CRP 514 : Introduction to Geographic Information Systems

Term 112

TERM PAPER

(Open Spaces Development using GIS)

Jalmuda District in Jubail Industrial City as A Case Study

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1.0 Introduction

In 1975, the Kingdom of Saudi Arabia completed its Second Development Plan align text for economic diversification and industrialization.

The central focus of the development Plan was the development of hydrocarbon-based and energy intensive industries, including the production, refining and manufacturing of fuels, petrochemicals, steel and aluminum.

Two cities were established to implement the Kingdom's industrialization aspirations, including one in Jubail in the Eastern Province.

The Royal Commission for Jubail and Yanbu ("RCJY") was established in 1975 to develop the infrastructure required to transform Jubail into planned industrial cities.

Today, the RCJY continues to be responsible for planning and implementing infrastructure plans and well integrated public services for the development of Jubail and Yanbu.

Jubail Industrial City (JIC) is now a well-established, world-scale petrochemical industrial center.
It is Saudi Arabia's leading centre for foreign joint venture capital and overall investment.

2.0 **OVERVIEW**

The essence of a community lives within its diverse neighbourhoods, its schools, its abundant parks and lush open spaces, its vibrant commercial areas and welcoming community facilities. Since the design and construction of these community elements have a lasting impact on community residents, standards governing future development are of paramount importance.

The purpose of this report is to review and analyze existing community facilities in Jubail Industrial City (***JIC***) and make recommendations for new community planning standards.

JUBAIL CITY & THE HOUSING GROWTH

Residential areas being made to develop new housing facilities to accommodate about 50,000 additional people in the new 1,000 hectare Jalmudah District of Jubail City.

When fully operational, Jubail 2 is expected to generated about 55,000 new direct jobs along with over 330,000 indirect jobs.

For that, the new *OPEN SPACES* will be characterized by extensive landscaped plazas, pathways, streetscapes and green spaces that will improve the environmental quality of the site as well as provide beautiful park spaces for the community.

The overlay method assigns values to thematic data (land cover, property lines, pathw ays and green spaces).
that are a measure of the ability of that condition to accommodate a particular use.
Multiple data layers are then overlaid and their overlapping values summed.
The results indicate the most desirable locations for the use in question.

This technique, will eventually reduce impervious areas with porous paving materials and increasing green spaces.
Also, street trees and a landscaped roundabout on avenue Street that will transform its role from a "back door" into a major gateway into the community city.

figure(1) :Jubail Industrial City Community Area Size

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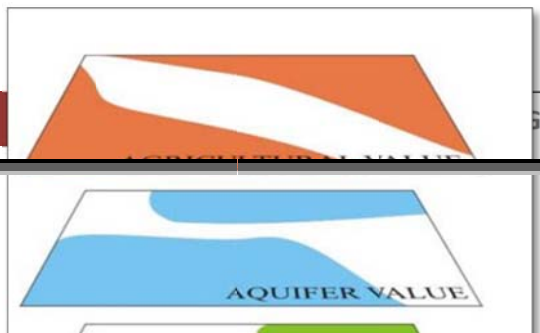
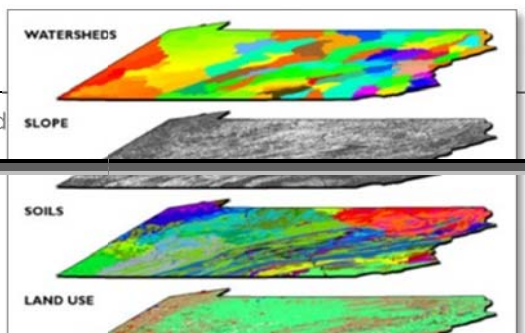
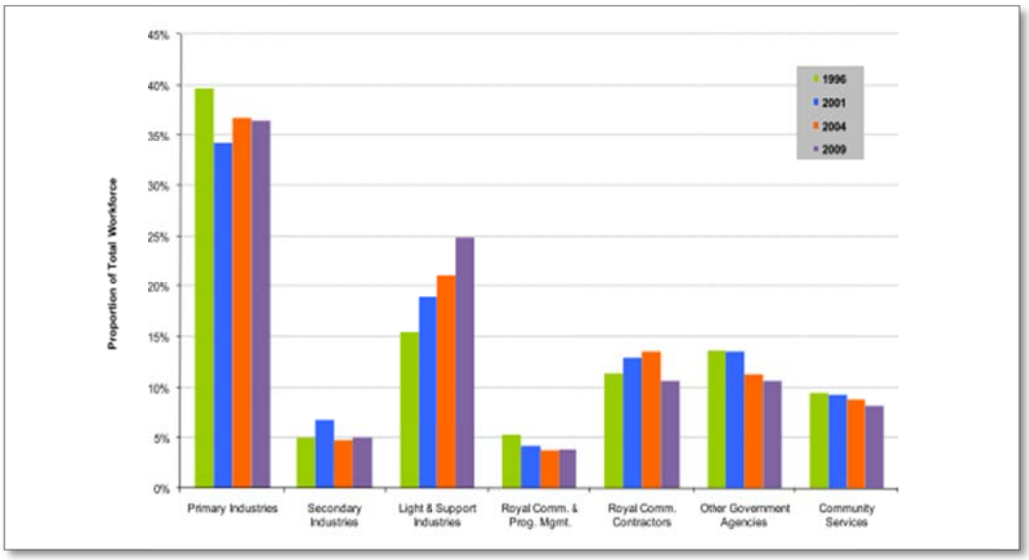




3.0 **POPULATION TRENDS**

Population Trends according to the Seventh Census Report for JIC 2009, the resident population of JIC more than doubled to 105,367 persons from 1990 to 2008.
In comparison, the resident population of the Kingdom increased by about 50%.
As shown on Table 2-1, the population of JIC increased by 6.5% on average per year from1990 to 2004.
In comparison, the annual growth rate in the Kingdom averages 2.9% over the same period. Between 2004 to 2009, JIC's growth rate was 2.3% per annum.

figure(1) :Jubail Industrial City Community Area Size By District and Classification



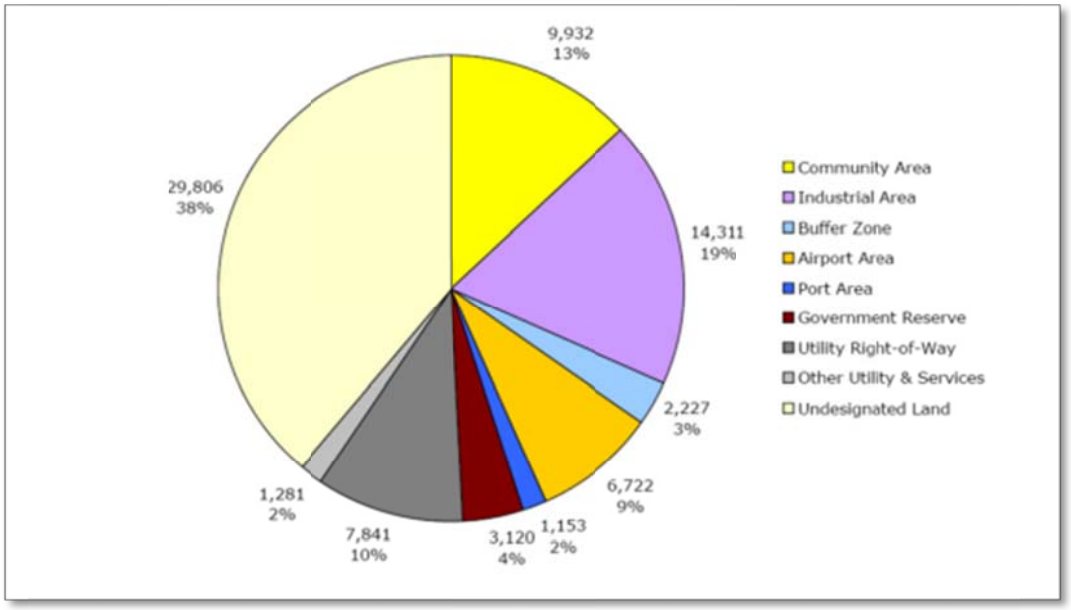
4.0 GENERAL LAND USE

JIC covers a land area of approximately 76,300 hectares (ha) or 763 square kilometers (km2). Undesignated areas within JIC account for over 38% of the total land mass within
the limits of JIC.

The Industrial Areas occupy 19%, the Community Area occupies 13% and Utility and their services occupy 12%.

Other land uses include Airport lands (9%), Government Reserves (4%), the ports (2%) and the Buffer Area (3%). As shown on Figure 2-3, just less than 40% of the city's land base is undeveloped and undesignated.

figure (1): General Land Use Area Breakdown (ha)



4.0 **COMMUNITY LAND USE AREA**

Intended to be the focus for long term community development, JIC's community Area is comprised of eight districts covering 9,800 ha of land.

The eight districts can be classified into three types:

- Existing developed areas (or built up area)

- Areas with approved plans/under development.

- Areas with no approved plan.

table(1):Jubail Industrial City Community Area Size By District and Classification

Districts	Area (ha)	Percent	Status
Al-Fanateer Al-Deffi Eastern Corridor *	2,900	30%	Existing Developed Areas
Jubail Industrial College	100	1%	
Jalmudah Al-Mutrafiah Mardumah	3,200	32%	Areas with Approved Plans/ Under Development
Jubail University College Proposed City Centre	200 300	2% 3%	
Al-Reggah Al-Surouge Al-Fasil	3,200	32%	Undeveloped Areas
Total	**9,900**	**100%**	

A generalized spatial analysis of the existing developed area in the Community area shows that roads represent the predominant land use within JIC.
Forty percent, or 1,067 ha of land, is dedicated to roads and adjacent areas.
Residential land uses account for 30% of the existing built up area. The remaining 30% of the built up area is comprised of commercial and community services, educational facilities and parks and public open space.
Table 2-3 provides a more detailed breakdown of JIC's existing developed area.

4.0 DISTRICT LAND USE

Analysis of the land use pattern at a district level shows that there is considerable variation in the amount of existing and planned land uses for certain types of land uses, and that the pattern varies from the community as a whole.

The amount of land dedicated to residential development within the existing and planned districts ranges from 27% (in Al-Fanateer) to 48% (in Mardumah), 21% higher.

The variation for land dedicated to roads and infrastructure is 20%, ranging from 25% (Mardumah) to 45% (Al-Deffi).

The amount of land dedicated to public open space also varies from 6% in the Eastern Corridor to 22% in Al-Fanateer, 16% less.

Other land uses, such as commercial, community services and education are relatively consistent across both the existing and planned districts, suggesting that standards have historically remained unchanged for all districts.

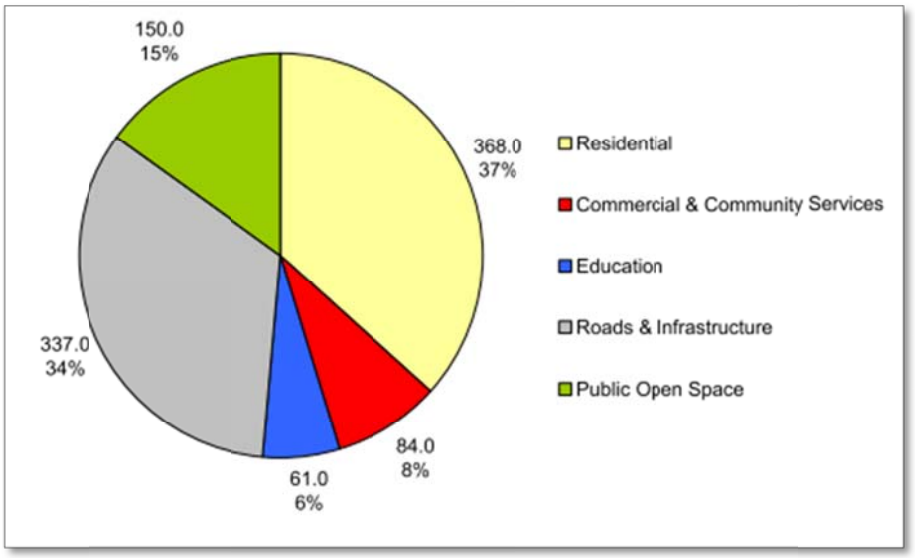
table(2):Jubail Industrial City General Land Use By Planned District

	Jalmudah		Al-Mutrafiah		Mardumah		Sub-Total	
Land Use	**Area (ha)**	**%**	**Area (ha)**	**%**	**Area (ha)**	**%**	**Area (ha)**	**%**
Residential	368.0	37	452.4	47	393.7	49	1,214.1	43
Commercial & Community Services	84.0	8	64.8	7	64.4	7	213.2	7
Education	61.0	6	66.9	7	63.4	7	191.3	7
Roads & Infrastructure	337.0	34	258.1	26	248.0	28	843.1	30
Public Open Space	150.0	15	127.7	13	107.1	12	384.8	14
Total	**1,000.0**	**100**	**969.9**	**100**	**876.6**	**100**	**2,846.5**	**100**

In more recent district plans, there was a conscious effort to increase residential density without dramatically changing built form. Al-Mutrafiah and Mardumah Districts, for instance, have a planned gross density of 9.5 units per ha, which is significantly higher compared to Al-Fanateer and Al-Deffi Districts planned at 6.7 and 6.9 units per ha, respectively. However, public open space was reduced as a tradeoff.

In the future residential districts, there may be an opportunity to decrease road rights-of-way, while maintaining current road widths that could rebalance the land allocation to public open space.

figure (1): Jalmudah General Land Use Area Breakdown (ha)



4.0 **STUDY AREA (** Jalmudah District **)**

The selection of suitable sites is based upon a specific set of local criteria. The following characteristics have been considered for suitability analysis: slope, aspect, flood hazard and visual properties of the ridge line. The analysis determines how these factors will fit into the design process to evaluate site suitability. The data needed for the study was obtained from different sources. The elevation data was obtained from the Shuttle Radar Topography Mission (SRTM) 90 m digital elevation model. Drainage lines were digitized from existing topographic map while the ridge line was digitized from a derived contour map. The elevation data was used to drive slope and aspect for the study area. The distances to the drainage lines and to the ridge line were calculated.

Suitability analysis is performed to identify sites suitable for a specific purpose so that planning and management decisions can be made in a site-specific manner. Land suitability analysis is similar to choosing an appropriate location and mapping a

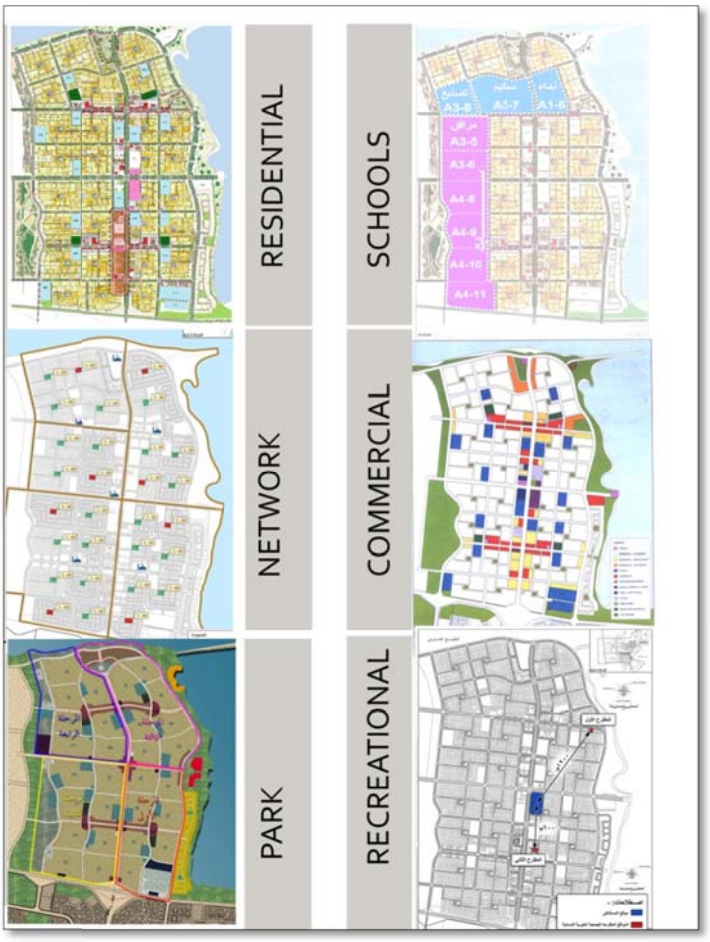
suitability index for the entire study area. It is the fundamental work and an important content of overall land use planning, which requires a scientific approach to guide development, avoid errors in decision-making and over-investment, for sustainable utilization of land resources. The availability of GIS and Multi-Criteria Decision analysis (MCDM) methods allow combining knowledge derived from different sources.

4.0 **IMPLEMENTATION**

Since our objective is to find the best location for playground area In *Jalmudah* district. The selection of suitable sites is based upon a specific set of local criteria. The following characteristics have been considered for suitability analysis :

-**Residential areas** -apartments and villas
-**Commercial areas** -neighborhood, sector and district
-**Schools**
-**Parks**
-**Recreational facilities**
-**Network transportation** - vehicle and pedestrian

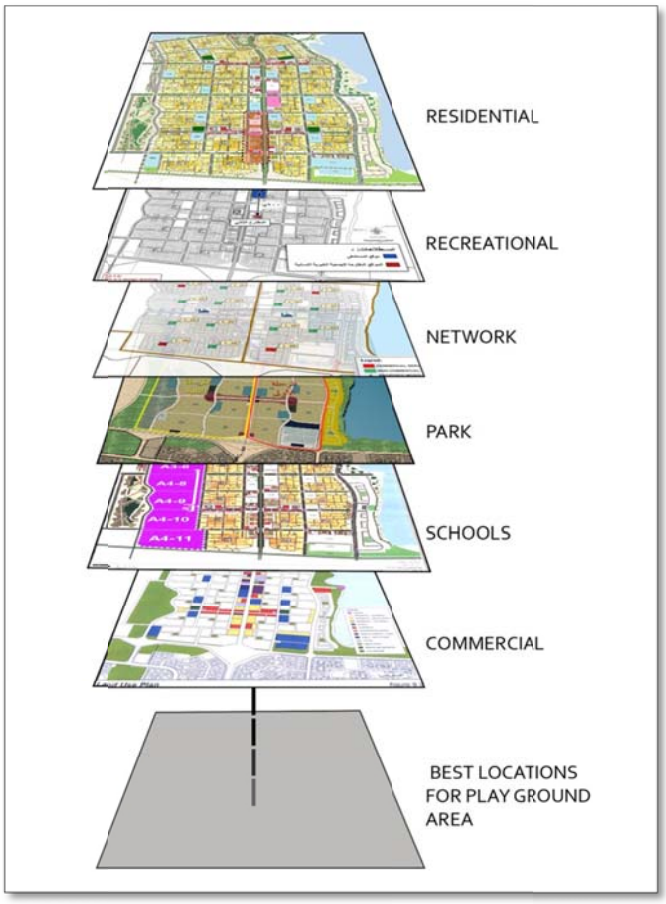
figure (1): Jalmudah General Land Use Area Breakdown (ha)



4.0 USING OVERLAY TECHNIQUE

Multiple data layers are then overlaid and their overlapping values summed the results indicate the most desirable locations for **playground** area which use in question overlays and
can be used estimate the combined effects of multiple properties.

This method has become a standard practice in site suitability analysis and is extremely effective for incorporating natural resource information into planning and design processes.

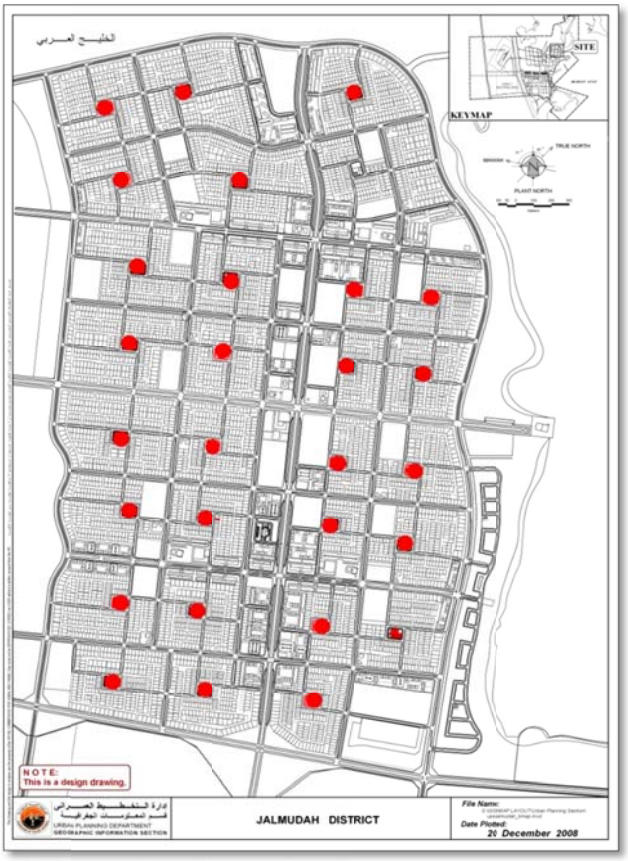


4.0 **DESIRABLE LOCATIONS**

The basic premise of GIS suitability analysis is that each aspect of the landscape has intrinsic characteristics that are in some degree either suitable or unsuitable forthe activities being planned.

Suitability is determined Through systematic Multi-factor analysis of the different aspect.

figure (1) : Results indicate the most desirable locations for playground area



5.0 **SUMMERY**

This paper provides an overview of innovation occurring in the technological and theoretical world of GIS.

Innovations in software and method are pushing well beyond the conventional applicatio n of GIS and developing tools that could vitally improve the practice of landscape archit ecture.

GIS now supports early integration into the design process, offers new analysis techniq ues that expand awareness of neighborhood values, and eliminates social barriers to te chnology.

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