An equity program allowed several low-income construction workers to buy homes, and some apartment units are part of the development project as well.
- 6- **LIVABLE COMMUNITIES:** The local Homeowners Association owns and manages the household commons, greenbelt commons, agricultural lands and the community center, and handles the revenues from office space and some rental units. There are frequent community events, and 80% of the residents participate in community activities.
- 7- **Community barbecue events encourage evening gatherings for people.**

The turnover rate is very low, with most residents preferring to rearrange and add on, rather than move to a larger home.
- 8- **Sewage and storm water:** The narrower streets produce less storm water runoff, which is handled by simple infiltration paths and on-site detention holding tanks instead of storm drains, saving nearly \$200,000. These savings were invested into public parks, walkways, gardens and other recreational facilities.
- 9- **ENERGY:** All the houses are passive solar designed, with natural cooling and solar hot water. The overall design, with reduced pavement and more space for trees, lowers surrounding air temperature and reduces the need for air conditioning. Annual household bills are 1/2 to 1/3rd less than those of surrounding neighborhoods, because of the locally grown food and the energy savings.

3.1.2 Limitations and Successes: When Village Homes went through the planning process in the 1970s, the plans were opposed by the planning staff, the public works department and the Federal Housing Authority (FHA). The police

had concerns about watching the narrower streets, and the fire officials worried about managing the movement of their fire trucks. The FHA questioned the existence of agricultural uses, fearing that it would reduce property values. The engineers opposed the natural drainage system, saying that it wouldn't work, and would attract harmful and disease-cause insects. In order to get approval, the developer had to put a guarantee to pay for adjusting and replacing the storm sewers in case the system failed. Soon after, a strong storm hit the area and the Village Homes system worked fine and also took some of the run-off from the neighboring subdivisions, whose storm sewers failed.



3-2 Regional scale – Masdar City, Dubai, UAE

The world's energy requirements are expected to double in the next 50 years, a fact which places energy use and conservation at the heart of the world sustainability challenge. Today, approximately 3.5 billion people (nearly 50% of the world's population) live in cities, a number which is expected to rise to nearly 6 billion by the year 2050. These urban environments (which only account for 2% of the planet's land mass) are responsible for almost 80% of the world's energy consumption and 75% of its carbon emissions. The problems created by such dramatic urbanization place an increasing emphasis on making the world's cities more resource-efficient and

Figure 3: Masdar City master plan

environmentally friendly. In response to this challenge, Masdar Company is building Masdar city, as a green print for sustainable urban development and strategic Business hub. Located in Abu Dhabi, the capital of the United Arab Emirates, Masdar City is a sustainable urban development and economic free zone. The city provides a green print for cities of the future, with traditional Arabic architecture merged very well with state of the art modern technology to maximize energy efficiency. Masdar City has the potential to host up to 40,000 residents and 50,000 commuters by 2025. This mixed-use development provides a unique, sustainable, living and working environment, with integrated residential and commercial zones that feature food and drinks outlets, along with extensive leisure and entertainment facilities.

3.2.1 Sustainable construction

Every element of Masdar City's 700-hectare site has been designed with sustainability in mind. cutting energy demand and water consumption by 40% while also reducing embodied carbon by 30% compared to business as usual.

The city's streets have been built to be optimally oriented on a southeast-northwest axis, thereby providing shading at street level throughout the day. The materials used for the building facades are also designed for cooling purposes. Buildings within the Masdar Institute Campus are shielded with special materials that ensure almost no solar gain on the structures as well as limiting the heat radiated on to the street. While windows not already shaded by adjacent buildings have a set of slots to prevent direct sunlight from entering the building. With 10MW solar power plant on the site, supported by a series of smaller rooftop installations, helps to provide the development with a clean, sustainable source of energy.

3.2.2 Sustainable living

With integrated residential and commercial zones that feature food and beverage outlets, alongside extensive leisure and entertainment facilities, Masdar City offers a unique, environmentally friendly, living environment. The development's pedestrian-friendly design looks to encourage a healthier and more active lifestyle, with amenities easily accessible on foot or via public transport, while communal areas have been intelligently landscaped and designed to provide natural shading and cooler air temperatures.

3.2.3 Sustainable business

Masdar City is more than a sustainable urban development; it is also an environment in which organizations, businesses and NGOs can do business. As an economic free zone offering 100% foreign ownership, no restrictions on capital movements, profits or quotas, and a favorable tax environment, the city provides a strategic base from which businesses can explore opportunities available within the United Arab Emirates and beyond.

3-3 Local scale – Rawabi City, Ramallah, Palestine

Rawabi is a city first of its kind for Palestine. The city is intended to host 40,000 middle income families (where the average family size is of five people), a number of cafes, restaurants, mosques, commercial centers, parks and playgrounds, job, business, and excellent opportunities, and even an outdoor amphitheater. Moreover, Rawabi is to be Palestine's first planned green and sustainable city. Among the plans for making Rawabi sustainable include harvesting rainwater from roofs, a pedestrian-only city Centre, wind energy turbines, and electric car charging stations. Rawabi is also dedicated to environmental sustainability. The

masterplan applies environmentally responsible landscape and development practices designed to preserve the natural features of the landscape.

The vision is to serve as a prototype of the first Palestinian green city and ultimately, “to guarantee a higher quality of life for present and future generations.”

In addition to eco-friendly building features, construction uses a large percentage of recycled materials from Rawabi’s own natural resources. Furthermore, multiple aspects of the residential lifestyle at Rawabi enhance sustainability, including its community gathering spaces and education, health and cultural facilities.

In order to reduce CO2 emissions, public transport within the city is not permitted, however Rawabi will have its own public transport system based on the usage of electric cars. The city also has its own wastewater treatment plant which will collect, treat and reuse reclaimed wastewater.

One of Rawabi’s core objectives, in addition to the provision of housing for the middle class, is to provide jobs for Palestinians, to attract businesses and to stimulate the Palestinian economy. Unemployment in Palestine is high, and the biggest challenge for the private sector is to create jobs.

Whilst Rawabi has already achieved to create thousands of direct and indirect jobs in the construction sector, the challenge is to create permanent jobs in the city itself, Dajani explains. “Our main focus now is to build a small economic embryo within the city, to create 3,000 to 5,000 jobs for teachers, working mothers, entrepreneurs, and the companies that are interested to launch their operations in Rawabi,” he says.

Rawabi's wastewater treatment plant, which will collect, treat and reuse reclaimed wastewater, sits on a 3.5 acre plot northeast of the city. Underground wastewater collection pipes run downhill from Rawabi to the treatment facility site, eliminating the need for pumps. The treatment site is accessed by a dedicated 1.5 kilometer road, construction of which has recently been completed.

As water is treated and tested, it will then feed into separate reservoir. This reservoir is connected to an underground pipeline dedicated exclusively for the transmission of treated water to irrigation pipes in parks and green spaces and for use in agriculture. The reclamation of treated wastewater is part of a national water consumption reduction plan established by the Palestinian Water Authority for the preservation of scarce water resources in the region.

Housing National Policies in Palestine

The draft for the Palestinian National Housing Policy (PNHP) was prepared in 2013 with a technical support from the United Nations program for sustainable settlements.

The Palestinian vision for housing: Sustainable human settlements with appropriate housing for all Palestinian families (PNHP).

The existence of an efficient housing sector that provides equity is considered a strong supporter for the State of Palestine to achieve its following political, environmental and social goals:

- 1- End the occupation and build a Palestinian State.
- 2- Support the opportunities for all citizens to get a good levels of health, dignity and citizenship by providing them with an appropriate housing.

3- To help the Palestinians having an enough, affordable and good quality housing.

4- Achieve sustainable development including more logical urban growth and wiser management for natural resources and lands.

5- Energizing the national economy.

One of the main goals for the PNHP is to support the establishment of a new sustainable growth model of human settlements in Palestine which takes into consideration the limited lands and natural resources of this country.

Their Vision: Sustainable human settlements with appropriate housing for all Palestinian families.

The current development of land and housing in Palestine is mostly individual efforts, and is characterized by a great deal of spontaneity, and the state doesn't contribute to it except with a few regulations. Therefore, the output from this Urban Development, takes the form of urban expansion with low density, which is characterized by irregular structural activity.

In this small area that is subject to intense pressure and characterized by a high population density, face a serious threat in the future development by its informal development, because it consumes valuable lands and adds more pressure on limited natural resources of water in Palestine and elsewhere.

The Palestinian authorities should adapt the principles of sustainable human settlements as a new model for development instead of the current spontaneous model that leads to low density urban sprawl.

According to the PNHP, its preferred to located any new housing project as close as possible to the cities and large communities to reduce the costs of infrastructure, increase accessibility and transportation availability, protect the green natural areas from the Urban sprawl and also its better to use a governmental land to reduce the costs since the land price forms 30-40% from the project price while the infrastructure forms 10-15% from the costs. These criteria lead us and works as a guide line for site selection process.

Site Selection Process

As a sustainable housing located in the Palestinian lands, many aspects and criteria must be taken into consideration, the following points are considered as restrictions for the site:

1-Avoid C Areas

2-Avoid high value agricultural lands

3-Avoid Natural Reserves

4-Avoid biodiversity Areas

5-Avoid archeological sites

6-Avoid valleys

7-Avoid springs and natural water sources

On the other side, a governmental land within a close distance to a large Palestinian community is considered as an attraction for the project. All of these points were reflected on the maps and combined together to reduce the choices for the project locations as shown in the following maps.

After that and by taking the PNHP into consideration with the principles of sustainability, an evaluation table was made for the alternatives of the site and the following criteria were used as an indicators for the suitability of the site.

1-Slope: less slope is better to reduce the construction costs and to give less effort in moving in the site and so more walkability and easiter distribution for services.

2-Transportation: the existence of transportation line close to the site is very useful and significant also to provide an attraction for the site and to reduce the reliance on cars.

3-Distance to a main road: main road means more accessibility to the site which is a positive point for most housing projects.

4-Distance to the nearest community: a closer distance to a large Palestinian community means more services and less costs to connect with infrastructure.

5- Distance to services (Schools, Health): it's important to see what services we need inside the housing project and whether these services are already existed in a close community and within a walkable distance to the site.

6-Infrastructure availability: a very important side of a housing project is the availability of infrastructure since it constitutes by 15% in the total costs for the project.

7-Land price: less land price means less apartments price and so more affordable housing which is one of the sustainable housing principles.

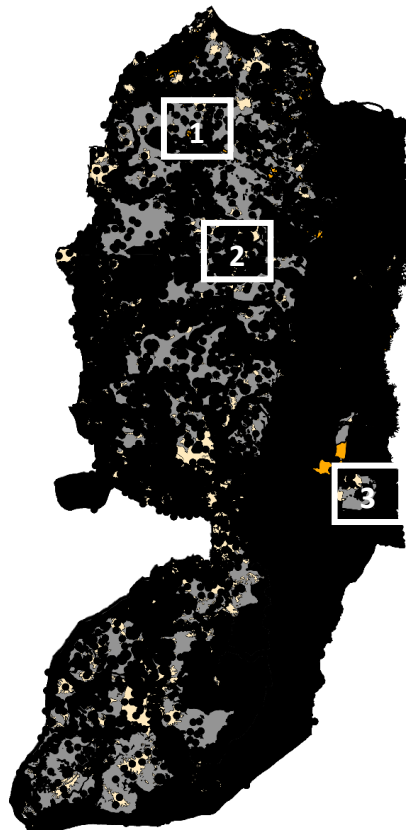
8-Not damaging natural resources: it's not logical to build a sustainable housing while destroying forests and green areas because the objective and the goal of sustainability is to save the natural resources for the next generations.

9-Security: by saying security, two aspects are included, the political aspect and the social one. The political aspect means that it's preferred to locate the housing project away from any Israeli army camp or an Israeli settlements or any area has a problems between Palestinians and occupation.

The social aspect means that an area with high crime ratio should be avoided.

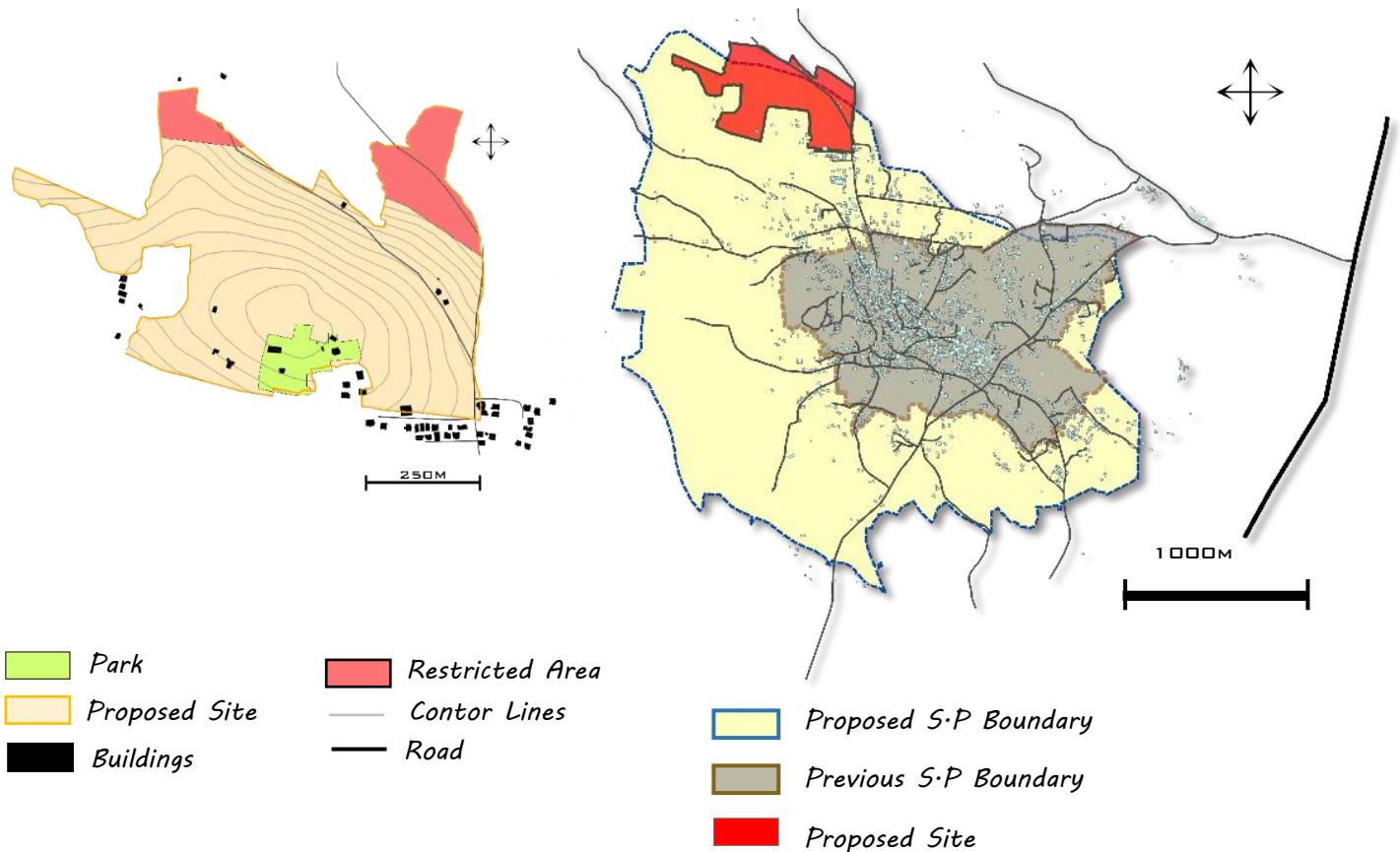
10-Social acceptance: it gives an indicator for the willingness of a person to live in a specific are, for example if someone was asked would you like to live in a refugee camp, mostly he will say no because he has a low degree of social acceptance to live there.

After applying the restrictions and attractions layers on the map, Three site were selected and weighted overlay is made to Choose the best location for the sustainable housing project



Site1: Arraba Town

Arraba Town is located 11 Km to the south west of Jenin city, the project site is located to the north west of Arraba within the schematic plan borders and classified as a State land with an area of 258 Donums.



The map on the right shows Arraba borders and the main streets network, while the one on the left gives us a closer look to the proposed site for the housing project.

Criteria Evaluation Table:

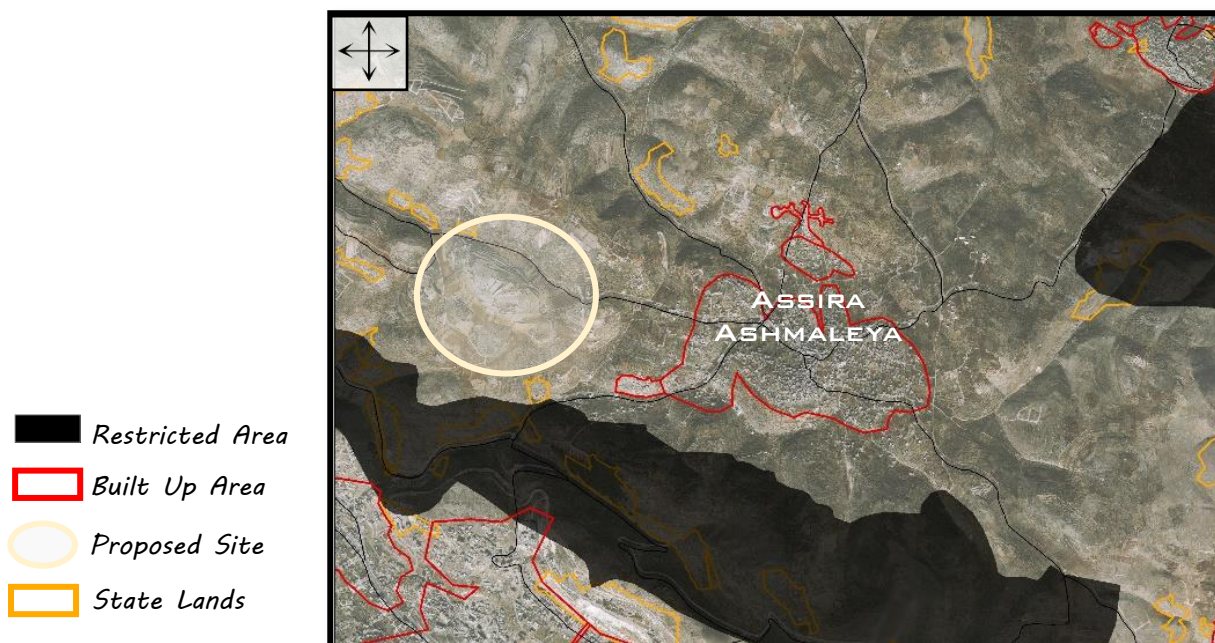
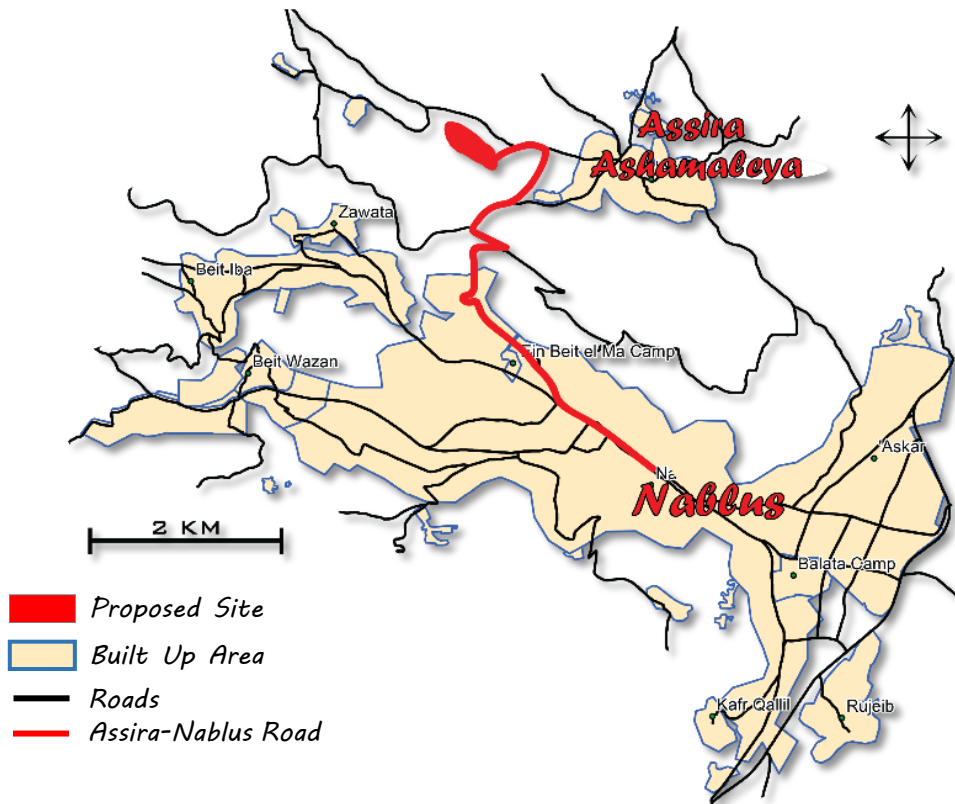
Site1: ArrabaTown.

Criteria	Weight (1-5)	Criteria Value	Rank (1-5)	Total
Slope	3	(25%)	2	6
Transportation	5	-----	2	10
Distance to a main road	3	1.5 km	2	6
Distance to the nearest community	5	100 m	4	20
Distance to services Schools, Health	3	1 Km	3	9
Infrastructure availability	5	-----	3	15
Land price	5	0	5	25
Not damaging Natural resources	4	-----	4	16
Security	4	-----	3	12
Social Acceptance	5	-----	3	15
Total			134/210	

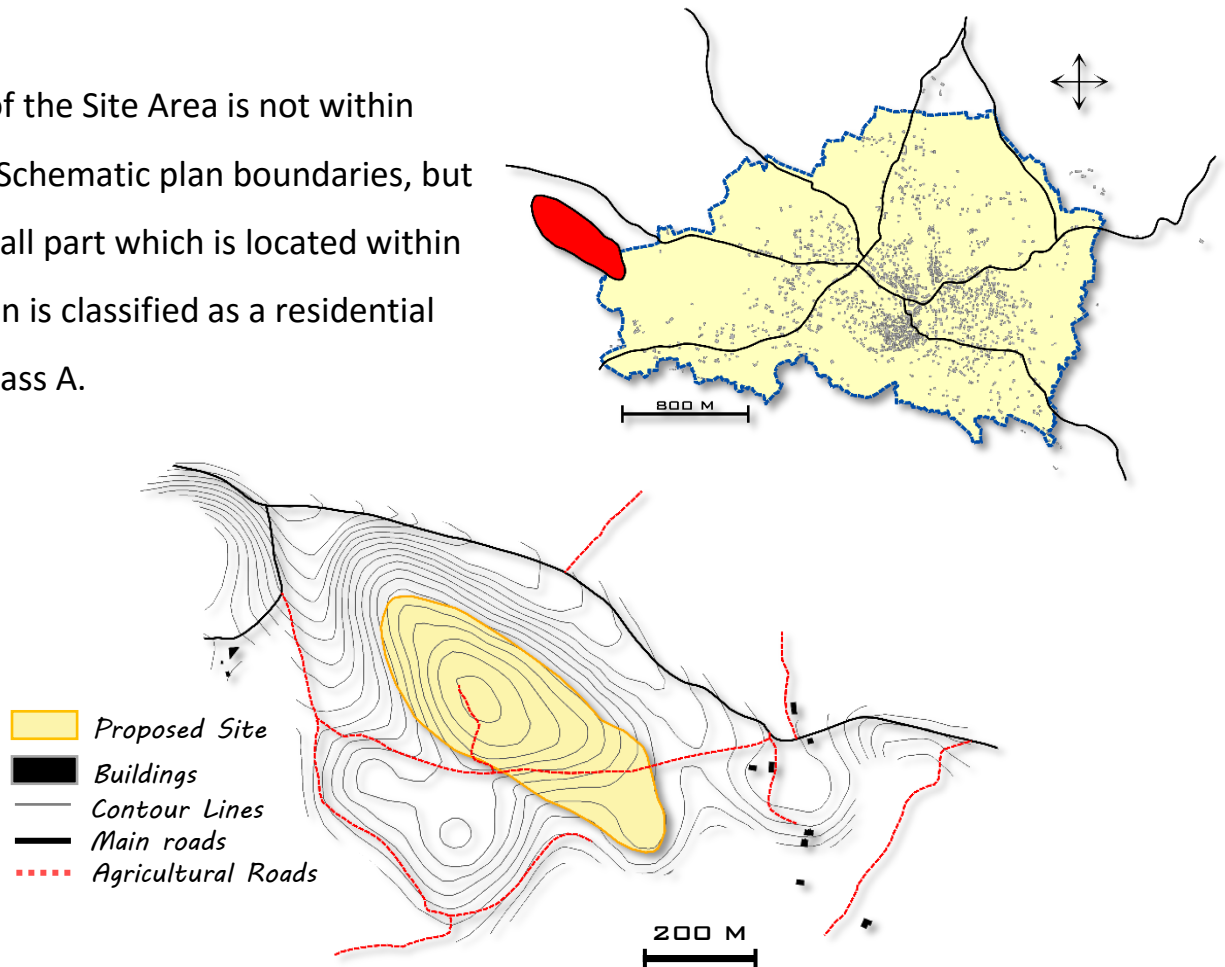
As we can see, the site got a grade of 134/210 and one of the most significant factors was the land price because its government land.

Site 2: Assira Ashamalya Town

Assira Ashamalya is one of the biggest towns around Nablus cities with a municipal services and a population of nearly 12000. The proposed site for the project is located to the west of Assira, on the road that connects with Jnesenya Village and has a distance of 7 KM from Nablus city with an area of 158 Donums.



Most of the Site Area is not within Assira Schematic plan boundaries, but the small part which is located within the plan is classified as a residential Area class A.



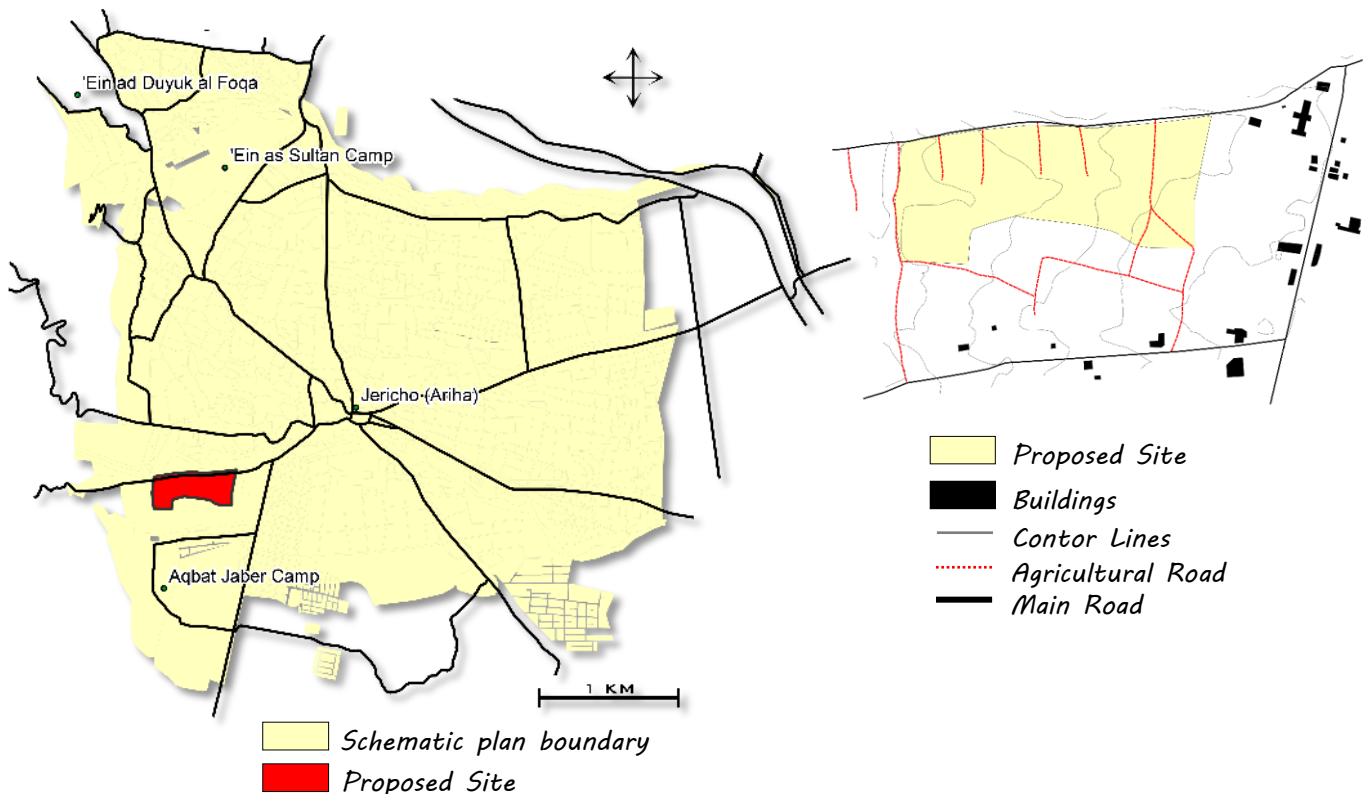
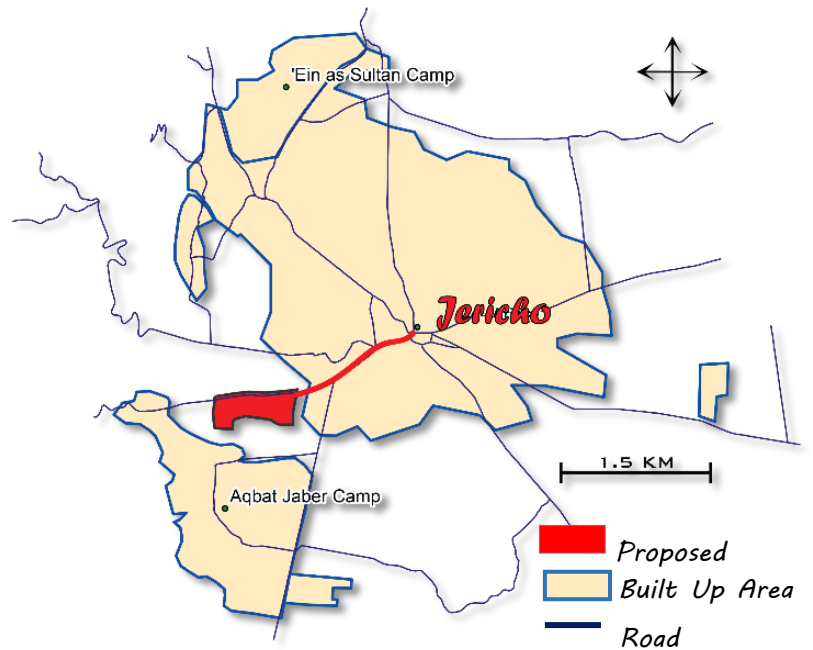
The same way as the previous site, a general survey for the site was made and some needed information were collected and after that an evaluation was made as shown in the following table.

Criteria	Weight (1-5)	Criteria Value	Rank (1-5)	Total
Slope	3	12%	4	12
Transportation	5	-----	1	5
Distance to a main road	3	1.7 KM	2	6
Distance to the nearest community	5	1.7 KM	2	10
Distance to services Schools, Health	3	2 KM	1	3
Infrastructure availability	5	-----	2	10
Land price	5	15 JOD/M ²	4	20
Not damaging Natural resources	4	-----	4	16
Security	4	-----	4	16
Social Acceptance	5	-----	4	20
Total	118/210			

As seen in the table, the site got a grade of 118/210, so the previous site still has the forefront.

Site3: Jericho City

The proposed Site in Jericho has an area of 245 Donums and is 1.5 KM distance from the city center. It is located within Jericho's schematic plan boundary. The site is classified as Residential Area class A. One of the significant points about this location is that it's a flat terrain with a very gentle slope.



s previous sites, an evaluation was made in the following table:

The site has a grade of 124/210 which leads us to the final result between the three sites, which is Arraba

Criteria	Weight (1-5)	Criteria Value	Rank (1-5)	Total
Slope	3	2%	5	15
Transportation	5	-----	3	15
Distance to a main road	3	350 M	4	12
Distance to the nearest community	5	500 M	3	15
Distance to services Schools, Health	3	0.4 – 1 KM	3	9
Infrastructure availability	5	-----	3	15
Land price	5	70 JOD/M ²	2	10
Not damaging Natural resources	4	-----	2	8
Security	4	-----	5	20
Social Acceptance	5	-----	1	5
Total			124/210	

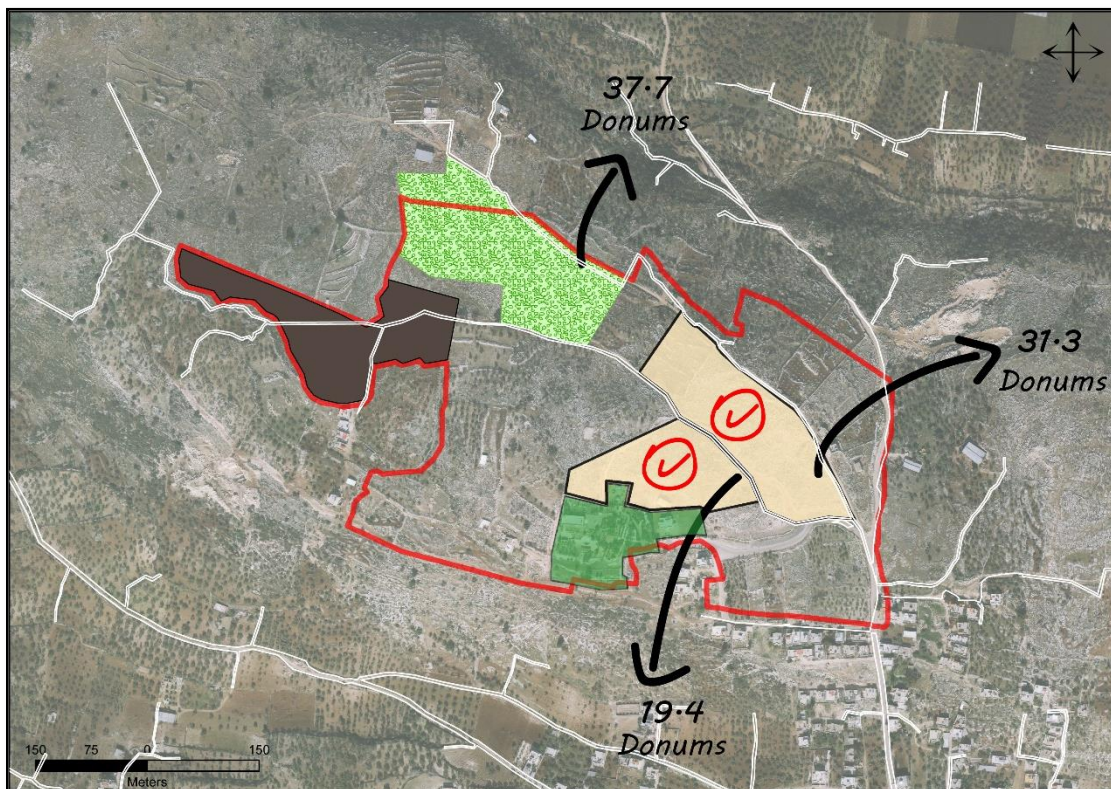
Site Analysis:

General overview

After this process for site selection, the site of Arraba was selected for the sustainable housing project. A field survey was made and information from the municipality was collected for further analysis of the site.

As seen in map (number) the borders of the state lands in the red color with an area of 258 Donums. After checking the maps for the land from the municipality, more information appeared about the land which is that a big part of it was privatized for some people from Arraba to use for a period of time, and another part of the land was Arraba Park and a suggested agricultural school. All of these limitations were presented in a map to make more clear.

As seen in the map after excluding all of the limitations, two parcels of land stayed available to use with an area of 31.3 Donums , 19.4 Donums and 16.5 Donums for the existing park and kindergarten And so we have a total area of 67.2 Donums to be used for the housing prject. The Green polygon in the west



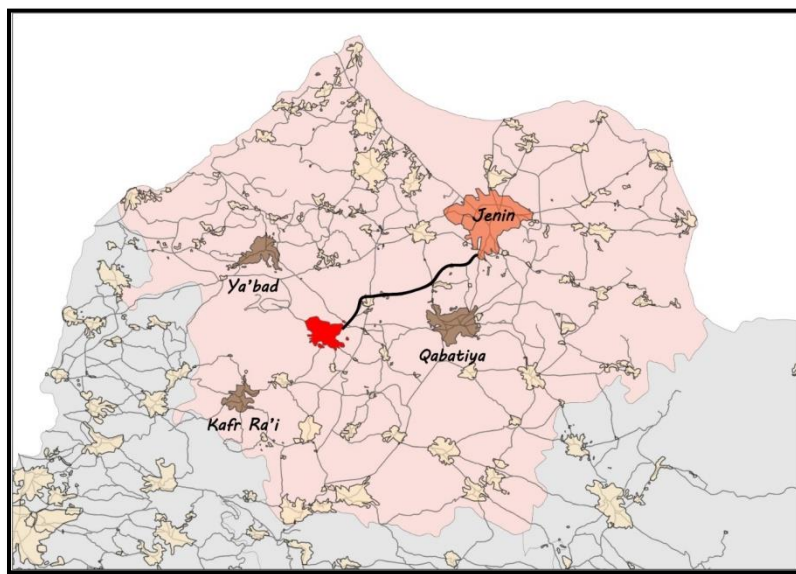
Arraba town is located to the south west of Jenin city and in the south-western part of Jenin governorate. It is surrounded by three large Palestinian communities which are Ya'bad, Kafr Ra'l and Qabatiya with a distance of 7 KM, 6.5 KM and 6 KM respectively from each community.

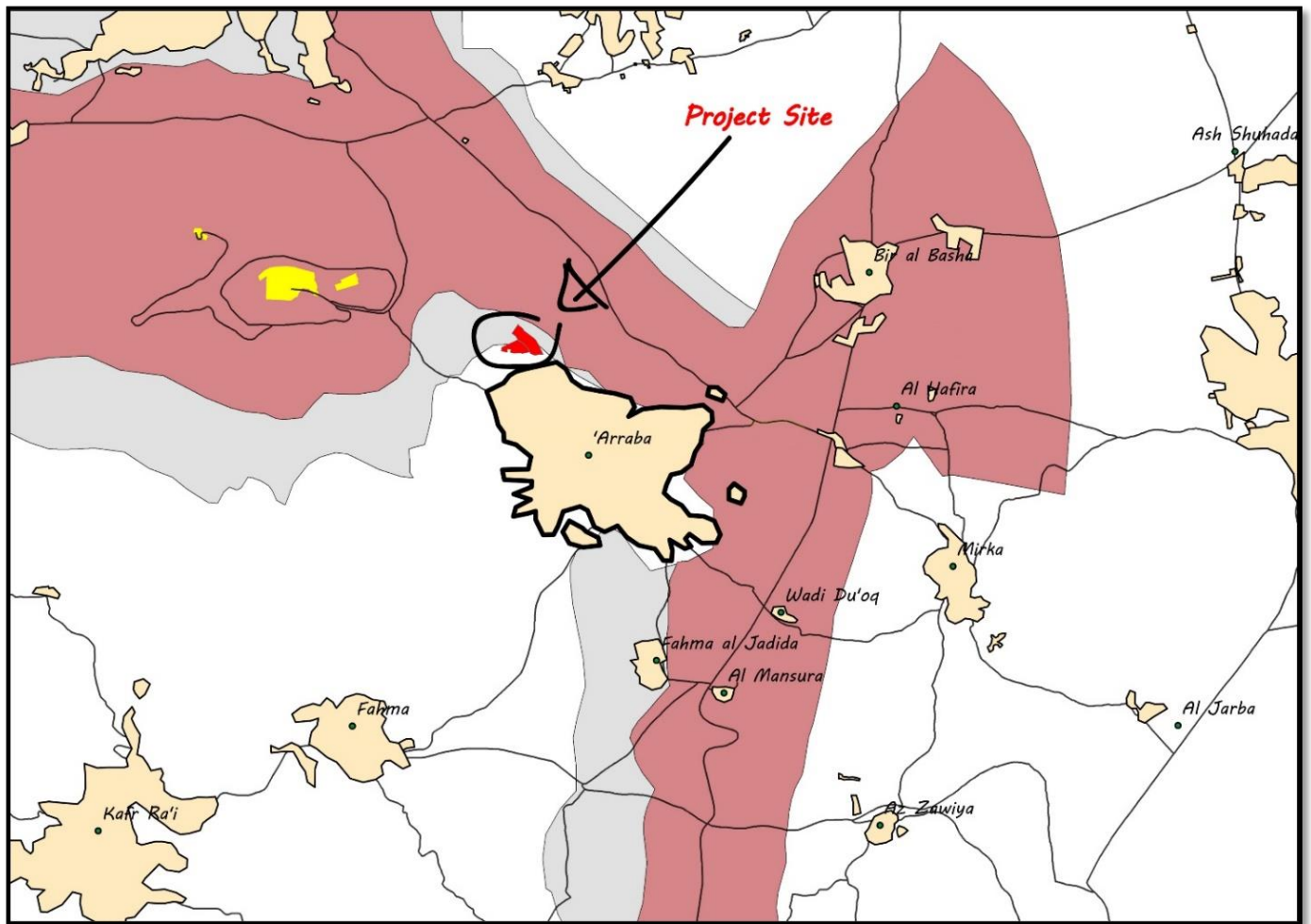
And it is 11 km from Jenin. Arraba and the three large communities around have a population of 62269 which forms a big demand for housing in the area.

Part of the Land shown in the map is proposed to make an afforestation project in it with an area of 37.7 Donums. So the selected land is closer to Arraba, has larger area and not contradicts with any proposed projects by the municipality.

Political condition

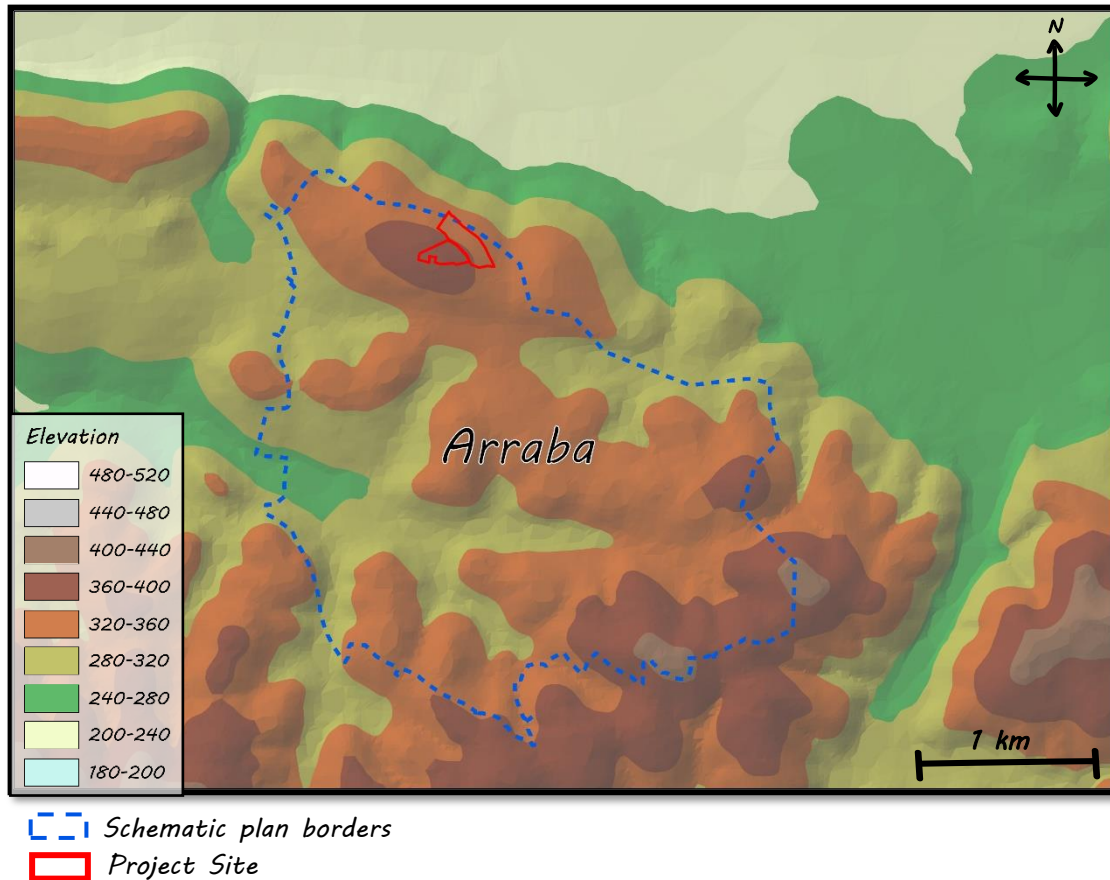
About the political conditions in the project area, the site is not located in C area but it's close to it. 34.4 Donums (68%) of the project land is located in A area while 16.3 Donums (32%) is located in B area. An Israeli settlement is located above a hill 1 km to the west of the site and it doesn't form any threat of political problems.





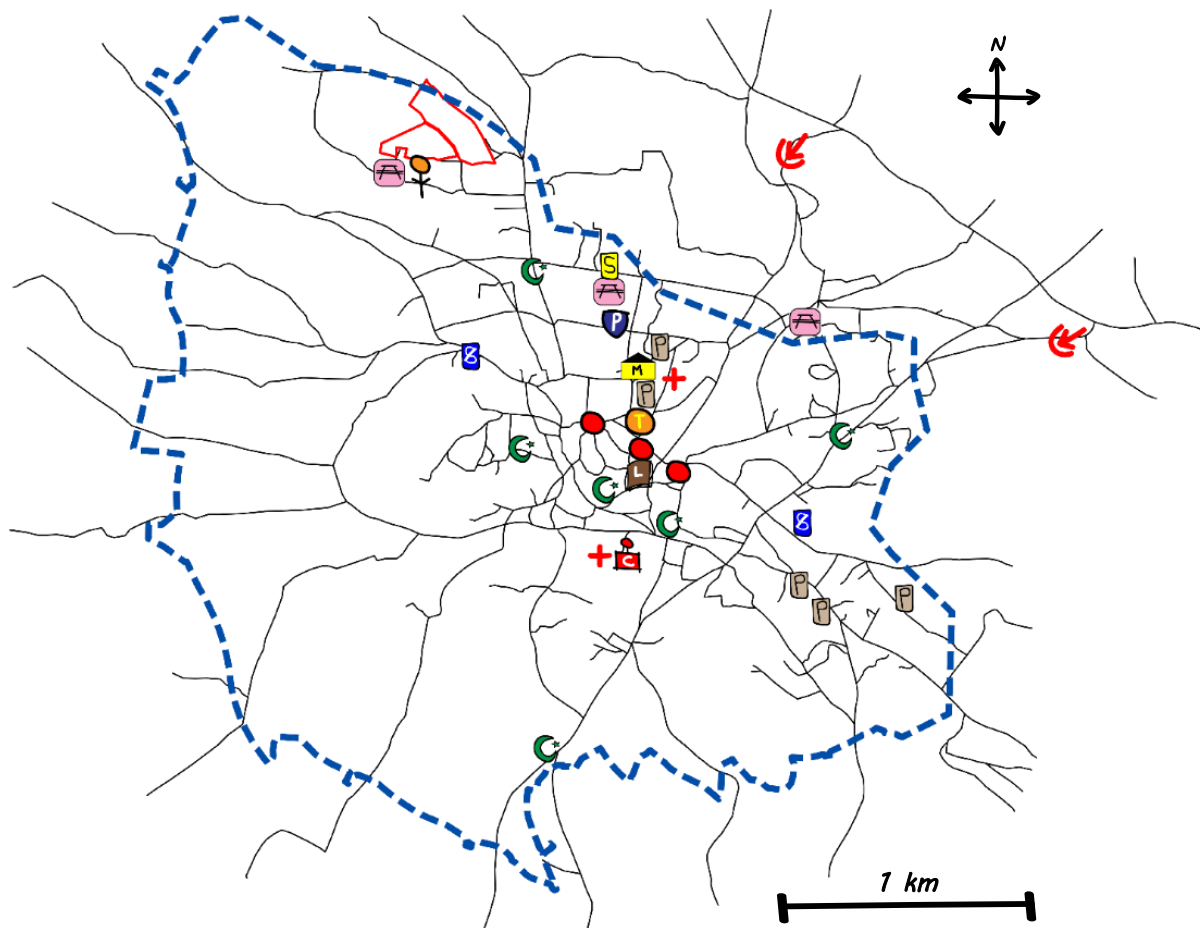
Topography

The site is located on a high land as shown in the map which gives a beautiful view for Arraba agricultural plain. The photo (number) shows the view from Arraba plain towards the project site.



Services:

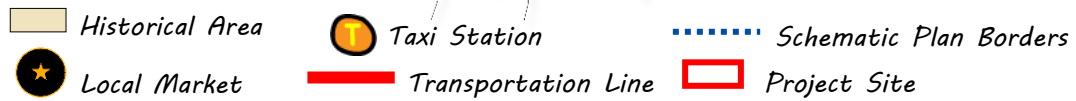
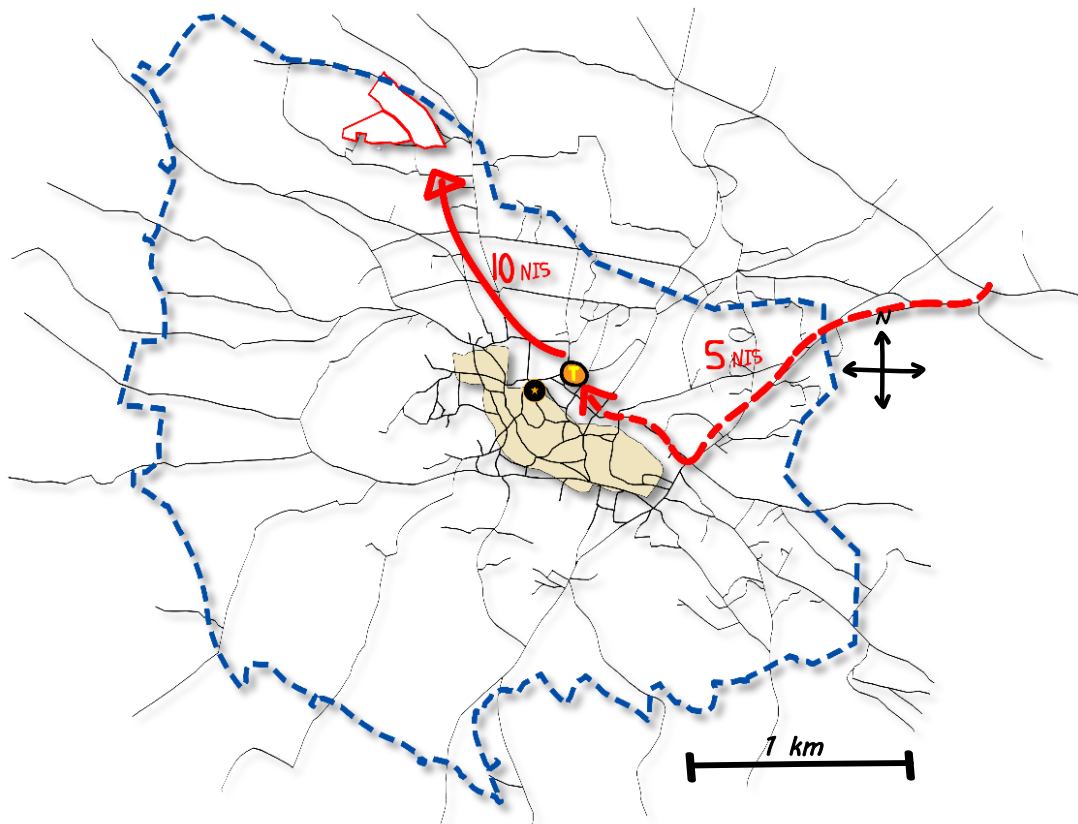
After a detailed field work, all of the services in Arraba town were located in a map to see what are the services that can be used and are within a walkable distance from the housing project and what are the services needed to be made inside the housing project. This way of analysis will emphasize the social connection between the housing project and Arraba, and so no making and



isolated housing project.

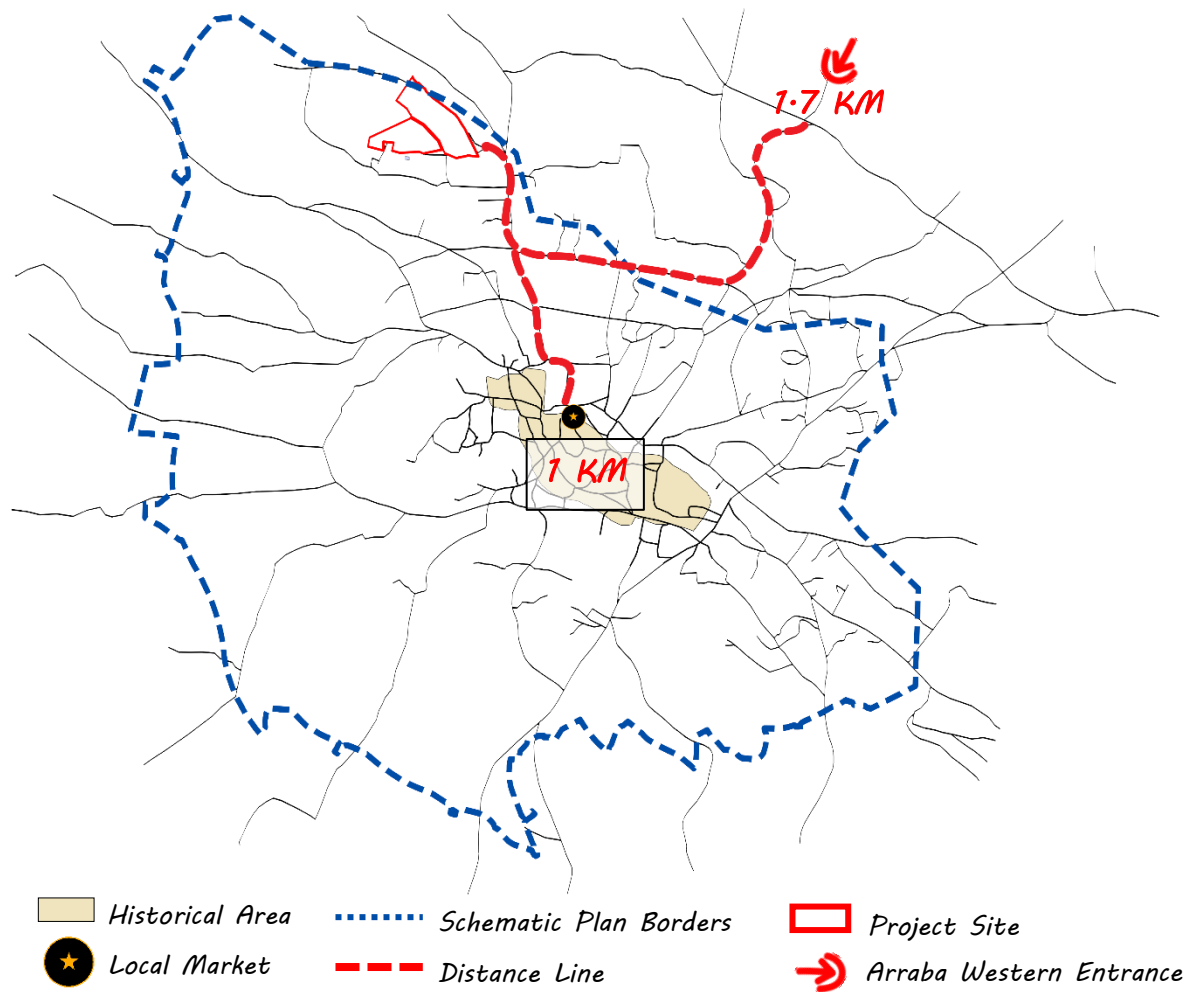
After presenting all of the services, each service was checked separately to see if it's located within a walkable distance from the housing project or not The transportation line to Arraba is available from Jenin city by bus and it costs 5 Shekels but for moving to the site, 10 shekels must be added to take a taxi from Arraba to the project site The site has water and electricity infrastructure but it misses the sewage system and depends on the Absorbency Holes which cause a negative impact for the environment and works against sustainability.





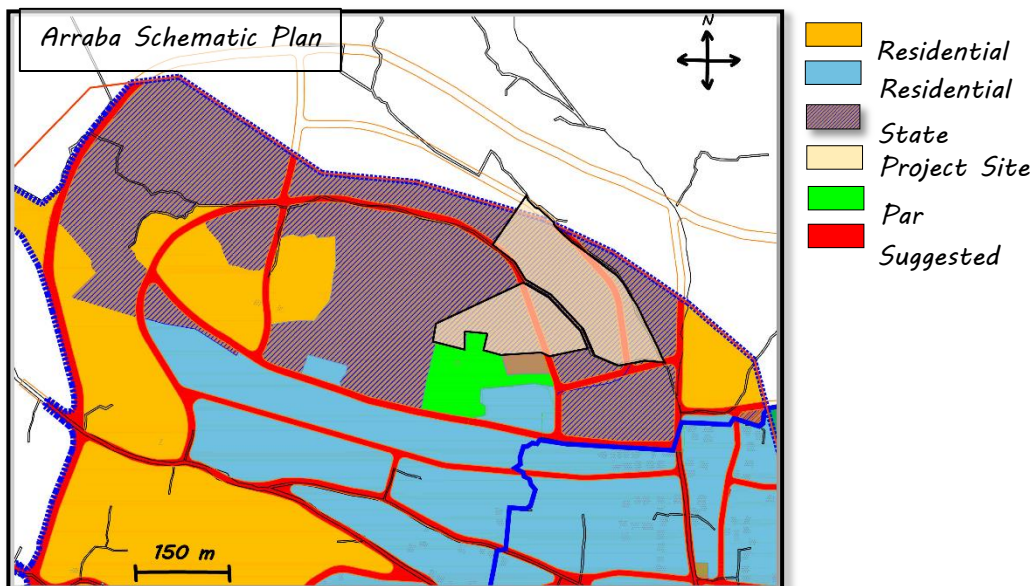
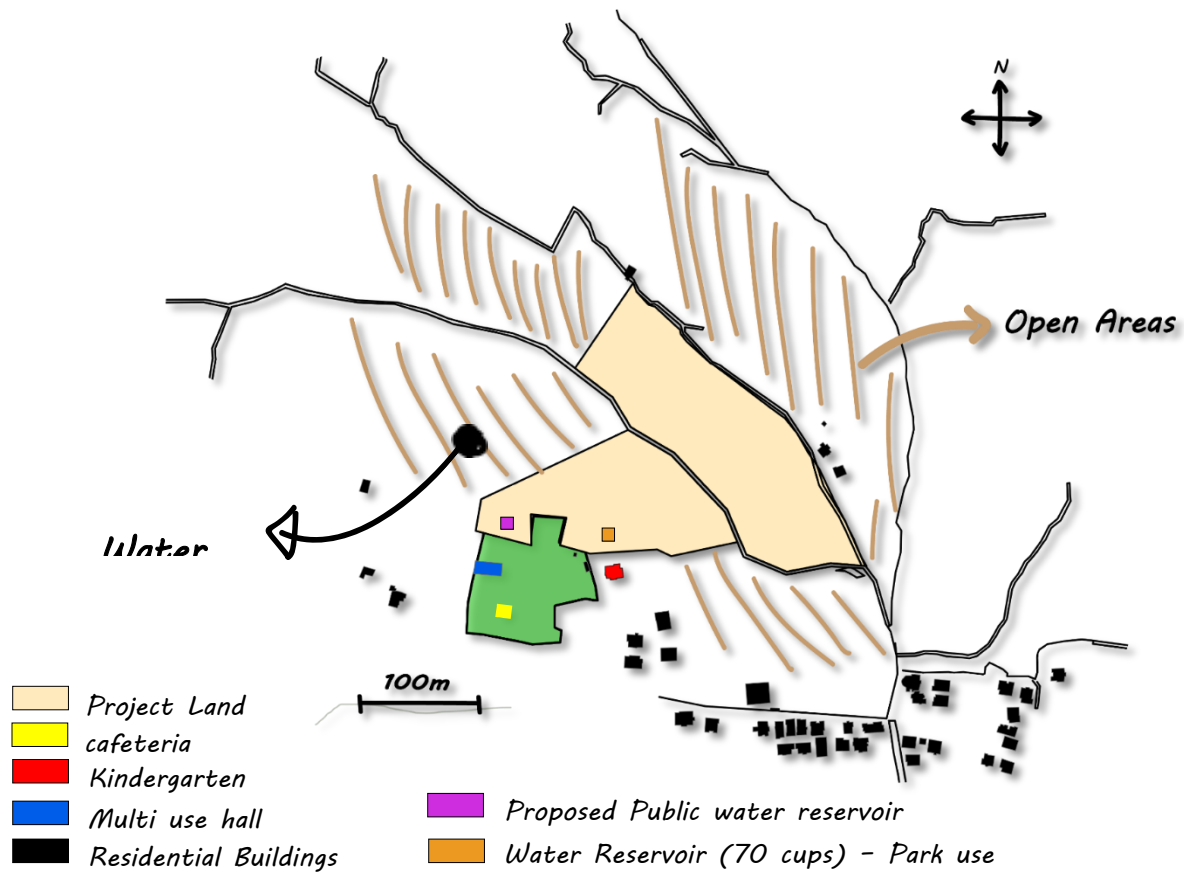
<i>Service</i>	<i>Walkable Distance</i>	<i>availability</i>
Primary Schoold	500m	X
Secondary Schoold	800m	✓
Kindergarten	300m	✓
Health Service	800m	X
Mosque	800m	✓
Local Market	500m	X
Police	800m	✓
Civil Defence	1500m	✓
Transit Station	400m	X

The project site is located 1 km from the local market and the center of the historical area, and 1.7 km from Arraba western entrance.



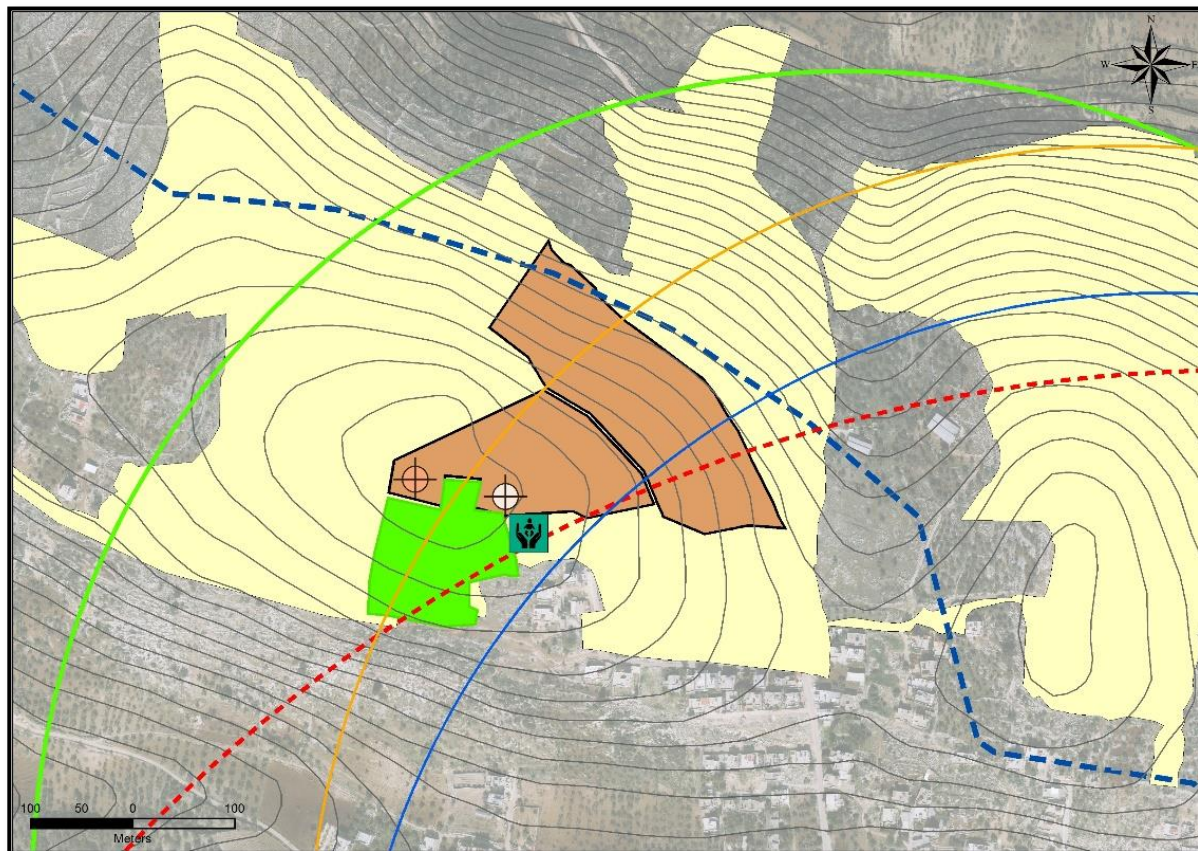
The site is surrounded by open areas from three sides and the park in the southern side, there is also a water well to collect rainwater and also a water reservoir for the park use (70 cups capacity) and another suggested reservoir to serve the town .The park has swimming pools inside, a playing area for children, cafeteria and green areas with chairs.

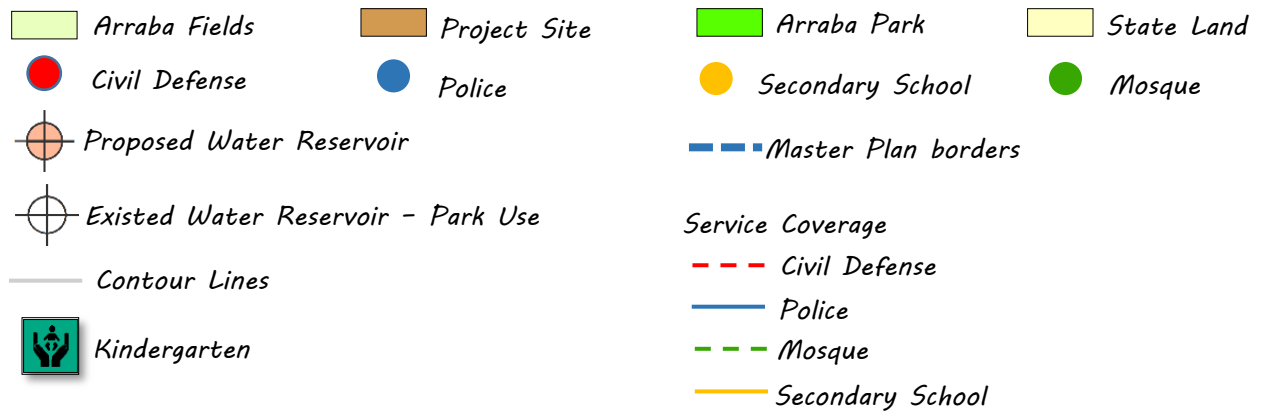
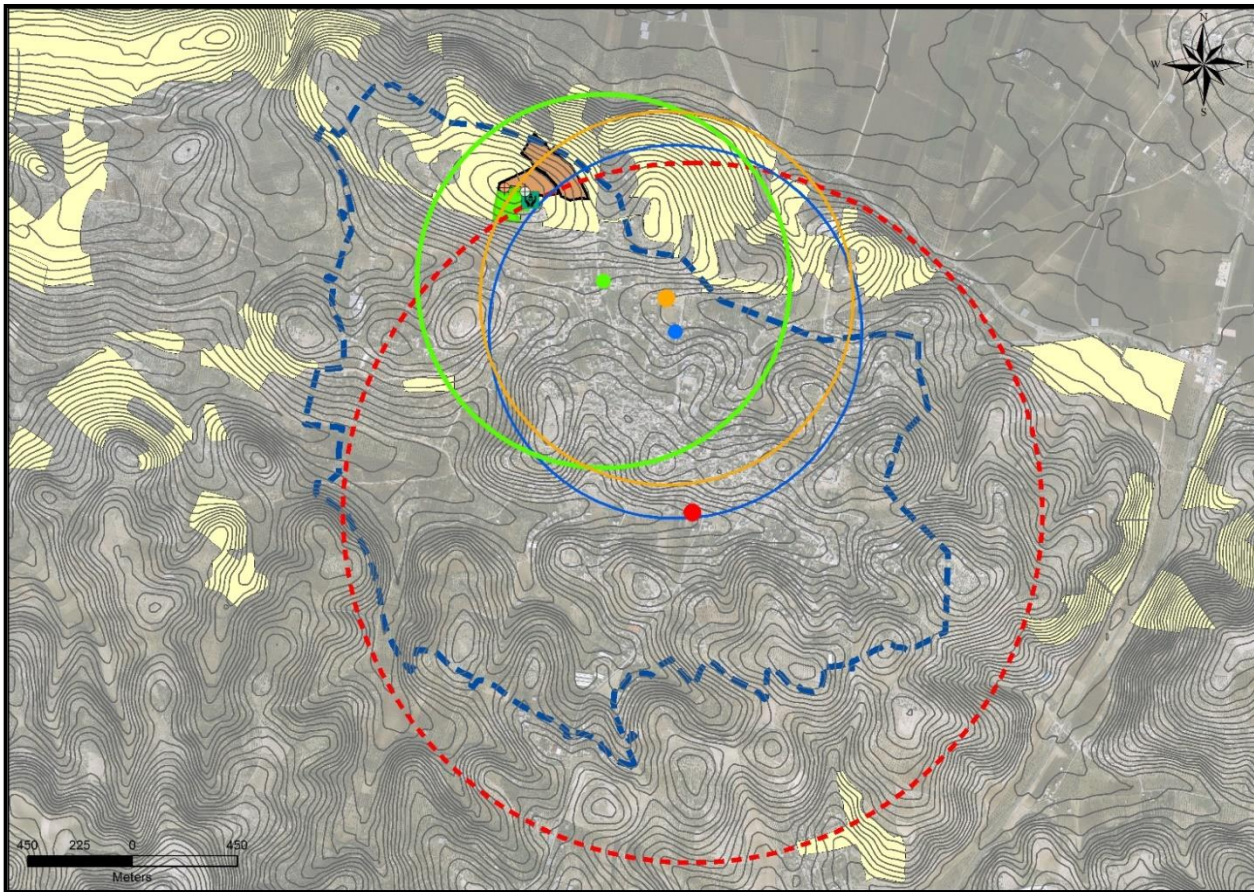
For the schematic plan classifications, the site is classified as state land and surrounded by residential A and Residential B areas and it has also suggested streets.

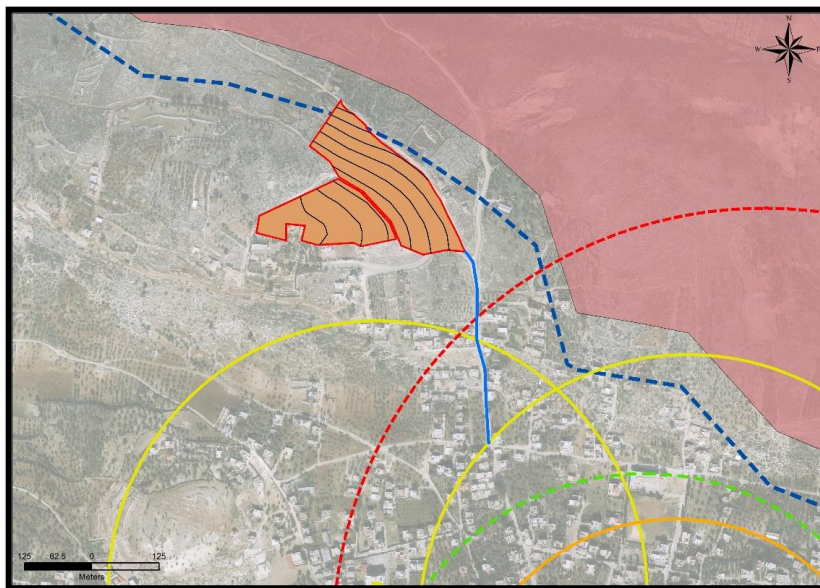
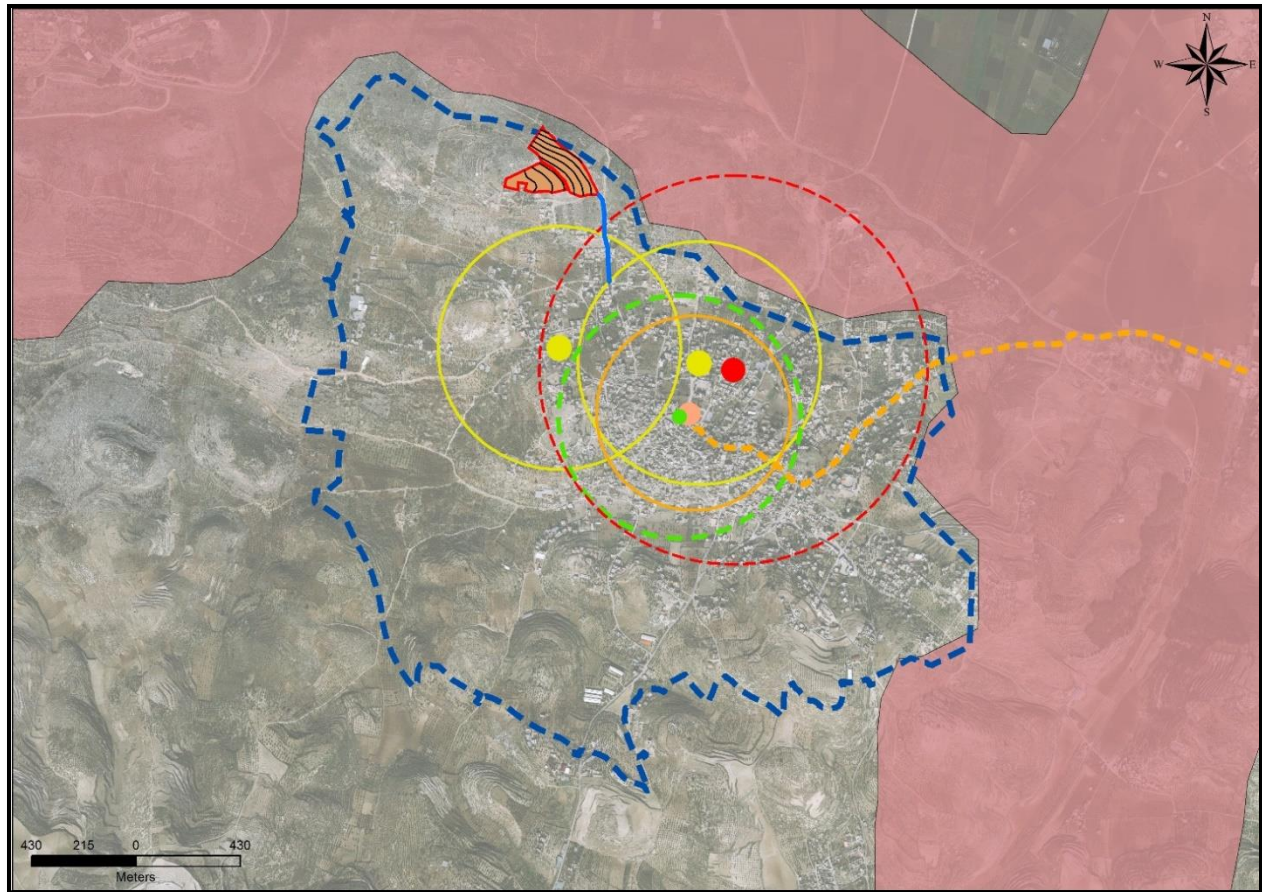


S.W.O.T Analysis

Strength	Weakness	Opportunities	Threats
<u>Sufficient Area</u>	<u>Slope</u>	<u>Adjacent to Public Park</u>	<u>No Public Transportation</u>
<u>State Land</u>	<u>Land Shape</u>	<u>Beautiful Spectacle</u>	<u>Close to C Area</u>
<u>Not Biodiversity Land</u>	<u>No Walkable Priamry School</u>	<u>Adjacent to Kindergarten</u>	<u>Accessible From one Road</u>
<u>Not High Agricultural Value</u>	<u>No Walkable Local Market</u>	<u>Electresity Availability</u>	
<u>Existence of Water Reservoir (For Park Use)</u>	<u>No Walkable Health Service</u>	<u>Water Availability</u>	
<u>Proposed Water Reservoir (For Public Use)</u>	<u>No Sewage Network</u>	<u>Existence of Many Services in Arraba</u>	
<u>Location on the Top of a Hill</u>			
<u>Covered by The Master Plan</u>			
<u>Good Wind and Sun Exposure</u>			



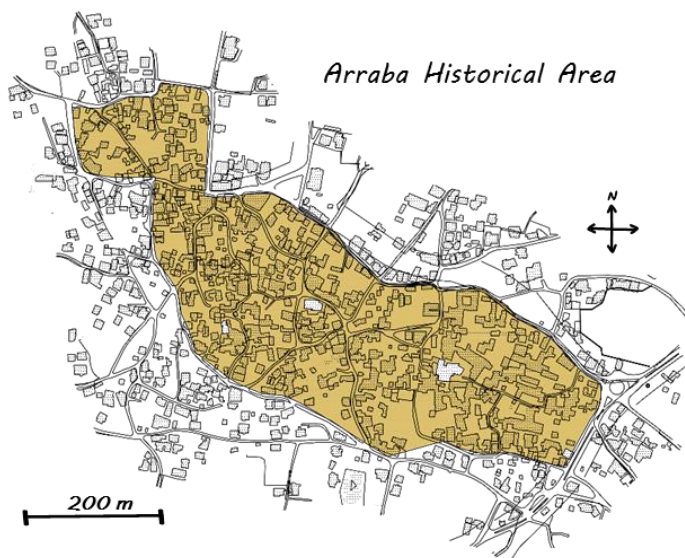




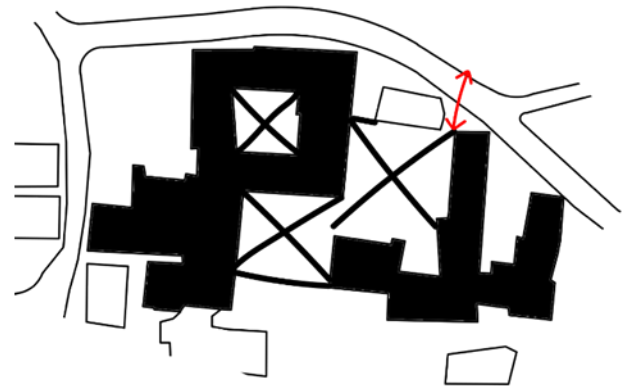
- C Area
 - Health Service
 - Public Transportation Line
 - Project Site
 - Primary School
 - Master Plan borders
 - Local Market
 - Project Access Road
- Service Coverage*
- Health
 - Local Market
 - Primary School
 - Taxi Station

Concept Development

The concept main idea was to make the housing project integrated with Arraba town, and so the main lines of the historical area were taken to form the streets and the main concept of the courtyard houses was taken.



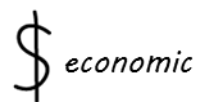
Housing units and shared Space



Traditional Design



Social

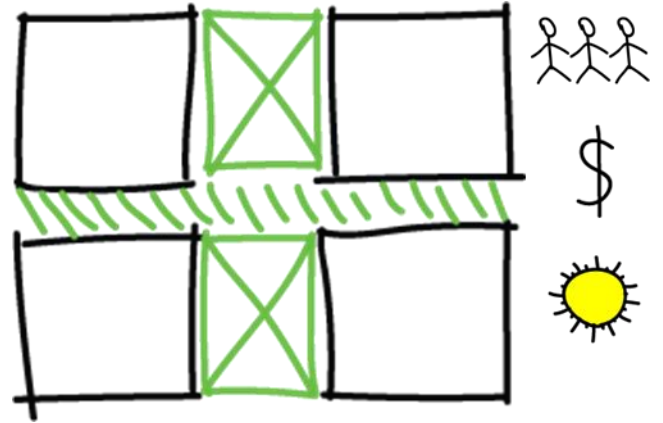


Economic



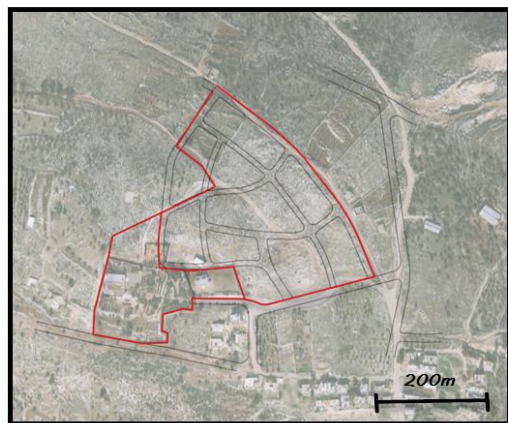
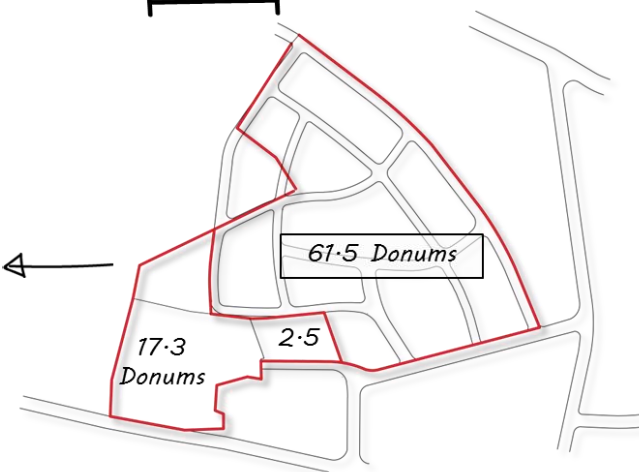
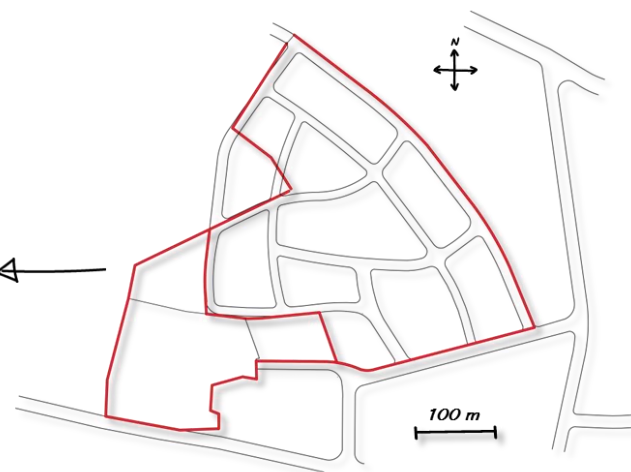
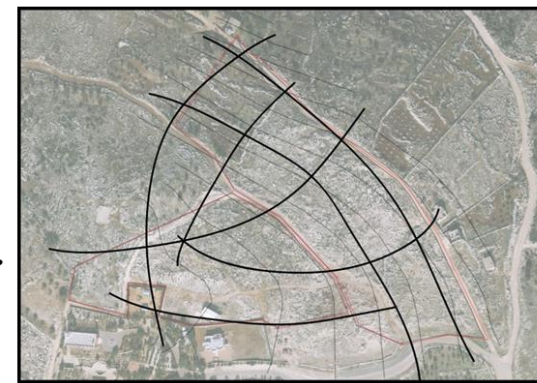
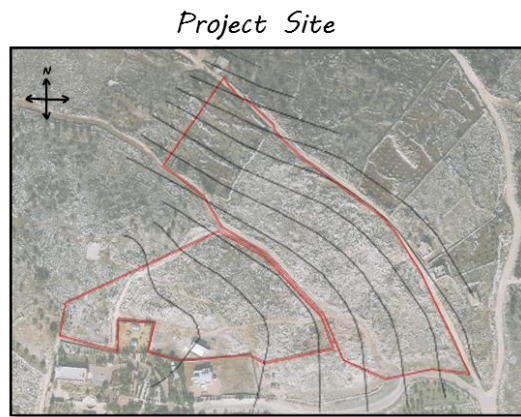
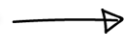
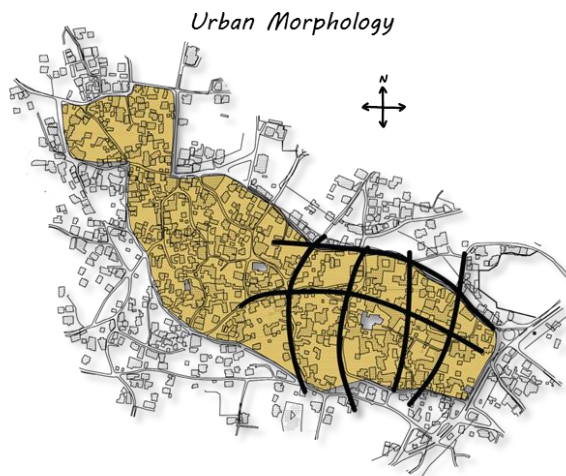
Environmental

Arraba Houses



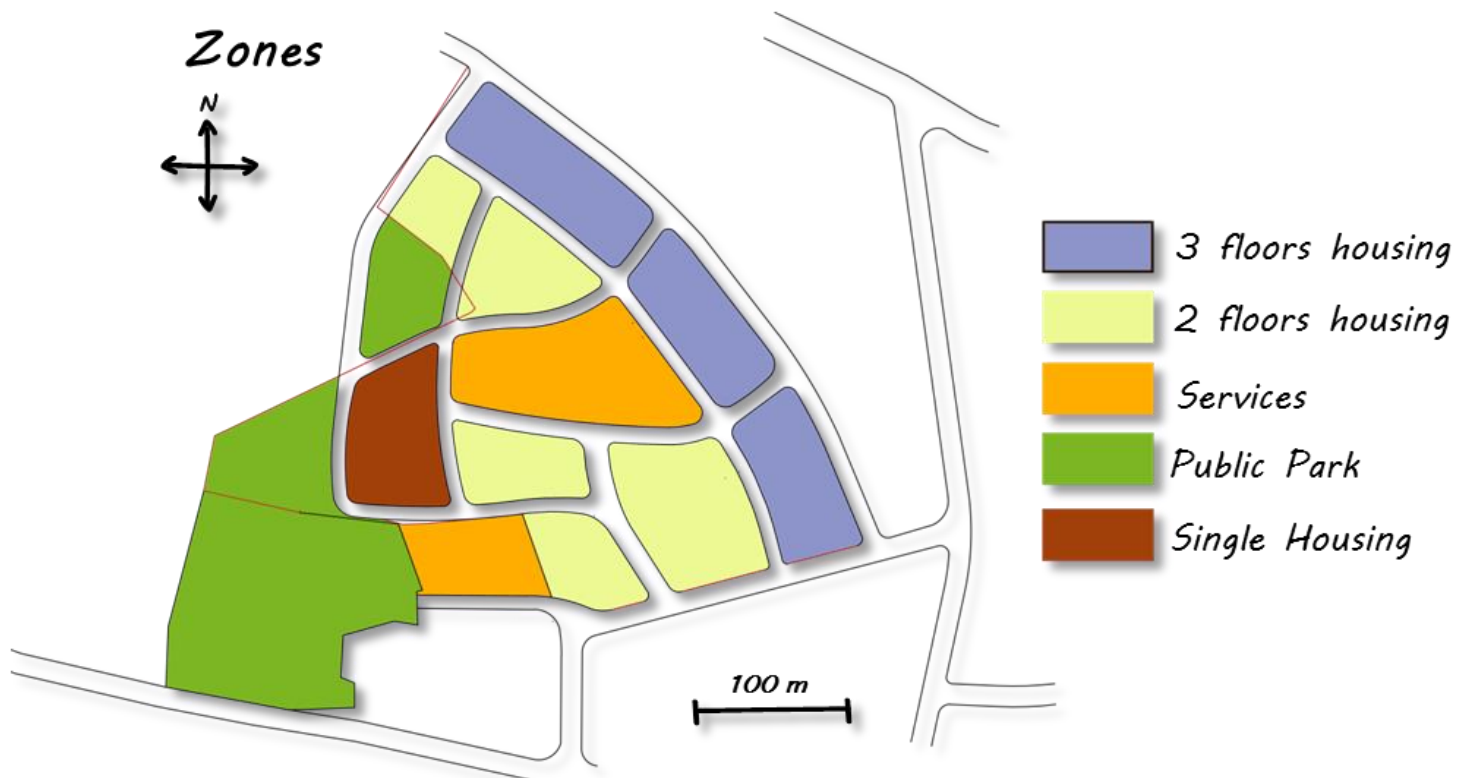
Arraba fields



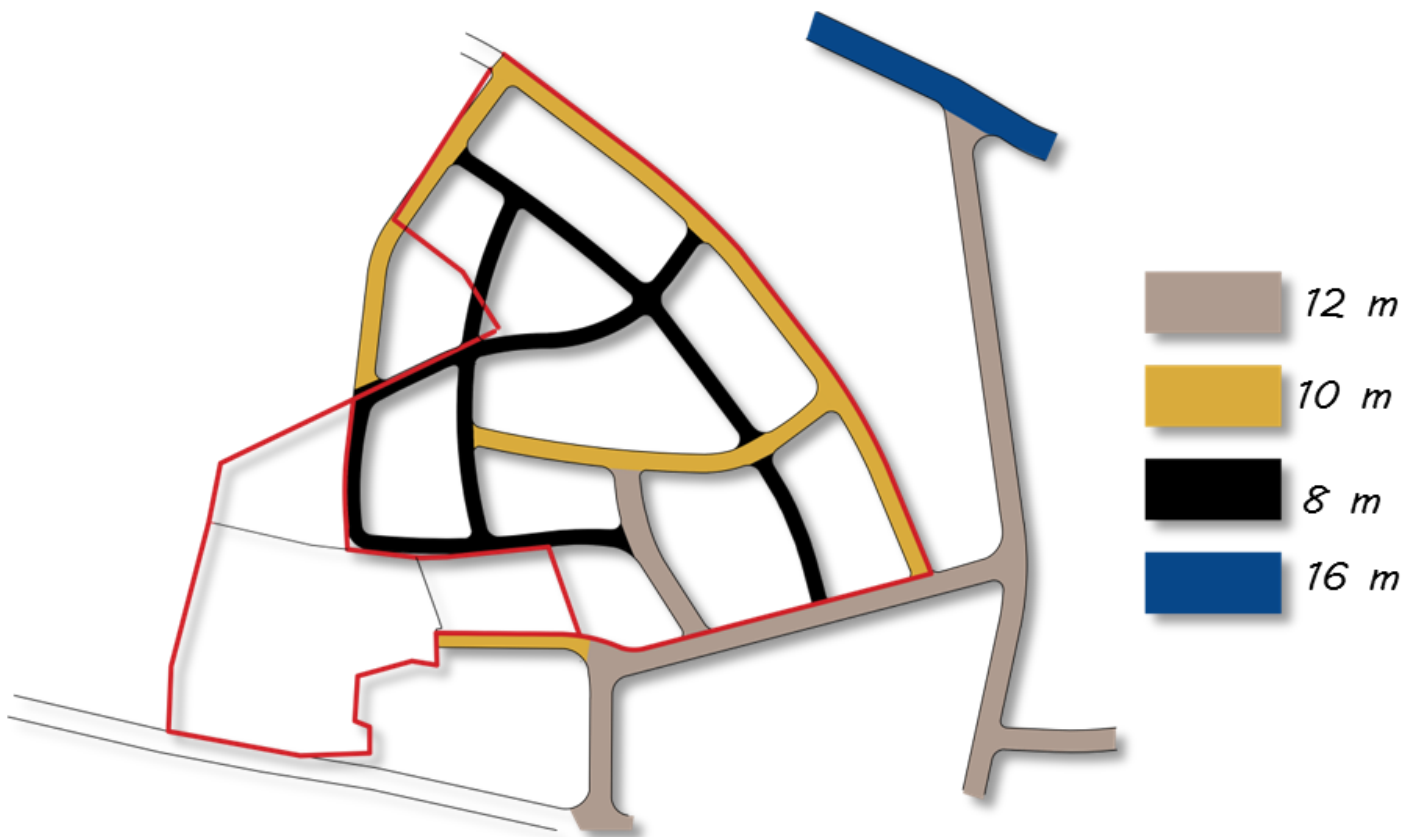


Zoning and Hierarchy

After applying the concept of the urban morphology on the housing site, the zones should be distributed in a way that from high degree of walkability as seen in the following plans, we have three floors buildings, 2 floors buildings, single houses, green areas, and public park and services zones. Also Arraba public park area was increased from 13.2 to 17.3 Donums.



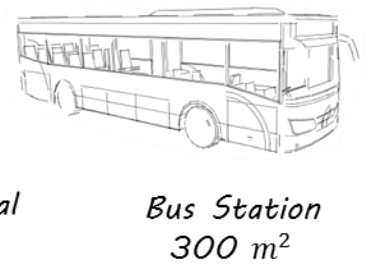
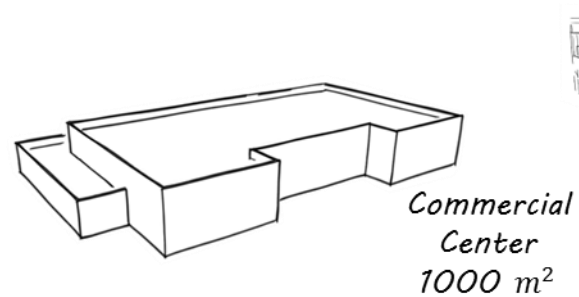
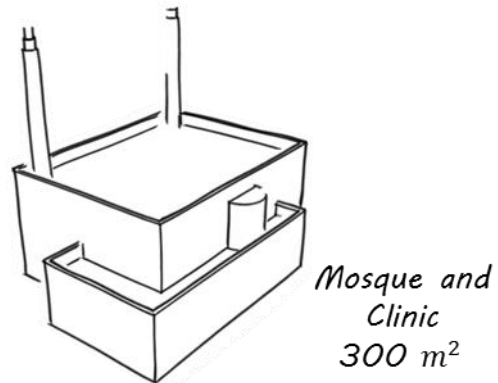
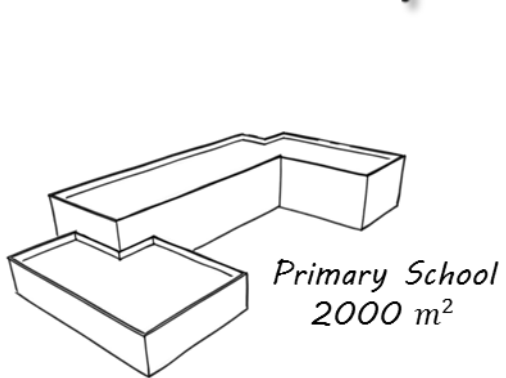
The street hierarchy of the housing project is one of the most essential things to give the area its entrance and character, a schematic road in the dark blue color started with 16m width then to a main axis in the light brown color with 12m width and goes into the housing area then decreased to 10m around the service zones and 8m for the residential areas.



Housing prototypes

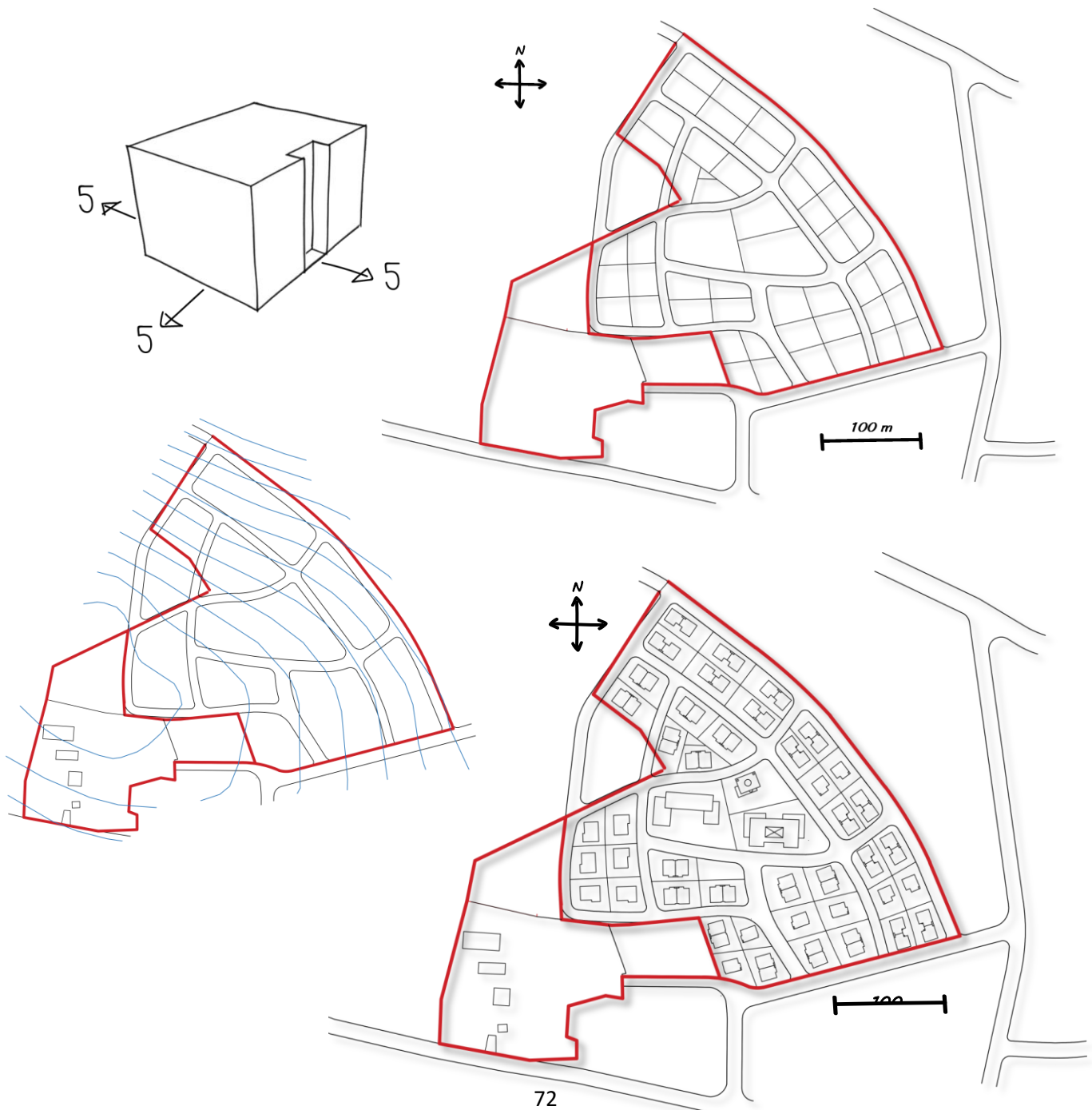
In this housing project, three prototypes of residential buildings were used, the single, the two floors and the three floors. Each building has two apartments in each floor so the three floors building have six apartments while the two floors building have four apartments. The three floors buildings were laid out on a parcel of 550m while the two floors buildings were laid out on parcels of 600m and the single houses on 500m parcels. There are also 1000m commercial center building and 300m mosque and clinic and 2000m school. All of these elements were clarified in the following sketches.

	Floors	Apartments	Area	Parcel



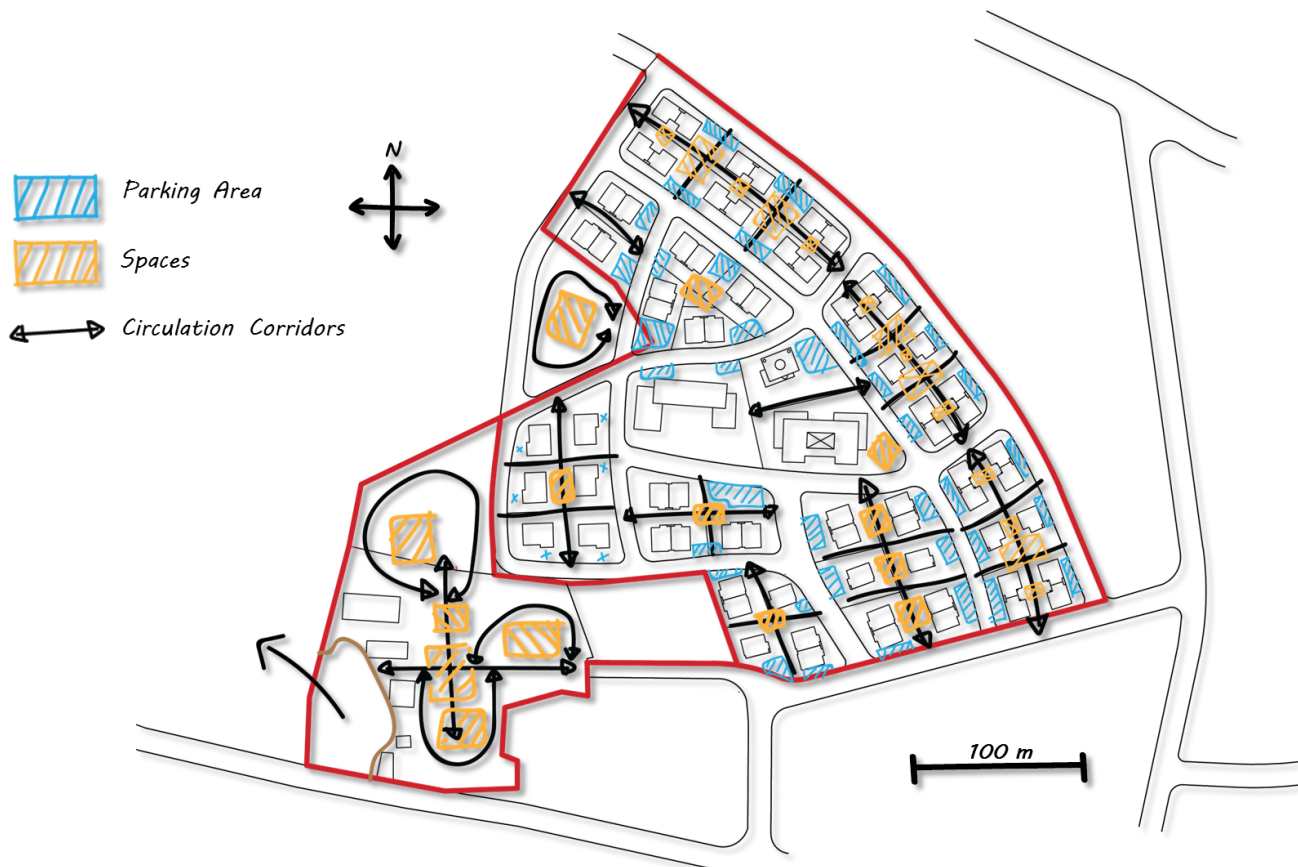
Parcels and Units

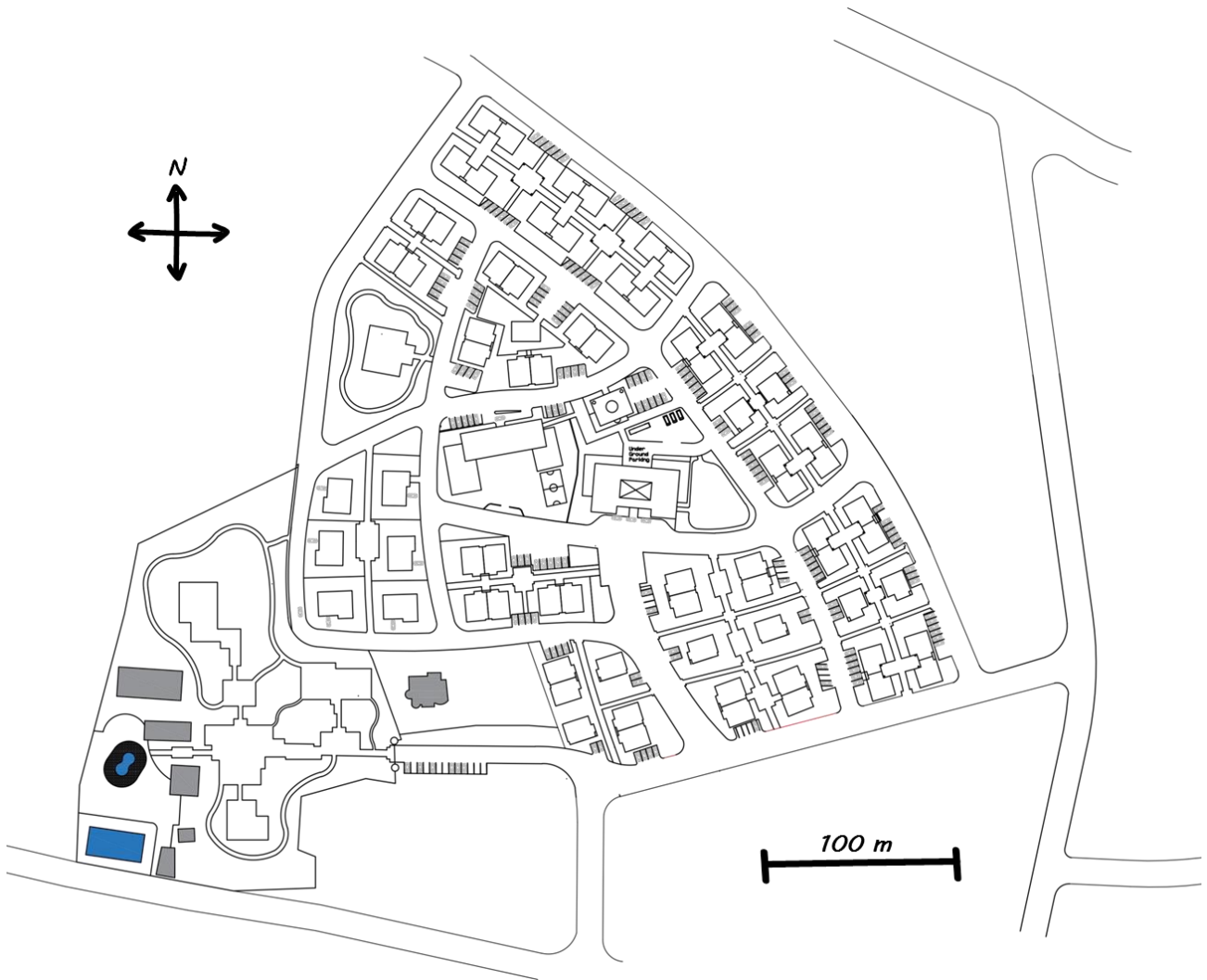
After the zones distribution and choosing the housing prototypes with their parcels areas, a plan was made with the parcels distribution to put all of the units in which has took the contour lines and offsets in consideration. Each housing unit should be away 5m for side, front and back from the other unit and the street.



Spaces and Circulation

The housing prototypes was made, the percolation and zoning and units distribution has been finished. So it's the time to know how to move between these units and streets which is called the circulation. Making all the housing project as walking paths will not be efficient but when we make space at the end of each alley will make the area more livable and from here came the idea of spaces and circulation. The following map shows the circulation and the spaces and the car parking's distribution.





Final Plan

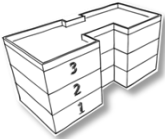
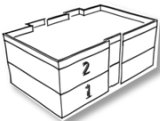
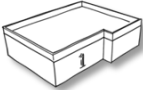
After applying all the principles and goals of sustainability and after distributing the units in the final shapes and the car parking and the green areas, the final plan of the project was made. But the question here is, what is achieved in this final plan? And what are the results that we gained from it.



What is achieved in this plan?

The researcher claimed that this is a sustainable housing plan. But to check this, many statistics and areas were collected and the results were as following.

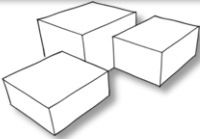
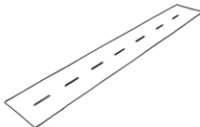
16 unit's three floors can accommodate 96 families, 17 units two floors can accommodate 64 families, 6 single units accommodates 6 families. The total number of families in this project 166 family and by taking the average number of members as 5 in each family then the population of this project will be 830 persons. About the built up area, it was just 19% of the land area which is very good and indicated that most of the area are open spaces. And the percentage of the streets is 25% which is an ideal percentage for streets.

	#	Families
	16	96
	17	64
	6	6

Total
166 Family



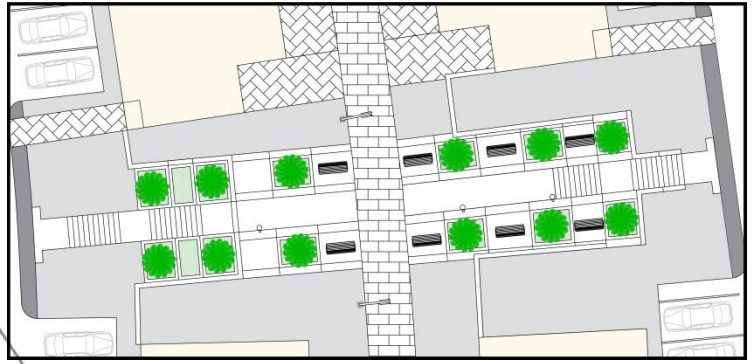
830

	%
 Built up Area	19%
 Streets	25%

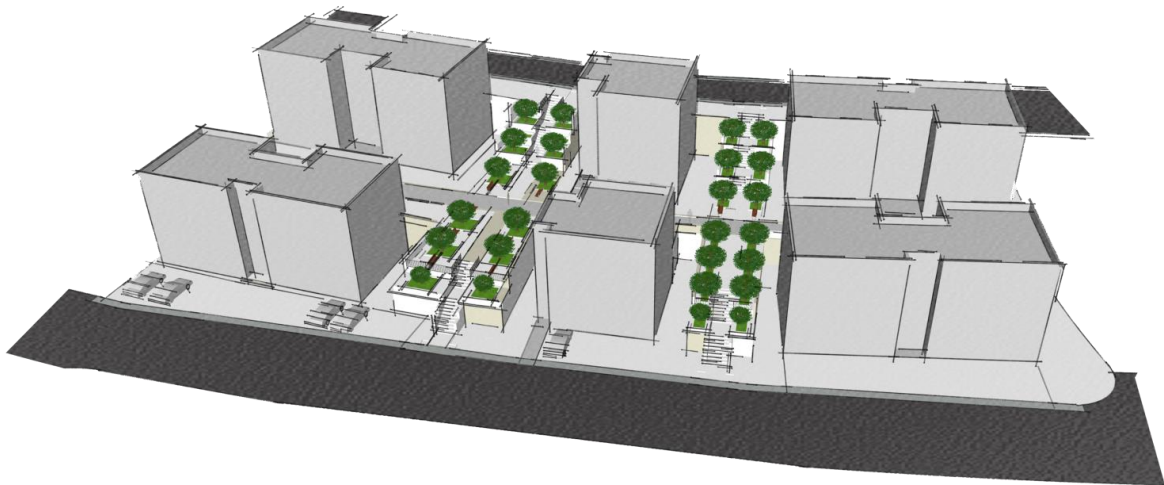
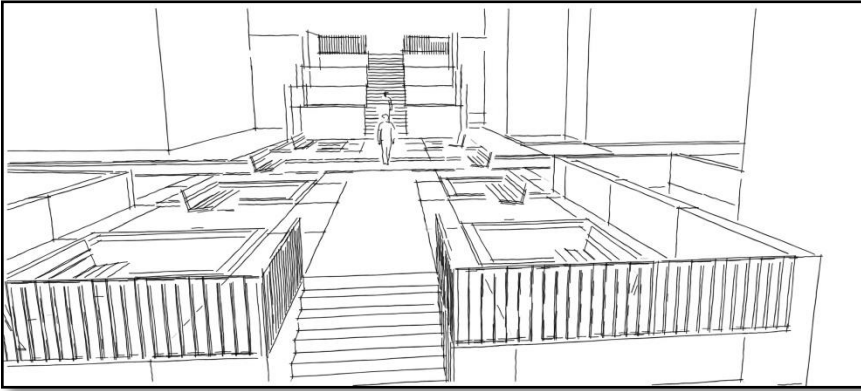
Site Design – Example

To clarify how the site will be designed and the slope will be solved, a housing block was taken to show the details. This group of houses consists of six housing units, between each two houses there are semi-private space and green area as seen in the 3D shots. The site was designed using stairs to move between the two streets since there is 8m difference in elevation between the streets.





— Contour Lines

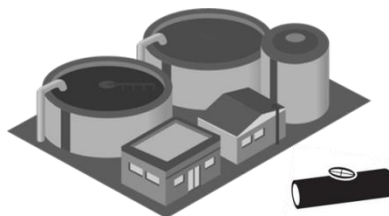


Sustainable Design Proposals

From the beginning of the project, everything was about sustainable planning and housing planning, but what about sustainable design? As urban planners we are not asked to make detailed design for sustainability elements but there are important issues should be mentioned to make this housing project as sustainable as possible. First of all, using local buildings materials, and environmentally friendly materials, to reduce pollution and to protect the surrounding environment from being destroyed. Secondly, to construct a water treatment plant an sewage system to prevent the absorption holes from polluting the land and water. Thirdly, to use solar cells in houses and street lights to reduce costs and electricity consumption, finally to make many open spaces and walkable areas and playing areas to make social sustainability .



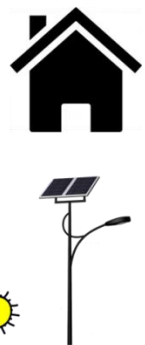
Local Construction Materials



Treatment Plant And Sewage System



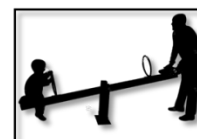
Solar Cells



Open Spaces



Walkability



Playing Areas

References

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- 2- UNHABITAT, 2012, Going Green.
- 3- UNHABITAT, 2012, sustainable housing for sustainable cities.
- 4- Nick Nuttall, 2013, integrating the environment in urban planning.
- 5- Todorov & D. Marinova, 2009, models of sustainability
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- 9- Dr. Paul Hendler and Lisa Thompson, 2007, sustainable housing.
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