Islamic Republic of Mauritania
Ministry of Land Use, Urbanization
and Habitation (MHUAT)
Urban Community of Nouakchott (CUN)

Nouakchott City Urban Master Plan Development Project In Islamic Republic of Mauritania

Final Report Summary

October 2018

Japan International Cooperation Agency (JICA)

RECS International Inc.
CTI Engineering International Co., Ltd.
PACET Corporation
PASCO Corporation

EI
JR
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Currency equivalents (interbank rates average of April to June 2018)
USD 1.00 = MRU 355.049
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MRU 1.00 = JPY 3.0464
Source: OANDA, https://www.oanda.com

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Abbreviations

AAGR Annual Average Growth Rate
ACCVC Climate Change Adaptation of Coastal Cities
ADU Urban Development Agency
AFD French Development Agency
AFESD Arab Fund for Economic and Social Development
AMEXTIPE Mauritanian Agency for the Execution of Works of Public Interest and Employment
AMU Arab Maghreb Union
ANAC National Agency of Civil Aviation
ANAT National Agency for Land Development
AORTR Authority of Organization and Regulation of Transport
ARE Authority of Regulation
ARTOR Authority for Regulation and Road Transport Organization
ATTM Company of Sanitation of Works, Transport and Maintenance
BDR Road Data Bank
BNT National Office of Transport
BOP Balance Of Payments
BRGM Office of Geological and Mining Research
BRT Bus Rapid Transit
CAD Computer Aided Design
CCC Communal Consultation Committee
CET Landfill
CMC Community Consultation Meetings
CON Consultation and Coordination Meeting
COS Floor Area Ratio
CPAN Nouakchott City Sanitation Unit
CRED Centre for Research on the Epidemiology of Disasters
CTCE China Tiesiju Civil Engineering
CUF Land Use Coefficient
CUN Urban Community of Nouakchott
DCIG Department of Mapping and Geographic Information
DEPAEC Department of Studies, Projects and Planning of the Community Space
DFR Draft Final Report
DGBEP Department of Buildings and Public Facilities
DGDPE General Directorate of State Property and Heritage
DGHU General Department of Habitation and Urbanization
DGIT General Department of Transport Infrastructures
DU Department of Urbanism
DUT Department of Urbanization and Topography
ECOWAS Economic Community of West African States
EEZ Exclusive Economic Zone
EIA Environmental Impact Assessment
EIB European Investment Bank
EMDAT Emergency Events Database
ENER National Institution of Road Maintenance
ENRE National Reference Survey on Employment and the Informal Sector
EPCV Permanent Survey on the Living Conditions of Households
ERRT Institution for the Rehabilitation and Renovation of the city of Tintane
FAO Food and Agriculture Organization of the United Nations
FDI Foreign Direct Investment
FISIM Financial Intermediation Services Indirectly Measured
FR Final Report
FTP Technical and Vocational Training
GF Ground Floor
GIZ German Agency for International Cooperation
GMT Greenwich Mean Time
GoM Government of Mauritania
GPS Global Positioning System
GRDP Gross Regional Domestic Product
GRDR Research and Development Group for Rural Development
GT Taskforce
IADC International Airport Development Core
ICD Islamic Corporation for the Development
ICR Inception Report
IDA International Development Association
IEE Initial Environmental Examination
IMF International Monetary Fund
IMROP Mauritanian Institute of Oceanographic and Fisheries Research
ISKAN National Company for Land Development, Housing and Real Estate Management
ITR Interim Report
ITS Intelligent Transport System
JICA Japan International Cooperation Agency
LRT Light Rail Transit
LWF Lutheran World Federation
MAD Mean Absolute Difference
MDRE Ministry of Rural Development and the Environment
MEDD Ministry of Environment and Sustainable Development
MEF Ministry of Economy and Finances
MEFPTIC Ministry of Employment Vocational Training and Information and Communication Technologies
MET Ministry of Equipment and Transport
MHA Ministry of Hydraulics and Sanitation
MHUAT Ministry of Land Use, Urbanization and Habitation
MIA Ministry of Islamic Affairs
MLIT Ministry of Land, Infrastructure and Transport
MNT Non Communicable Disease
MOF Ministry of Finance
MPI Medical Professional Institute
MPN Fish Market of Nouakchott
NADP National Agricultural Development Plan
NCSI Non Collective Sanitation Installation
NGO Non Governmental Organization
NRPA National Recreation and Park Association
OD Origin Destination
OFDA Office of Foreign Disaster Assistance
OJT On the Job Training
OMRG Mauritanian Office of Geological Research
OMVS Organization for the Development of the Senegal River
ONAS National Office of Sanitation

ONS National Statistical Office
OSPUN Observatory of Urban Services and Heritage of Nouakchott
PAD Detailed Development Plan
PAN Autonomous Port of Nouakchott
PANPA Autonomous Port of Nouakchott aka Port of Friendship
PCU Passenger Car Unit
PDALM Mauritanian Coastal Master Plan
PDAN Nouakchott Sanitation Master Plan
PDC Communal Development Plan
PGR Progress Report
PHPDT Peak Hour Peak Direction Traffic
PIB Gross Domestic Product
PIF Land Intervention Perimeter
PL Subdivision Plan
PLU Local Urban Plan
PME Small and Medium-sized Enterprises
PNDSE National Program for the Development of the Education Sector
PPRI Flood Risk Prevention Plan
R&D Research and Development
RBU Urban Land Consolidation Plan
RESEN Status Report on the National Education System
RGPH General Census of Population and Housing
RGU General Urban Regulations
RU Urban Renewal Plan
SCAPP Strategy for Accelerated Growth and Shared Prosperity
SDAU Urban Master Plan
SEA Strategic Environmental Assessment
SEEI Electrical and Industrial Equipment Company
SEZ Special Economic Zone
SIG Geographic Information System
SMH Mauritanian Company of Hydrocarbons
SNDE National Water Company
SNDT National Tourism Development Strategy
SNIM National Industrial and Mining Company
SOCOGIM Real Estate Construction and Management Company
SOMELEC Mauritanian Company of Electricity
SONELEC National Water and Electricity Company
STP Public Transport Company
STPN Public Transport Company of Nouakchott
TBS Gross Enrollment Ratio
TCR Traffic Capacity Ratio
TDM Traffic Demand Management
TFR Total Fertility Rate
TIC Information Technology
TNS Net Enrollment Ratio
TOD Transit Oriented Development
TVET Technical and Vocational Education Training
TVZ Tevragh Zeina
TWG Technical Working Group
UDP Urban Development Program
UNEP United Nations Environment Program
USPR Urban Services Penetration Rates
VAINCRE Program of Valorization of the Fair Regional Growth Initiatives
VIH Human Immunodeficiency Virus
WARCIP West Africa Regional Communications Infrastructure Project
WHO World Health Organization
WLC Weighted Linear Combination
WWTP Wastewater Treatment Plant
ZAC Join Development Zone

INTRODUCTION

Background

Nouakchott City has been growing rapidly since the establishment of the city in 1960 as capital of Mauritania. According to the statistics by the National Statistical Office (OSN) of Mauritania the population of the City has grown from around 2,000 in 1957 to 558,195 in 2000, and 958,399 in 2013. The average annual growth rate was 4.61% from 2000 to 2013. This rapid growth of the city was driven not only by the "pull factors" such as commercial and economic center of the country, but also by some "push factors" such as serious poverty and scarcity of foods in the inland and rural areas caused by droughts and sandstorms took place in 1970's. The influx of the population resulted in formation of vast unplanned residential areas, or shanty towns, in the areas close to the central area, as well as in the outskirts of the City as ribbon type sprawl. Accordingly, the quality of lives of the citizens of Nouakchott was deteriorated considerably by severe shortage of access to infrastructure and social services, among others.

In order to overcome these urban problems of Nouakchot City, the Government of Mauritania (GOM) introduced necessary policies and projects, such as creation of the Urban Development Agency (ADU) to implement the Shanty Town Improvement Project which started in 2001, restructuring of central government ministries to enhance efficiency of the urban management, formulation of Urban Master Plan (Schéma Directeur d'Aménagement Urbain: hereinafter referred to as "SDAU") of Nouakchott in 2003 (hereinafter referred to as "SDAU 2003"), and creation of the Urban Planning Law (L*oi No 2008 - 07 portant Code de I'urbanisme*: hereinafter referred to as "Urban Planning Law 2008").

While shanty town problem has been gradually resolved by concerted efforts of above mentioned policies and projects, other urban problems gradually become prominent as Nouakchott grows to be a metropolis. Those problems include: inland inundation over built-up areas, occasional traffic jams, poor access to water and other urban services, coastal erosion, thread of sand dune against residential communities at urban fringe, etc.

Although the SDAU 2003 has been functioned as a fundamental policy to guide government activities related to urbanization, not all the decisions and public investments have followed its rules. The reason of these malfunctioning of the SDAU 2003 largely attributes to the luck of credibility, caused by existence of several factors which SDAU 2003 could not effectively address due largely to insufficient planning technology. Although the Ministry of Land use, Urbanization and Habitation (MHUAT) attempted to revise SDAU in 2013, it was abandoned because of the lack of capacity. In addition, the area of Nouakchott has expanded in 2015 to cover the new international airport and the new branch of Nouakchott University. Thus, there is no effective SDAU to guide the urbanization of the enlarged Nouakchott even though the long-term horizon of the SDAU 2003 was set to 2020.

Based on the above-mentioned circumstances, the Government of Mauritania submitted the official request of the Project to the Government of Japan for assistance to develop an SDAU for Nouakchott City. Responding to the request, Japan International Cooperation Agency (JICA) conducted

necessary survey missions to confirm development needs related to the urbanization of Nouakchott City. As a result, JICA recognized that it is necessary to revise the SDAU 2003 as well as carrying out capacity development for urban planning and management. Consequently, the Record of Discussion was signed in May, 2016 and the Project was started in November, 2016.

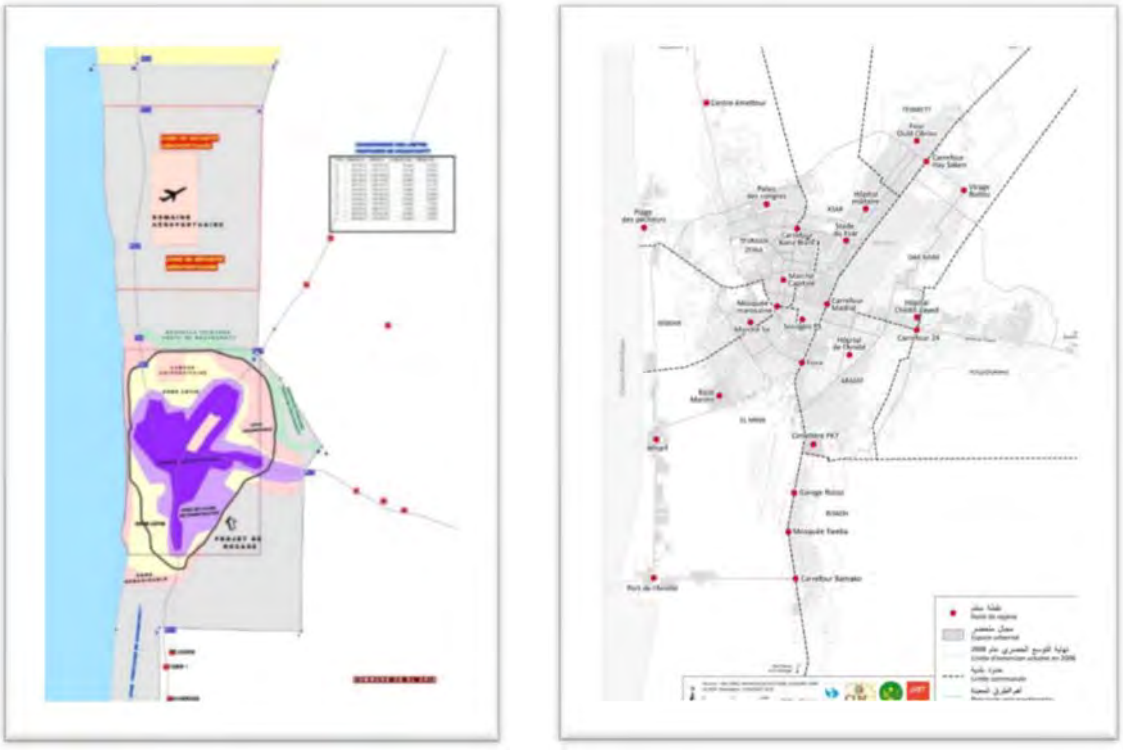
Objectives

The objectives of the Project consist of the following two items:

1) To formulate an SDAU for the entire administrative area of Nouakchott City and a PLU, a law binding plan to restrict regulations with more detailed drawing, for the administrative area of one Commune to be selected in the course of the Project; and
2) To enhance capacity of related agencies responsible for urban planning and realization.

Target Area

The target area of the SDAU covers the administrative area of Nouakchott City, which was expanded in 2015, with 1,129 km2 The target area for the PLU will be the administrative area of one Commune to be selected in the Project. It should be noted that the administrative area of Communes in Nouakchott has not been officialized yet. The new administrative areas of the Communes need to be defined by the Ministry of Interior and Decentralization, through consultation with the Ministry of Habitatt, Urbanization, and Land Use (MHUAT). Figure A shows the composition of administrative areas of Nouakchott City, before and after 2015.



Entire coverage of Nouakchott City after 2015 Composition of Communes before 2015

Figure A: Composition of Administrative Areas of Nouakchott City, before and after 2015

Target Year

The target year of both plans of the SDAU and the PLU are 2040, as described in the Record of Discussion signed in May. 2016.

Reports and Other Outputs

All the reports to be produced in the Project are listed below:

Name of the Report	Major Contents	Expected Time of Submission
Inception Report (ICR)	Outline of the Project, approach to the planning, work operation plan, assignment schedule, etc.	December, 2016
Progress Report (PR)	Results of analyses of the existing conditions, including the results of the social survey and GIS data development. Draft of major concepts of the SDAU, including theme/philosophy of development, future framework, expected position and role in wider context, targets for sustainable urban development, and strategies for realizing the targets.	June, 2017
Interim Report (ITR)	Conception works, land use plan, infrastructure development plan, framework of PLU planning, and results of project activities	March, 2018
Draft Final Report (DFR)	Results of all analyses works, concepts agreed through public consultation (SEA), draft of SDAU and PLU.	July, 2018
Final Report (FR)	All the results of the entire project activities.	October, 2018
Draft SDAU	Draft of the SDAU to be compiled in accordance with law requirement, aiming at smoother approval and enforcement. The document shall be prepared mainly by the hands of DU with necessary supports by the JICA Project Team.	Ditto
Draft PLU	Draft of the PLU for the selected Commune to be compiled in accordance with law requirement, aiming at smoother approval and enforcement. The document shall be prepared mainly by the hands of DU with necessary supports by the JICA Project Team.	Ditto
Leaflet of SDAU		Ditto
GIS data set		Ditto

Work Operation Structure

(1) Overall project management

The project was conducted under the ownership of the Government of Mauritania. The Project Team consisting of JICA experts and its Mauritanian counterpart (C/P) staff carried out the Project. The overall structure of the project management is illustrated in Figure B, followed by explanation on roles and assignment of relevant organizations.

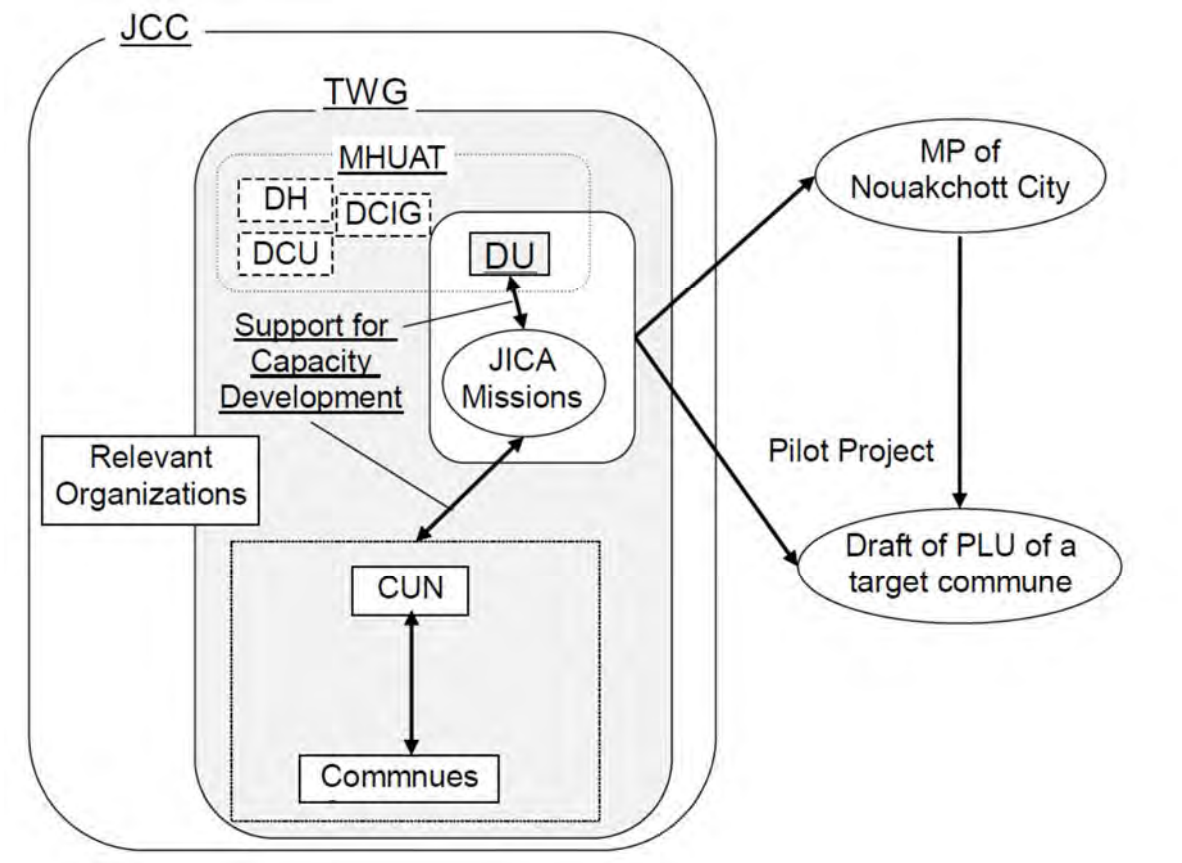


Figure B: Overall Project Management Structure

1) MHUAT

(a) Project Director
Secretary General of MHUAT was responsible for overall administration and implementation of the Project.

(b) Project Manager
Director of the Department of Urbanization and Topography (hereinafter referred to as "DUT"), MHUAT was responsible for smooth implementation and coordination of the Project.

(c) Assignment of counterpart personnel
MHUAT assigned counterpart personnel to formulate MP and the Model PLU together with JICA Team for capacity development.

2) CUN

(a) Project Coordinator at Commune level
Director of Department of Studies, Projects and Planning of Community Space (hereinafter referred as to "DEPAEC"), responsible for Observatory of Urban Services and Heritage of Nouakchott (hereinafter referred to as "OSPUN") of Urban Community of Nouakchott (hereinafter referred to as "CUN"), was responsible for coordination among CUN and all the communes.

(b) Assignment of counterpart personnel
CUN assigned counterpart personnel to cooperate on formulation of MP and the Model PLU and capacity development activities.

(c) Public Consultation
CUN is responsible for public consultation to local residents in all communes with collaboration with MHUAT and cooperation with JICA Team.

3) Joint Coordinating Committee

Joint Coordinating Committee (JCC) was established in order to facilitate inter-organizational coordination. JCC meetings were held at the beginning of the Project, and the time of discussion for each report in order to fulfill the following functions:

i. Approve work plan and review overall progress;
ii. Discuss and approve the reports;
iii. Conduct monitoring and evaluation of the Project; and
iv. Exchange opinions on major issues arising during the implementation of the Project.

4) Technical Working Group

Technical Working Group (TWG) was established in order to discuss technical issues and capacity development activities. TWG will be held whenever deemed necessary in order to fulfill the following functions:

i. Discuss and approve the technical matters;
ii. Conduct capacity development activities of relevant organizations; and
iii. Exchange opinions on technical issues arisen during the Project.

(2) The Project Team

Works for formulation of SDAU and PLU were carried out by the Project Team consisting of JICA Experts and C/P Staff assigned by MHUAT and CUN. The Project Team was composed of three Task Forces and two Units as illustrated in Figure C.

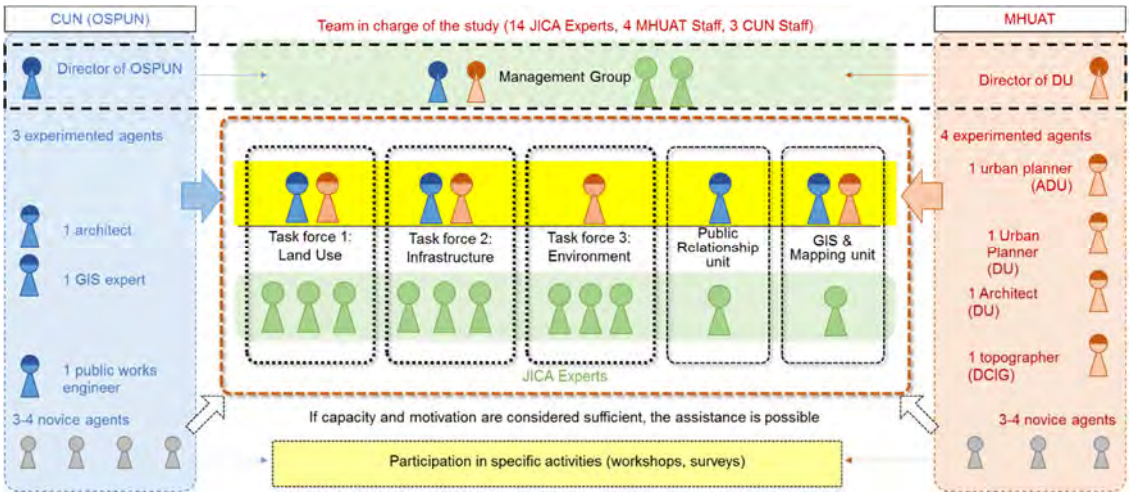


Figure C: Composition of the Project Team

The two units in the Project Team were in charge of 1) GIS and mapping, and 2) Public relationship, respectively. The GIS and mapping unit conducted development of GIS database, produced thematic maps for analyses, and finalized drawings of SDAU and PLU. The public relationship unit conducted preparation of public information systems, and carried out public consultations as a part of SEA. Role of the three Task Forces, on the other hand, were flexibly determined by work phases.

Operation of the Project Team is a major part of the CD activities. In the Analyses phase, the Task Forces concentrated on collection and analyses of information. This was done through internal discussion and creation of common understandings for necessity and usage of required information between JICA Expert and C/P staff. The Task Force jointly conducted data collection and analyses, and presented the results to the management group consisting of chief of DUT, chief of OSPUN and delegation from the JICA Expert in charge. In the planning phase, the Task Forces developed proposals and gave presentation in sector wise meetings of the Technical Working Groups. The TWG were held attended by members of related organizations in accordance with themes discussed. It should be noted that the core member of the TWG were appointed by MHUAT to attend all the TWG meetings.

PART I: SDAU

I-1. Reminder of the nature and scope of SDAU

The Master Plan of Urban Planning and Development (SDAU) is described in Chapter 4, in Articles 18 to 26 of Law No. 2008-07 on the Town Planning Code. Its nature and scope are described in this section, referring to the code as well as the previous experience of SDAU 2003.

I-1.1 Maijor Characteristics and Objectives

The SDAU can be described by the following features.

- Coverage of the entire urban area and administrative area of the city, that is to say the entire territory that will be urbanized or ristricted in the future;
- Long-term planning horizon, usually in the range of 10 to 20 years;
- Determination of the general strategy of spatial development. The SDAU is primarily a programming and planning document;
- No compulsory power to the third parties but a binding document for the administration, which must integrate its orientations and obligations in their decisions and actions.

The SDAU sets the main directions of urban planning and allows the following objectives to be fulfilled.

- Based on demographic and economic projections, allocate residential density, major urban functions, hierarchical development poles;
- Determine the limits of the urban perimeter and fix the areas to be opened to urbanization, illustrating the coherence between the various forms of land use;
- Develop strategic guidelines to guide urban planning over the long term;
- Provide major structuring equipment;
- Facilitate the drafting of PLUs by initiating the translation of the main strategic directions into the PLU regulations;
- Evaluate the compatibility of major projects that will be subject to its approval by having a constant reference framework known to all operators.

I-1.2 Strategic Document for Cordination

In addition to this direct use as an instrument of control and urban planning, it should not be underestimated the role that an SDAU can play as a coordination instrument by influencing the expectations of public and private operators, as underlined by the SDAU 2003. As intentions of the public authorities are expressed, various actors basically try to comply with the policies in order to avoid problems, delays and administrative difficulties. This anticipation will mainly be reflected in their strategies for setting up businesses and acquiring land.

However, This is possible only if the SDAU fulfills the following conditions.

- Policies expressed in the SDAU are clear and shared to administrative agents, and are easily understandable to everyone;
- Policies are credible to convince operators that the MHUAT can achieve what it provides;

- Policies express sufficient supply of land for all necessary price categories and social classes.

I-1.3 Regulatory Expectations

The Urban Code defines the content of the SDAU as presented in the table below. There is a draft plan of the SDAU 2040 prepared as a part of the Project covering all the regulatory expectations required by the Mauritanian law.

Table I-1 Regulatory Requirements for SDAU

Theme	Regulatory requirements to SDAU by Urban Code
Urban growth	• 1. Shows the urban perimeter by 10 years to 20 years
	• 2. Indicates the preferred areas of extension
Network and transport infrastructure	• 3. Defines the layout of the network and transport infrastructure
Public facilities	• 4. Defines the location of the key public facilities of the agglomeration
Area Vocation / Land Use	• 5. Indicates industry in different zones
	• - Urban areas for use as residential, commercial, businesses, infrastructures and green spaces, as well as specifying the areas to be restructured, renovated or safeguarded,
	• - Conservation of water resources,
	• - Agricultural areas as well as natural areas to be preserved,
	• - Sites of environmental, historical or archaeological interest to protect or enhance.

Source: JICA Study Team based on the Urban Code

I-2. Existing Conditions

I-2.1 Regional Context

Nouakchott, located on the oceanic edge of the Sahara, capital of the Islamic Republic of Mauritania, is one of the largest cities of the Saharan region, it is at the same time the political, cultural, and economic center of the country. At the international and regional levels, however, Nouakchott occupies a secondary and relatively isolated position compared to the other capitals of North Africa and West Africa, in geographical, demographic and economic terms.

(1) Strategic Position of Nouakchott in the Regional Context

Figure I-1 shows locations of the cities with more than 50,000 inhabitants. As shown from this figure, Nouakchott is rather isolated among population centers in North and West Africa. Nouakchott is also located outside the main cross-border trade corridor, linking Dakar at sea shore and Bamaco of the landlocked country of Mali. However, Mauritania can be considered as a transit country regarding the trade integration platform. This gives Nouakchott an advantage in the region.

Source: JICA Study Team on ESRI Background

Figure I-1 Location of Nouakchott and Major North and West African Cities

(2) Position of Nouakchott in the Urban Hierarchy of the Country

Regarding the positioning of the city of Nouakchott in the urban hierarchy of Mauritania, the capital is located in the geographical center, but is distant from other major economic centers of the country, as shown in Figure I-2. Saint Louis of Senegal (about 250 000 inhabitants) is 250 km south, while Nouadhibou (about 120 000 inhabitants), the second largest city of Mauritania, is located 300 km to the north. In support of the development of Nouakchott. Strengthening of the entire urban hierarchy of the country is a key to the socioeconomic integration of the countly but requires development of some other poles, such as Nouadhibou, Atar, Rosso (as a bridge with Senegal), Kaédi and Kiffa.

Despite absence of large urban centers near Nouakchott, there are several small towns in the surroundings (direct hinterland) of the capital, which are currently developing as dormitory towns of Nouakchott: Arya 50 km south on the road to Rosso, Ouad Naga 50 km east, and Tanit 80 km north, which will also host a large-scale port development in the near future. However, these are still recognized as villages because of the lack of infrastructure and services, and will require some more time to obtain any perticular hire urban functions to support development of Nouakchott.

Source: JICA Study Team based on ESRI Background

Figure I-2 Locaton of Major Settlement in the Hinterland of Nouakchott

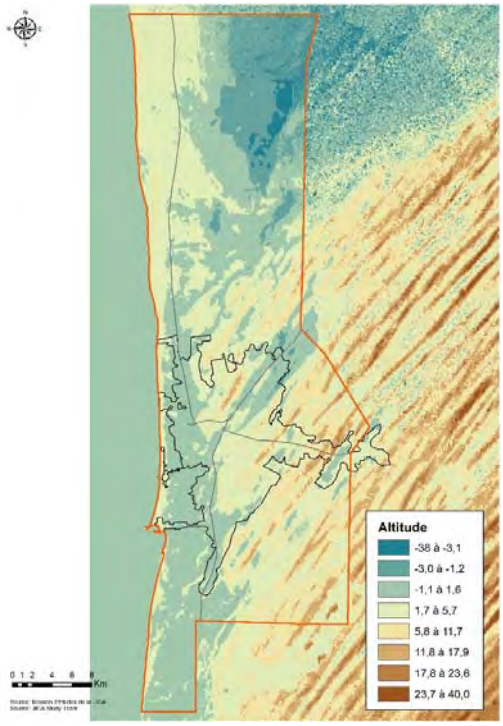
I-2.2 Physical Conditions

(1) Climate

The climate of Nouakchott is called desert, characterized by warm temperatures throughout the year. The average high temperatures are relatively constant at 33 °C, while the average low temperatures turn around 25 °C during the summer, and 13 °C during the winter. The very low average annual rainfall of around 100mm explains the water stress situation of the city. Nouakchott is characterized by strong wind, notably the desert wind (brings strong sand storms and silting), and the sea wind and the monsoon wind (bring rains).

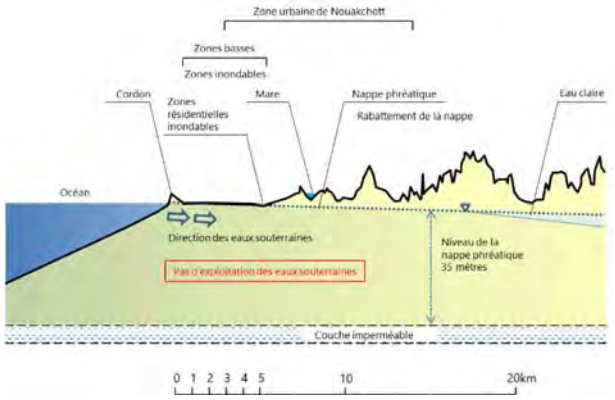
(2) Topography

Nouakchott presents a flat topography without accident of relief. An important part of the city of Nouakchott is located below sea level, where floods bring considerable damages.



Source: JICA Study Team

Figure I-3 Topographic Condition of Nouakchott



Source: JICA Study Team

Figure I-4 Typical Groundwater Condition of Nouakchott

(3) Geology and Nature of Soils

Nouakchott is found in the Atlantic Coast basin, consisting of Cenozoic sedimentary rocks. On a shallow level, the Nouakchott region consists of layers of sand and limestone that form the first aquifer. This sheet is located at an altitude of about 35 m below sea level.

On the surface, the soils of Nouakchott consist of either strata of fossilized shellfish or fine sand, with the exception of the areas of sebkhas which have a rather thin layer of clayey sand.

(4) Hydrological Dynamics

Nouakchott is not traversed by any river. At present, the city's groundwater is not used for drinking nor for agriculture. In addition, since seawater enters the land area about 50 km from the coastline, the salt concentration is very high, which causes corrosion of the foundations of buildings in the city.

A large-scale study was conducted by the National Water Company (SNDE) in 2015, to identify the level of groundwater and water quality in the urban area. In this study, 20 core piezometers equipped with automatic loggers were installed in the urban area.

I-2.3 Constraints and Environmental Vulnerabilities

With the background of desert climate and a flat topography, the natural conditions of the Nouakchott area present strong constraints and risks for human settlement.

(1) Sand

Nouakchott is exposed to significant silting process, accelerated by the strong wind dynamics. For this reason, the Mauritanian government has devoted financial resources to silting control measures such as the Green Belt projects. The main role of the latter is the stabilization of sand dunes. Sand stabilization processes are both mechanical and biological. However, the most commonly used species, Prosopis Juliflora which grows well in an arid environment, is considered as an invasive species, and thus may disrupt the ecological balance of the environment.

(2) Sebkha

Sebkha is a salty depression formed during the Quaternary period. The coastal dune has gradually isolated this gulf from the ocean: the lagoons are no longer fed and the evaporation transforms the lowest zones (+1 to -1 m) into sebkhas. These are characterized by clay-salt soils and diffuse halophilic vegetation. Beyond a certain level of salt, no plant is able to grow, and thus create bare ground. A superficial water table, mainly brackish, is subcropped in the lowest areas reaching 4 meters deep. During heavy rainfall, this water table causes significant flooding. The exploitation of the Trarza aquifer has caused a breakthrough on the salt water front and may lead to permanent salinisation. The sebkhas is not suitable to constructions because salt damages concrete walls and structures unless using expensive materials for the average dwellers of the city.

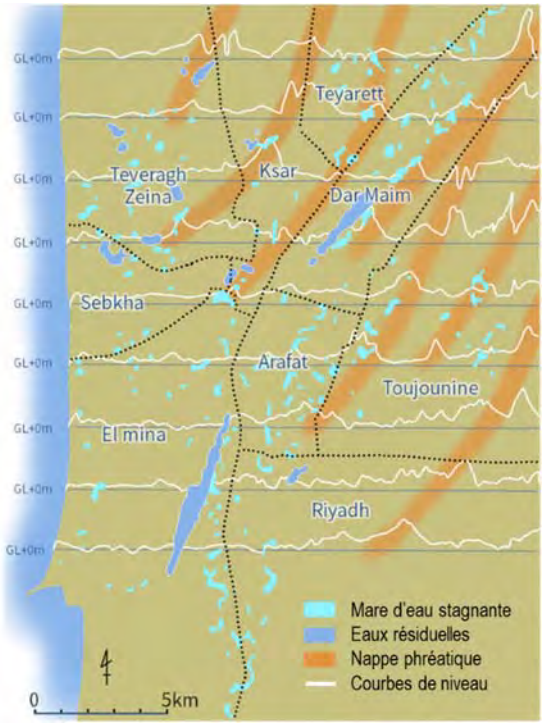
(3) Marine Incursions

Floods caused by marine incursions damage the coastal plains, particularly by increasing salinity. For this reason, these areas are not suitable for urbanization without major investment. In addition, the dune ridge has a role of natural bank, although its integrity has been reduced in recent years. Conservation of the dune cord is an important issue for the city.

(4) Stagnant Water

Damage caused by standing water occurs when the amount of daily precipitation exceeds 30 mm at which roads and residential areas are flooded. In addition, due to the lack of a functioning urban

drainage system, contaminated water remains exposed to the soil surface, leading to a deterioration of sanitary conditions.



Source: CUN Atlas Nouakchott (2011), ONAS, JICA Study Team

Figure I-5 Location of Stagnantt Water Spots

The map above shows the contours and distribution of pools of standing water. When it rains, many parts of the city are temporarily flooded. Rainwater is concentrated in low-lying areas and pools of stagnant water are formed. The development of drainage equipment to solve the damage of stagnant water is one of the important issues as the problems of stagnant water is closely linked to sanitation problems.

(5) Sea Level Rising

According to the GIZ (2015) report, sea level rise at the coast of Nouakchott is expected to increase for 0.2 to 1.1 meters over the next 100 years. Damage caused by floods and stagnant pools of water should also increase. In addition, the report indicates that the erosion of the sandy beaches is accompanied by a coastline retreat, at a rate of 3 to 4 meters per year over the period 2004 - 2014. Thus by the rise of the sea level, it is expected that further coastal erosion and flood damage may take place.

Human development on the coast has also caused morphological changes to the coast. In addition to significant sedimentation on the north of the industrial port, a remarkable decline of the coastline on the south side is underway.

(6) Air Pollution

The atmospheric pollution in Nouakchott is brought by accumulation of three factors: the discharges coming from the industrial activity (in particular cement works of the road of the PANPA close to certain residential zone in El Mina), the pollution due to the car traffic (aging car fleet), and natural wind dusts. These fine particles have a detrimental effect on human health and are responsible for many chronic diseases and the emergence of more serious diseases that affect all of Sahelian Africa,

such as meningococcal meningitis (wind dusts irritate the mucous membranes; which inhibits the immune defenses and stimulates the invasion of bacteria).

(7) Existing Policies

The Mauritanian Coastal Master Plan (PDALM) is a national-level strategic document that the SDAU must observe and interpret.

Table I-2 Major Contents of PDALM

Description of the content	Integration levers in the SDAU
MEASURE A6: Restoration of the coastal dune	Not directly related to urban planning. Nevertheless, actions to be planned to requalify the coastal dune that will be specified during the formulation of Nouakchott Coastal Planning Directive (DAL: Directive d'Aménagement du Littoral) may influence existing buildings and coastal land.
MEASURE A7: Development of the coastal front	Not directly related to urban planning. Nevertheless, actions to be planned to develop the coastal front that will be specified during the formulation of the DAL may influence existing buildings and coastal land.
MEASURE B5: Hydrological functioning of the Nouakchott water table	Not directly related to urban planning. However, the results of the hydrological studies of the Nouakchott water table will serve as a basis for the formulation of the Flooding Risk Prevention Plan (PPRI: Plan de Prévention du Risque Inondation) and should therefore be carried out as a priority.
MEASURE A2: Nouakchott Coastal Planning Directive (DAL)	This is the measure that concerns the most urban planning, with MHUAT designated as executive agency of the study. Nouakchott DAL which will have the same value as a Coastal Risk Prevention Plan (PPRL: Plan de Prévention du Risque Côtier) is considered in the SDAU, along with the proposition of PPRI, in the planning principle of " Strongly prohibit construction in high flooding risk areas of sebkhas" of Strategic Orientation 1 (see Section 4.4.1). The Nouakchott DAL study is also included in the SDAU priority project proposals in the same terms as those stated in the PDALM, with the MHUAT as implementation agency.
MEASURE A10: Pilot resettlement of populations	This measure is contained in SDAU planning principle of "Ensure limited land consumption by operating densification, regeneration and polarization of the urban area: The Intense City" of Strategic Direction 1 (see Section 4.4.1) to set-up urban renewal zones. Areas for pilot resettlement of populations shall be specified in detail in the PLU of the concerned communes, on the basis of the technical zoning contained in the PPRI and the PPRL to be formulated.
MEASURE A15: Solutions for the restoration of sediment transit	Not directly related to urban planning.

Source: JICA Study Team

I-2.4 Demographics and Macroeconomic Conditions

(1) Population

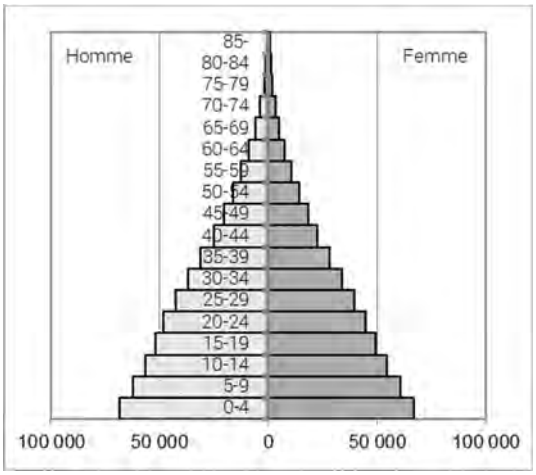
According to the General Census of Population and Housing (RGPH 2013), the total population of Mauritania was 3,537,000 inhabitants and that of the city of Nouakchott was about 958,000 inhabitants, or 27% of the population national.

The population growth rate of Nouakchott City has been considerably higher than that of Mauritania. The average annual growth rate of Nouakchott City was 4.3% from the 2000 census to the 2013 census, while that of Mauritania was 2.7% in the same period.

In the communes of Nouakchott, Riyadh has the highest growth from the 2000 census to the 2013 census at 8.1%, followed by Toujounine at 7.5% and Dar Naim at 6.8%, which are located in the eastern part of the city, while Tevragh-Zeina, Ksar and Sebkha, which are located in the western part of the City, have negative or low growth rates at -0.3%, 0.6% and 1.0%, respectively.

(2) Age Group Structure

The age structure of the population of Nouakchott in 2013 forms a typical pyramid, showing a demographic dividend with a large number of younger generations. This situation is the same as that of 1988 and 2000.



Source: RGPH 2013

Figure I-6 Age Structure of Population of Nouakchott in 2013

(3) Number and Size of Households

The total number of households in 2013 amounted to 575,678 in Mauritania and 160,842 in Nouakchott, respectively. The average size of household in Mauritania has increased between 2000 and 2013, i.e.; from 5.64 in 2000 to 6.14 in 2013. On the other hand, that in Nouakchott has increased from 5.46 to 5.96 between 2000 and 2013. The numbers of Nouakchott in both years are slightly smaller than the national average.

(4) Workforce and Employment Structure

The share of the economically active population or participation rate at work varies between 44 and 47% in Mauritania and between 46 and 52% in Nouakchott. The share of hired labor or employment ratio is between 73 and 90% in Mauritania and between 75 and 83% in Nouakchott.

(5) Poverty and Inequality

In Nouakchott, the poverty rate based on a poverty line estimated in real terms at 169,445 MRO at harmonized prices in 2014 was 20%, which is well below the national average of 31%.

In addition, 16.6% of the country's population and 7.5% of the population of Nouakchott live below the poverty line set in 2014 at 126,035 MRO.

although the Gini index declined at the national level, corresponding to a reduction in inequality between 2008 and 2014, that of Nouakchott has increased slightly.

(6) Economic Structure

The economy of the city of Nouakchott is more characterized by trade (buying and selling) and consumption rather than production.

The fishing sector is however well represented with the various ports (PANPA, artisanal fishing port). The industrial activities of the city (plastic, metal products, paper and packaging, leather, textiles and

building materials) are mainly concentrated in the communes of El Mina, Sebkha, Ksar and Teyarett, while the industrial zone located in Dar Naim is gradually filling up.

I-2.5 Socio-economic Context and Cultural Characteristics

The analysis of the socio-economic context was based on the best available data. However, because of the lack of information on certain social domains, the results of a social survey conducted on 1,000 households in 2016 were taken as the main source of this analysis.

(1) Level of Education

The population of Nouakchott is characterized by the fact that the majority of the population (25%) has never attended school. Education level of correspondents consisted of primary school (19%), mahadra (18%), high school (7%) and high school (8%). The holders of diploma including the baccalaureate nevertheless represent 23%.

(2) Health

While most health indicators are in regional or global averages, the prevalence of hypertension and the lack of physical activity are particularly high in Mauritania compared to other countries.

(3) Revenue

About half (50%) of respondent households live with a monthly income equal to or less than 100,000 MRO. A sizeable proportion of households have no income (7%) and about the same proportion (9%) of households have incomes in excess of 300,000 MRO.

(4) Security

The three main safety aspects of terrorist risk, ordinary crime and feelings of insecurity are quite satisfactory despite there is an unstable transnational context reportedly.

(5) Origin of Inhabitants

The survey results revealed that populations from the northern regions of the country are more likely to settle in the northern part of the city, while populations from the eastern regions are more likely to settle in the eastern part of the city. It confirms the known tendency that the populations settled in Nouakchott are made along the four penetrating entrances to the city. Yet, it can be seen that part of the new generations is starting to settle near the central area, which means that there is a process of densification of the urban area and regeneration of the central urban tissues.

(6) Housing Conditions

The average electricity connection rate (91.7%), piped water supply (53.4%), wastewater system (3.9%) and solid waste collection service (24.3%) was calculated to give the urban services penetration index (IPSU). The average IPSU in Nouakchott is 43.3%, and varies from 15.0% in the less well-served areas, especially in the new extensions along the Adrar road and in the precarious residential areas. along the Boutilimit road, to 70.4% in the new extensions north of the commune.

The criteria of the ideal housing for the citizens are firstly the living space (78%), followed by aeration (17%), while very low about the purchase or rental pricees (1%). According to the results of the household survey, the average living area of Nouakchott is 130.3 m^2. The ideal type of accommodation is the single-family house for a large majority of citizens (87%), with a preference for the house completely separate type (50%) the the adjoining type (37%). Nevertheless, a significant proportion of respondents are willing to live in an apartment (12%).

(7) Importance of Social Link and Religion

Several indicators show that the citizens of Nouakchott consider the social bond and religion as key factors for the stability of their society. More than the need to modernize the country or achieve a better individual financial situation, the value that respondents consider the most important in Nouakchott is the preservation of the social bond and the quest for spirituality.

I-2.6 Characteristics of Urbanization

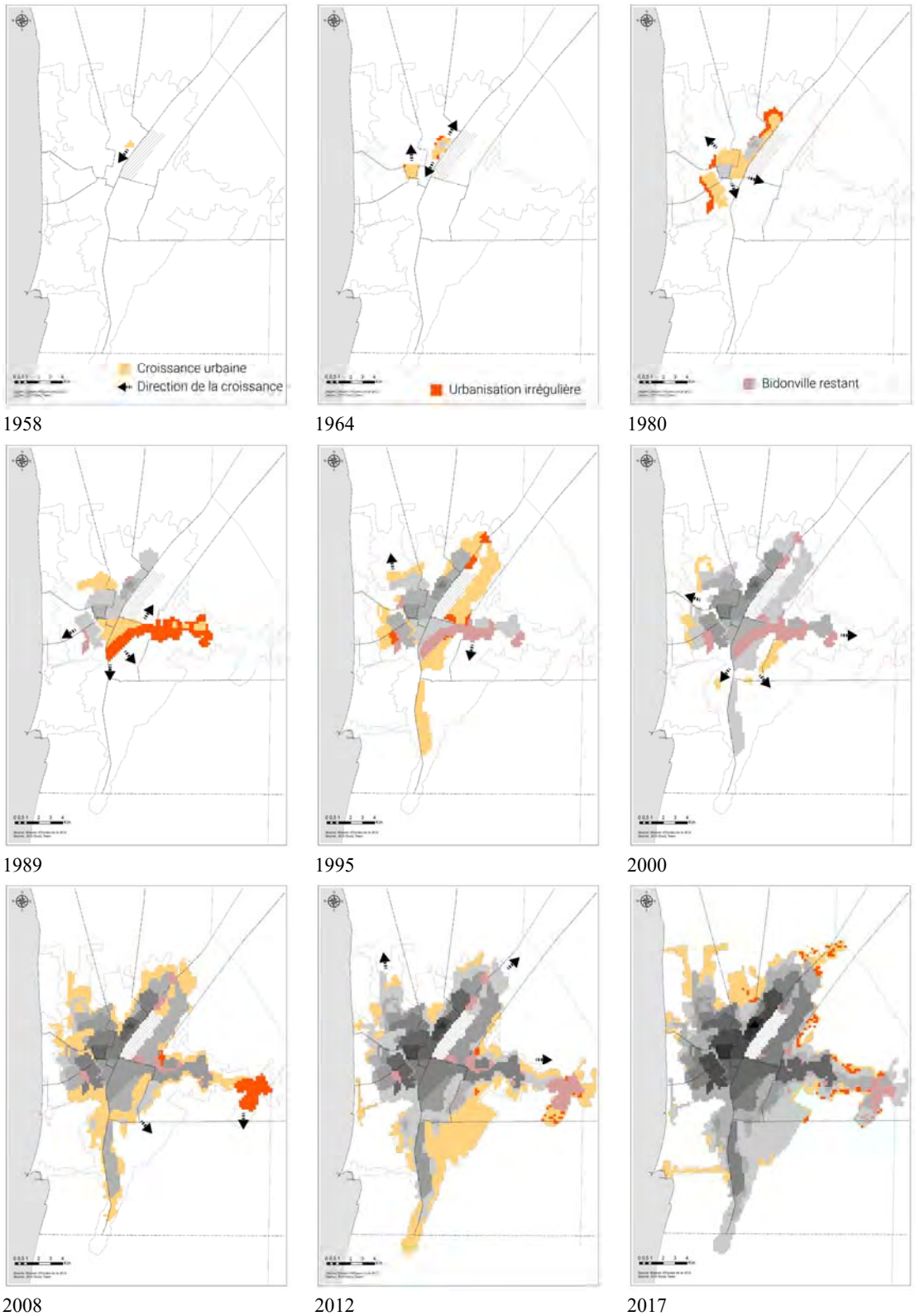
(1) Historical Evolution of the City

The urbanization history of Nouakchott, in terms of growth of population and of built-up area, is summarized in Table I-3 and Figure I-7 below.

Table I-3 Evolution of Population and Built-up Area Growth in Nouakchott

Year	Popu-lation	Annual growth rate (%)	Built-up area (km^2)	Annual growth rate (%)	Average density (pop/ha)	Elements of Context
1958	1,995	-	0.5	-	39.9	Foundation of the city. Free distribution of land to encourage officials located St. Louis to settle in Nouakchott.
1964	9,100	15.0%	2.4	15.2%	37.8	Two urban cores, designed in 1959 by the French architect André Leconte, are established: one around the fort called "Capital" which hosts public institutions; the other around the Ksar Mosque, the first residential core.
1980	140,000	6.2%	14.1	5.5%	99.4	The tow cores merge. Demographic and spatial growth of the city is continuing at a rapid pace as a result of a high birth rate and drought-related rural exodus (1968-1973) from the interior of the country. Shantytown (*kebbe*) of Sebkha and El Mina are born.
1989	407,064	3.5%	32.4	6.7%	125.7	In the 80's, first efforts of land management and distribution of land to stop progression of shantytown. This strategy and the second wave of drought will lead to intense irregular urbanization and starting of land speculation (*gazra*) in the new districts of Arafat, Dar Naim and Riyadh.
1995	489,499	2.9%	60.2	6.9%	81.3	The city extends mainly along major axis and especially towards the South.
2000	558,195	2.5%	66.4	2.0%	84.1	In the second half of the 1990's, demographic and urban growth slow down, even if it remains one of the highest in Africa.
2008	672,539	9.3%	137.4	6.7%	49.0	In 2001, ADU is created and launches the first major program of shantytown restructuration. In 2003, beginning of the requalification of El Mina *kebbe* under the PDU. Urban sprawl continues in urban fringes at a steady pace.
2012	901,227	4.3%	176.7	3.8%	51.0	Creation in 2009 of the large resettlement district of Tarhile. Shantytowns are resorbed and densified.
2017	1,116,738	3.7%	204.5	2.8%	54.6	Urban growth pressure slows down relatively, even though a town of villas is growing on the urban front of Sukuk in the North of Nouakchott, and scattered urbanization in the East on the roads of Boutilimit and Adrar is getting more intense.
Average on 2000-2017 period		**4.1%**		**6.6%**		

Source: JICA Study Team based on ADU, CUN, Ateliers de Cergy, interpretation of 2012 and 2017 satellite images



Source: JICA Study Team based on ADU, Ateliers de Cergy, interpretation of 2012 and 2016 satellite images

Figure I-7 Urbanization History of Nouakchott City (1958 to 2017)

As explained above, Nouakchott has grown rapidly in a few decades. The urban growth of the Mauritanian capital can be characterized by two factors: the importance of irregular urbanization and a certain tendency towards de-densification.

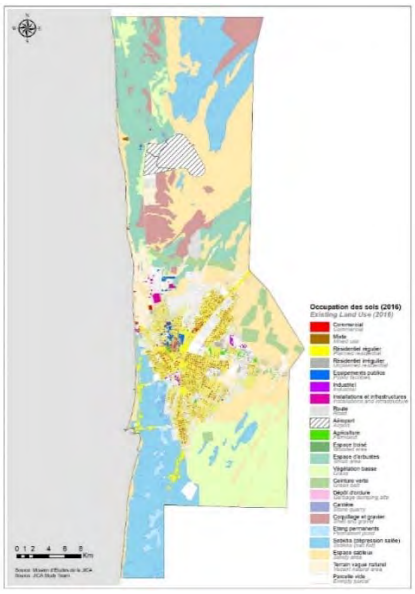
Just after its creation, the city of Nouakchott was confronted with the massive influx of people from the inner parts of the country. These populations began to settle in camps that they built in and around the city. Since then, the formation of different irregular neighborhoods became common and the official urban development of Nouakchott is always followed by or punctuated by spontaneous extensions.

The curve of the evolution of the population and that of the growth of the builtup area of Nouakchott has been reversed in the course of history. During the first period, from the founding of the city in 1958 until the mid-1990s, the population evolved more rapidly than the built-up area. Conversely, from the end of the 1990s to today, the builtup area has grown faster than the population, corresponding to the de-densification phenomenon that characterizes Nouakchott. Indeed, in recent years, over the period of 2000-2017, the average population growth rate was lower than the growth rate of the builtup area by 4.1% and 6.6% respectively. This means that the city of Nouakchott has been in the process of redefining itself for the past two decades.

(2) Current Land Use of Nouakchott

In the absence of plot representation or other detailed information on land use in Nouakchott, the current land use data were created on the basis of various GIS works carried out by the Study Mission of Nouakchott. Source information include (1) collection and correction of available official plot data, (2) digitization of non-available plots from satellite images, (3) qualification of the use of plots built on the basis of the satellite image and field survey (100% of the plots in the PLU area and sample in the remaining areas of the SDAU), and (4) identification of the status of occupation of plots by buildings through interpretation of satellite images.

The current land use map of the city of Nouakchott was thus created as shown in Figure I-8. The sandy zone and the sebkha zone (salty depressions) constitute the dominant land use, representing over half (53.3%) of the area of the city of Nouakchott. Conversely, green spaces, including wooded areas or farmland, are extremely rare (0.3%), reflecting the arid nature of soils. The built-up area represents 8.7% of the total area of the city of Nouakchott.



Source: JICA Study Team

Figure I-8 Current Land Use of Nouakchott

(3) Occupancy Rate of Plots in Residential Buildings

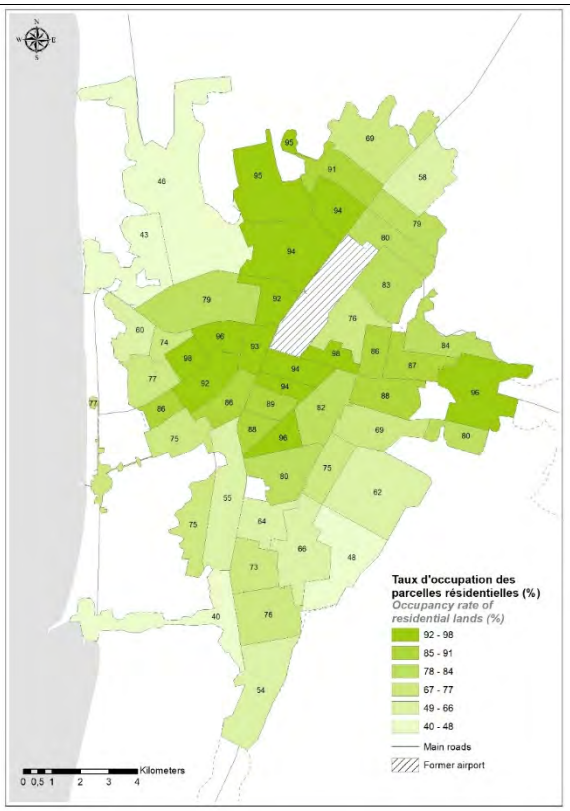
As mentioned in the previous sections, the public authorities have already carried out massive free distribution of plots to limit the proliferation of irregular settlements. This tradition for the government to provide a large number of parcels in large subdivision operations then began, resulting in the spatial expansion of formal neighborhoods. In addition, the subdivision usually takes a long time to be completely occupied because of the local culture of owning several plots without necessarily developing or constructing a house. As a result, the average occupancy rate of residential plots is quite low at around 75% in the entire Nouakchott, as shown in Table I-4. Moreover, as evidenced by the geographic distribution of occupation on the map below, even relatively central neighborhoods developed decades ago are still far from fully constructed.

The filling of empty parcels in existing subdivisions would be sufficient to accommodate a relatively large population in the near future (approximately, if the 287,611 parcels occupied in 2017 correspond to the population of 1,116,738 inhabitants of the same year, the filling of the 94,663 empty plots could accommodate 367,558 new inhabitants).

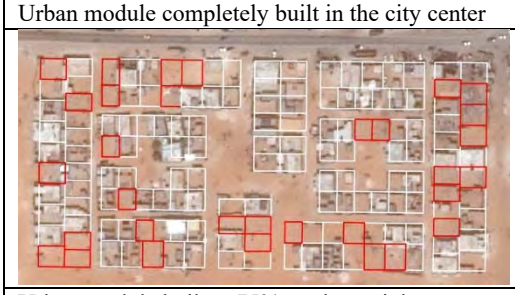
Table I-4 Situation of the Occupancy of the Residential Land Plots in Nouakchott in 2017

	Plots of the pilot PLU area	Official parcels	Digitized plots	TOTAL number of parcels
Occupation identification method	Field visit	Sample visit and satellite image	Sample visit and satellite image	
Number of total parcels	22 970	311 869	47 435	382 274
Occupied plots	12 384	236 336	38 891	287 611
Empty parcels	10 586	75 533	8 544	94 663
Occupancy rate	54%	76%	82%	75%

Source: JICA Study Team



Urban module completely built in the city center



Urban module built at 75% on the periphery

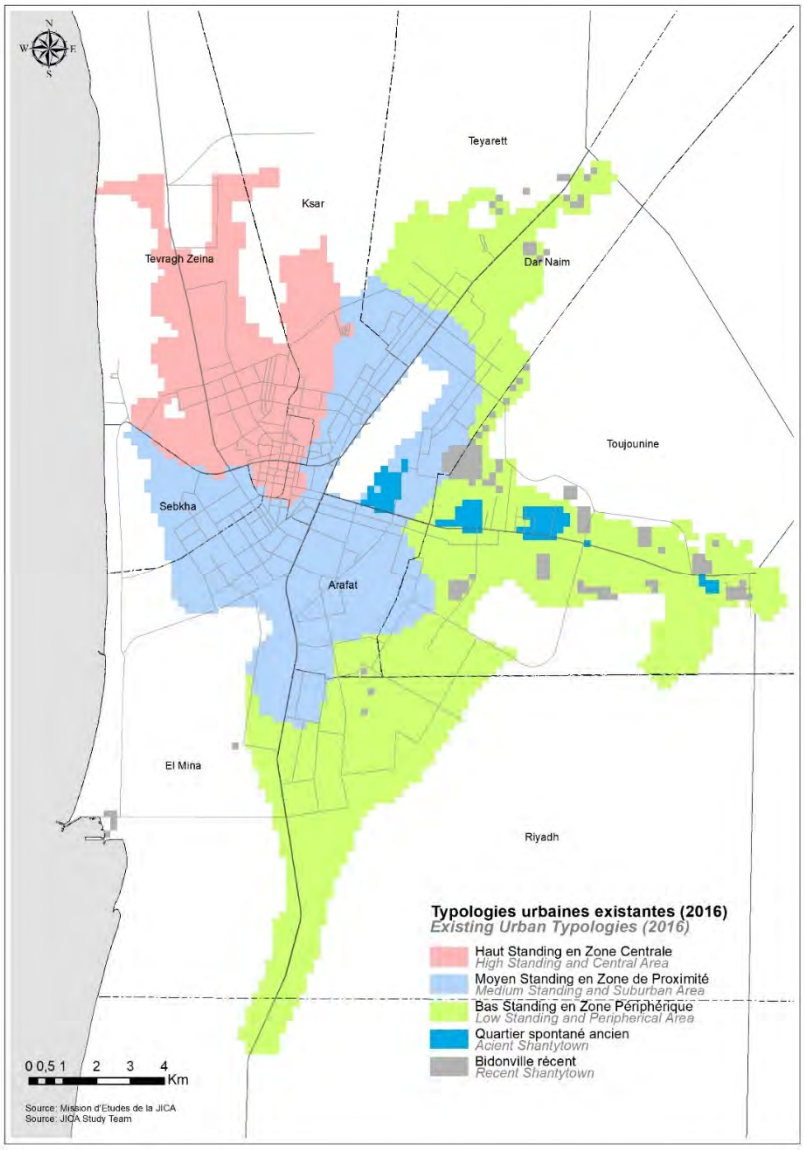
Urban module built at 34% in the front of villas

Source: JICA Study Team

Figure I-9 Geographic Distribution of Housing Occupancy Rate

(4) Typologies of Built-Up Areas

Based on the existing land use analyzed through GIS data, the density and on the housing characteristics, built-up areas in Nouakchott can be categorized roughly into the following categories, distributed geographically as shown in Figure I-10 below.



Source: JICA Study Team

Figure I-10 Existing Urban Typologies (2016)

High Standing and Central Area

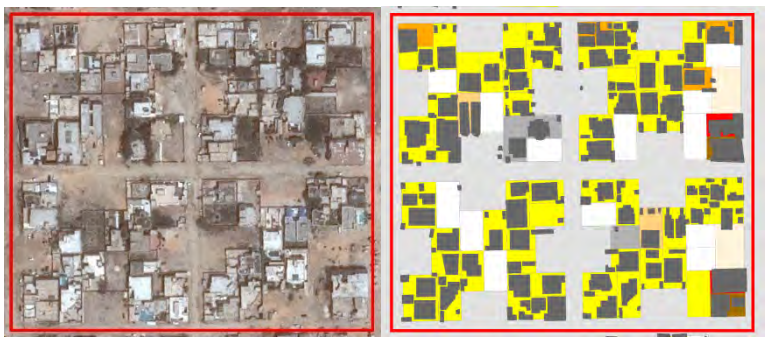
In the oldest and central parts of the city, mostly in the communes of Tevragh Zeina and Ksar, a typology of high standing built-up area can be found. It designates an urban fabric made of commercial and mixed land use alongside large roads, and of wealthy villas and well-equipped large houses in the inside the urban blocks, as shown in Figures I-11 below.

Source: en Haut! - enhaut.org, JICA Study Team

Figure I-11 Typical Land Use Pattern of High Standing and Central Area

The average density in the high standard and central area is quite low: around 4 to 10 dwelling units (DU) per ha, i.e. approximately 25 to 50 inhabitants /ha. This low density comes from the low intensity of land use, as explained in sample analysis below. It is coming from the fact that houses are built on relatively large parcels (from 700 to 2,000 m2), that occupancy rate which is still low due to the phenomenon of land keeping (gazra) in those areas, and from the large sizing of roads and interstitial spaces.

Taking advantage of the availability of full land use and building data on Tevragh Zeina, a typical sample area has been taken as shown in Figure 2.65 below in order to verify the assumptions about the characteristics of high standing and central area. In this 8.4 ha urban block containing 80 parcels, 51 residential parcels are occupied, leading to an average of 6 DU / ha (around 30 inhabitants/ha). 13 parcels are unoccupied (in white) and 3 parcels are occupied by precarious settlements, obviously gazra (in grey). Thus, the occupancy of parcel is relatively high (76%). The standard area of the parcels of this type of subdivision is 700 m2. Average living area of buildings is 267 m2. Finally, large roads and unused interstitial spaces (in light grey) represent a substantial part of the area (37%). As a result, despite the quite high occupancy of the area, the land use intensity of built-up area is low (27%).



Sample Area: 84,370 m2; Built-Up Area: 22,539 m2; Land Use Intensity Ratio: 27%
Source: JICA Study Team based on 2016 satellite image and produced GIS data

Figure I-12 Sample of Land Use Intensity in High Standing and Central Area

Medium Standing and Suburban Area

The most populous suburbs of the city, mostly in the communes of Sebkha, El Mina, Arafat and Teyarett, a typology of medium standing built-up area can be found. This typology designates an

urban fabric composed of a dense residential area dotted with small boutiques, most of the times organized surrounding a market, from which are starting commercial and mixed use corridors, as shown in Figures I-13 below (example of central market of Teyarett).

Source: en Haut! - enhaut.org Source, JICA Study Team

Figure I-13 Typical Land Use Pattern of Medium Standing and Suburban Area

The average density in the medium standard and suburban area is relatively high: around 20 to 40 dwelling units (DU) per ha, i.e. approximately 100 to 200 inhabitants /ha. This high density comes from the high rationalization and intensity of this populous and commercial areas.

A typical sample area has been taken as shown in Figure 2.68 below in order to verify the assumptions about the characteristics of medium standard and suburban area. In this 3.4 ha urban block containing 100 parcels, 87 residential parcels are occupied, leading to an average of 26 DU / ha (around 120 inhabitants/ha). Only 1 parcel is unoccupied, and 1 parcel is occupied by precarious settlement. Thus, the occupancy of parcel is extremely high (98%). The standard area of the parcels of this type of subdivision is 225 m2. Living area of buildings is relatively small, with an average of 102 m2. Finally, large roads and unused interstitial spaces represent a substantial part of the area (33%). As a result, the land use intensity of built-up area is relatively high (38%) for Nouakchott.

Sample Area: 33,814 m2; Built-Up Area: 12,401 m2; Land Use Intensity Ratio: 38%
Source: JICA Study Team based on 2016 satellite image and produced GIS data

Figure I-14 Sample of Land Use Intensity in Medium Standing and Suburban Area

Low Standing and Peripherical Area

The low standing of housing can be found in the peripheries surrounding the city, namely in the North part of Dar Naim, East of Toujounine and Riyadh. This typology designates isolated neighborhoods far from major urban axis, composed by small houses built with modest materials (zinc roofs), organized around a small traditional courtyard left unused. The parcel is constantly

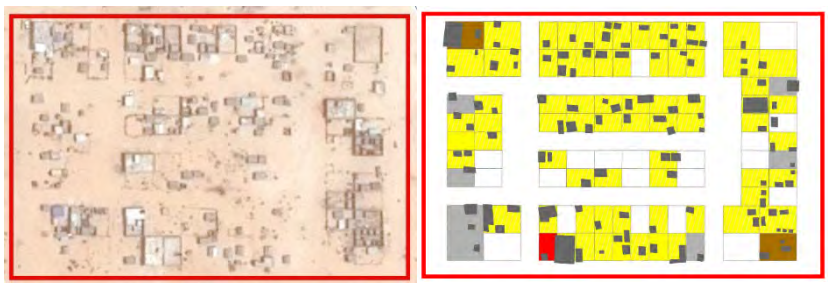
densifying according to the growth of the household. Alongside asphalt roads, scattered and small-scale local commercial activity can be found. Low standing and peripherical area is shown in Figures I-15 below.

Source: en Haut! - enhaut.org, JICA Study Team

Figure I-15 Typical Land Use Pattern of Low Standing and Peripherical Area

The average density in the low standard and peripherical area is average: around 10 to 30 dwelling units (DU) per ha, i.e. approximately 50 to 150 inhabitants /ha depending on the extremely variable occupation situation. This high population density is contrasting with the low intensity of land use.

A typical sample area has been taken as shown in Figure 2.71 below in order to verify the assumptions about the characteristics of low standard and peripherical area. In this 2.8 ha urban block containing 100 parcels, 82 residential parcels are occupied, leading to an average of 29 DU / ha (around 150 inhabitants/ha). 18 parcels are unoccupied, and 7 parcels are occupied by precarious settlement. Thus, the occupancy of parcel is relatively high (82%). The standard areas of the parcels of this type of subdivision are 150 m2 for the smallest parcels, and 300m2 for the biggest. Living area of buildings is relatively small, with an average of 60 m2 by barrack. Finally, sand access roads and unused interstitial spaces represent a substantial part of the area (38%). As a result, the land use intensity of built-up area is very low (9%).



Sample Area: 84,370 m2; Built-Up Area: 22,539 m2; Land Use Intensity Ratio: 27%
Source: JICA Study Team based on 2016 satellite image and produced GIS data

Figure I-16 Sample of Land Use Intensity in Low Standing and Peripherical Area

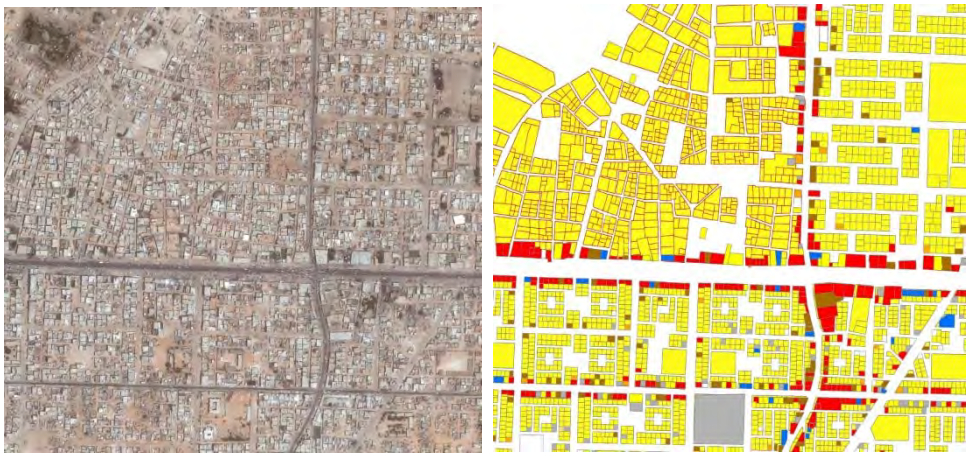
Shantytowns and Slum Pockets

Based on the history of urbanization discussed above, currently three major types of irregular occupancy are remaining in Nouakchott: ancient shantytowns, recent shantytowns, and slum pockets.

Ancient shantytowns

Even though most of the shantytowns formed in the first decades of urban expansion of Nouakchott have been resettled and requalified through the action of ADU, some of them have evolved as dense urban blocks, and have been formalized on-site by the administration. In the urban fabric, ancient shantytowns can be identified by a more organic shape, by the irregularity of parcel size and orientation, as shown in Figure 2.72. Ancient shantytowns generally gather vigorous commercial activity and are now fully integrated to the city, even though their level of equipment in urban services and infrastructure is still not sufficient.

In terms of density, ancient shantytowns have the same characteristics than medium standing and suburban area explained above.



Source: JICA Study Team

Figure I-17 Example of Typical Ancient Shantytown Land Use Pattern

Recent shantytowns

Even after the massive intervention of ADU, the phenomenon of kebbe has continued, and shantytowns established from the 2000's are still visible in the extreme outskirt of the city, especially alongside major roads to the East and Northeast. Recent shantytowns have established in the continuity of the urban sfringe, generally of low standing and peripherical areas, as shown in Figure I-18. However, a major characteristic of recent shantytowns is that they settled in the direct proximity of their livelihood source, as the famous kebbe installed recently on the site of the Port of Wharf, as shown in Figure I-19.

Source: en Haut! - enhaut.org, JICA Study Team

Figure I-18 Example of Recent Shantytown Formed in the Continuity of Urban Fringe (Dar Naim)

Source: High! - enhaut.org Source: JICA Study Team

Figure I-19 E Example of Recent Shantytown Formed Near Livelihood Source (Wharf Port)

Slum pockets

Another representation of irregular urbanization in Nouakchott is the presence of small slum pockets within the formal subdivisions, and especially in the wealthiest parts of Nouakchott, as shown in Figure I-20 below. It can be analyzed that the presence of slum pockets in more intense along the main commercial axis and in the developing parts where there are still vacant parcels.

Source: JICA Study Team on the basis of the field survey for the verification of land use

Figure I-20 Important Presence of Slum Pockets in the Wealthiest Part of Nouakchott (Tevragh Zeina)

As discussed earlier about historical formation of kebbe and gazra phenomenon, the presence of slum pockets in the formal city can be of two natures, as shown in Figure I-21 below: (1) the keeping of lands by the servants of wealthy households in the perspective of land speculation (gazra), testified in general by the presence of a unique tent or barrack in a large parcel closed by walls; (2) the presence of poor population packed in interstitial spaces in precarious housing (kebbe), generally giving service (construction, food cooking, security) to wealthy households.

Source: JICA Study Team

Figure I-21 Two Types of Slum Pockets: Gazra (left) and Kebbe (right)

(5) URBAN LAND

REGULATION OF THE LAND

The land issue arises with the independence of the Mauritanian state and the birth of its capital Nouakchott. Hoping to limit the customary land rights which implied that the lands are the property of the local tribes, the State appropriates the land monopoly by voting the land law of August 2, 1960. The latter, modeled on the French model, declares the unique belonging of the land to the state.

Subsequently, the State further strengthened its position by realizing its land reform through Ordinance 83-127 of 5 June 1983, which intended to break with land practices that hindered the planning and management of space. This reform, in addition to reaffirming the State's omnipresence of property and land, establishes the recognition of sole individual property by abolishing all traditional tenure and in particular any claim based on collective and customary rights.

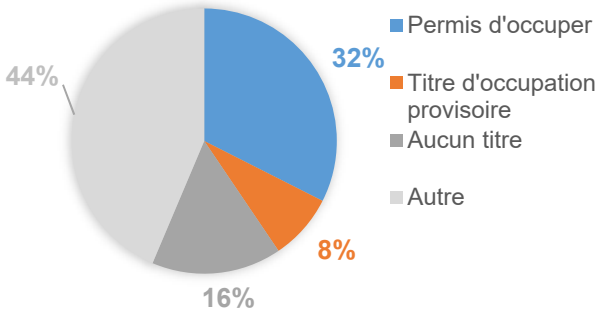
The urban domain is governed by Decree No. 2010-080 of 31 March 2010, revising Decree No. 90-020 of 31 January 1990. It defines the powers to grant urban concessions. This power falls, as explained in Article 126 of the Decree, the Ministry of Finance when the area does not exceed 1,000 m2, and the Council of Ministers when the area is greater than 1,000 m2. Previously, the hakem and the wâli also had this jurisdiction for residential land.

PROCEDURE FOR ACCESS TO THE LAND

Normally, in the case of a concession of less than 1 000 m2 in residential, commercial, industrial or craft centers, the planned procurement procedures apply.

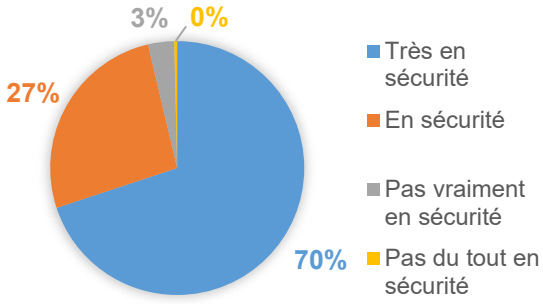
The process of obtaining land titles is, however, very little practiced, because registering at the Department of Domains leads to additional costs. As explained by the numerous studies on the land in Nouakchott, the license to occupy is enough to establish the property in the collective imagination.

In 2009, only 10,000 title deeds were issued by the DGDPE since the creation of Nouakchott. This result is corroborated by the results of the social survey since none of the 1,000 households surveyed said they had a real land title, only 32% have a license to occupy, 8% have a land title. temporary occupation, and a large majority of 60% have no document proving their legitimacy to occupy a land.



Source: Household Survey, JICA Study Team

Figure I-22 Possession of Land Titles



Source: Household Survey, JICA Study Team

Figure I-23 Sense of Security with Respect To Evictions

This situation of insufficient land titling can be explained by the cumbersome administrative procedures, but can also emanate from the fact that households have been accustomed to being provided with plots without obtaining a document. These households are also not anxious about their situation, since, as the results of the social survey show, almost all of them say they feel safe from crowding out: 70% feel very safe and 27% fairly secure, a total of 97% who feels safe, as shown in the graph above. Even if these figures show the confidence of the households in the institutions, which is a guarantee of stability of the urban society of Nouakchott, this situation of absence of land title leads to a shortfall for the State which can not therefore perceive tax, and participates in the appearance of all kinds of excesses, the proliferation of illegal occupations or the high speculation of land.

PROPERTY SPECULATION AND ILLEGAL OCCUPANCY

As explained above, the city of Nouakchott has experienced tremendous and rapid growth during the last decades, which has inevitably been accompanied by pressure and competition on land, causing land prices to skyrocket. At the same time, in order to accommodate the growing population, the state has distributed free land, most of the time not taking into account the current urbanization plans. The beneficiaries of these awards, having sniffed the right opportunity, sell the land at a high price and are once again illegal, looking for new land to invest. This is the beginning of the phenomenon of land speculation called gazra. Speculation is maintained by the existence of a dual price system: land is allocated by the state at a derisory administrative price that is not revalued, and is resold by the beneficiaries on the market at a higher price. . The same land can be sold several times on this informal land market, taking advantage of both the differential between administrative price and market price, but also the added value of urbanization in cases where the land is valued by the development. infrastructure and public facilities.

Even though land speculation has slowed down with the slowdown in urban growth, it is still present in Nouakchott, as evidenced by the purchase of land from the old airport by real estate investors up to 80%, for 20% only purchased directly by individuals. The household survey was an opportunity to survey the Nouakchottois on the prevalence of the phenomenon of speculation, but the results were weak (among the 16% of multi-landowners, only 8% said they wanted to sell their second long-term ground for profit), proving that the informal land market is now led by a handful of investors.

However, it seems that the system of concession and allocation of land in this informal land market is an essential component of the social bond, but also a guarantee of stability and social peace for the state administration that distributes the land. It is therefore advisable to regain control of the situation with caution and to propose concerted reforms by all.

ATTACHMENT TO PROPERTY AND LACK OF ALTERNATIVES FONCIÈRES

Although speculation is practiced only by a minority, the attachment of Mauritanian households to land ownership is an important phenomenon, since it is perceived as the safe haven and heritage par excellence. Thus, the social survey shows that a large majority of households (64%) Nouakchottois own their land and their housing, even if the share of households living in rental housing (30% in private rental and 5% in public rental) is growing.

There are few alternatives to individual homeownership, which further strengthens its attachment to the population.

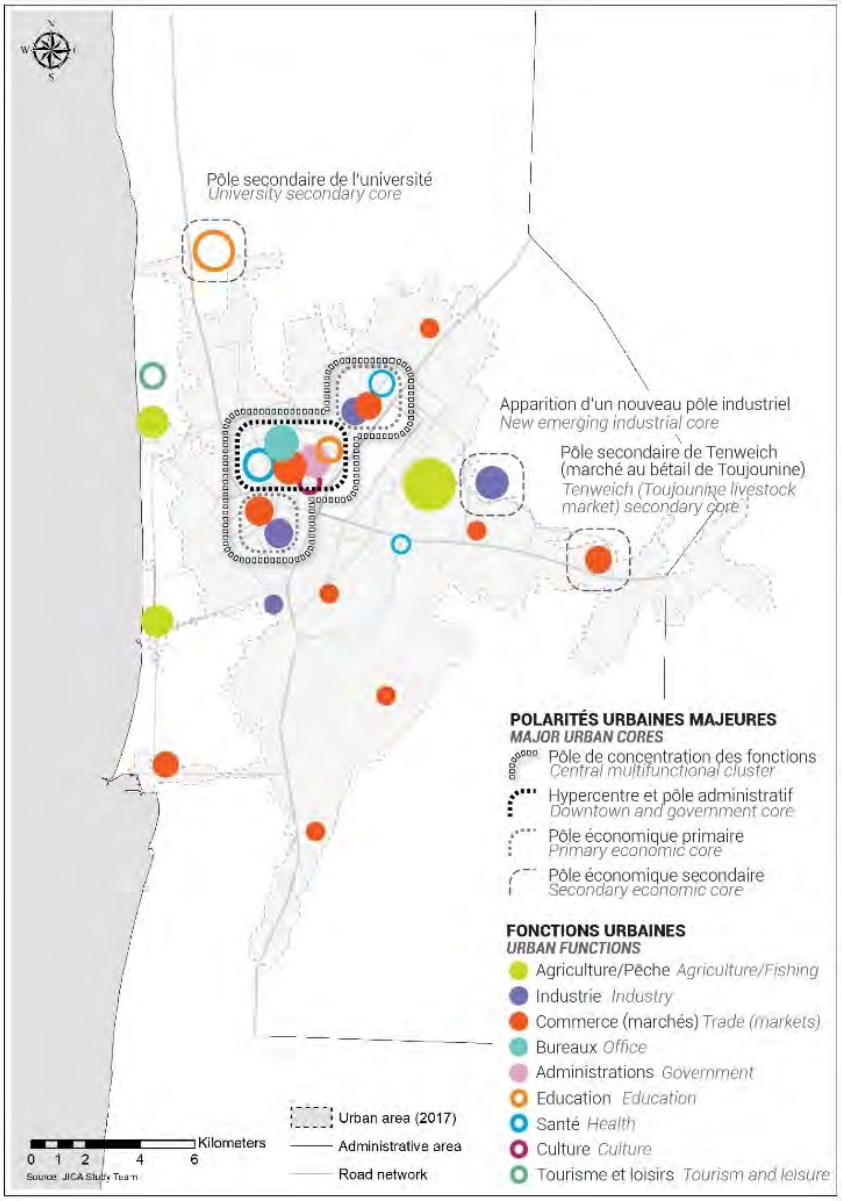
- Absence of law authorizing the co-ownership, even if it seems that it is born in the next years;
- lack of a housing offer for assisted homeownership;
- Disorganization of the private rental offer which is not very qualitative and targets the most precarious strata of the population;
- Weakness of the social rental supply due to the demobilization of social landlords.

While these elements reinforce the attachment of households to land ownership, they also reinforce the importance of the individual house in the urban fabric and constitute an important accelerator for urban sprawl.

(6) Existing Urban Structure

Having been developed in an unplanned manner, Nouakchott has grown with a macrocephalic, unipolar structure. Historic downtown area concentrates all the urban functions, and thus is saturated. In the detail, the existing urban structure of Nouakchott City, as shown in Figure I-24 below, can be characterized by the following:

- The overwhelming dominance of the historical downtown core of Ksar-Capital, which concentrates most of the urban functions: economic activities, administration and services;
- The downtown core is supported by two primary economic cores located in its vicinity: Marché Cinquième of Sebkha-El Mine in the South, and Ksar-Teyarett in the North;
- The agglomeration of the three cores mentioned above forms the biggest multifunctional cluster of the city of Nouakchott;
- Outside the multifunctional cluster, the rest of the city can be considered having low multifunctionality, consisting mostly in residential areas;
- The relatively small markets, which are a structuring element of Nouakchott city life, are mostly located alongside major roads, except for the one in Tarhil, which has an off-center position;
- At the outskirt of the city, two secondary poles are getting more and more importance: the university pole on Nouadhibou road in the North, and Tenweich market on Boutilimit road in the East;
- A relatively new industrial core is structuring the nearby outskirt in the Eastern direction.



Source: JICA Study Team

Figure I-24 Existing Urban Structure of Nouakchott (2017)

(7) Development Trends and Projects Affecting Urban Structure Transformation

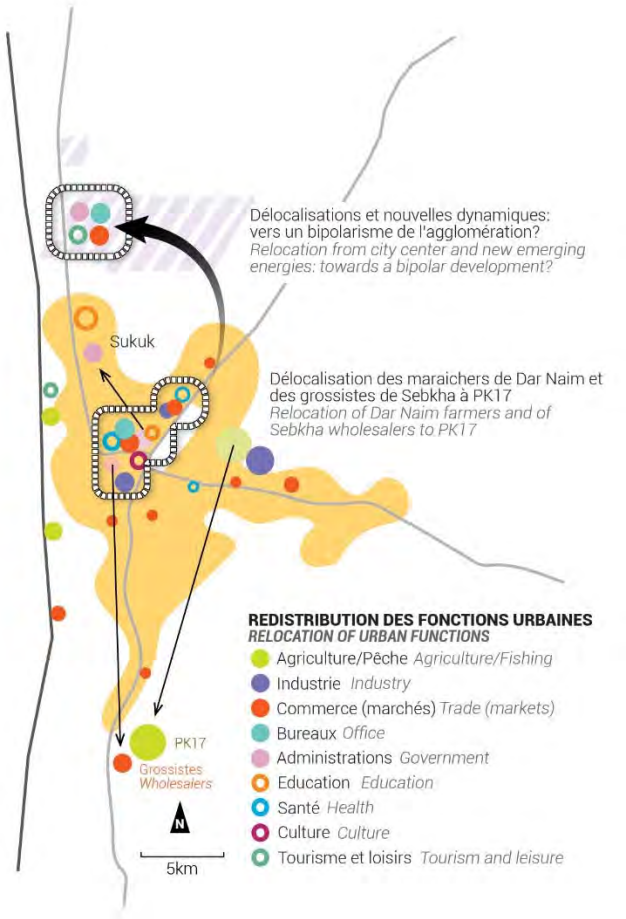
The following emerging phenomena are considered having an influence on the transformation of the existing urban structure. They will be considered as structuring factors in the elaboration of the different urban expansion scenario and development alternatives.

Relocation and specialization of urban functions at the metropolitan scale

The Mauritanian government has started to implement a policy of relocating major urban functions, particularly from the center to the periphery of the agglomeration. This redistribution aims at the rationalization of the metropolitan area, as well as the decongestion of the city center. The rationalization of the urban space is based on an objective pursued of functional specialization of certain peripheral cores. For example, the PK17 project, including agricultural, commercial and livestock components, will find synergies with the Port Autonome of Nouakchott, particularly in terms of freight forwarding.

The following projects, shown in Figure 2.79 above, can be cited as examples illustrating the efforts of relocation and specialization by Mauritanian government.

- Relocation to PK17 of fruit and vegetable wholesalers, traditionally located at the Sebkha Fifth Market, which will still keep the retail market. This project will reduce the number of trucks entering downtown;
- Relocation to PK17 of Dar Naim vegetable gardens farmers. Even if the project is quite ancient, nothing has been implemented yet. Many issues remain unresolved, such as the problem of accommodation of farmer near their workplace. The vegetable gardens, located very close to city center, represent a major added value for the city of Nouakchott: that of proposing a close-distance urban agriculture which is allowing to establish short food circuits which distribute quickly the agricultural production. Once relocated to PK17, agricultural production will have to keep its urban character by proposing a rapid diffusion of its products in the urban space;
- The emergence of the Resistance industrial zone, which is welcoming more and more companies, is occupying a significant surface on the urban continuity of the Toujounine neighborhoods. The steel foundry under construction or the recently completed solar power plant are two symbolic achievements of this industrial area. The proximity of the industrial area to the dwellings should be well considered, and the appearance of slums should especially be avoided since different types of pollution and nuisances can be generated by the industries.



Source: JICA Study Team

Figure I-25 Relocation of Urban Functions

Urban development in airport and coastal zone of Tevragh Zeina

Although urban pressure is lower than during the previous decades, it should be noted that a strong development towards the north of the agglomeration is ongoing. It is a largely a qualitative urbanization, symbolized particularly by the following projects.

- Construction of an international congress center, currently under completion, which should be ready to host the 30th Summit of African Union Heads of State in Mauritania in 2018;
- Expansion of luxury villas from Sukuk under progress;
- Private tourism and residential investments represented by Ribat Bahar project and the future airport city currently under consideration;
- Relocation of some central administrations to Sukuk, etc.

A detailed presentation of these projects is available in Part II of this report.

Nouakchott city, traditionally unipolar as described above, evolves in the direction of a bipolarity: the traditional downtown core (Ksar-Capital) in one hand / the new city established around the airport to the north in the other hand. It is likely that mostly administrative, office, tourist and luxury residential functions that will be relocated and attracted to this new airport city.

This evolution can be interpreted as a sort of new quest for a new urban modernity. It is necessary to take the measure of the real geographical consequences of this type of urban expansion. As was previously the creation of the university in a peripheral exclave, this type of expansion is disconnected from the existing city. It is contrary to the principle of urban continuity, which shall be strengthened in Mauritania.

Large-scale linear expansion towards east alongside hope road

To the east, alongside the hope route (route de l'espoir) to Boutilimit, a linear urban expansion over an extremely long distance is in progress. It seems that most of the land alongside this road to Ouad Naga (50km from Nouakchott) is already subdivided and allocated. This presupposes a colossal built-up expansion in the near future. The urban typology that characterizes this expansion is of two radically different types: high standard large secondary villas on one hand, but also a precarious habitat built by people who cannot afford to stay in Nouakchott on the other hand. The social dimension of this new urban growth must be taken into consideration. Public authorities should be able to propose affordable parcels or even housing (social housing policy) within the city of Nouakchott, in order to limit urban sprawl.

Nouakchott green belt: between success and fragmentation

The green belt, whose initial objective is the stabilization of dunes, has also a significant effect on the urban structure of the city of Nouakchott. Indeed, it allows to set a physical limit to the city and to contain inside the urban expansion. As such, the successes in creating this green belt over the long term should be encouraged. However, as shown in Figure I-26 below, although the green belt has expanded significantly in recent years, its integrity is threatened, as some projects could encroach on its area, such as the solar power station built in the neighboring industrial area. The building prohibition that will be prescribed in the SDAU must be followed by a political conviction not to derogate from it.

2002 2015 2017

Figure I-26 The Green Belt of Nouakchott between Success and Fragmentation

I-2.7 Situation of Transport and Mobility

In order to develop the SDAU, various studies on mobility in Nouakchott were carried out, namely a simple personon trip survey on 1,000 households, cordon line survey, vehicle count survey, Truck OD survey, traffic speed survey, mobility interviews and traffic survey. The full results of this work, summarized below, are available in the Main Report.

(1) Simple Person Trip Survey

The car ownership rate was linked to family income. The current average rate of possession of a car was 23% (230 vehicles per 1000 households).

The share of the main mode of transport consisted of market: 58%, taxi: 27%, private car: 11%, mini bus and big bus: 3%.

(2) Cordon Line Survey

The total volume of incoming and outgoing traffic from the city of Nouakchott was 5,833 vehicles per half-day (12 hours). Most of the trips were internal within Nouakchott. On the other hand, the number of vehicles crossing the city of Nouakchott was only 38 vehicles per 12 hours.

(3) Truck OD Survey

The total volume of traffic of freight vehicles entering and exiting the port of Nouakchott was 592 vehicles per half-day (12 hours). In terms of vehicle type, the semi-trailer was the most used with 91% entries and 87% exits, followed by heavy trucks with a proportion of 5% entries and 8% exits.

More than 90% of the freight vehicles entering and exiting the port of Nouakchott had their points of origin and destination within the city of Nouakchott.

More than 90% of the cargo vehicles entering the port of Nouakchott were not loaded (empty trucks). However, 54% of the transport vehicles leaving the port of Nouakchott were loaded with agricultural products.

(4) Traffic Count Survey

Generally, the number of road users tends to increase in the morning (7:00 to 9:00) and in the late afternoon (17:00 to 19:00) depending on home-work commuting.

Road traffic was concentrated in the city center (approximately 20,000 to 30,000 vehicles) and decreases as one moves away from the center.

The modal share of private cars and taxis was highest at 93%, followed by motorcycles.

(5) Traffic Speed Survey

The average traffic speed on each route was greater than 20 km/h. The circulation was usually quite fluid;

However, the speed of traffic in the city center was less than 20 km/h in all time zones. This reduction in speed was caused by the concentration of traffic and the decrease in road width caused by parking on the edge of the roads by cars, taxis and minibuses.

(4) Interview survey

Most respondents were not satisfied with the current taxi service. In particular, respondents were not satisfied in terms of safety and comfort.

With respect to the current bus service, respondents were not satisfied with almost every aspect except about ticket prices. Only 19% of respondents often use the bus. If a new bus line is created in the future, 64% of respondents said they would want to use the bus.

With regard to the current transport system, respondents assessed that traffic conditions (traffic jams), roads and installations (road conditions, street lighting, etc.), and transport services (bus, taxi) were the points to be improved in priority.

I-2.8 Infrastructure Conditions

(1) Water Supply

The water supply system of Nouakchott city has two water sources, a groundwater source at Iddini located about 60km east of the city and a surface water source of "Aftout Essahli Drinking Water Project" (hereinafter referred to as "Aftout project"), which is a surface water source of the Senegal River. To conserve the resources of the groundwater source, Iddini's yield was limited to about 20,000 m3/day after the start of Aftout project service.

Water service in Nouakchott city is provided by private connections connected to the water distribution network of SNDE, public water station, water tankers and water supply cart of water venders.

It is estimated that per capita water consumption for a private connection is 80 lhd (liters per capita per day) and 10-15 lhd for those who purchase water from vendors. The water bought from the sellers is expensive (3 to 5 times) compared to the unit water price of SNDE; as a result, the amount of water used by these population is limited to a minimum.

Significant leaks existed in the city's water distribution system due to its deterioration. For this, the effective network rate was 0.42 in 2011 (estimated by SNDE). The situation has gradually improved and with the progress of the water supply rehabilitation project, it is estimated that the effective network rate increased to 0.68 in 2016.

Currently, the water supply in the city of Nouakchott has been greatly improved due to the start of Aflout project's supply, but the rehabilitation of the water distribution network can not cope with the expansion of the urban area.

For this reason, areas without water supply extend into the city and residents in these areas can only obtain water from public water stations, water tankers and water vendors.

(2) Sanitation and Wastewater Treatment

The topography of the city means that during the rainy season, the water infiltrates rapidly in the high areas, due to the porous nature of the mostly sandy soils, and flows to the lower areas. On the other hand, in several places characterized by low altitudes (between -0.5 and 1.5m), the wastewater, which is not sanitized, together with the non-discharged rainwater, is injected into the basement and form ponds on the ground for large areas for a long peiod of time in a year.

This difficult natural context has led to multiple malfunctions of the sewerage network, which covers a tiny part of the city (5%): poor state of the old hydromechanical equipment, lack of maintenance of the network structures, frequent breakdowns of the water pumps in discharge stations due to the presence of debris of all kinds arriving at the suction covers, clogging of the drains, etc. In addition, problems specific to the WWTP contribute to the paralysis of the network as a whole: defective screening, engine burnout, valve malfunctioning, archimedes defect problem, etc.

The management of urban space directly impacts the functioning of sewerage networks. Road maintenance is essential in order to avoid network congestion and therefore the reduction of its transfer capacity. Poorly managed urban waste means that the existing network is largely clogged (municipal waste and silting).

In addition to the sanitary and aesthetic damage associated with the non treatment of domestic wastewater loaded with pathogenic microorganisms, the accumulation of this wastewater in the subsoil feeds the water table, which contributes to its rise and the formation of an impermeable thin layer.

I-2.9 Summary of the diagnosis and design concepts

(1) Identified Problems and Planning Issues to be Addressed

Based on the full diagnosis presented briefly in this section, a total of 39 issues, classified into right different themes, were identified as planning issues for the city of Nouakchott, as shown in the table I-5 below.

Table I-5 Identified Problems, Planning Issues and Implication in City Planning

Category	Identified Problem	Planning Issues	Implication / Solutions in City Planning [reference to Strategic Orientation]
Global Environment and Vulne-rability to Disaster (GE)	GE-01: Hot desertic climate	• Hot weather makes walking / biking throughout the city difficult • Usage of public space by day time is limited • Making of the city (urban development and urban planning) shall consider specific climatic aspects (heat,	• Create a green network to allow walking / biking in cooler conditions [2.3] • Create more green spaces to cool down the general temperature of the city [2.1, 3, 4 & 5] • Consider shadow in designing public spaces [R]
	GE-02: Frequent flooding on large area	• From the viewpoint of the city, frequent flooding hinders smooth running of the city (transportation, social services, infrastructure) thus represents a major economic loss • From the viewpoint of the citizen, frequent flooding implies costly damage and resettlement, social conflicts and public health problems	• Control urban development in areas at risk of flooding by conditional construction [1.1.2] • Restructure and adapt buildings already located in flooding area [1.1.4] • Relocate social services (schools, hospitals etc.) located in flooding area • Pursue the efforts of large-scale drainage facilities construction

Category	Identified Problem	Planning Issues	Implication / Solutions in City Planning [reference to Strategic Orientation]
	GE-03: Stagnant water on low land areas	• Stagnant water ponds where gather all types of toxic effluents represent major risks to public health • Rehabilitation of stagnant water ponds shall consider both public accessibility and public health (mosquito hatching etc.)	• Promote change of land use of stagnant water ponds into local green areas [2.5.2] • Pursue the efforts of pumping and drainage facilities construction
	GE-04: Erosion of coastal dune and shoreline	• Breach in coastal dune aggravates the risk of flooding due to sea incursion • Urbanization of shoreline leads to modification of sediment distribution and threatens the integrity of human settlements inside the city	• Restrict new construction on the shoreline [2.2] • Promote shoreline as a major recreation area for the whole city while ensure protection of the dune [2.2] • Promote beach accessibility by soft modes of transportation (Rapid Transit to walk) [2.2] • Pursue the efforts of conservation of the coastal dune integrity
	GE-05: Silting threatening a part of the city	• Silting in the city area hinders smooth operation of urban services, and especially water supply and sanitation • Progression of dunes in the city implies important costs of sand removing in the streets by technical services	• Strengthening green belt efforts [2.1] • Greening the city to reduce wind velocity and sand drifts and increase soil moisture [2.1, 3, 4 & 5]
	GE-06: Salty soils (sebkhas)	• Building concrete is attacked by salt threatening the durability of the houses and public facilities • Majority of neighborhood built on sebkhas is already abandoned, causing public health problems (waste dump)	• Strongly prohibit construction in high flooding areas of sebkhas [1.1.1] • Restructuration of abandoned areas located on salty low lands of sebkhas [1.2.1]
	GE-07: Rise of underground water table	• Densification of urban area and provision of drinkable water and sanitation services in a concentrated area shall be performed carefully and with control	• Strongly prohibit construction in areas where underground water table is rising [1.1.1] • Plant trees in parks and green network to absorb rain water and shallow underground water to make the water table level decrease [2.3] • Pursue efforts of rain water drainage improvement
	GE-08: Climate change aggravating vulnerability	• Prepare the city to the worst scenario of climate change (sea level rise, global warming, increase of rain and wind intensity)	• Pursue efforts of adaptation of the city form to disaster risks
Environmental Pollution (EP)	EP-01: Natural and anthropic air pollution	• Nouakchott has natural air pollution from suspended particles due to sand and dust storms • Low GHG emission urbanization patterns and transportation models are prioritized • Further increase of car traffic amount by road infrastructure construction shall be controlled carefully	• Pursue pavement of roads, greening of the city and planting of green belt to increase resilience to sand and dust pollution • Articulate urban development and urban renewal with public transport to create a compact and polarized city [1.2] • Promote walkability and bikeability to decrease car dependence by strategically intensifying urban fabric [1.1] and designing green network [2.3]

Category	Identified Problem	Planning Issues	Implication / Solutions in City Planning [reference to Strategic Orientation]
	EP-02: Water and soil contamination	• Water and soil contamination, alongside with increase of rain and stagnant water, creates a major public health risk to dense urban areas especially appearance of diarrhea in local commercial (market) areas • Densification of urban areas shall be performed carefully and based on strict sanitary standards	• Detail plans (PLU) shall organize land use through a perspective of public sanitary and especially shall operate a redistribution of commercial land use (markets) in low risk areas throughout the city • Pursue efforts of improvement of rain water drainage and sanitation environment
Socio-economic Situation (SE)	SE-01: Large urban poverty and income gap	• Poverty is important in terms of proportion of poor inhabitants and of seriousness of poverty • Social disparities created by income gap is an obstacle to the realization of harmony in the city • Traditional social safety nets and solidarity shall be preserved	• Promote and secure economic poles radiating at the metropolitan level [3.1] • Promote social mix and territorial balance by ensuring resettlement and affordable housing [1.4]
	SE-02: Mostly informal and weak economic sectors	• Solidification of all economic sectors, including industry, with increase of added-value through facilitation of economic activity in the urban environment • Structuration and formalization of economic sectors while keeping a tolerance for necessary informal sector in the urban environment	• Support economic growth through redefined sectoral poles and private investment [3.3] • Promote diversification of activities and jobs [3.5] • Detail plans (PLU) shall organize land use for promotion of formal economy sectors but shall also give a tolerance for more mixed and informal uses
	SE-03: Geographically unbalanced employment pools	• Concentration of jobs in city center generates a dual city with spatial discrimination • Urban environment shall favor job opportunity creation at the most fine-grained scale possible	• Promote the development of secondary mixed-use poles throughout the city in link with public transportation [1.3] • Optimize land use to introduce business activities and non-polluting small industries within residential urban fabric [3.4.1]
	SE-04: Degraded human health situation	• Urbanization patterns and transportation models, since they impact directly consumption habits and thus human health, shall be focused towards more regular physical activity	• Promote walkability and bikeability of the city to motivate physical activity by strategically intensifying urban fabric towards compact city [1.1] and by designing green and blue internal network [2.3]
	SE-05: Unstable security and feeling of unsafety	• Concentration of political power including foreign embassies in central district with important road accessibility makes the city vulnerable to terrorist attack • Feeling of unsafety shall be tackled through the establishment of socially and culturally inclusive environment	• Promote the rationalization of land uses towards more security, especially through the redistribution of political and administrative functions in dedicated metropolitan level cores (airport city administrative pole) [3.1] • Promote the multiplication of small scale public and green spaces [2.5] • Ensure a high and appropriate level of security in public and green spaces [2.7]
Urban Environment	UR-01: An isolated position of Nouakchott	• Nouakchott is an attractive economic magnet for rural population from hinterland.	• Promote the setting of urban growth boundary in Nouakchott city

Category	Identified Problem	Planning Issues	Implication / Solutions in City Planning [reference to Strategic Orientation]
and Land Use (UR)	in the regional context	• Urban growth of Nouakchott outside its administrative area and re-balance with other cities in Mauritania shall be well considered	• Ensure the balance of settlements at the regional scale • Establish Nouakchott as a hub at the regional scale
	UR-02: Uncontrolled and inequitable urban sprawl	• Urban sprawl is driven by the whole scope of economic realities through both survival occupation (*kebbe*) and land speculation (*gazra*). • Urban sprawl leads to the production of living environment deprived of services, jobs and infrastructures, and at risk of natural disaster • Discontinuous urban development leads to the extension of commuting times, partition of the city and to threatening of population unity	• Prohibit and control urbanization in risk areas especially flooding areas and outside ring road [1.1] • Articulate urban development with public transport to create a compact a polarized city [1.3] • Polarize urban extensions [1.5] • Pursue efforts for strong urban growth control
	UR-03: Low density of urban fabric	• Relatively large living area of individual houses is often pointed out as the main reason for low density of urban fabric • Nevertheless, there are other reasons for low density rather than living area: low occupancy rate of residential areas, only 30% of the urban area is built-up, lack of rational use of lands, disordered parking etc.	• Ensure limited land consumption by operating densification, regeneration and polarization of the urban area while ensuring the largest living area possible [1.2] • Promote various types of housing offer (rental/ shared ownership/ accessible home ownership, social housing/ high standing)
	UR-04: Influence of nomad culture and tradition	• Explaining some behaviors and for example driving habits, influence of nomad culture is still vivid in Nouakchott. • Values of nomads include freedom of movement and settlement on free and large spaces. • One symbol of Bedouin hospitality is the *khaima* (tent) which can be still be found throughout the city.	• Promote urbanization patterns and mobility policies that respect nomad culture and tradition • Preserve existing residential density and housing largeness • Introduce high level of public transportation service
	UR-05: Spontaneous and disordered land use	• Domestic breeding of goats and donkey is still practiced and leads to traffic obstruction, garbage eating, damaging green spaces. • Open spaces are used as garbage dumping sites. • Irrational land use and occupation of public roads shall be improved while not hindering economic and social activity.	• Detail plans (PLU) shall organize land use through a perspective of order and public sanitary • Design attractive and well managed green spaces in order to avoid garbage dumping in open spaces
	UR-06: Remaining shantytown area to address	• Shantytowns are generally erected in the most strategic places of the city: in the middle of dense areas, in proximity of working places (port, construction sites etc.), thus is represent an important potential for redevelopment, but at the same time relocation shall be carried out carefully to avoid moving the problem • Historical shantytowns evolved as proper urban entity and recent slum	• Promote in-situ consolidation and upgrade of ancient shantytowns [1.2.2] • Promote resettlement and relocation for newly formed slum pockets for strategic redevelopment towards common interest [1.2.4] • Explore innovate mechanisms to finance shantytown renovation by assistance of private sector

Category	Identified Problem	Planning Issues	Implication / Solutions in City Planning [reference to Strategic Orientation]
		pockets shall be considered separately • Traditionally shantytown settled on large areas, but some "slum pockets" can be still be find in interstitial spaces in rich neighborhoods	
	UR-07: Lack of green and public spaces	• Showing low density and lack of quality public spaces, Nouakchott is characterized by little invested interstitial spaces conducive to wild waste dumping • Creation of green and public spaces is an opportunity to struggle against various environmental problems, foster walkability and rationalize urban environment alongside intensification policies	• Foster the multiplication of small scale public and green spaces in the urban fabric by promoting change of land use of stagnant water ponds and former agriculture fields [2.5] • Support the establishment of nature in the city with major green poles [2.4]
	UR-08: Agricultural lands of uncertain future	• The important role of agricultural lands as a food source for the city shall be maintained in Nouakchott • Former agricultural lands shall be reallocated in priority to strategic urban development or conservation as open and recreational space	• Accompany the transition of urban agriculture from ancient Toujounine gardens to the establishment of the agricultural green belt in link with PK17 project [3.1]
Land Tenure Scheme (LT)	LT-01: Land speculation and illegal settlement	• Land speculation, only practiced by a handful of investors, is still vivid in Nouakchott, and leads to a continuous urban sprawl	• Pursue efforts for strong urban growth control • Establishment of a formal land market
	LT-02: Attachment to land property and lack of tenancy alternatives	• Attachment to land property and lack of tenancy alternatives reinforce the predominance of individual housing in the urban fabrics and urban sprawl	• Foster a law authorizing condominium ownership • Establish homeownership assistance program • Organize qualitative private rental offer targeting all social classes including middle classes • Promote social rental offer
	LT-03: Difficult securing of public lands	• Communes does not have any right on land. This situation hampers the process of decentralization and the responsibility of the commune in the planning and management of their own administrative space	• Simplify land request procedure from the commune to the State • Promote communication and coordination between State services and communes
Transport and Mobility (TM)	TM-01: Road traffic, congestion and road typology	• All the traffic passes through the city center, which suffers from serious traffic congestion • There are still many unpaved roads throughout the city	• Divert the unnecessary car trips in the city center by promoting bypass roads and ring roads • Pursue the paving of roads in all parts of the city
	TM-02: Low motorization rate	• A large proportion of the population is isolated in its neighborhood and cannot access to metropolitan services and jobs • Motorization rate increase shall be controlled towards the realization of NMT based city	• Propose affordable public transportation solutions • Promote the model of compact city in order to gather population and services and thus be less dependent of transportation
	TM-03: Limited public transportation system	• Almost not any public transportation, except for students, is established currently in Nouakchott, leading to a low transportation penetration rate	• Promote modal shift from private car to public transportation • Articulate urban development with public transport [1.3]

Category	Identified Problem	Planning Issues	Implication / Solutions in City Planning [reference to Strategic Orientation]
	TM-04: Disordered parking habits	• Parking space formalization and change of parking habits may constitute a cheap and soft way of resolving lack of public space and densification of urban fabric • Urbanization patterns shall be reoriented towards the use of the city by all citizens and not only by car users	• Limit parking space in central areas ("Heart of the city" zone) in order to clear space for public usage and encourage use of public transportation [1.2.3] • Reorganize parking lots in priority in the vicinity of Rapid Transit nodes to encourage modal shift [1.3.5]
	TM-05: Difficult traffic management	• Risky driving behaviors such as over-taking and counter flowing are frequent in Nouakchott • There were many roadside frictions that disturb the smooth car flow in the streets	• Improve traffic safety and parking management • Formulate the urban space for NMT users
Urban Services and Infrastructures (SI)	SI-01: Water source to secure	• Water resources for the city of Nouakchott are secured until the horizon of the SDAU, but sustainable settlement on longer term seems compromised	• Promote the expansion of capacity of water source at the appropriate time based on the capacities of the groundwater source and surface water source
	SI-02: Lack of integrated urban water management	• Wastewater treatment and sewage capacity is not sufficient regarding the needs of urban population, thus population discharge in open pits • In parallel, the amount of potable water supplied has increased radically, aggravating wastewater discharge in the subsoil	• Promote integrated and balanced urban water management system
	SI-03: Infrastructure penetration coverage is weak and unequal	• Water supply distribution is geographically unequal (pipe network, donkey cart, etc.) in terms of water tariff and water quality • Sewerage network only covers a small proportion of the city	• Pursue the extension of all utilities networks to cover the city the most equally possible • Ensure the affordability of urban services and connection to urban infrastructures
	SI-04: Infrastructure deprived areas cumulates problems	• Infrastructure deprivation leads to the cumulation of important social unrest (more expensive water tariff etc.) and environmental degradation (water contamination by sewage discharge etc.)	• Zones of infrastructure deprivation, in particular shantytowns, shall be part of financially supported improvement and renovation programs
	SI-05: Infrastructure is not functioning properly	• Water supply distribution system suffers important leaks leading to overflow of drinking water in the network • Sanitation system suffers multiple malfunctions of the mechanical equipment, lack of maintenance of network structure, breakdown of water pumps to the presence of sand and debris coming from garbage dumped in the city	• Improve the functioning of urban infrastructure features while limiting various environmental problems (silting) and anthropic input (wild garbage dumping) which would affect their smooth operation
Social Services and Public Facilities (PS)	SF-01: Shortage of land for public facilities	• State reserved land planned for public facilities, being often replaced by another land use, shall be secured • Necessary large-scale land opportunities shall be secured as early as possible in the outskirts of the city	• Ensure the rationalization of land use and the securitization of public land reserves • Promote city entrance as Metropolitan Gateways to provide large-scale public facilities to the city [1.6]
	SF-02: Service quality does not	• Public facilities especially in the educational field suffer the	• Promote quality schools, health centers and other cultural

Category	Identified Problem	Planning Issues	Implication / Solutions in City Planning [reference to Strategic Orientation]
	match the needs of citizens	competition from private institutions and cannot provide enough quality to citizens	amenities in the Mauritanian capital city
	SF-03: Service capacity and penetration coverage is unequal	• There is a lack of health and education facilities in some dense residential neighborhoods, while other parts of the city are well equipped	• Ensure the respect of localization norms of public facilities and construct schools and health points where needed

Source: JICA Study Team

(2) Recommended to Consider to Formulation Development Vision

Alongside the objective observation of the reality of the problems in Nouakchott, the development process of the SDAU is supported by three main types and sources of recommendations, namely (1) the recommendations of the existing strategic documents, (2) the citizens' recommendations and opinions based on the results of the household survey and public consultation workshops, and (3) the recommendations of urban stakeholders and experts collected during the July 2017 consultation seminar. Table I-6 below presents the total of the 60 recommendations.

Table I-6 List Of Recommendations to be Taken into Account for Planning

Analytic Component	Sub-Category	ID	Development Issue and Opinion
Recommendations from existing upper level strategies and plans	SDAU 2003 (SD)	SD-01	Densify formal neighborhoods
		SD-02	Stop the radial development of the city
		SD-03	Upgrade, reorganize and equip informal settlements
		SD-04	Prohibit development on unsuitable areas and protect environment
		SD-05	Promote economic growth
	Cergy Workshop 2014 (CW)	CW-01	In the short term, control water supply of the city
		CW-02	In the long term, restore water place
		CW-03	Green and fertilize the city
		CW-04	Preserve the dunes
		CW-05	Implement projects at the scale of the district
		CW-06	Develop multi‐polar structure
		CW-07	Improve mobility
		CW-08	Develop adapted planning tools
		CW-09	Harmonize the various levels of governance
		CW-10	Redevelop former airport site as eco‐town
		CW-11	Reinforce the identity of the capital city
		CW-12	Emphasizing on the future of the coastal area
Recommendations and opinions from citizens	Main results of household survey (HS)	HS-01	New settlements not only in suburbs but also within existing urban area
		HS-02	Traditional aversion to collective housing (apartment) tends to reduce
		HS-03	Wealthy households coexist with poorest households
		HS-04	Precarious settlements are still existing
		HS-05	Inequality regarding access to social services
		HS-06	Inequality regarding access to urban infrastructure
		HS-07	Inequality regarding mobility (low motorization rate and lack of public transportation)
		HS-08	Social peace, solidarity and religion as main pillars of Nouakchott society
	Opinions from Nouak-chott citizens	PC-01	Struggle against pollution
		PC-02	New public spaces
		PC-03	A better society

Analytic Component	Sub-Category	ID	Development Issue and Opinion
	through public consul-tation (PC)	PC-04	Coherent and functional urbanism
		PC-05	Mitigate vulnerability to natural hazards
		PC-06	Operational sewerage network
		PC-07	Improve mobility
		PC-08	Improve housing
		PC-09	Improve public health
		PC-10	Access to water and electricity
		PC-11	A modern and attractive capital city
		PC-12	Consolidate spatial balance and diversity
		PC-13	Ensure the security of urban areas
		PC-14	Consider density at the human-scale
		PC-15	Get the city prepared for high public mobility
Recommen-dations from urban actors and experts during consultation seminar (RS)	Recom-mendation from "City Planning & Mobility" Working Group	RS-01	Make change the attachment to land ownership
		RS-02	Establish a physical boundary to the city
		RS-03	Put an end to horizontal and linear urban expansion
		RS-04	Limit land speculation and tax lands kept undeveloped deliberately
		RS-05	Promote shared ownership (condo) to develop rental stock and densification
		RS-06	Create more diverse forms of financing of housing (home ownership accessibility)
		RS-07	Restructure remaining shantytowns
		RS-08	Raise awareness regarding mobility: traffic rules, usage of road space, etc.
		RS-09	Promote modal shift from private car to public transportation
		RS-10	Hold "urban management contests" between Wilayas to foster innovation
		RS-11	SDAU shall propose how to improve existing situation of urban areas
	Recom-mendation from "Society, living environ-ment & sustaina-bility" Working Group	RS-12	Create more public or recreational open spaces well distributed in the city
		RS-13	Promote the coastline as a large‐scale public space
		RS-14	Fill the missing link of waste collection in the solid waste management cycle
		RS-15	Mitigate public health risks generated by flooding
		RS-16	Struggle against silting by carrying out reforestation and greening
		RS-17	Establish and make respect zoning of flood‐prone areas
		RS-18	Take into account salinity in urban planning
		RS-19	Mitigate risks linked with electricity and electric network
		RS-20	Rely on the important role of the mosques in the city

Source: JICA Study Team

(3) Grouping of Problems and Recommendations into Priority Planning Themes

Identified problems and recommendations cannot be merged but they can be grouped into priority planning issues, as detailed in the Table I-7 below.

Table I-7 Grouping of Problems and Recommendations into Priority Planning Themes

	Priority Planning Theme	Identified Problem	Recommendations
1	Densification and limitation of urban sprawl	UR-02, UR-03	SD-01, SD-02, HS-01, HS-02, PC-14, RS-02, RS-03,
2	Shantytowns restructuration	UR-06	SD-03, HS-04, RS-07
3	Mobility improvement	TM-01~05	CW-07, HS-07, PC-07, PC-15, RS-08, RS-09
4	Green and public spaces	UR-07, UR-08	CW-03, PC-02, RS-12

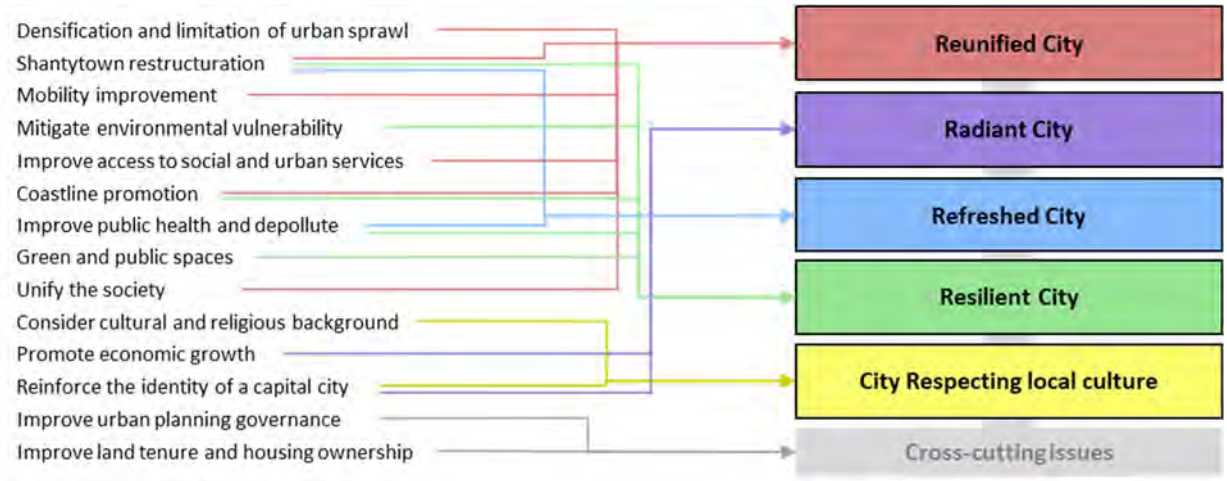
	Priority Planning Theme	Identified Problem	Recommendations
5	Coastline promotion	GE-04	CW-12, RS-13
6	Mitigate environmental vulnerability	GE-01~08	SD-04, CW-01, CW-02, CW-04, PC-05, RS-16, RS-17, RS-18
7	Improve public health and depollute	EP-01, EP-02, SE-04	PC-01, PC-09, RS-15
8	Improve access to social and urban services	LT-03, SI-02~05, PS-01~03	HS-05, HS-06, PC-06, PC-10, RS-14
9	Unify the society	SE-03, SE-05	CW-06, HS-03, PC-03, PC-12, RS-20
10	Consider cultural and religious background	UR-04	HS-08, RS-20
11	Promote economic growth	SE-01, SE-02, UR-08	SD-05
12	Reinforce the identity of a capital city	UR-01	CW-11, PC-11
13	Improve urban planning governance	UR-05	CW-05, CW-08, CW-09, PC-04, RS-04, RS-10
14	Improve land tenure and housing ownership	LT-01, LT-02	PC-08, RS-01, RS-05, RS-06

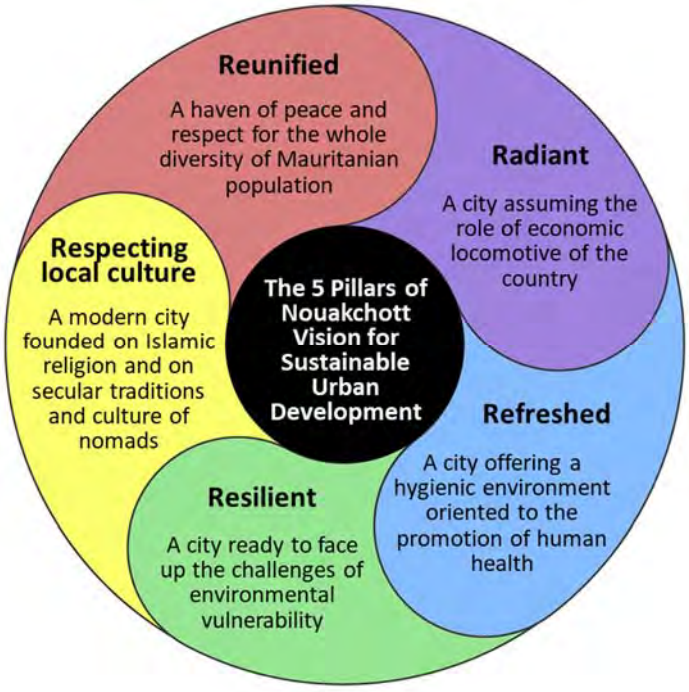
Source: JICA Study Team

I-3 Development Concepts

I-3.1 Basic Policy for Development of Nouakchott

It was discovered at the analysis of priority planning issues that it is not sufficient to cope with these issues by only focusing on the three ordinary pillars which seeks balance of economic, living, and natural environment. In Nouakchott, there is a need to focus on sanitary and health issues as well as consideration of Islamic religion and nomadic traditions and culture. Thus five pillars are introduced as basic policies for development of Nouakchott covering all the 14 priority issues as shown in Figure I-27 below.





Source: JICA Study Team

Figure I-27 Five-R Pillars for Development of Nouakchott City

All the propositions given in land use plan (Section 4.4) and sectoral development plans (Chapters 5 to 7) of the SDAU set foundation on thefive pillars (5 "R") as basic policy for development of Nouakchott. Elements of the "5-R" are described below.

Radiant:	Nouakchott is an international gateway assuming the role of economic locomotive of the country;
Resilient:	Nouakchott is ready to face up the challenges of environmental vulnerability;
Reunified:	Nouakchott is a haven of peace and respect for the whole diversity of the Mauritanian population;
Refreshed:	Nouakchott offers a hygienic environment without diseases, where human health is promoted;
Respecting nomad culture:	Nouakchott is a modern city founded on Islamic religion and on secular traditions and culture of nomads.

I-3.2 Elaboration of Basic Concepts for Nouakchott Development

(1) Goals of Nouakchott in wider context

Although it is expressed in the public consultations and seminar discussions that people puts more importance on improvement of the existing conditions of the city, development of Nouakchott city needs to contribute achieving national policies as a capital city of Mauritania, Potential and expected role of Nouakchott in wider contexts are itemized below as a goal of the development of the city, based on the discussion in wider gio-economic context (Section 2.1) as well as upper policies of macro-economic development (Sub-section 2.3.6). These goals need to be achieved as an effect of solving the city's own problems through 5-R pillars..

1) Role of Nouakchott in West Africa and beyond

- ✧ Although Mauritania is one of the members states of the Arab Maghreb Association (AMU), the cooperation treaty's application is limited.

- ➢ There is room to be active in the Association, although cultural and tourism exchanges are more promising than manufacturing and trade. Nouakchott needs to be established as a **major gateway of the country**.

✧ Trade with member states of the West African Economic Community (ECOWAS) is more active than that in AMU

- ➢ There is a chance to promote not only resource trade but also agricultural products and handicrafts. Nouakchott needs to be function as a **market to provide foundation of agricultural and handicraft activities**.

✧ Mauritanians are active in commercial services all over Africa. Transmission of funding from them is and continue to be the source of consumption based economy in the capital.

- ➢ There is a chance to transform Nouakchott as a **leading service and commerce center in the region**.

2) Role of Nouakchott in Mauritania

✧ Historically an emergency safety base for the population of the country

- ➢ Maintaining the function of the **emergency safety base**, along with national efforts to strengthen economy and public services in other cities and rural areas.

✧ Continue to be political, administrative, economic center of Mauritania

- ➢ Enhance the role of the **locomotive of national economic development**. As a consumption-led economy, contribution to promoting import substitution industry and suburban agriculture will be the key.

✧ International passenger gateway to the country

- ➢ Holds important role in the national tourism development strategy, as a **face of Mauritania**.

(2) Elaboration of the Theme of Nouakchott development

The basic theme of Nouakchott development was elaborated through a series of discussion especially among the Task Force members and the JICA Study Team, which extended to various aspects of the city. These include history, nature, culture, economy, physical issues, social vulnerability, and responsibility to the global issues.

Several key words were identified during the discussion meetings as iconic highlights of the issues the city has to address. These key words are as follows:

Sand and Water:

Are the primary elements the city stands on. Both of them are subjects to overcome in the history of the city, but also the symbol of the city which formed the life style and culture of the citizens. These have potential to enhance locating tourists and thus should be treated as precious resource of the city, A new idea to integrate these elements are to connect by green network and urban primary corridor.

Service and Commerce:

Are the fundamental economic activities of the city and will continue to be the locomotive of the economic development of the city and the country as a whole. The success of the Mauritanian expatriates all over the continent is one of the legends, and the similar or even better performance will take place in the city.

Sea and Land (and Air):

Are the symbol of cultural foundation of the population of Nouakchott. The city is a platform of the people of various cultural background. The strategic location of Nouakchott has enabled interaction of people from the different culture, and will be enhanced with the strengthened air connection which extends to every parts of the world.

Above key words were further examined and crystalized to the basic concept of the urban development of Nouakchott:

Nouakchott: The Meeting Place of the Pearls

By its strategic location, Nouakchott will be the meeting place of the natural and human identities. Each element meeting in the city has own value and identity with brightness of a pearl. The city provides spaces and chances of meetings between, but not limited to, the following:

- ✧ Land, sea and air,
- ✧ Sand, water and green,
- ✧ Nomads and settled people,
- ✧ Mauritanian and foreign citizens,
- ✧ Producers and consumers (via traders)
- ✧ Provider and beneficiaries
- ✧ Historical and modern lifestyles,
- ✧ Local and global wisdoms

All of them represents the development issues of Nouakchott. The city is still in the early stage of development and integration in both physical and socioeconomic aspects. At the same time, the city is in a contemporary global community which shares sophisticated technology, as well as common risks in sustainability. Development of Nouakchott will seek solutions and prosperity of local and global citizens.

The meeting place of the pearls would have a shape of a traditional jewel of Mauritania, having a shape of envisaged shape of the compact city:

Figure I-28 Sample Image of the Traditional Jewel of Mauritania

(3) Structure of Nouakchott Development Concepts

Relationship of vision, goal, and basic concept is illustrated in Figure 3.5. By the plans and projects formulated through the "5-R" development visions, the Meeting Place of the Pearls will be materialized, which will contribute to achiving expected roles in the national and regional

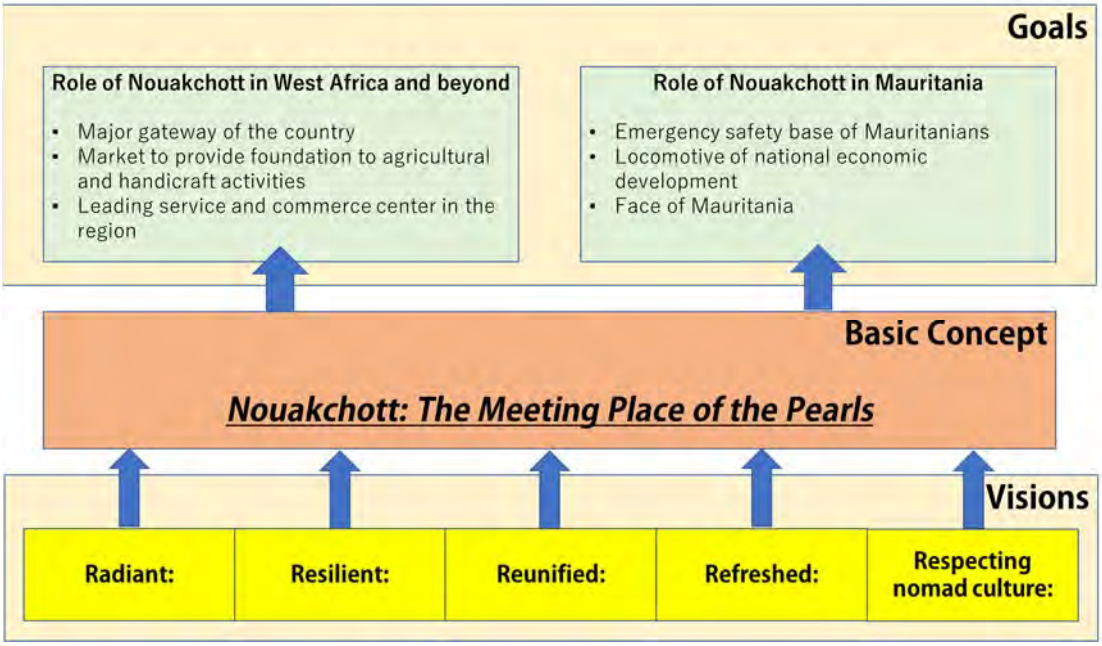


Figure I-29 Structure of Nouakchott Development Concepts

I-3.3 Development Framework

(1) Population Projection of Nouakchott in 2040

Based on the analysis in the preceding sub-section, the population of Nouakchott in 2040 will be established at 2.20 million.

This rounding number (2.20 million) is based on the population projection by Case 2-2 (2.18 million in 2040), which is discussed and shown in Table 3.6 and Figure 3.7, but the proposed one is slightly bigger than this projection considering the lessons from the past SDAU which lost the public credit due to smaller population projection.

From the viewpoint of the capacity of infrastructure, water resources and water supply in particular, this population size is within an acceptable range.

Other year's populations are projected as shown in Table 3.8.

Table I-8 Population of Nouakchott from 2013 to 2040

Year	Population	Source
2013	958,399	General Population and Housing Census (RGPH) 2013, ONS
2015	1,043,177	ONS projection
2017	1,116,739	ONS projection
2020	1,237,216	ONS projection
2025	1,467,489	ONS projection
2030	1,720,648	ONS projection
2040	**2,200,000**	JST

Sources: JST and ONS

(2) Projection of Future GRDP in 2040

The future GRDP of Nouakchott is estimated based on the economic growth rates by sector which is shown in the ONS projection and SCAPP 2016-2030 in the whole country. Also, the economic growth rates in the sub-sectors of the Secondary Sector except mining and quarrying and Tertiary Sector of Nouakchott are assumed to be 1% point higher than those of the country considering the role of the capital region as the driver of economic growth of the country.

As shown in Table I-9, the total GRDP at market prices amounts to MRO 715 billion at 2004 constant prices in 2040. In other words, the value of GRDP of Nouakchott rises from MRO 258 billion in 2017 to MRO 715 billion (a 2.78 fold increase) with the annual growth rate at 4.5%.

As for the composition of economic sector in 2040, Tertiary Sector shows the highest share at 67.0%, followed by the Secondary Sector at 27.4% and the Primary Sector at 5.6%.

Table I-9 GRDP projection of Nouakchott by the Economic Sector in 2040

Value of GRDP by Economic Sector

Unit: Million MRO at 2004 constant prices

Sector	*2017*	*2020*	*2030*	*2040*	*Annual growth rate between 2017-40*
Primary Sector	**12,075**	**14,740**	**23,640**	**38,011**	***5.1***
Agriculture & Forestry	1,072	1,286	2,095	3,412	*5.2*
Livestock	1,174	1,295	1,741	2,340	*3.0*
Fishery	9,829	12,158	19,804	32,259	*5.3*
Secondary Sector	**73,020**	**77,718**	**118,837**	**186,862**	***4.2***
Mining and Quarrying	17,649	14,886	16,443	18,163	*0.1*
Manufacturing	23,423	27,233	49,698	90,695	*6.1*
Construction	31,948	35,600	52,696	78,003	*4.0*
Tertiary Sector	**164,674**	**182,826**	**287,211**	**457,359**	***4.5***
Transport	9,717	10,950	17,837	29,055	*4.9*
Communications	38,017	44,009	78,813	141,143	*5.9*
Trade/Business	26,830	29,906	46,000	70,756	*4.3*
Other services& FISIM	59,237	66,325	105,996	169,395	*4.7*
Administration	30,874	31,637	38,565	47,010	*1.8*
GRDP at factor costs	**249,769**	**275,284**	**429,688**	**682,232**	***4.5***
GRDP at market prices	**257,649**	**288,418**	**450,313**	**714,979**	***4.5***

Share of Composition of GRDP by Economic Sector

Unit: percent (%)

Sector	*2017*	*2020*	*2030*	*2040*
Primary Sector	**4.8**	**5.4**	**5.5**	**5.6**
Agriculture & Forestry	0.4	0.5	0.5	0.5
Livestock	0.5	0.5	0.4	0.3
Fishery	3.9	4.4	4.6	4.7
Secondary Sector	**29.2**	**28.2**	**27.7**	**27.4**
Mining and Quarrying	7.1	5.4	3.8	2.7
Manufacturing	9.4	9.9	11.6	13.3
Construction	12.8	12.9	12.3	11.4
Tertiary Sector	**65.9**	**66.4**	**66.8**	**67.0**
Transport	3.9	4.0	4.2	4.3
Communications	15.2	16.0	18.3	20.7
Trade/Business	10.7	10.9	10.7	10.4
Other services& FISIM	23.7	24.1	24.7	24.8

Sector	*2017*	*2020*	*2030*	*2040*
Administration	12.4	11.5	9.0	6.9
GRDP at factor costs	**100.0**	**100.0**	**100.0**	**100.0**

Source: JICA Study Team

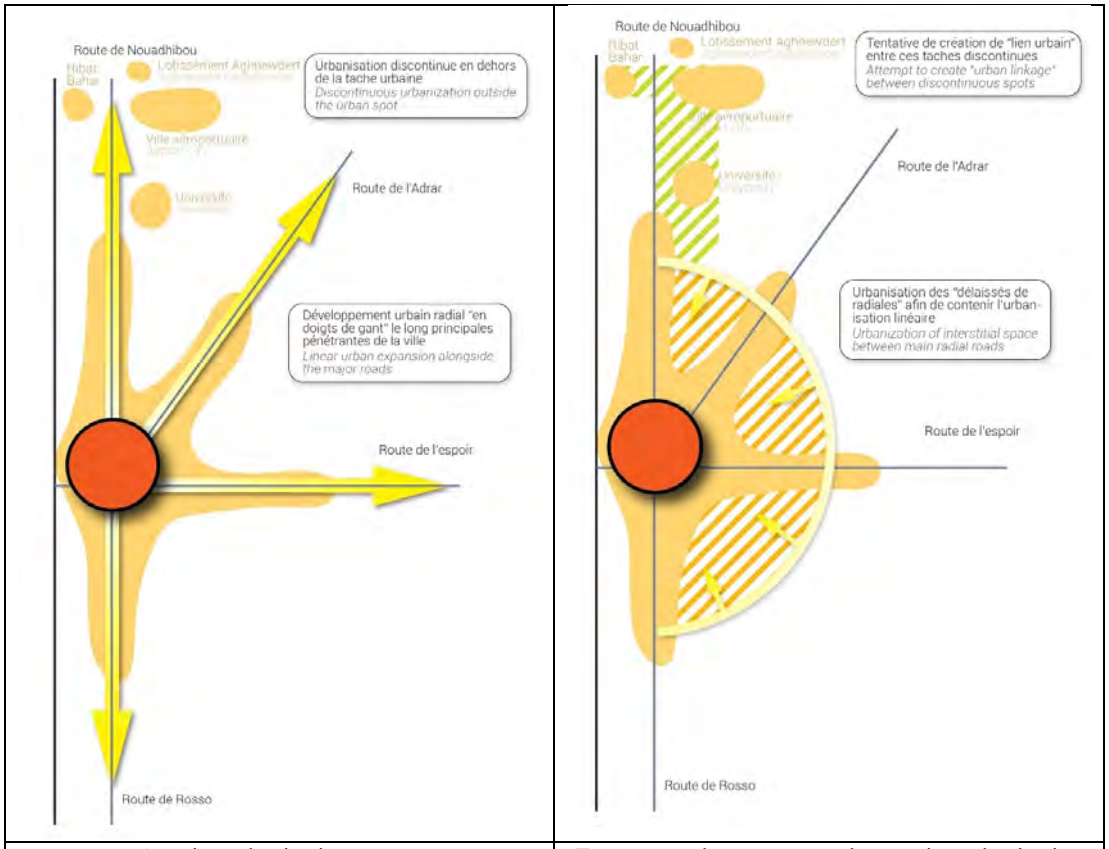
I-3.4 Future Urban Structure of Nouakchott City

(1) Basic structural concepts for future urban development of Nouakchott

Based on the observation of the current development trends explained above, two basic structural approaches have been identified in order to achieve a more coherent urban development in the future.

- The first approach is the creation of "urban linkage" between discontinuous scattered urban spots that will appear in near future in the Northern side of the city. Those interstitial spaces will have the function to articulate all the spaces to each other and give a general coherence to the urban region. Needless to say that urban continuity shall be basis of a decent urban development and that scattering of subdivisions shall be stopped;
- The second approach, which was already promoted by SDAU 2003, is the urbanization in priority of interstitial space between main radials, and the abandon of linear development.

Figure I-30 shows the two structural approaches (right) against on-going urbanization pattern (left).



Ongoing urbanization pattern	Two approaches to counter the ongoing urbanization pattern

Source: JICA Study Team

Figure I-30 Basic structural Approaches for Future Urban Sevelopment of Nouakchott

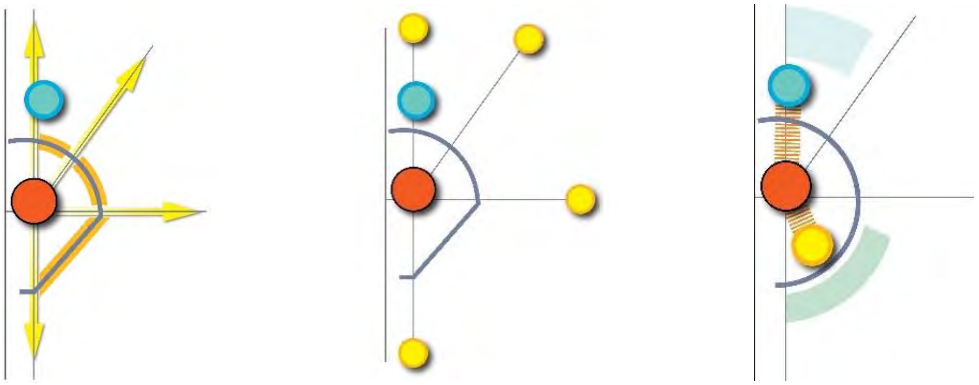
(2) Urban Expansion Scenario and Development Alternatives

Based on the observation of the current development trends and on the basic structural concepts for urban development of Nouakchott explained above, different development alternatives for the 2040 horizon have been elaborated. The prospective phase in an urban planning project makes it possible to better anticipate the changes that a city may experience over the long term, and thus guide the development towards a horizon that is collectively desired.

Indeed, alongside the technical aspect of prospective planning, which is detailed in this section, the point of view of the residents, regarding the future urban development image of their city, is a crucial element to fulfill a sustainable prospective planning. That is why the development alternatives elaborated by the JICA Study Team have been discussed with inhabitants of each commune, in order to identify strengths and weakness of each proposition, from the viewpoint of citizens (transportation, social life, facilities, security etc.)

The three scenarios for the 2040 horizon can be summarized as below.

- The trend scenario, also known as “business as usual” or "0" scenario, is the first to be identified. It is the one that would occur if the current trend would continue to apply in the same way on the city, without intervention of the project or the public authorities in general. This scenario should shed light on the aspects to rely on or oppositely to fight against for the planning of the future shape of the city;
- Development alternative "A: bipolar development model supported by satellite cities" that promotes the concepts of relocation and specialization. This alternative represents the solution based on relocation often considered in cities like Nouakchott which have difficult natural settings. This alternative was mainly proposed by counterpart agency and is based on a current political vogue of urban sector decision makers;
- Development alternative "B: tripolar scale model at the metropolitan scale" which promotes the concepts of densification and balance. This alternative is based on the two following technical findings: Firstly, the scientific results of urban expansion potential analysis (refer to Section 4.3) which concludes that the most suitable location for the expansion of the city is the continuity of Tarhil in South-East part of the city; Secondly, the basic structural concepts (see above Section) that urbanization shall be carried out in priority of interstitial space between main radials.



Business as usual scenario | Development alternative A | Development alternative B

Figure I-31 Broad Concepts of Three Alternatives

(3) Evaluation of development alternatives through SEA and public consultation

1) Evaluation objective and methodology

The process of prediction and comparison of the effects of the strategic alternatives is realized in order to pursue the best yet realistic alternative with well-balanced combination of advantage of each development alternative rather than to select the most preferable one from two alternatives emphasizing respectively economic, social or environmental objectives.

In terms of evaluation methodology, it shall be observed that this evaluation has been realized in the framework of the SEA, which basically corresponds to the comparison of effects on the environment and the discussion with Nouakchott citizens through public consultations. The methodology of evaluation is thus less comprehensive that what the Ministry of Land, Infrastructure and Transport (MLIT) of Japan has elaborated for the evaluation of city planning (handbook on evaluation of urban structure, 2014). However, the two following remarks regarding the nature of evaluation criteria and evaluation scope shall be observed.

Nature of evaluation criteria

The definition of environment contained in the SEA Objectives is broad and reflects both the effects on natural environment but also on human environment.

Nevertheless, in order to be as comprehensive as possible in this study which targets a multisector Masterplan, economic and social criteria have been added to strictly environmental criteria.

Evaluation scope: qualitative or quantitative dimension

Being carried out at a strategic level of the project, the evaluation of the development alternatives is done on the qualitative dimension only. Having been designed in a very simple way to foster a better understanding during public consultations, the maps of development alternatives do not contain geographical information that can be used for a quantitative analysis. At this stage of the project it is important to gather the opinions of the citizens in order to be able to draft the best land use plan possible, rather than focusing on quantitative details. That is why the emphasis was put on the definition of sharply contrasted development models that shows different development paradigms, on which opinions can be expressed.

Nevertheless, if the section above already mentions quantitative data (length of the road network to extend, cost of infrastructure works, etc.), a reminder will be shown in the evaluation table.

2) Prediction and comparison of the effects of the different development alternatives

The results of the assessment and comparison of the business as usual scenario and two development alternatives according to SEA objectives is shown in Table I-10 below.

Table I-10 Results of the Evaluation of Alternatives

Pillars of the planning vision		Trend scenario	Alternative A	Alternative B
1	Reunited	AT-	B -	A +
2	Radiant	B +	B +	B +
3	Reinvigorated	AT-	B +	B +
4	Resilient	AT-	B +	A +
5	Respecting the local culture	B-	A +	B +

Criterion's SEA		Trend scenario		Alternative A		Alternative B	
1	Climate change (at the local level) -	AT-	Uncontrolled urbanization in the flood	B-	The further development of housing on areas prone to floods	A +	The abandonment of housing development in the

	vulnerability to floods		zones of sebkhas leads to increased vulnerability.		of sebkhas leads to increased vulnerability.		flood zones of sebkhas leads to the reduction of vulnerability.
2	Natural environment - green and wooded areas	AT-	Uncontrolled urbanization makes it impossible to increase green spaces.	A +	Green and open spaces can be developed in satellite towns; the low density in Nouakchott makes the city more open and airy.	A +	The creation of a new development center in a virgin zone makes it possible to freeze large areas for green and open spaces.
3	Climate change (globally) - GHG emissions	B-	The lack of an efficient public transport system leads to an increase in car use and therefore greenhouse gas emissions and air pollution.	AT-	Massive displacements to Nouakchott of satellite towns create congestion, increased greenhouse gas emissions and significant air pollution.	B +	The effort to implement an effective system of mass public transport leads to the stabilization and reduction of air pollution through traffic.
4	Environmental pollution - deterioration of water quality	AT-	Uncontrolled urbanization is leading to further degradation of water quality and public health in general. The worsening of the silting phenomenon leads to an increasingly deficient sanitation system.	B +	The disappearance of the silting problem thanks to the success of the green belt leads to an increase in the performance of the sanitation system.	B +	The disappearance of the silting problem thanks to the success of the green belt leads to an increase in the performance of the sanitation system.
				B-	However, further housing development in flood-prone areas of sebkhas could lead to degradation of the aquatic environment.	C-	However, the development of the artificial lagoon can have negative effects on the hydrological and ecological balance of the site.
5	Inclusiveness - disparity s social, insecurity housing and solidarity	AT-	Loss of activity e conomic of the existing city and many fraining slums around the city along the ring road.	B +	The mastery of urban growth in satellite cities allows the control of the formation of new slums. With the expansion of the distance between the place of residence and place ofwork, disparaité s accessat employment may be born.	A +	Controlling urban growthinside the ring roadallows the non-spread of slums. The construction of social housing and public transport provision willontribuer toc Atte nuence disparitiessocial.
6	Inclusiveness - hum ains basic needs	B-	The continuing urbanization under the same conditionsperpetuates the probè m e lack of land for public facilities.	C	Social services (education, health, etc.) should be e tnewly ablis in all satellite towns. This will involve significant costs. Not realistic.	B +	Socialservices (education, health, etc.)will be located within the existing city, especially for the people who need it most in the south of the city.
7	Inclusiveness - mobility	B-	Absence of an effective public transport system andreliance on the car traffic fre q uential.	B-	Longer distances between places of residence and places of employment created a i m with new mobility needs. Citizens' travel time in transport will impact the health of the ec onomic v ille.	B +	Even if the mobility of auto mobilists is likely to bereduced in the central areas,most of the population can enjoy a syste mpublic transportation and

							fast to reach the nearby pole between them.
8	Urban Infrastructure - Improving Urban Infrastructure	AT-	The construction of the infrastructure a posteriori by the public authorities tries to catch up with the galloping and anarchic urbanization.	C	Basic infrastructure (sanitation, drinking water, waste collection) will be e tnewly ablis in all satellite towns. This will involve significant costs. Not realistic.	B +	Urban infrastructure is concentratedin the compact city and can benefit from econo m ic scale.

Source: JICA Study Team
Note: A+/-: Remarkable positive/ serious negative effect is predicted
B+/-: Positive/ negative effect is predicted to some extent
C+/-: Limited positive/ negative/ neutral effect is predicted but further survey is required
D: Effect is very small or nil and further survey is not required

Even though it is not the purpose of the SEA to decide the alternative to be chosen for the future SDAU, but rather to provide information on the relative environmental performance in order to make the decision-making process more transparent, it seems obvious, from the results of the comparison of effects, that Alternative B is the most environmentally beneficial, sustainable development alternative for Nouakchott city.

3) Evaluation from the public consultation

As explained in Part III.2 of the Main Report, the second round of public consultation (January - February 2018) devoted to the evaluation of the scenarios explained above in terms of strengths and weaknesses. One workshop has been carried out in each commune to collect the opinions from the inhabitants.

Even though the purpose was not necessarily to make the members of the CCC chose one on the scenario, but more to discuss on the possible effects on everyday life of Nouakchott citizens and to make a brainstorming on how the alternatives can be improved, it is likely that the development alternative that has been preferred to become the basis of future SDAU was Alternative B.

(4) Conception of future urban structure of Nouakchott City

1) Major concepts of future urban structure

Based on the results of the evaluation of development alternatives through SEA and public consultation, Alternative B of tripolar model at the metropolitan scale is tentatively selected for the conception of future urban structure of Nouakchott city. Indeed, Nouakchott has grown as a unipolar city, with downtown concentrating all the urban functions. This area is thus congested and saturated. The development of the balance pole in Tarhil and the international pole in the surroundings of the airport will give more equilibrium to the city at the metropolitan scale.

However, in addition of the three major cores that will compose the Nouakchott of the year 2040, some supplementary secondary poles of development shall be developed towards a multipolar structure. The goals of this structure are the following.

- Give more strength to the general city structure by dispatching urban functions;
- Achieve compact city concepts by getting services and shops closer to the inhabitants;
- Improve existing urban area, as it was requested by Seminar recommendations.

2) Identification of secondary development poles for the realization of multipolarity

In order to identify secondary development poles in the existing city to realize the future multipolar structure of Nouakchott, several types of suitability analysis have been carried out based on the following criteria.

- Proximity from Tarhil balance pole.
- Density of commercial activity, mixed land use, and residential land use with boutiques, which are all evidences of high urban attractivity, as shown in Figure I-32 below. This criterion could be computed through the analysis of GIS land use data gathered on field;
- Accessibility and connectivity by existing arterial road network;
- Availability of unoccupied land parcels within existing city, which could be utilize in a land redevelopment operation, as shown in Figure I-33 below. This criterion also could be computed through the analysis of GIS land use data gathered on field.
- Presence of shanty towns which can be the target of restructuration projects.

The result of the analysis of candidate secondary development poles for the realization of multipolarity based on proximity analysis of above criteria is shown in Figure I-34, and the identification of possible free land to promote or restructure as secondary pole is shown in Figure I-35 below.

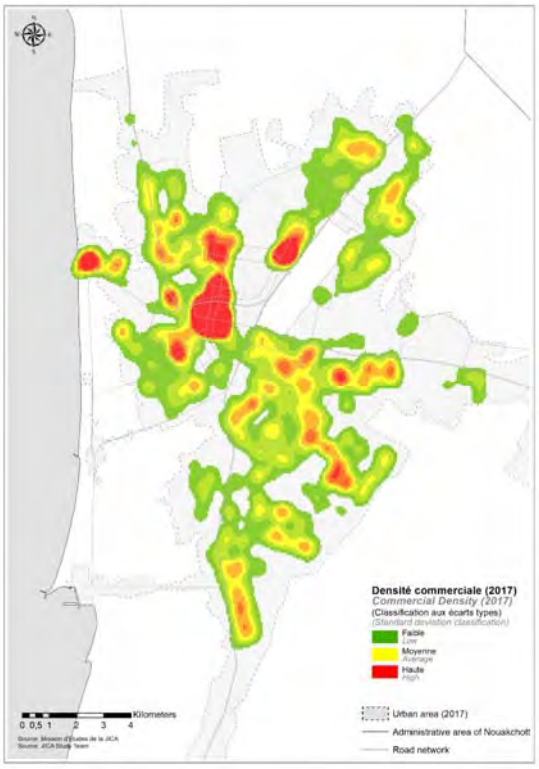


Figure I-32 Commercial Density

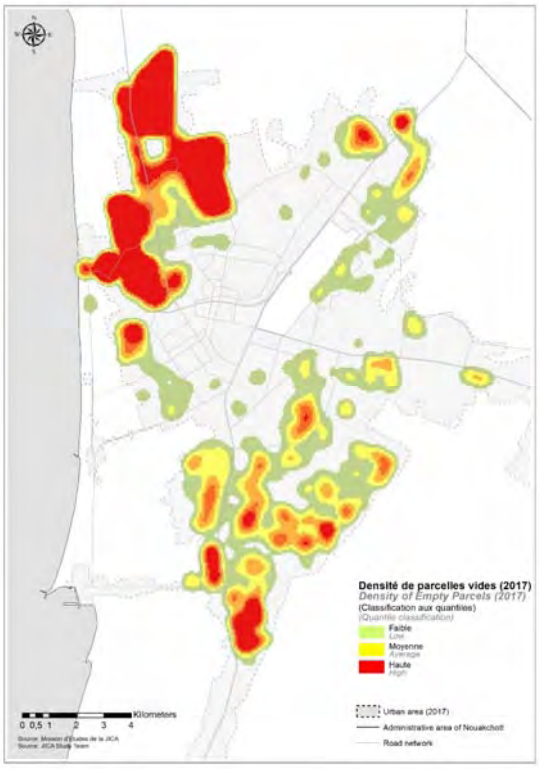


Figure I-33 Density of Empty Parcels

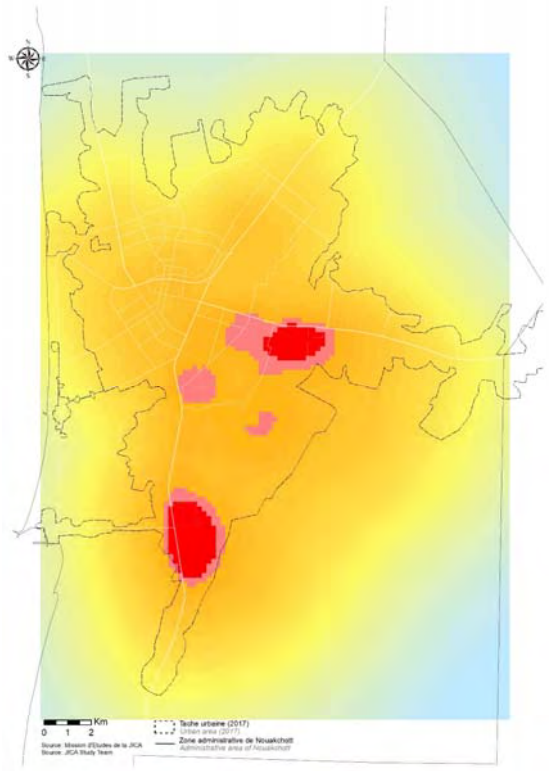


Figure I-34 Proximity Analysis

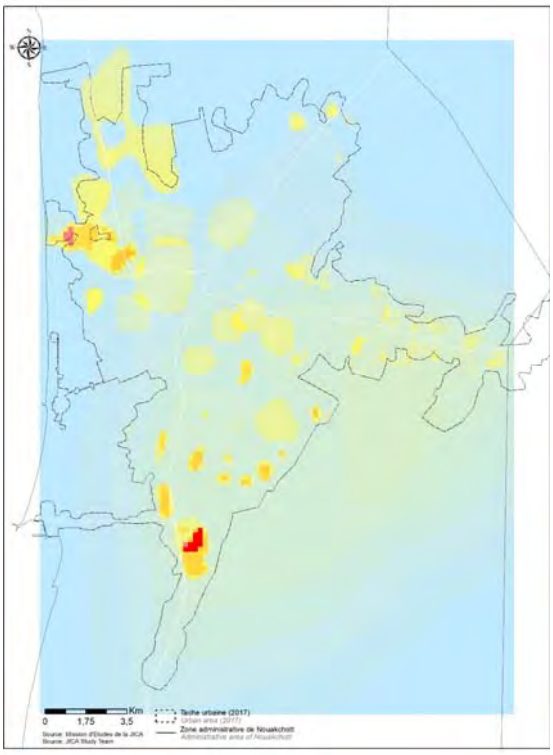
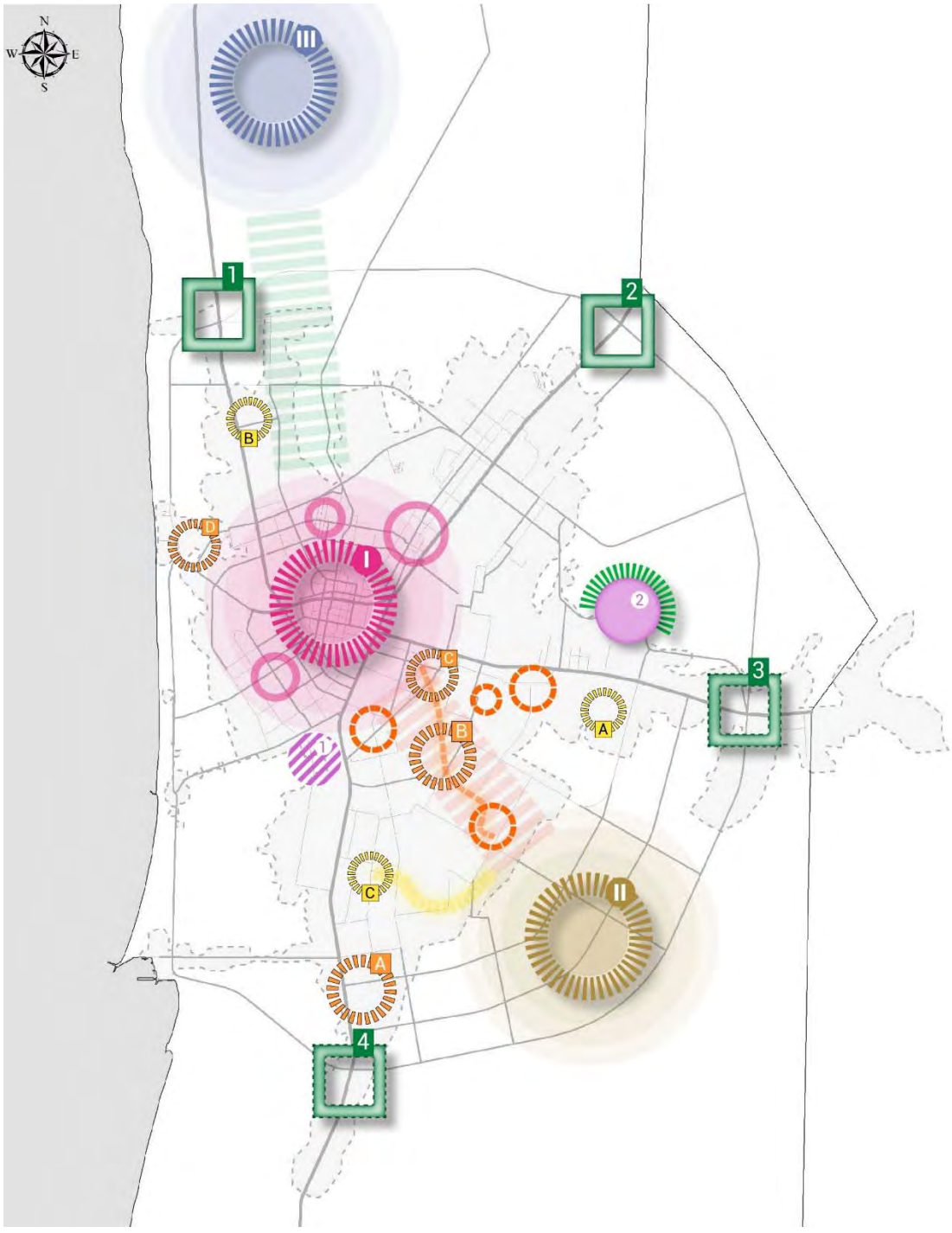


Figure I-35 Opportunities of Land Development (Empty Parcels and shanty Towns)

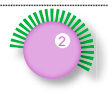
3) Future urban structure of Nouakchott City

Based on the existing urban structure, selected development alternative and on identified secondary poles, the multipolar future urban structure of Nouakchott city is established tentatively as shown in Figure 3.14 below. Description of each feature of proposed future urban structure follows.



Source: JICA Study Team

Figure I-36 Proposed Tentative Future Urban Structure of Nouakchott (2040)

	Icon	Designation	Future function / role in the urban structure	Proposed strategy / leverage for development
Main cores		Downtown Metropolitan Core	Office and trade	-
		New Tarhil Balance Core	Large scale public facilities, small-scale industries related to agriculture and fishery, mixed housing including social housing	Important intervention from both government and private sector is necessary (ZAC)
		International Airport Development Core (IADC)	Tourism, high standard residential, transportation, convention	Large private investments and monumental public actions
Potential secondary poles		High potential secondary pole	Both commercial activity and land opportunities are coexisting. Pole B is likely to become a key pole for articulating Tarhil and Downtown	Government shall acquire and freeze land to be developed as soon as possible, especially Pole A which is on the way of Rapid Transit route
		Newly created secondary pole	Land opportunities are available (Pole "A" is slum area), but no particular commercial activity is existing. Economic activity shall be developed from scratches	Development needs great interventionism of ADU and support from medium scale private sector
		Urban redevelopment secondary pole	Structuring commercial activity is existing, but no land opportunity. Promotion to secondary pole shall necessarily be achieved through urban renewal / land readjustment	Urban renewal schemes such as land readjustment shall be mobilized. Most likely difficult to be implemented
Industrial poles		Industrial zone to be relocated	Together with the restructuration of flood-prone areas, El Mina industrial zone will be relocated in the exterior of the city on long term (destination to be defined)	-
		Industrial and ecological development pole	Continuation of the expansion of Resistance industrial zone in link with green belt and newly developed green spaces	-
Metropolitan gateways		Metropolitan gateways with high land opportunity	Metropolitan gateways have an important role of interconnection between public transportation and private car. They can welcome new public service that necessitate high level of traffic (hospitals, universities, sport facilities) but also new economic sectors	Important intervention from both government and private sector is necessary (ZAC)
		Metropolitan gateways with low land opportunity		Urban renewal schemes such as land readjustment shall be mobilized. Most likely difficult to be implemented
Main linkages between cores		Downtown – IADC linkage	Downtown – International Airport Development Core linkage is ensured by two national roads	-
		Downtown – New Tarhil linkage	Direct Downtown – New Tarhil linkage poses problems of feasibility. Several technical solutions shall be proposed, including widening of community road.	For direct linkage, expropriation might have to be utilized. Most likely difficult to be implemented
Potential corridors		Commercial corridor to be developed	Structuring secondary commercial activity is existing alongside community road, but land opportunity is rare	-
		Land opportunity corridor	Numerous land opportunities are still available along this community road	-

Source: JICA Study Team

I-3.5 Land Use Planning

(1) Restricted Lands for Urban Use

Related to description of environmental conditions, Nouakchott city faces numerous natural hazards. The conditions for the construction of residential areas and infrastructures are not easy. Thus, it is necessary to study well the degree of vulnerability of each zone and to not propose to establish housing and facilities where specific difficulties make the construction of infrastructures almost impossible, and where future populations would be exposed to dangerous living conditions. As a strategic city planning document, SDAU has the responsibility to set-up "non aedificanti" (construction prohibited) areas. It will help to formulate the boundary of urban growth, and it will be a guideline for the establishment of bidding zoning and regulations to be formulated in the future PLU of each commune. The major environmental components to be taken into consideration in the establishment of non aedificanti areas are the following.

Flood-prone areas

The salty depressions (sebkhas) between the city and the sea are the areas most exposed to floods. Vulnerable to the breaches of the coastline, these areas are flooded in the event of heavy rain, and are also subject to rising groundwater, making the development of sanitation equipment or drinking water problematic. It would be unacceptable to let the city grow further in such an unfavorable area.

A specific scientific study based on the interpretation of multi-temporal satellite images and on a good knowledge of the climatic dynamics was evaluated as the most accomplished and therefore suitable for the formulation of the zones concerned. The study identifies two levels of flood risk: the highest in the coastal sebkha; and average risk in the plains inside the city.

Coastal dune

In order to establish protection zoning for the coastal dune, land use extracted from the interpretation of the satellite image that the JICA Study Team procured was used because it is the source the most recent and accurate information available.

The proposal to establish a buffer zone between the dune and the city should be studied at the political and technical levels.

Industrial hazard areas

The dazzling expansion of Dar Naim's new Resistance Industrial Zone is a source of concern for residents. It seems necessary, in view of international standards, to establish a non-aedificandi zone of 500 meters around the industrial area, as a preventive buffer against any industrial risk.

Green belt

The green belt plays an important role in the fight against the silting up of the city. It also plays a major symbolic role in the prevention of anarchic urban sprawl. This symbolic role must be legally fulfilled by SDAU, which has a binding power for administrations.

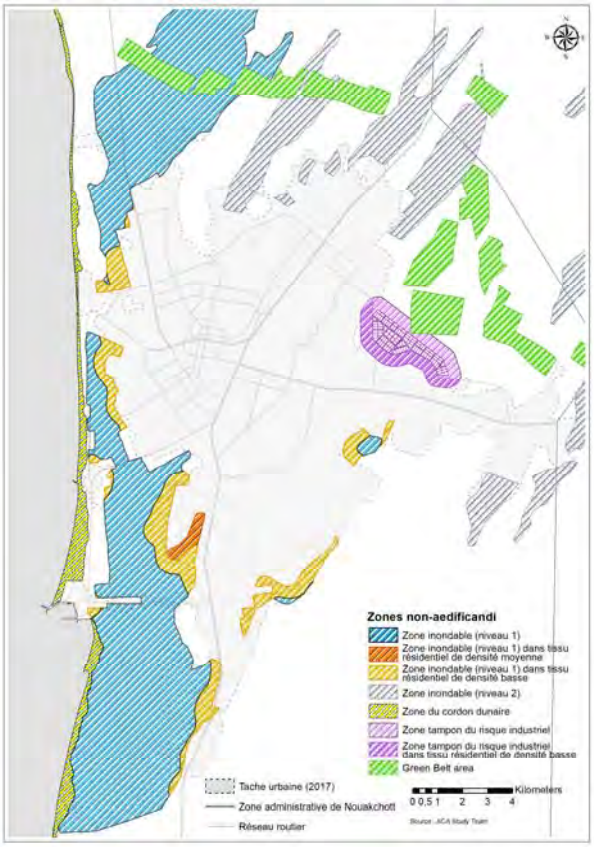


Figure I-37 Construction Prohibited Areas

General Land Availability and Existing Density Analysis

Taking into account existing built-up density, unoccupied parcels inside the existing urban area, and previously established construction prohibited areas, a general land availability analysis has been carried out for each commune.

Gross density of existing built-up areas has been calculated based on a remote sensing operation of the satellite image acquired by JICA Study Team. Building polygons have been interpreted roughly and then computed through a kernel interpolation analysis.

The results of existing built-up density analysis have allowed to establish four different gross density categories. The calculation of average density for the area of each category gives an overall result in terms of population that is extremely close to the macro figure of Nouakchott population in 2017 (1,116,638). Thus, it can be concluded that the four identified gross density categories can be used for the housing planning of Nouakchott city.

Verification calculation based on GIS figures for establishment of existing built-up gross density categories is shown in Table I-10 below.

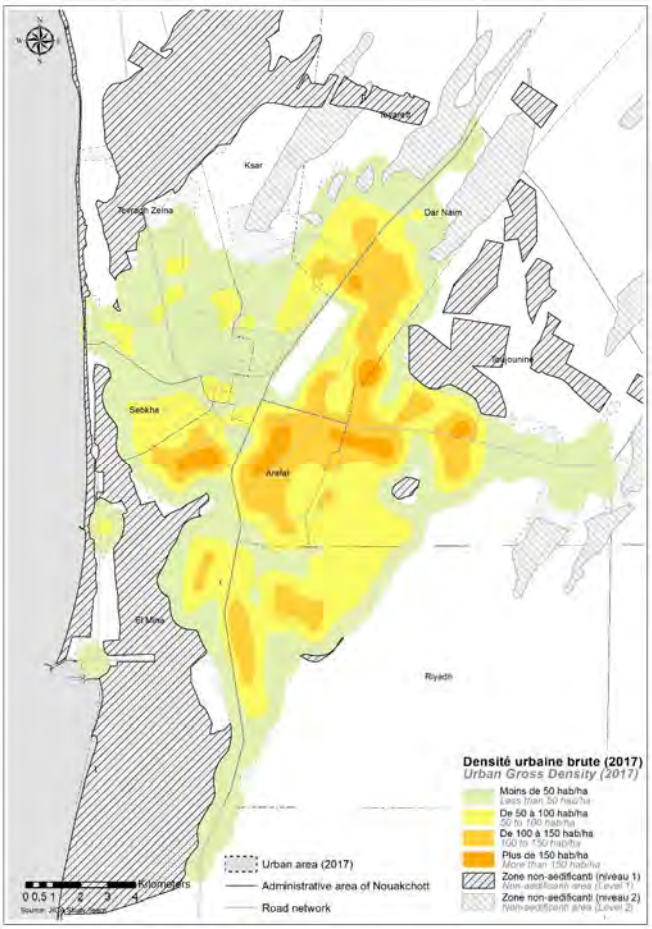
Table I-10 Verification Calculation For Establishment Of Existing Built-Up Gross Density Categories

Category designation	Density scope (population/ha)	Average density (population/ha)	Area (ha)	Population
Very low density	0 to 50	25	10,443	261,081
Low density	50 to 100	75	6,223	466,691
Average density	100 to 150	125	3,120	389,998
High density	150 and more	150	467	70,094
Total calculated population				1,187,863

Source: JICA Study Team

In addition, on the basis of parcel data that has been surveyed all over Nouakchott on asphalted roads, and with a 10% sample rate in residential areas, a general categorization of 50 zones has been done in terms of occupancy of parcels and residential density categorization. The latter density has been extracted thanks to the land use information contained in the sampled parcels (especially the share of mixed-use parcels).

The results of gross built-up density analysis and general occupancy is shown in following Figures I-38, respectively. The comparison of the two maps allows to make qualitative extrapolation in terms of potential urban expansion by commune. As it can be seen on the maps, some communes such as Sebkha or El Mina are extremely handicapped in their future urban expansion, while Riyad has a enormous amount of available land for urban development.



Source: JICA Study Team

Figure I-38 Gross Built-up Density

ANALYSIS OF THE POTENTIAL OF URBAN EXPANSION

In the perspective of selection of the preferential extension zones of the city of Nouakchott, an analysis of the potential of urban expansion of the surroundings of the city was carried out, on the basis of purely geographical criteria. As Nouakchott is a vulnerable city with many environmental issues, the capacity of its soils to accommodate new urbanization needs to be rationalized. The criteria taken into account in the analysis are of natural and human nature and are either attractive or repulsive for urbanization. Table I-11 below shows the different criteria used in the analysis of the urbanization potential of the city of Nouakchott.

Table I-11 Criterion Used for Urban Expansion Potential Analysis of Nouakchott City

Criterion	Effect on the score	Spatial influence	Weight (on a 1 to 10 scale)
Airport zone	Repulsive (-)	Overlap	10.0 (urbanization forbidden)
Flood-prone and inland flooding areas	Repulsive (-)	Overlap	9.0 (extremely repulsive)
ROW of high-voltage line	Repulsive (-)	Overlap	9.0 (extremely repulsive)
Green belt	Repulsive (-)	Overlap	9.0 (extremely repulsive)
Coastal dune	Repulsive (-)	Overlap	9.0 (extremely repulsive)
Airport security zone (5,000 m)	Repulsive (-)	Overlap	7.0 (relatively repulsive)
Industrial zones surrounding area (500 m)	Repulsive (-)	Proximity	7.0 (relatively repulsive)
High sand dunes (15 m high or more)	Repulsive (-)	Overlap	4.0 (relatively repulsive)
Cemetery	Repulsive (-)	Proximity	2.5 (slightly repulsive)
Low sand dunes (less than 15 m high)	Repulsive (-)	Overlap	2.0 (slightly repulsive)
Area of bus service	Attractive (+)	Proximity	2.0 (slightly attractive)
Waste dumping site proximity	Repulsive (-)	Proximity	2.0 (slightly repulsive)
Senegal river proximity	Attractive (+)	Proximity	1.5 (slightly attractive)
Slaughterhouses proximity	Repulsive (-)	Proximity	1.0 (slightly repulsive)

Source: JICA Study Team

Figure I-39 below presents the results of the urban expansion potential analysis, represented by the score of the aggregation of the criteria explained above through a gradient from red (low urbanization potential) to green (high urbanization potential).

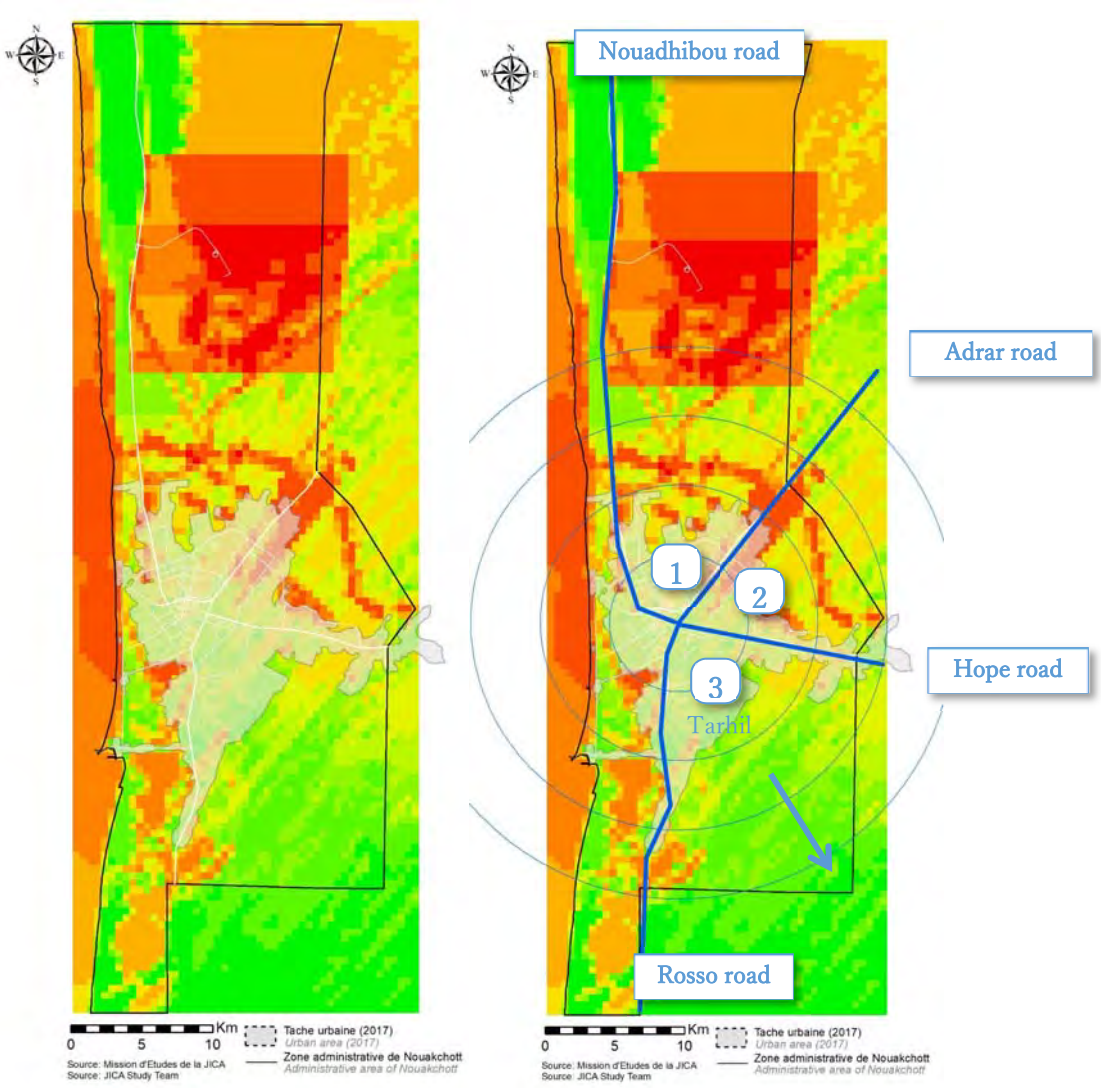


Figure I-39 Urban Expansion Potential of Nouakchott city

It seems clear from the results of the analysis of the potential for urban expansion that the preferential direction for urbanization is the Southern direction between Hope road and Rosso road, in the urban continuity of the neighborhood called Tarhil, located at the extreme south of the city of Nouakchott. This conclusion is true at the same time on the short term, but also on the medium and long terms, since the urbanization will be blocked notably in the North by the presence of the airport.

(2) Strategic Orientations

As explained in the scope of SDAU in introduction of Part I of this report, strategic orientations and planning concepts has been elaborated in order to make the link between the Priority Planning Issues and the land use plan.

The three proposed strategic directions are explained below using summary maps.

Strategic Direction 1: Limit urban sprawl and intensify urban area in a new polycentric, fluid and federative model

In order to reverse the trend of linear urban sprawl and dedensification of the urban area and to operate the re-equilibrium of the metropolis that was identified as the most suitable development

alternative, the SDAU intends to densify and intensify the urban fabric. This will be possible by putting in relation newly introduced public transportation and urban development, especially through the realization of secondary poles. A qualitative and quantitative offer of housing and services in the city center and in the new development poles will help to make the whole city attractive. The proposed intensification model is aiming at polarizing the densification effort on some strategic urban nodes (primary and secondary poles), while generally preserving Nouakchott's low density and quality of life in already existing residential areas.

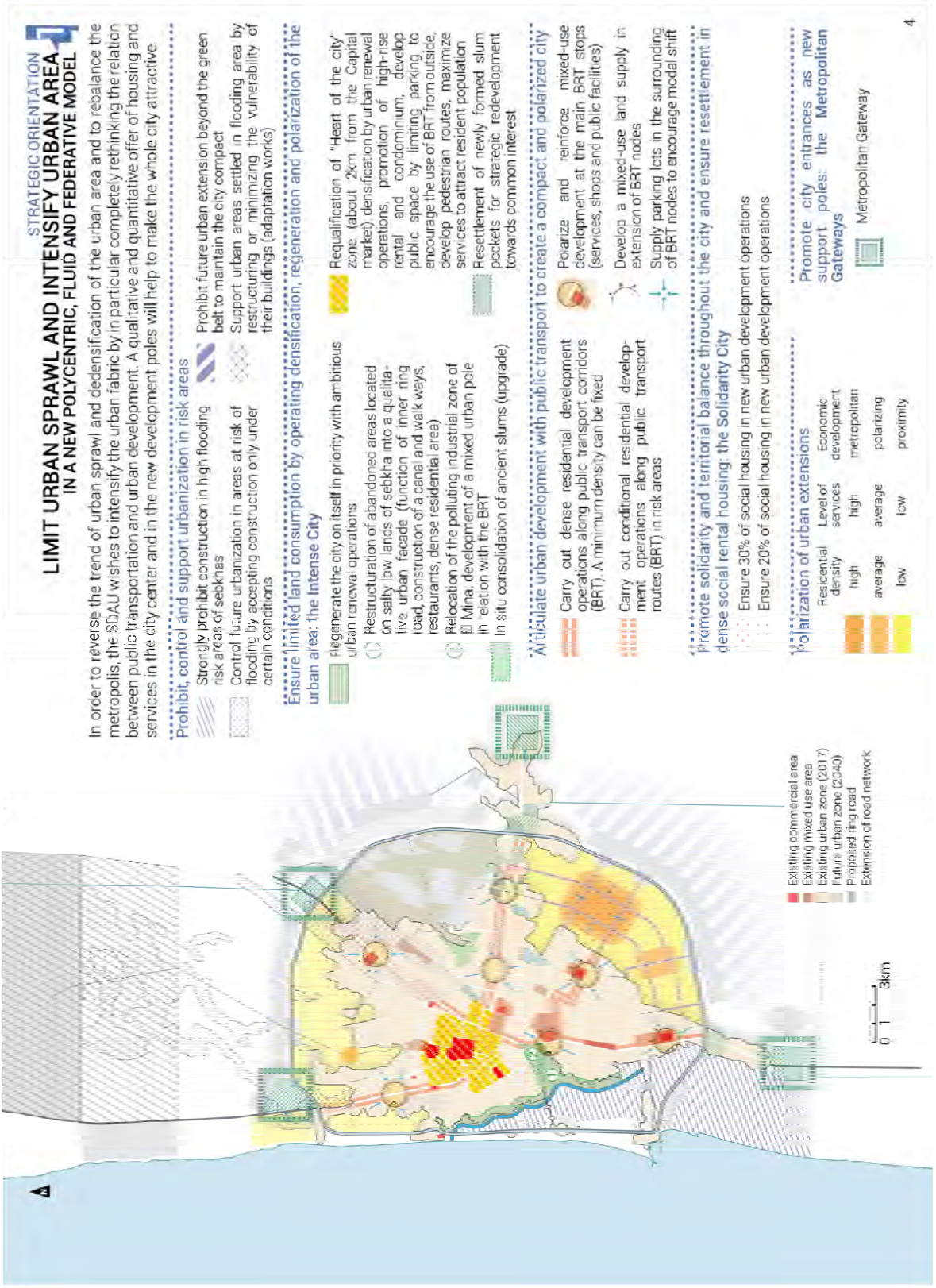


Figure I-40 Summary of Strategic Orientation 1

Strategic Direction 2: Build a new relationship with nature and elements while ensuring safety

Nouakchott is settled on a vulnerable natural environment. In order to guarantee a harmonious future development of Nouakchott, it is necessary to reconsider in depth the relationship of the city with natural environment and phenomenon like presence of stagnant water and silting. The SDAU proposes to create a city which would benefit and not suffer from its environment. Also, since the need for more green space has been demanded by citizens through household survey and public consultations and has been recommended by professionals during the seminar, greening and the opening of public spaces is a key strategy for the future of the city. In the Nouakchott of 2040, nature will be present on three scales: an outer green belt, an inner green and blue network and a multitude of parks within the urban fabric.

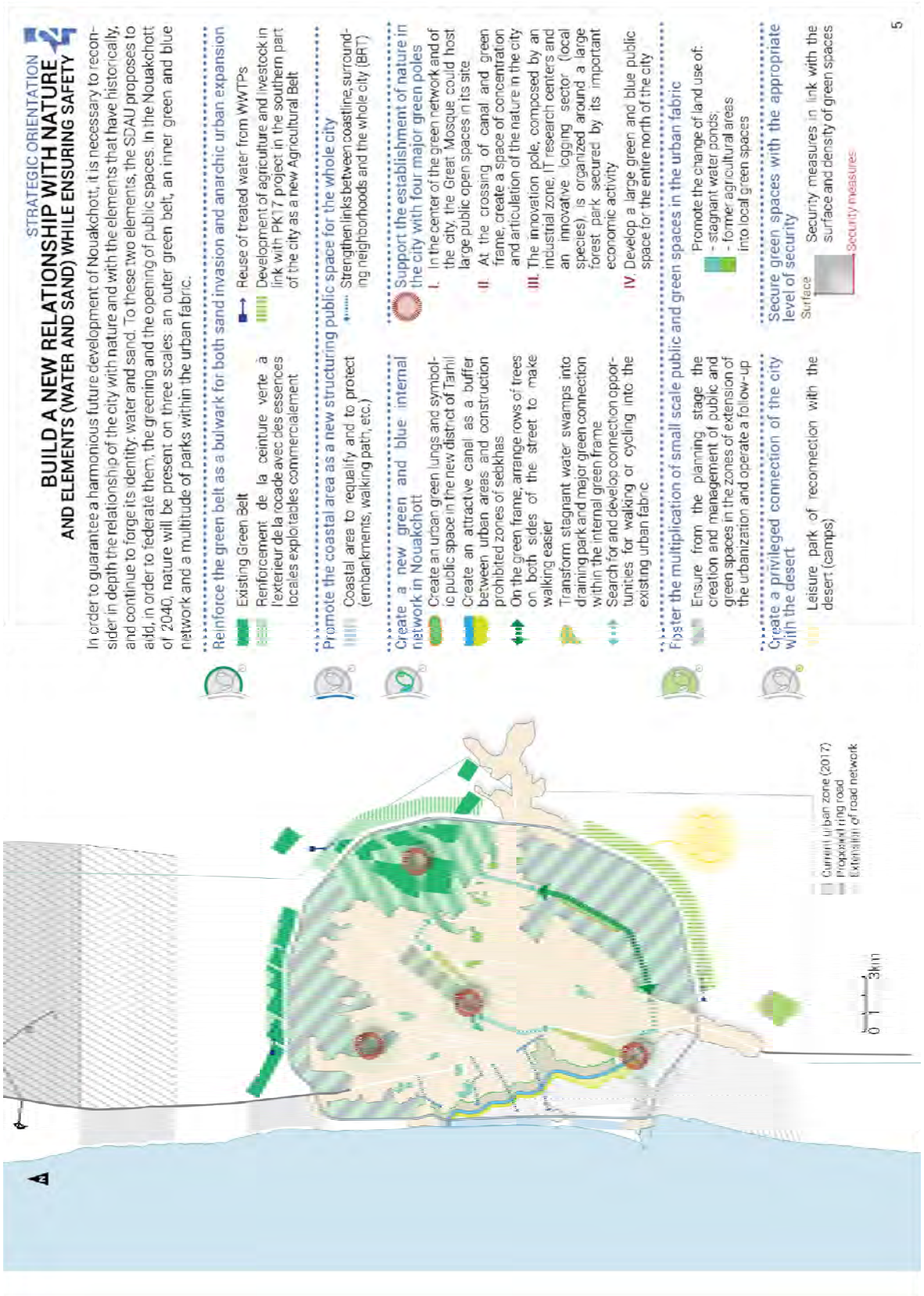


Figure I-41 Summary of Strategic Orientation 2

Strategic Direction 3: Promote economic influence and boost employment

As explained by current SDAU, urbanization masterplan has a role of enabling the organization and development of new economic activities towards job generation in the city. In order to anticipate and support economic development in a logic of coherence and of spatial complementarity, the SDAU proposes to study economic development solutions at all the scales of the city, relying on one hand on the new major levers that are the ring road and the BRT, while taking care on the other hand on the dynamism of employment and the satisfaction of needs within the smallest neighborhoods.

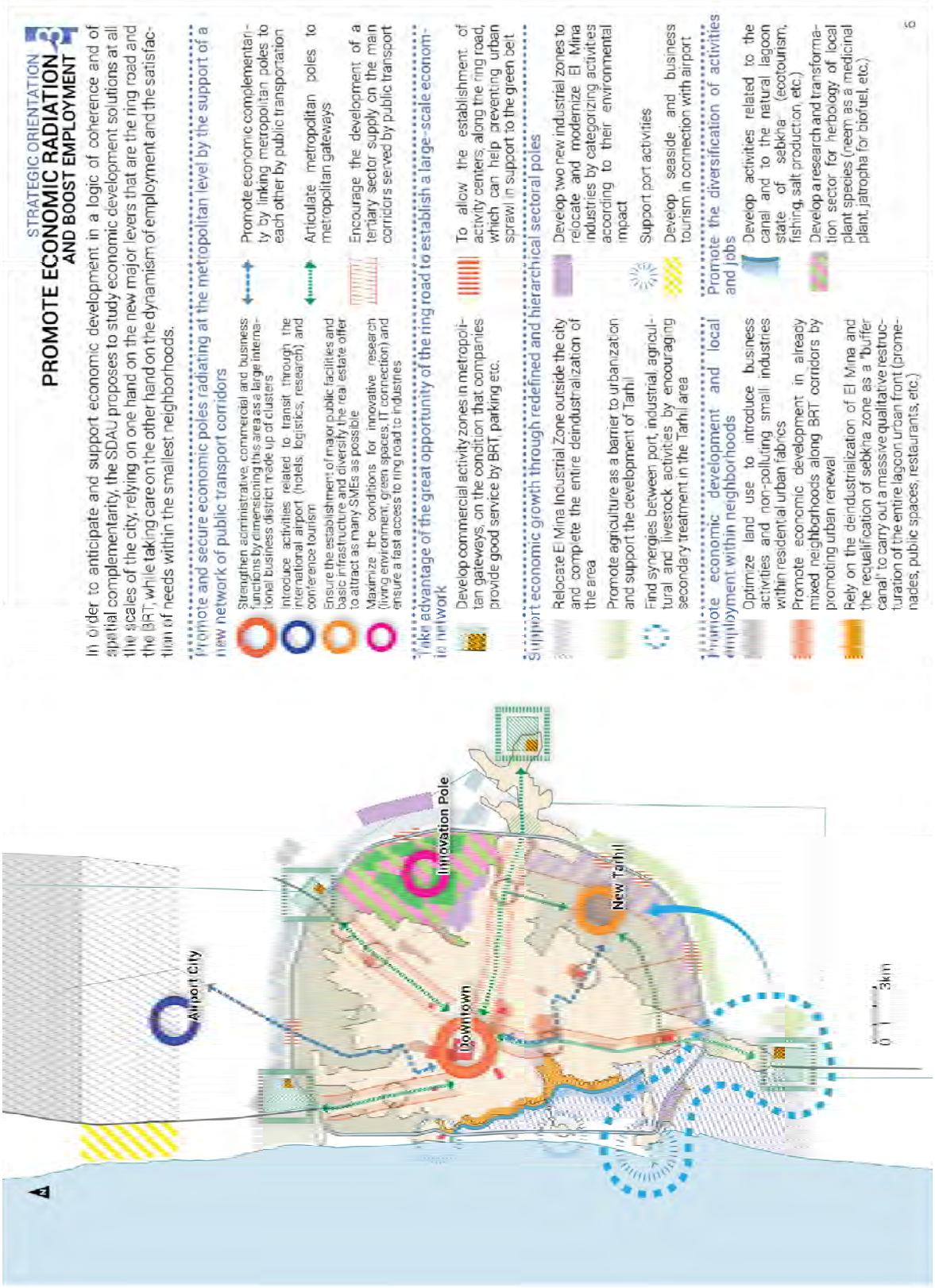


Figure I-42 Summary of Strategic Orientation 3

(3) Formulation of SDAU Land Use Plan

As stipulated in the Mauritanian Urban Planning Code, the SDAU plans the different aspects of the city from 10 to 20 years. Continuing the experience of the SDAU 2003 which focused on the two horizons of 2010 and 2020, the current SDAU aims to plan for the 2030s for the medium term and 2040 for the long term.

The current part is articulated around the four axes required by the Town Planning Code, namely (1) the distribution of the population and the number of employment, (2) the delimitation of the urban perimeter, showing reservation of land and future preferential extension zones, (3) the layout of the network and transport infrastructures, and (4) the definition of the location of the structuring public infrastructures of the agglomeration.

Distribution of Population

As described above, the population of Nouakchott is estimated at 2,200,000 by 2040. The distribution of all inhabitants in different parts of the city for 2017, 2030 and 2040 has been studied on the basis of different hypotheses.

The distribution of the reference population (2017) was calculated using a two-step process: first, a bottom-up approach with field data, and secondly a top-down adaptation to the macro-demographic framework estimates.

Second, the reference population (2017) was estimated for each traffic area based on the results of the GIS survey on land use. Indeed, this survey was carried out on all plots in the PLU zone, on all parcels with an area of more than 1000 m2, on all plots along the tars and on a sample of 10% of all other areas, residential areas. The assumptions in terms of household size and population for each land use category were formulated on the basis of the literature and the results of the social survey.

Finally, the figures obtained for each traffic zone were compared with the macro-demographic data of each municipality. The margin of error between the two figures was 1% to 30%. Then, the figures from the demographic framework were extrapolated to each traffic area based on the population share of each traffic area calculated with the GIS land use data.

Since the land use survey also identified unoccupied parcels through satellite image observation, the residential occupancy rate could be established for each traffic zone.

Results of Distribution of Population and Employment

Based on the assumptions and calculations detailed in the previous paragraphs, the results of the distribution of population and employment by traffic zone for base year 2017 and horizons 2030 and 2040 are presented in the following tables and maps. .

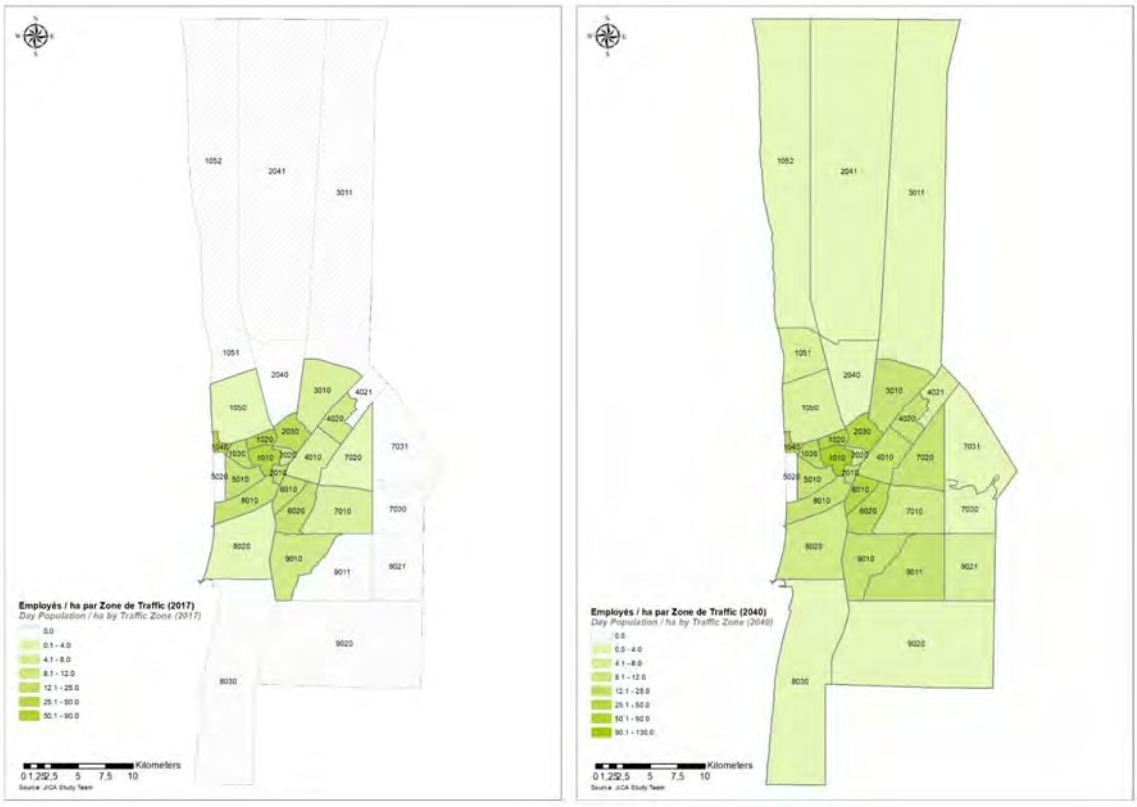
Table I-12 Distribution of Night and Commuting Population per Traffic Zone in 2017, 2030 and 2040

Commune	Traffic Zone	Dwelling Unit (DU)			Household per DU			Night Population			Day Population		
		(2017)	(2030)	(2040)	(2017)	(2030)	(2040)	(2017)	(2030)	(2040)	(2017)	(2030)	(2040)
Tevragh Zeina	**1010**	2,964	4,279	8,423	4.7	4.3	3.8	13,931	18,163	32,009	48,498	66,698	70,781
	1020	1,300	1,955	4,341	4.7	4.3	3.8	6,108	8,297	16,495	17,590	19,043	23,088
	1030	2,825	3,852	7,169	4.7	4.3	3.8	13,277	16,350	27,244	8,539	10,770	12,379
	1040	732	920	1,067	4.7	4.5	4.2	3,439	4,088	4,483	14,319	15,502	15,364
	1050	3,602	14,144	30,989	4.7	4.5	4.2	16,931	62,857	130,154	9,084	16,399	20,840
	1051		1,938	7,919	4.7	4.6	3.9	-	8,905	30,885	-	8,381	8,306
	1052	661	3,778	4,811	4.7	4.6	4.6	3,108	17,357	22,129	-	12,080	35,783
	TOTAL	**12,084**	**30,866**	**64,719**				**56,793**	**136,019**	**263,400**	**97,850**	**148,873**	**186,541**
Ksar	**2010**	1,153	1,478	2,126	5.9	5.3	4.7	6,805	7,826	9,991	3,066	4,319	5,586
	2020	1,889	3,606	5,146	5.9	5.3	4.7	11,146	19,086	24,188	2,048	3,077	4,803
	2030	5,907	7,475	9,152	5.9	5.6	5.3	34,851	41,802	48,503	34,711	37,579	39,801
	2040	357	9,019	10,666	5.9	5.6	5.3	2,106	50,437	56,528	-	6,060	9,009
	2041		3,787	13,910	5.9	4.6	4.6	-	17,395	63,986	-	3,394	17,125
	TOTAL	**9,306**	**25,365**	**41,000**				**54,908**	**136,546**	**203,196**	**39,824**	**54,429**	**76,324**
Teyarett	**3010**	15,506	25,561	33,444	5.9	5.8	5.6	91,484	146,782	187,285	10,769	19,819	29,990
	3011	383	386	9,101	5.9	5.3	4.6	2,259	2,627	41,865	-	-	23,949
	TOTAL	**15,889**	**25,947**	**42,545**				**93,743**	**149,409**	**229,151**	**10,769**	**19,819**	**53,939**
Dar Naim	**4010**	13,679	20,296	25,416	6.7	6.4	6.0	91,651	128,710	152,494	9,791	17,930	20,615
	4020	10,863	13,027	13,134	6.7	6.5	6.3	72,779	80,564	82,746	8,073	11,320	13,479
	4021	440	4,444	7,564	6.7	6.2	5.6	2,951	27,292	42,358	-	1,720	5,783
	TOTAL	**24,982**	**37,767**	**46,114**				**167,381**	**236,566**	**277,598**	**17,864**	**30,970**	**39,877**
Sebkha	**5010**	10,647	14,760	14,775	7.8	7.4	7.0	83,044	109,079	103,427	13,901	15,050	16,621
	5020	111	99	214	7.8	7.2	6.5	869	1,408	1,394	-	-	-
	TOTAL	**10,758**	**14,859**	**14,989**				**83,913**	**110,487**	**104,821**	**13,901**	**15,050**	**16,621**
Arafat	**6010**	12,594	13,676	16,553	6.0	5.7	5.4	75,567	77,849	89,387	8,946	22,725	31,561
	6020	21,158	22,358	26,966	6.0	5.9	5.7	126,949	130,620	153,707	19,688	23,895	37,141
	TOTAL	**33,752**	**36,034**	**43,519**				**202,516**	**208,469**	**243,094**	**28,634**	**46,620**	**68,702**
Toujounine	**7010**	12,789	21,972	25,926	6.6	6.4	6.2	84,410	140,433	160,740	13,370	19,635	25,545
	7020	10,573	14,251	14,650	6.6	6.4	6.2	69,782	91,084	90,832	2,212	18,006	31,974
	7030	2,062	9,191	12,295	6.6	6.4	6.2	13,610	58,746	76,231	-	3,734	7,804
	7031	14	49	1,027	6.6	6.1	5.5	91	297	5,651	-	2,874	13,476
	TOTAL	**25,438**	**45,463**	**53,898**				**167,893**	**290,560**	**333,454**	**15,582**	**44,249**	**78,799**
El mina	**8010**	18,044	18,448	20,869	5.1	4.9	4.6	92,025	94,328	95,996	16,682	18,620	21,408
	8020	9,904	11,918	15,380	5.1	5.0	4.8	50,510	58,917	73,826	6,365	12,051	26,720
	8030	2,190	3,006	3,390	5.1	5.0	4.8	11,171	14,862	16,272	-	2,580	3,448
	TOTAL	**30,138**	**33,372**	**39,639**				**153,706**	**168,106**	**186,094**	**23,047**	**33,251**	**51,576**
Riyadh	**9010**	27,507	35,754	37,093	4.6	4.5	4.4	126,531	160,682	163,208	25,249	32,055	37,696
	9011	1,055	24,797	41,385	4.6	4.2	3.8	4,853	104,010	157,264	-	50,816	62,974
	9020	978	1,873	5,028	4.6	4.5	4.4	4,500	8,416	22,123	-	-	5,251
	9021		2,998	4,368	4.6	3.8	3.8	-	11,377	16,598	-	7,018	11,534
	TOTAL	**29,540**	**65,422**	**87,874**				**135,884**	**284,485**	**359,193**	**25,249**	**89,889**	**117,455**
TOTAL		**191,887**	**315,095**	**434,297**				**1,116,738**	**1,720,648**	**2,200,000**	**272,720**	**483,150**	**689,832**

Source: JICA Study Team

Source: JICA Study Team

Figure I-43 Estimation of Distribution of Night Population by Traffic Zone in 2017 and 2040



Source: JICA Study Team

Figure I-44 Estimation of Distribution of Commuting Population by Traffic Zone in 2017 and 2040

General land use plan

Scope and drawing style of General Land Use Plan

The land use plan is formulated based on the future urban structure, on analysis of urban expansion potential and on distribution of population by traffic zone explained above. The future road network and land use plan are proposed in broad terms. Thus it should be noted that the character of the map is indicative, and that should not be used for measuring by individual plot holders.

The drawing style chosen for the land use plan is based on a 200 m x 200 m grid. Each square of the grid receives a land use category. This method of land use design can be qualified as "General" Land Use Plan. The reason for selecting this method of representation are the following.

- Land use category on each square of the grid is computed into the GIS software with a value in terms of dwelling units and number of employees (commuting population). While painting the land use, the software recalculates dynamically the total number of dwelling units and number of employees for each traffic zone, each commune, and for the whole city of Nouakchott. Thus, it can be said that the land use plan is consistent with the population framework decided earlier;
- The representation is simplified in order to facilitate the understanding of land use changes between 2017 and 2040 at the masterplan level, this it participates to a better decision-making process at this stage of the project.

Land use categories

The major role of the land use plan in a SDAU, as defined in Mauritanian Urban Planning Code, is the definition of preferred zones of urban extension, and the indication of land usages in terms of housing, trade, equipment and green spaces. Moreover, even though it is not specified in the law, the major role of the land use plan of the SDAU is the designation of future densities.

Land use categories for General Land Use Plan are specified in Table I-13 below.

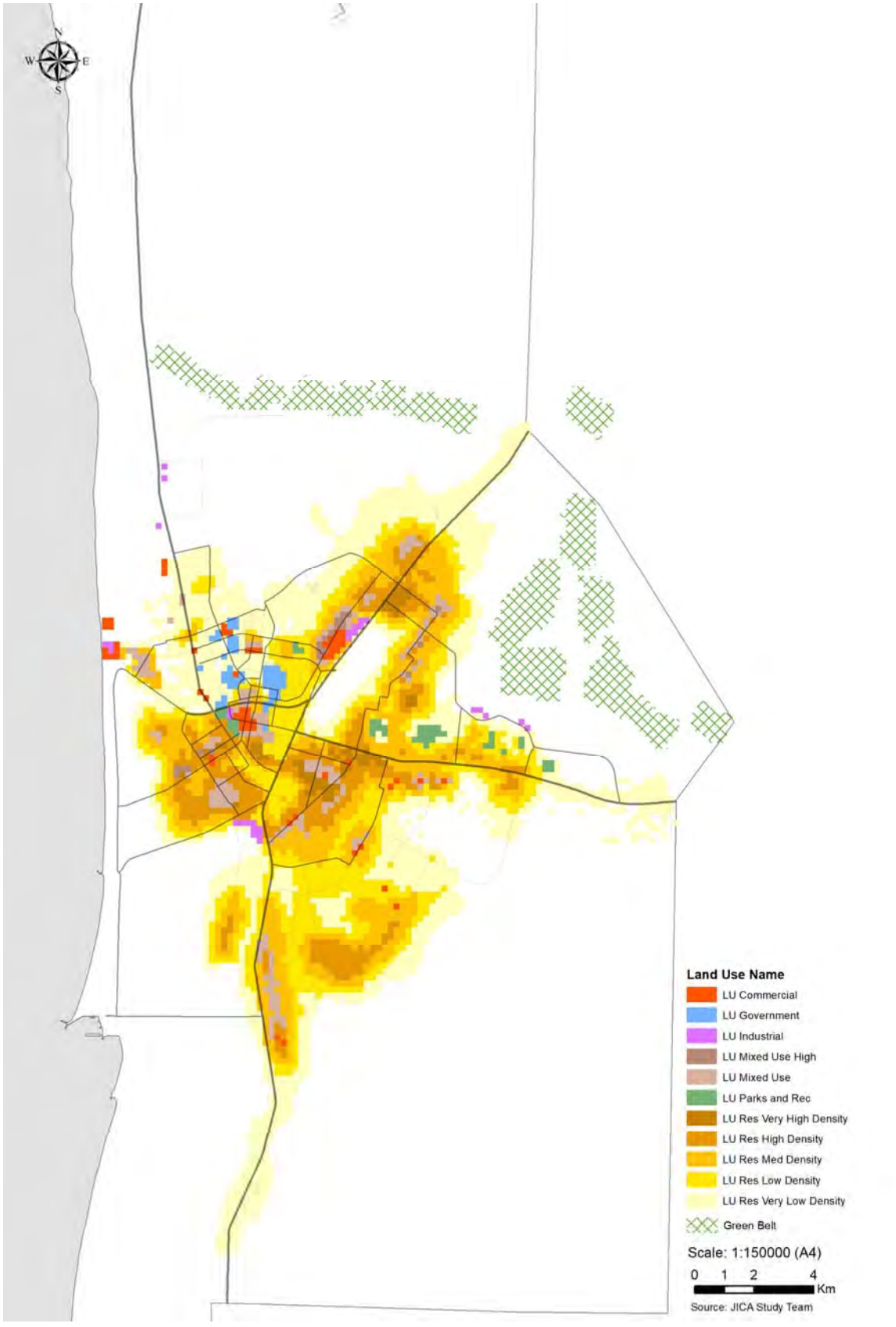
Table I-13 Land Use Categories and Allocation of Densities in SDAU General Land Use Plan

	Land Use Category		Number of Dwelling Units / ha	Average Population / ha	Number of Employees / ha
Settlement allocation		Very low density residential	0-4	25	-
		Low density residential	5-10	50	-
		Medium density residential	11-20	100	-
		High density residential	21-30	150	-
		Very high density residential	31-40	200	-
Commercial		Commercial	-	-	1,085
		Average density mixed use	11-20	100	860
		High density mixed use	21-30	150	1,000
Industrial		Industrial	-	-	479
Public services		Public services and government	-	-	739
Green spaces		Recreation and green spaces	-	-	-

Source: JICA Study Team

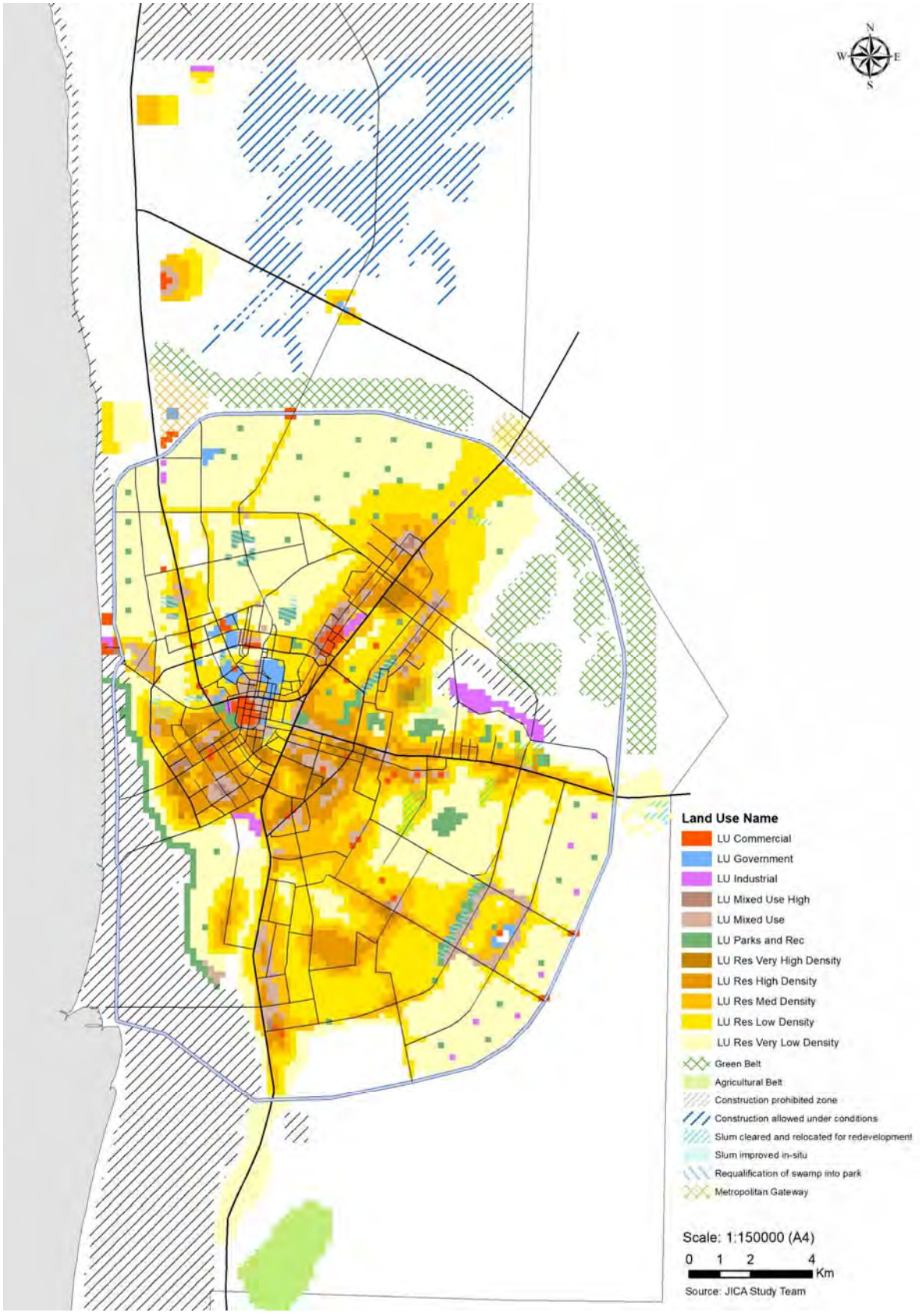
Land Use plan

Existing land use (2017) and proposed future general land use plan for horizons 2030 and 2040 are shown in Figures I-45 I-46 and I-47 respectively.



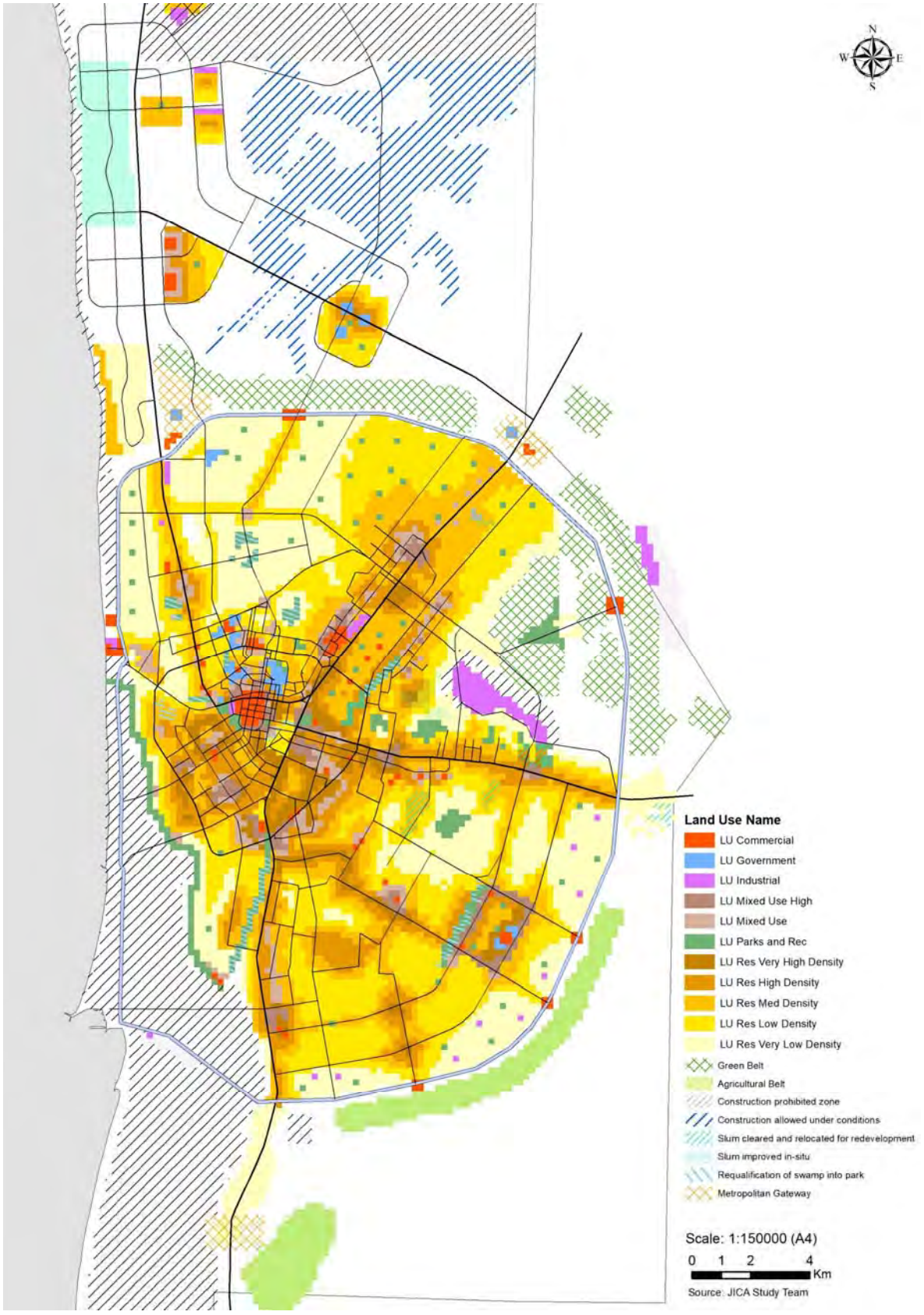
Source: JICA Study Team

Figure I-45 Existing Land Use (2017)



Source: JICA Study Team

Figure I-46 Proposed Future General Land Use Plan (2030)



Source: JICA Study Team

Figure I-47 Proposed Future General Land Use Plan (2040)

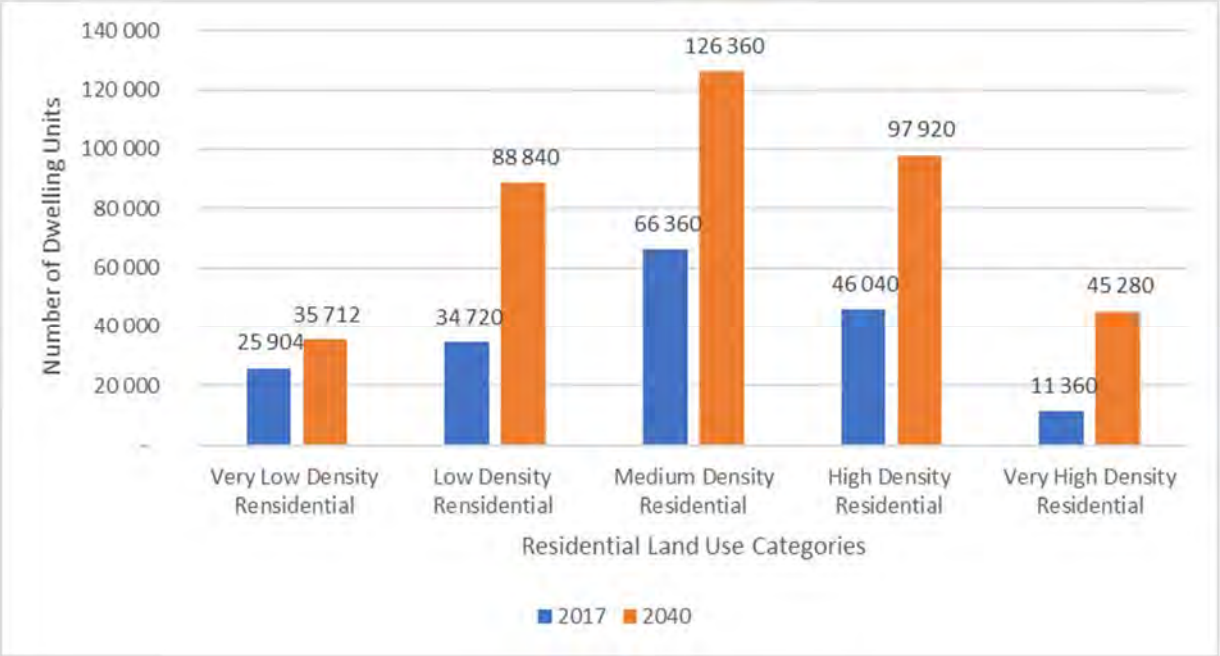
Summary of Land Use composition

The table below presents the current (2017) and proposed (2040) land use composition, while the graph shows the distribution of housing units by residential land use categories.

Table I-14 Composition of Existing and Proposed Land Use

Land Use Category	Dwelling Units		Area (ha)		17-40 Growth	Share (%)		17-40 Trend
	2017	2040	2017	2040		2017	2040	
Very low density residential	24 722	35 430	6 476	8 928	+38%	35.3%	21.0%	-14.3%
Low density residential	33 135	88 139	3 472	8 884	+156%	18.9%	20.9%	2.0%
Medium density residential	63 331	125 363	3 318	6 318	+90%	18.1%	14.9%	-3.2%
High density residential	43 939	97 147	1 535	3 264	+113%	8.4%	7.7%	-0.7%
Very high density residential	10 842	44 923	284	1 132	+299%	1.5%	2.7%	1.1%
Commercial	-	-	952	2 342	+146%	5.2%	5.5%	0.3%
Average density mixed use	13 514	21 033	1135	1 699	+50%	6.2%	4.0%	-2.2%
High density mixed use	2 404	22 262	135	1 202	+790%	0.7%	2.8%	2.1%
Industrial	-	-	108	496	+359%	0.6%	1.2%	0.6%
Public services, government	-	-	204	256	+25%	1.1%	0.6%	-0.5%
Recreation and green spaces	-	-	730	7 989	+994%	4.0%	18.8%	14.8%
TOTAL	191 887	414 297	18 349	42 510		100.0%	100.0%	

Source: JICA Study Team



Source: JICA Study Team

Figure I-48 Distribution of Dwelling Units by Residential Land Use Category

(4) Layout of Transport and Network infrastructure

On the basis of the land use plan proposed for SDAU, the layout of the network and transport infrastructures have been conceptualized as transcribed in the following maps. The Main report provides a comprehensive description of the planning methodology for the different infrastructures.

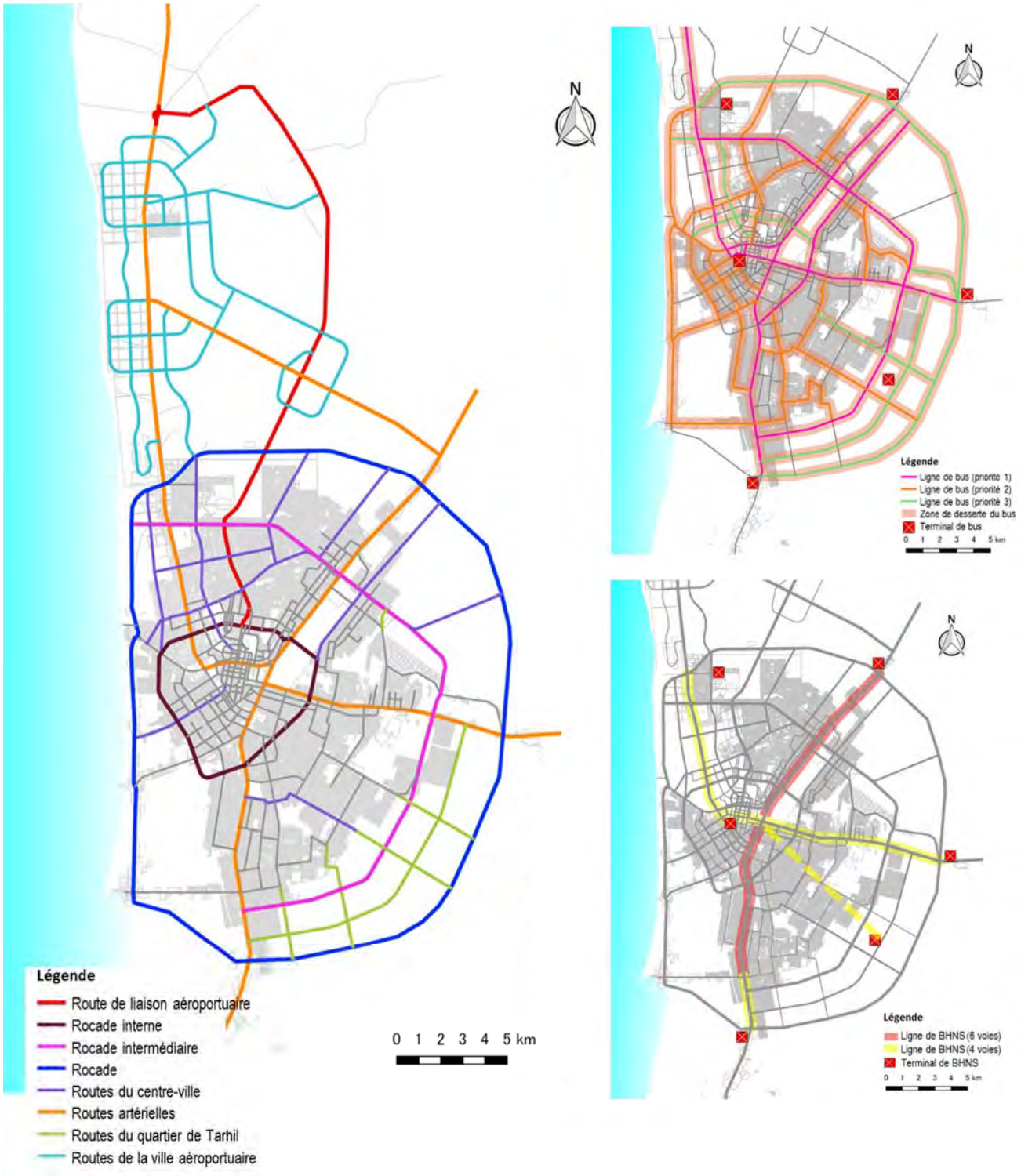


Figure I-49 Proposed Future Road Network and Public Transport Networks (Bus And BRT)

Figure I-50 Plan for the Drinking Water Supply Network (2040)

Figure I-51 Proposed Future Sanitation Network (2040)

Structuring public facilities of the agglomeration

On the basis of projections and orientations of the SDAU, the structuring public facilities of the agglomeration have been conceptualized as transcribed in the following maps. JICA's detailed report provides a comprehensive overview of the planning methodology for different urban services.

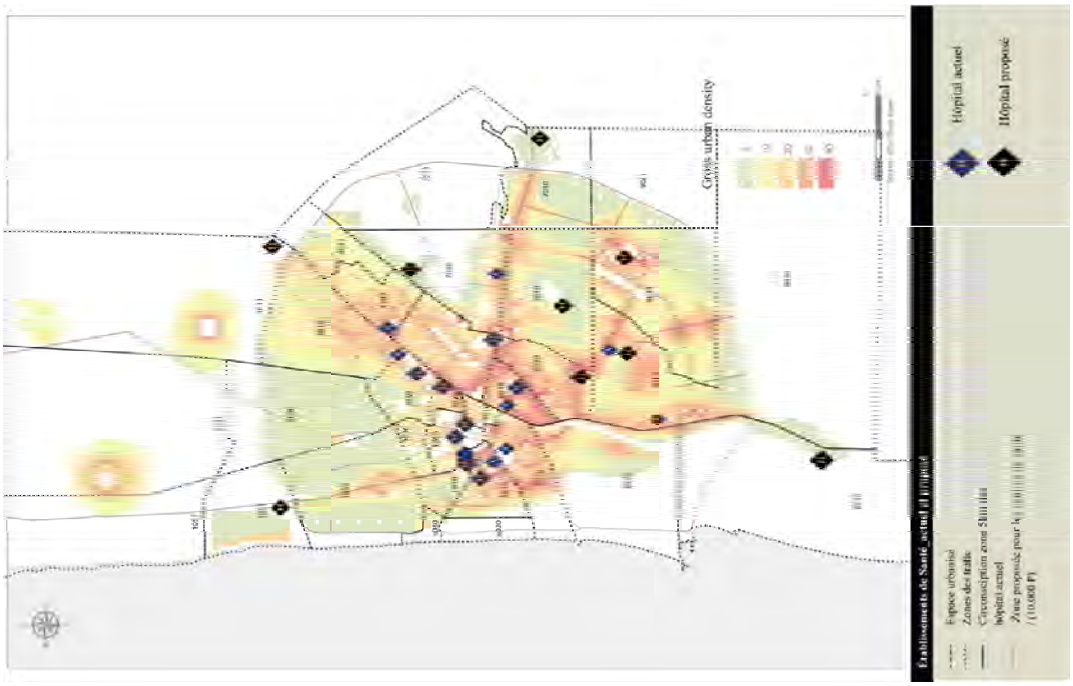


Figure I-52 Structuring of Public Facilities In Nouakchott

Figure I-53 Structuring of Health Facilities in Nouakchott

I-4 Implementation and Accompanying Measures

Despite its non-binding nature for private operators, the present SDAU, strategic and indicative document, must however be respected and carried by the various operators in charge of urban development. Administrations will need to ensure that actions and actions are taken in line with the requirements of the SDAU Strategic Directions and Planning Principles. Controlling urbanization will also involve managing housing supply and demand, in line with the demographic framework.

The main phases of implementation of the SDAU as well as the accompanying measures that will have to be taken to ensure the proper implementation of the requirements of the SDAU are detailed in this section.

I-4.1 Major phases of implementation of the SDAU

The realization of the SDAU urban master plan at horizon 2040 is expected to begin immediately following the completion of the JICA Study, i.e. from the year 2019. The period of 21 years of expected realization period of the SDAU has been divided in 4 major phases, namely phase 1: from 2019 to 2025; phase 2 from 2026 to 2030; phase 3 from 2031 to 2035 and phase 4 from 2036 to 2040.

- Phase 1 from 2019 to 2025;
- Phase 2 from 2026 to 2030;
- Phase 3 from 2031 to 2035;
- Phase 4 from 2036 to 2040.

The land use phase-wise development scenario explained in Table I-15 and Figure I-54 below has been elaborated based on the various factors such as (1) the legal and institutional framework of territorial administration and city planning in 2019 and the one expected 2040 according to our previsions based on capacity development program (refer to Chapter 2 of Part III), (2) the scale and complexity of planning issues to be tackled in 2019 and the way it is expected to change until 2040, especially in terms of climate change.

The formulation of land use phase-wise development scenario will help to facilitate the realization of the SDAU by setting-up the basic conditions and planning milestones to make its achievement possible. In the perspective of financial viability of the city development proposals, both public and private sectors, international donors are expected to support the realization of the SDAU.

Table I-15 Land Use Phase-wise Development Scenario

	Phase 1 (2019-2025)	Phase 2 (2026-2030)	Phase 3 (2031-2035)	Phase 4 (2036-2040)
Keyword	**Preparation**	**Exploration**	**Maturation**	**Renewal**
Major development trend at the scale of Nouakchott	The ongoing urbanization patterns are continuing in subdivisions of Northern and Southern areas of Nouakchott while all the strategic orientations elaborated in SDAU, especially the one which improve	Based on the knowledge accumulated from pilot studies of final technical study of SDAU strategies, first wave of large-scale implementation is carried out throughout the city. The city starts searching and	Nouakchott city is finalizing its modern shape. The city limits are reached and most of urbanization is contained inside the ring road, expect for the airport city in the north which continues its growth. The urban planning policies and division	Nouakchott enters in a totally new phase of its urban history. Rather than building on new lands, large-scale urban renewal operations are going on. Intensification process is launched, while the city is showing its nomad identity of space

	Phase 1 (2019-2025)	Phase 2 (2026-2030)	Phase 3 (2031-2035)	Phase 4 (2036-2040)
Keyword	**Preparation**	**Exploration**	**Maturation**	**Renewal**
	existing urban area, are studied in technical terms for further implementation.	experimenting its regeneration for the future while New Tarhil neighborhood is established.	of governance between State and communes reach maturity.	largeness and freedom of movement through BRT system completion.
Major urban development operations	Preparation of New Tarhil balance pole with construction of necessary infrastructure networks and public facilities.	Large-scale housing development is open in New Tarhil neighborhood. The southern part of Nouakchott is filling inside the ring road.	First urban renewal operations are launched as pilot in several parts of the city, in cooperation with national and foreign investors.	Large-scale urban renewal operations are launched in parallel with the construction of BRT infrastructure and introduction of mass-transit system.
Priority infrastructure projects at the scale of Nouakchott	The outer ring road is built as a priority to give the skeleton of the future limits of the urban growth.	-	Preparation of construction of Sebkha-El Mina canal as a final bulwark to disasters.	-
Major studies to support SDAU realization	Flooding Risk Prevention Plan (PPRI) and Nouakchott Coastal Planning Directive (DAL) are studied in priority to give a framework to PLU formulation.	Legal studies are launched on several aspect of city planning realization: potential social housing policies, urban renewal operational process, etc.	-	-
Decentralization and role of the communes	Preparation of next steps of decentral-lization of powers to communes by simplifying land request procedure to the State. Several PLU are completed in most advanced communes.	All PLU of Nouakchott are completed, and all communes are getting ready technically and financially to imple-ment their plans.	Division of competences and responsibilities between State services and commune enters a new era, with the delegation of city planning to CUN and communes.	-

Source: JICA Study Team

Phase 1 (2019-2025) Phase 2 (2026-2030)

Phase 3 (2031-2035) Phase 4 (2036-2040)

Source: JICA Study Team

Figure I-54 Urbanization of Nouakchott during the 4 phases of SDAU realization

Table I-16 Realization Schedule of Strategic Orientations

Strategic Orientation		Phase 1 (2019-2025)	Phase 2 (2026-2030)	Phase 3 (2031-2035)	Phase 4 (2036-2040)
1. Limit Urban Sprawl and Intensify Urban Area	1-1 Controlled urbanization in risk areas				
	1-2 Urban renewal and densification: Intense City				
	1-3 Public transit-led urban development				
	1-4 Social mix: The Solidarity City				
	1-5 Polarization of urban extensions				
	1-6 Metropolitan Gateways				
2. Build a New Relationship with Nature	2-1 External green belt as bulwark to sand and city				
	2-2 Coastal area as major public space				
	2-3 Green and blue internal network				
	2-4 Four major green poles to structure the city				
	2-5 Small scale green and public spaces				
	2-6 Leisure place in the desert				
	2-7 Ensure security of green and public spaces				
3. Promote Economic Radiation	3-1 Promote economic poles with public transit				
	3-2 Economic network based on Ring Road				
	3-3 Support economic growth of sectoral poles				
	3-4 Promote local jobs within neighborhoods				
	3-5 Promote economic diversification				

Source: JICA Study Team

Priority actions to be committed in the first phase of implementation (2019-2025) are listed in Table I-17 below.

Table I-17 Priority Actions to be Committed in The First Phase of Implementation (2019-2025)

Thematic	Priority Action (2019-2025)
Tissue actionsurbanexisting andthe environment	- Launch of Topographic Studies and Flood Risk Prevention Plan (PPRI) - Launch of studies for the valorization of the littoral as a public space - Launch of studies on the achievement of green and blue tra m e including 4 poles of nature - Resorption 50% of small pockets of re s iduaires slum east of the city
Developmenturban	- Realization of half of the residential area of the old airport in Dar Naim - Consolidation of the Soukouk district in the north of the city - AChE v ement of the construction of lotisse m ents inte r IOR internal ring road south of the city - Launch of detailed studies of the new century neighborhood Tarhil - Launch studies of commercial planning and e c onomic mesh ring road
Great equipmentstructuring	- Construction of 2 hospitals in the east of the city (Teyarett, Dar Naim, Toujounine) - Construction of 1 hospital in the west of the city (Sebkha, El Mina) - Construction of 3 multifunctional cultural centers
transport network	- Construction / widening of the airport link road - Construction / widening of the internal ring road - Construction / widening of the intermediate ring road - Completion of the construction of the ring road - Densification of the secondary and tertiary network of the city center - Construction of the new urban road network of the Airport City - Launch of studies for the improvement of the bus transport system - Arrangement of terminals and bus stops
infrastructures	- Launch of studies to expand the water supply capacity of the Aftout system - Launch of studies re w ing sewerage and sewage disposal system of rainwater - Completion of construction of three sewage treatment plants water used e s

Source: JICA Study Team

I-4.2 Recommended legal, administrative and institutional measures

The realization of the SDAU project requires, beyond the required investment effort, a favorable legal, administrative and institutional environment. This can be stimulated by the few measures mentioned below.

(1) LEGALLY APPROVE THE SDAU

The first step to start the process of implementation and to give legal force to the document of the SDAU and have it approved by decree in the Council of Ministers. This will enable urban development actors to become aware of the intentions of the SDAU and to adapt their own sectoral strategies accordingly. This will also provide an official framework for the development of the various PLUs of the Nouakchott municipalities by the departments in charge of urban planning associated with the mayors concerned.

(2) EVALUATING THE FEASIBILITY OF PRIORITY ACTIONS AND PROJECTS

To study precisely the feasibility of the priority actions proposed by the SDAU (see previous page), and this, in technical terms, cost estimation, and local financial and institutional arrangement. This will allow the implementation of SDAU's intentions to be implemented through special operations.

(3) DISSEMINATE THE SDAU AND PROMOTE AWARENESS OF BENEFICIARIES

As explained by the experience of the SDAU 2003, the SDAU is a document that must be widely distributed and can not remain confined to the circle of some administrations in charge of urban planning. The SDAU can serve various beneficiaries and non-public actors, such as the private sector and civil society, who wish to reorient their implementation strategy in accordance with the guidelines of the public authorities.

The dissemination and awareness-raising activities undertaken by the project team, namely the organization of a seminar to present the results of the study, the exhibition in the Nouakchott communes of the results of the consultation workshops, the publication a bilingual French / Arabic promotional brochure, the distribution of a video clip or the setting up of a website, must be continued. The document having been officially approved as well as the map of the SDAU are intended to be read and used by all sectors of the administration, and may be displayed in town halls.

(4) REALIZE THE SDAU BY INTEGRATING ITS PROVISIONS IN THE PLU

The implementation of the orientations and the vocations of soils expressed by the SDAU will be possible only by their translation in documents opposable to the thirds, namely the Local Plans of Urbanism (PLU). It is recommended to launch the PLU studies for each commune of Nouakchott in a short time and within the limits of the financial and institutional capacities of the authority in charge of urban planning. The intentions of the SDAU should be a guide for PLU studies. The collaborative reach of the work engaged in the SDAU must be pursued with the PLUs, using mayors and CCCs.

Although it is very briefly stated in the Town Planning Code, the principle of compatibility of planning documents is not currently implemented, simply because there is no mechanism for assessing compatibility and judicial settlement. litigation between two documents does not exist. The legislator will quickly (before the elaboration of the first PLU) define the contours of the procedures for assessing the compatibility between the different documents at the time of their approval.

Even if the compatibility report between a strategic document such as the SDAU and a detailed construction plan such as the plan of subdivision or the building permit is not to be established, the presence of the SDAU can help to clean up a situation of planning sometimes confused in Nouakchott. Thus, even in the absence of PLU, the guidelines of the SDAU could serve as a reference to the public authorities to arbitrate conflicts between the overlap of a road and a plan of subdivision for example. Regarding planned subdivisions but not yet bounded or developed, their consolidation to meet the guidelines of the SDAU is desirable, but it is preferable to do it within the framework of a land consolidation operation designated per perimeter of land intervention when formulating a PLU.

(5) GUARANTEE THE MONITORING, EVALUATION AND FREQUENT REVIEW OF THE SDAU

The SDAU, because it is based on estimates (especially demographic) and assumptions based on socio-economic phenomena in constant evolution, must be regularly updated, if it wants to maintain its credibility as a framework document. urban planning. The obligation to monitor and periodically evaluate the effects of the SDAU, which may or may not lead to the revision of the document, must be recorded in the Town Planning Code.

The latter may establish that no more than five years after the deliberation approving the SDAU, the authority in charge of urban planning must carry out an analysis of the results of the application of the SDAU, notably in the areas of the environment, transport and travel, control of space consumption and commercial locations. On the basis of the results of this analysis, the authority in charge of urban planning deliberates with the other technical services, and decides on the maintenance in force or the partial or complete revision of the SDAU. This analysis is communicated to the public and to the administrative authority responsible for the environment. The Code may

establish that in the absence of a start of a monitoring / evaluation procedure within the time allotted, the SDAU becomes obsolete.

(6) STRENGTHEN HUMAN RESOURCES

In order for the implementation of the SDAU to be supported by the necessary level of commitment of the urban planning officers, a capacity building program (detailed in the JICA report) must be deployed. It concerns in particular the training in urban control of zoning regulations inspectors and the training of construction inspectors or specific training in advanced techniques for mounting urban renewal operations or urban land consolidation.

(7) MOBILIZE FINANCIAL CAPACITY

The financial challenge of implementing the metropolitan project presented in the SDAU is significant, for two main reasons. Firstly, there is a growing gap between Nouakchott's land prices, which have risen sharply in recent years, and the purchasing power of the less well-off categories of the stagnant population. In order to provide rental housing that is accessible to both the less privileged classes (social housing) and the middle classes, it will be necessary to mobilize large amounts of public funding and to demand contributions from donors. The second challenge is the financing of all the infrastructure and equipment needed to cope with urban growth, bring Nouakchott to the rank of a major world metropolis and guarantee an ideal urban living environment for Nouakchottois.

A first avenue to mobilize the financial capacities for the realization of the SDAU would be to involve the owners in the realization of equipment and infrastructures. The allocation of rights to be built in the extension zones established by the SDAU may be subject to a levy on the real estate capital gains that will be realized there. The levy can be of different orders, such as a tax dedicated to the financing of various networks, a direct contribution for the realization of work by the owner, or a contribution in kind (removal of part of the plot).

Another solution to deal with the possible lack of public funding is the private sector contribution, which can be divided into two tracks. The first would be to opt for public-private partnerships (PPP) for urban development operations such as ZACs or construction of major works or urban projects. Moreover, the private sector can also be solicited through the establishment of COS or CUF bonuses in exchange for various services rendered to the city and citizens, such as the opening of public spaces for leisure purposes.

(8) SOLICIT EXTERNAL MEASURES TO ACCOMPANY THE IMPLEMENTATION

Some measures do not directly concern the authority in charge of urban planning and are not conditioned by the approval of the SDAU, but may have an accelerating effect on the implementation of the intentions of the scheme. This is particularly the case of the establishment of a law of co-ownership in Mauritania, which is one of the necessary elements to make the transition to a denser city that has the opportunity to verticalize. In addition, a major ambitious reform of social housing policies seems to be needed to be able to implement the intentions of the SDAU and in particular the realization of the new district of Tarhil.

I-5 Environemntal Considerations

The urban planning master plan shows infrastructure development policies but does not consider concrete infrastructure plans. The scoping studies were conducted and initial environmental impacts were assessed for the proposed infrastructure projects. Mitigation measures are proposed for each infrastructure sector as follows.

(1) Transport Infrastructure

Table I-18 Transport infrastructure mitigation measures

	Influence item	Assumed effect	Mitigation plan
Environmental pollution	Air pollution	・ Gas emissions increase due to increased traffic volume。	・ Enhance regulations on automobile emissions ・ Introduction of low pollution vehicles such as fuel cell vehicles ・ Modal shift from automobile to public transport ・ Traffic Demand Management (TDM) ・ Introduction of Intelligent Transport System (ITS)
	Noise and vibration	・ Noise and vibration caused by an increase in traffic volume	・ Introduction of appropriate measurement and evaluation system ・ Roadside environmental measures such as maintenance of environment facility zones, installation of low noise pavement, installation of sound insulation walls, etc.
Social environment	Resident resettlement	・ Resident resettlement will occur as the main road is built.	・ Appropriate implementation including land acquisition and resident relocation plan formulation, monitoring and evaluation
	Social organizations such as social capital and regional decision-making organizations	・ Land problems occur. ・ Regional demands complicate the route arrangement of public transportation etc.	・ Appropriate implementation including land acquisition and resident relocation plan formulation, monitoring and evaluation
	Uneven distribution of benefits and damage	・ Regional benefits and damage are unevenly distributed due to road routes and route arrangement of public transport.	・ We will consult with local communities in advance at the planning stage (implementation of SEA).
	Conflict of interest within the region	・ If benefits and damage are unevenly distributed, conflicts of interest within the region may occur.	・ We will consult with local communities in advance at the planning stage (implementation of SEA).
	Traffic accident	・ Accidents occur on new roads.	・ Promotion of traffic safety education for drivers and residents ・ Installation of traffic signs

(2) Water supply

Infrastructure related to water supply can be said to be the most important infrastructure facility for Nouakchott citizen. Improvement of turbo pump, water purification plant, construction works of water distribution buildings themselves are thought to have little influence on pollution from the current city situation, but because they are important infrastructure facilities, benefits and damages may be unevenly distributed and conflict of interest may occur. In order to avoid these, it is necessary to consult with representatives of local communities beforehand in addition to making fair facilities placement plan for citizens.

Table I-19 Water supply mitigation measures

	Influence item	Assumed effect	Mitigation plan
Social enviro	Uneven distribution of benefits and damage	・ If benefits and damage are unevenly distributed, conflicts	・ We will consult with local communities in advance at the drawing stage (implementation of SEA).

	Conflict of interest within the region	of interest within the region may occur.	・ Consider this issue at the planning stage so that water distribution facilities can be distributed fairly to residents in the city.

(3) Sanitation and Wastewater Treatment

The construction works of sewer network themselves are thought to have little influence on pollution from the current city situation, but because they are important infrastructure facilities, benefits and damages may be unevenly distributed and conflict of interest may occur. In order to avoid these, it is necessary to consult with representatives of local communities beforehand in addition to making fair facilities placement plan for citizens.

Table I-20 Sanitation and wastewater treatment mitigation measures

	Influence item	Assumed effect	Mitigation plan
Social environment	Resettlement	・ Resident resettlement will occur as the main road is built.	・ Appropriate implementation including land acquisition and resident relocation plan formulation, monitoring and evaluation
	Uneven distribution of benefits and damage	・ If benefits and damage are unevenly distributed, conflicts of interest within the region may occur.	・ We will consult with local communities in advance at the drawing stage (implementation of SEA). ・ Consider this issue at the planning stage so that facilities can be distributed fairly to residents in the city.
	Conflict of interest within the region		

(4) Rainwater Drainage

Infrastructure related to rainwater drainage can be said to be the most important infrastructure facility for Nouakchott citizen. Improvement of turbo pump, water purification plant, construction works of discharge pipeline etc. themselves are thought to have little influence on pollution from the current city situation, but because they are important infrastructure facilities, benefits and damages may be unevenly distributed and conflict of interest may occur. In order to avoid these, it is necessary to consult with representatives of local communities beforehand in addition to making fair facilities placement plan for citizens.

Table I-21 Rainwater drainage mitigation measures

	Influence item	Assumed effect	Mitigation plan
Social environment	Resettlement	・ Resident resettlement will occur as the main road is built.	・ Appropriate implementation including land acquisition and resident relocation plan formulation, monitoring and evaluation
	Uneven distribution of benefits and damage	・ If benefits and damage are unevenly distributed, conflicts of interest within the region may occur.	・ We will consult with local communities in advance at the drawing stage (implementation of SEA). ・ Consider this issue at the planning stage so that facilities can be distributed fairly to residents in the city.
	Conflict of interest within the region		

PART II: PLU

II-1 General Objectives

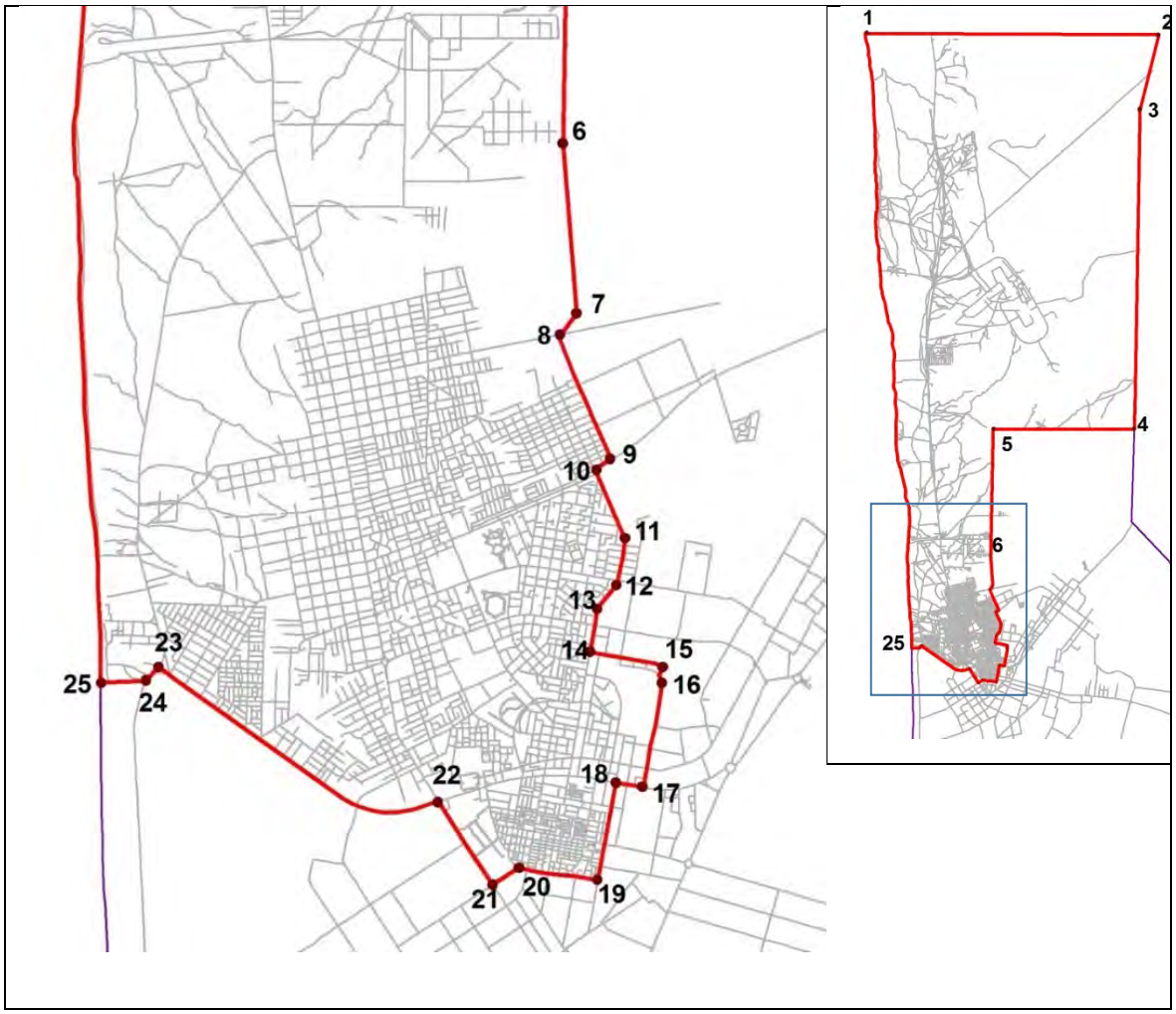
According to the Urban Planning Code, preparation of a PLU is not mandatory in areas where there exists an approved SDAU. The main function of a PLU is to provide tools to manage and control urbanization through the binding power on citizens (a document imposable to all public and private entities). The law stipulates that when developing a PLU, it must follow the guidelines shown in the SDAU, if it exists. With reference to this requirement, the model PLU proposed in this section has the following objectives:

- Establish the ristrictions to control urbanization in the most urgent and critical territories of Nouakchott;
- Provide a direct / indirect reference to areas where PLUs need to be prepared after completion of the project; and
- Facilitate the establishment of urban management mechanisms in Mauritania through a practical case in the capital.

II-2 Presentation of the PLU Target Area

II-2.1 Perimeter of the Model PLU

The perimeter boundaries of the Pilot PLU are defined in the following map covering the entire territory of the Tevragh Zeina Commune and most of the northern area of Nouakchott covering the vicinity of the Nouakchott Oumtounsy International Airport, Nouakchott-Al Sasirya and the main concession areas to be converted into large-scale subdivisions or for seaside tourism purposes.



Source: JICA Study Team

Figure II-1 Map of the Perimeter of PLU

The following table shows the coordinates of the main points corresponding to Figure 2.1.

Table II-1 Coordinates of Key Points

No.	Latitude	Longitude	No.	Latitude	Longitude
1	18.453253°	-16.056670°	14	18.100077°	-15.975646°
2	18.456807°	-15.873707°	15	18.098576°	-15.967977°
3	18.413389°	-15.888260°	16	18.097336°	-15.967999°
4	18.226294°	-15.890806°	17	18.086638°	-15.970067°
5	18.225920°	-15.977725°	18	18.087109°	-15.972898°
6	18.150859°	-15.978731°	19	18.077315°	-15.974656°
7	18.133914°	-15.977107°	20	18.078582°	-15.983074°
8	18.131760°	-15.979029°	21	18.076817°	-15.985620°
9	18.119362°	-15.973462°	22	18.085131°	-15.991294°
10	18.118269°	-15.975203°	23	18.098405°	-16.020659°
11	18.111373°	-15.972077°	24	18.097088°	-16.021923°
12	18.106968°	-15.972876°	25	18.096800°	-16.026506°
13	18.104437°	-15.974883°			

Source: JICA Study Team

II-2.2 Scope of the PLU

(1) Applicable Planning Tools to the Target Planning Area

According to the Urban Planning Law 2008, there are several statutory plans apart from PLU, as tools to materialize the proposed elements of SDAU. These statutory plans are the Detailed Development Plan (PAD [1]), Concerted Development Zone (ZAC [2]) and Subdivision (LT [3]). Application of these planning tools would be determined by physical conditions and implementation body, among others.

The target planning area involves several types of land areas regarding the current development status and on-going planning procurement status. Application of these planning tools can be proposed in the model PLU to be applied in accordance with the typology of the land area and development status. Table II-2 and Figure II-2 show suitable statutory planning tools as implementation measures to be applied to the target planning area based on the development status of five types as described below.

TYPE1: Vacant area as national domain (not deeded yet)
TYPE2: Land deeded or to be deeded such as large-scale concession land without occupation
TYPE3: Subdivision areas of both planned or under implementation
TYPE4: Existing built-up areas with occupation land plots
TYPE5: Airport adjacent areas with Government Control
TYPE6: Existing urban planning area for "Airport City Development" (see note below)

Table II-2 Effective Planning Tools and Implementation Measures Applied to the PLU Planning Area

Statutory Planning Tools and Implementation Measures (Urban Planning Law 2008)		Effective Measures to be Applied					
		TYPE-1 (vacant land)	TYPE-2: (Land to be deeded)	TYPE-3: (Subdivision Area)	TYPE 4: (Built-up Areas)	TYPE 5: (Airport Adjacent Areas)	TYPE 6: (Airport City)
Local Urban Plan PLU)	Zoning and Regulations (urbanization)	●	○	○	●	○	○
	Large Public Use Area to be designated	●	●	●	○	--	--
	Key Road Network to be designated	●	●	●	○	●	●
	Reservation Area for Future Development	●	○	○	○	●	●
	Conservation Area to be protected	●	●	○	○	●	●
Detailed Development Plan (PAD) *		●	●	●	--	●	●
Implementation Measures	Subdivision (Plan: LT)	○	●	●	--	○	○
	Concerted Development Zone (ZAC) *	●	●	○	○	●	●
	Others for urban revitalization (RU, RBU4)	--	--	○	●	--	--

Legend 1 : Type 1: Vacant area as national domain (not deeded yet), Type 2: Land deeded or to be deeded such as Concession Land without occupation, Type 3: Subdivision designated, planned or under implementation, Type 4: Existing Built-up Areas developed with Occupation (around over 60% of plots)

Legend 2: ● = compulsory to manage and control ○= possible control and management partially if necessary, -- = not applicable

[1] PAD: Plans d'Aménagement de Détail
[2] ZAC: Zone d'Aménagement Concerné
[3] LT: Lotissement
[4] RU: Rénovation Urbaine, RBU: Remembrement Urbain

PLU: Local Urban Plan, PAD: Detailed Development Plan, PL: Subdivision Plan, ZAC: Concerted Development Zone, RU: Urban Renewal Plan, RBU: Urban Land Consolidation Plan

∗: This planning measure is workable as binding plan.

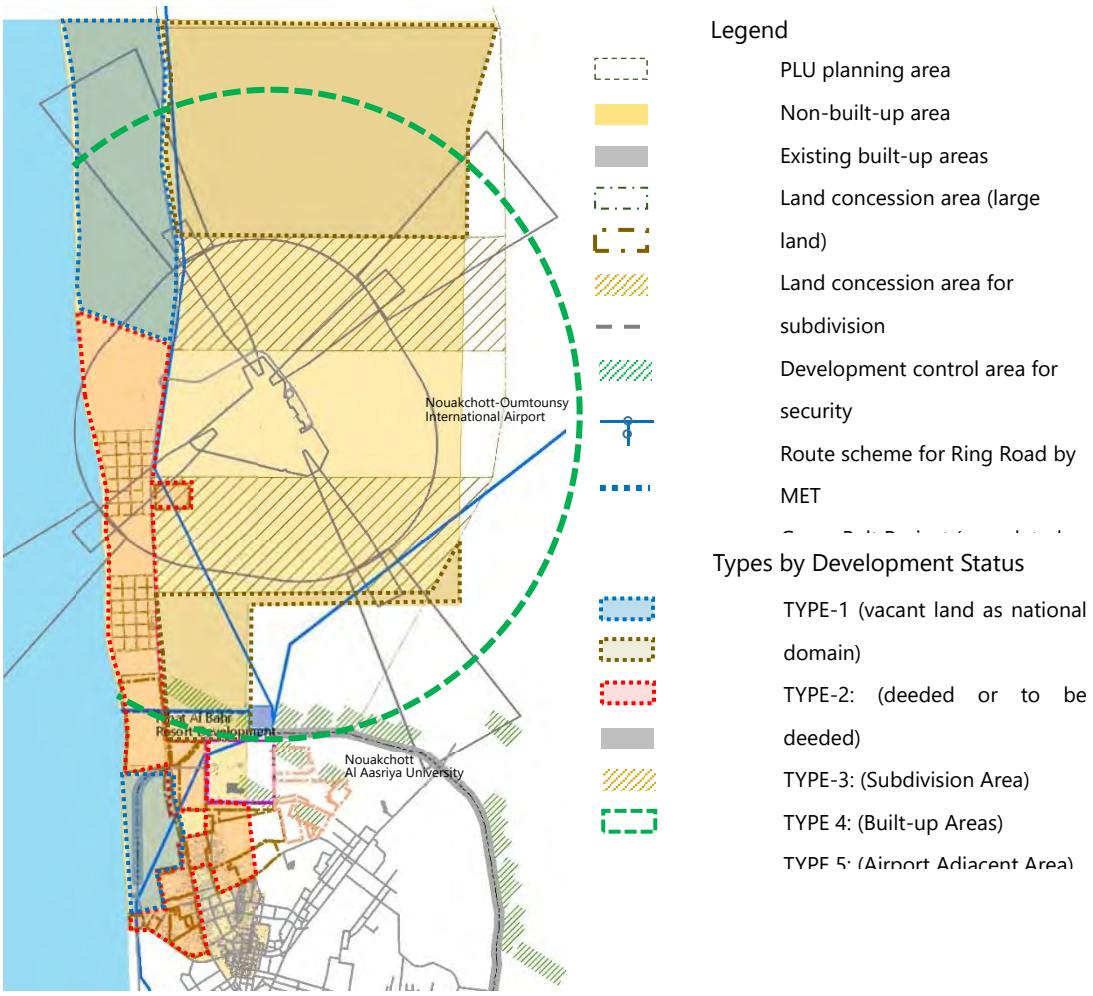
Source: JICA Study Team reviewing in consideration with Urban Code (Law 2008-07)

Note: Procurement for the Airport City Development Planning Services (2017/2018)

The Government has embarked the urban development surrounding of Nouakchott-Oumtounsy International Airport in order to enable it to be an economic center as high potential area capable of stimulating the sustainable urban development of the future city. MHUAT as one of the responsible authorities for urban development has scheduled the procurement of consultancy services for the study to develop the International Airport area as an airport city development in the year of 2018.

The study aims to formulate a master plan for the airport city including defining the target area (study area ranging 10-15km radius) in Phase I and to draw architectural development in Phase II, of which developments include economic activity center, commercial business center (hotel, shopping center, etc) taking account of environmental open space creation.

In this status, MHUAT has decided that the target area for PLU planning should be excluded, although the model PLU plan would treat essential zoning measures for conservation and urbanization area in association with trunk roads alignment.



Source: Several authorities (MHUAT, MET, SOMELEC, MOF-Domain) arranged by JICA Study Team

Figure II-2 Land Development Status in the PLU Planning Area

(2) Planning scope for the Model PLU

Based on the examination of current status and the on-going development planning aforementioned, the target area for the model PLU is defined as following Table II-3, and also defined as a kind of the scope of work of PLU planning. In principle, the planning area for Airport City ranging 10-15 km radius from the Nouakchott-Oumtousy International Airport is excluded for the model PLU planning area, although key planning intervention is proposed in that area.

Table II-3 Planning Scope for the Target Planning area for the Model PLU

Area Type by Development Status	PLU Planning Area	PLU Planning Measures				
		Urbanized Area/Reserved Area	Conservation Areas	Land Use Zoning	Key Road Network Designation	Key Public Area Designation
TYPE-1	●	○	●	--	●	●
TYPE-2	●	●	●	○	○	--
TYPE-3	●	●	○	●	●	--
TYPE-4	●	●	--	●	●	--
TYPE-5	--	○	○	○	●	--
TYPE-6	--	●	●	--	●	--

Legend 2: ● = compulsory to manage and control ○ = possible control and management partially if necessary, -- = not applicable

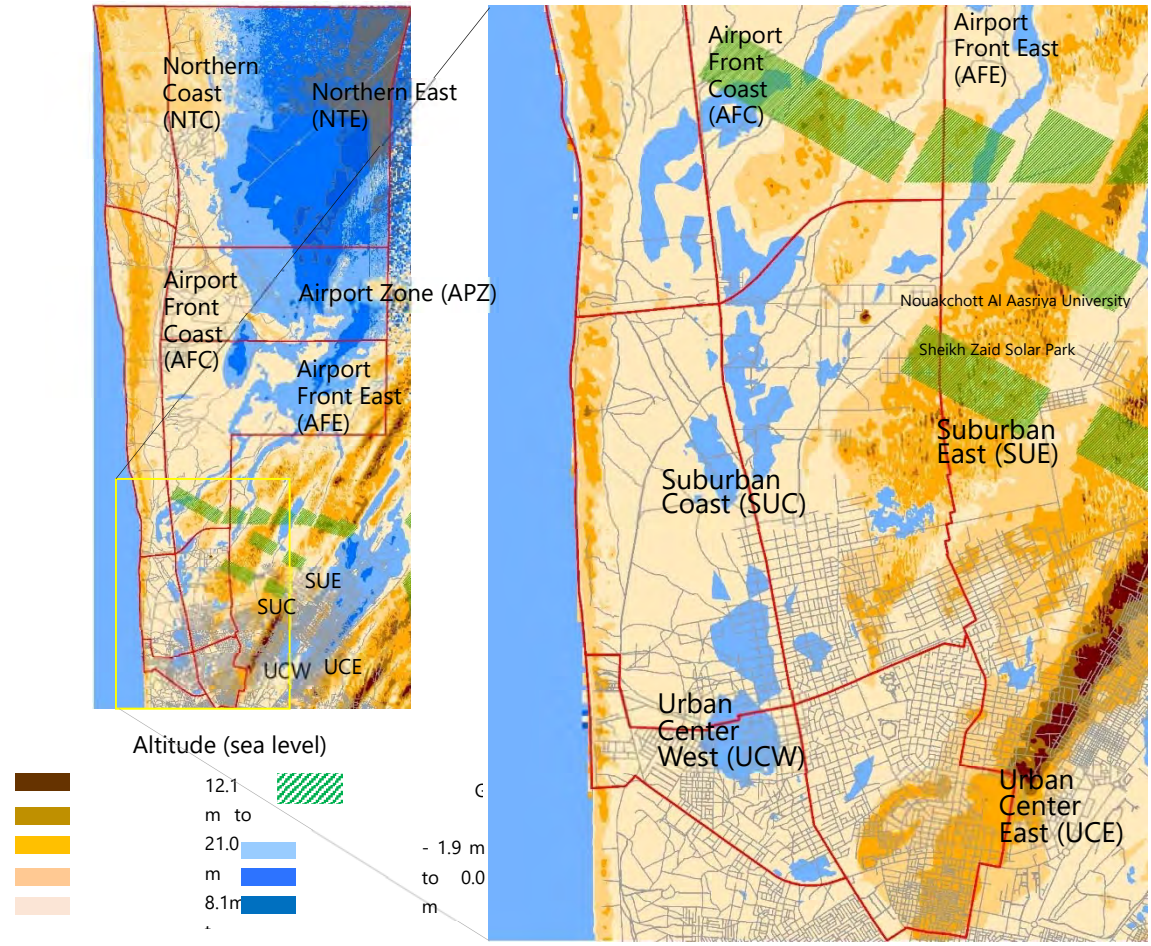
Source: JICA Study Team

II-3 Existing Conditions of the PLU Planning Area

II-3.1 Natural Environmental Conditions

(1) Topographic condition

A topographic condition in the target area for the Model PLU are identified in Figure 3.1, where the urban blocks can be introduced into the target area in consideration with the character of existing and future urbanization. Low lands causing inundation or flood-prone areas in the target area can be defined as unsuitable urban development areas, of which this natural condition is examined for “land availability assessment” in the section of 4.1.2 (3) of the Main Report.



Source: JICA Study Team, Topographic data is based on the Digital Elevation Model (2016) data.

Figure II-3 Existing Topographic Condition in the Target Area for the Model PLU

Table II-4 Topographic Conditions by Urban Blocks

Urban Block	Lands above 0 m height (ha)					Total	Under 0 m	Total Area (ha)	The share of Under 0 m Lands
	12.1 to 21.0 m	8.1 to 12.0 m	4.1 to 8.0 m	2.1 to 4.0 m	0.1 to 2.0 m				
Urban Center East (UCE)	0.0	1.5	247.6	192.0	485.7	926.8	12.1	939.0	1.3%
Urban Center West (UCW)	0.0	0.1	13.5	28.9	410.9	453.4	105.5	558.9	18.9%
Suburban East (SUE)	0.7	9.3	229.1	389.5	1,079.2	1,707.8	238.1	1,945.9	12.2%
Suburban Coast (SUC)	0.0	1.2	55.0	116.3	1,144.9	1,317.4	195.5	1,512.9	12.9%
Airport Front East (AFE)	0.2	37.0	286.1	825.5	6,040.1	7,188.8	2,645.9	9,834.7	26.9%
Airport Zone (APZ)	0.0	0.0	11.7	362.8	2,935.4	3,309.9	4,093.7	7,403.5	55.3%
Airport Front Coast (AFC)	0.0	10.1	1,088.3	2,088.9	1,904.6	5,091.8	181.2	5,273.0	3.4%
Northern East (NTE)	0.0	1.1	49.7	1,225.5	3,129.3	4,405.7	14,709.9	19,115.6	77.0%
Northern Coast (NTC)	0.0	18.5	797.5	2,598.8	1,714.7	5,129.5	40.9	5,170.4	0.8%
Total	0.9	78.8	2,778.5	7,828.2	18,844.7	29,531.1	22,222.9	51,754.0	42.9%

Source: JICA Study Team

Coastal erosion has recently become a critical issue related to rising sea levels due to climate change. The frequency and intensity of storms affected urbanized areas in the southern part of the target area.

(2) Plants and Trees

In the target area, natural bare lands including Sebkha (salty low lands), dune, and desert plants as low diversity of flora (e.g. low shrubs with Euphorbia, Zygophyllum) are predominantly shared by over 80% out of the total area. On the other hand, there are large artificial planting areas as recognized by "Green Belts" in the target area by a reforestation project which is managed by the Mauritanian Authorities in order to prevent desertification.

(3) Coastal Area

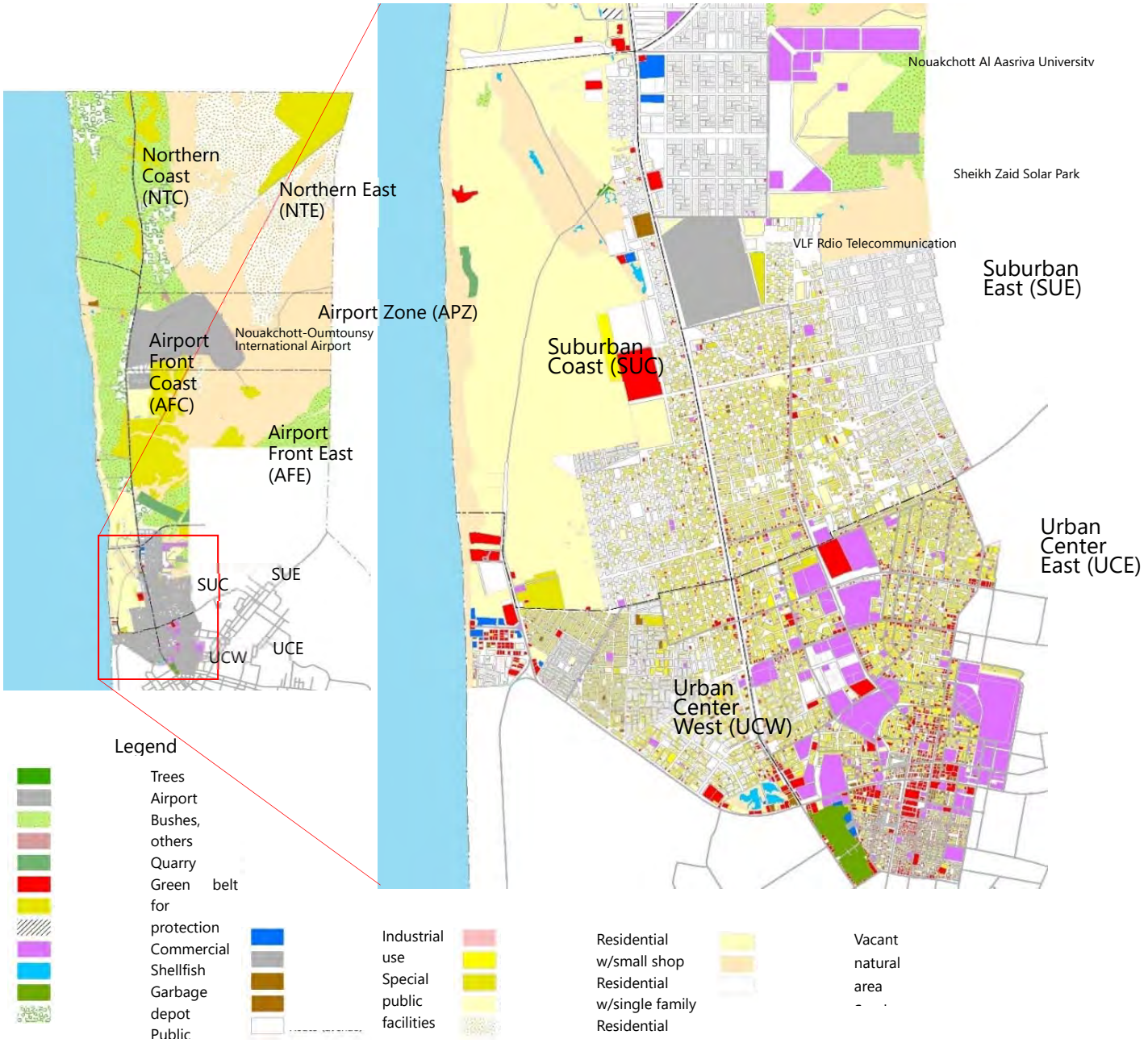
In the target area, the coastline spreads more than 40 km, where the urbanized area in southern part of the coast only shares 5 % out of total length. According to the report of Banda Field development - Gas Project Environmental Impact Assessment, various and large marine mammals were identified in this coastal marine area such as whales, dolphins, and turtle. On the other hand, it describes that the beachside has very scarce vegetation, and the main living species of seabirds, some small mammals.

(4) Seashell Distribution

Seashell is distributed in the northern part of the target area, where they are the only aggregate available within a few hundred kilometers from Nouakchott as one of the basic building materials in the area.

II-3.2 Existing Land Use Conditions and Characteristics

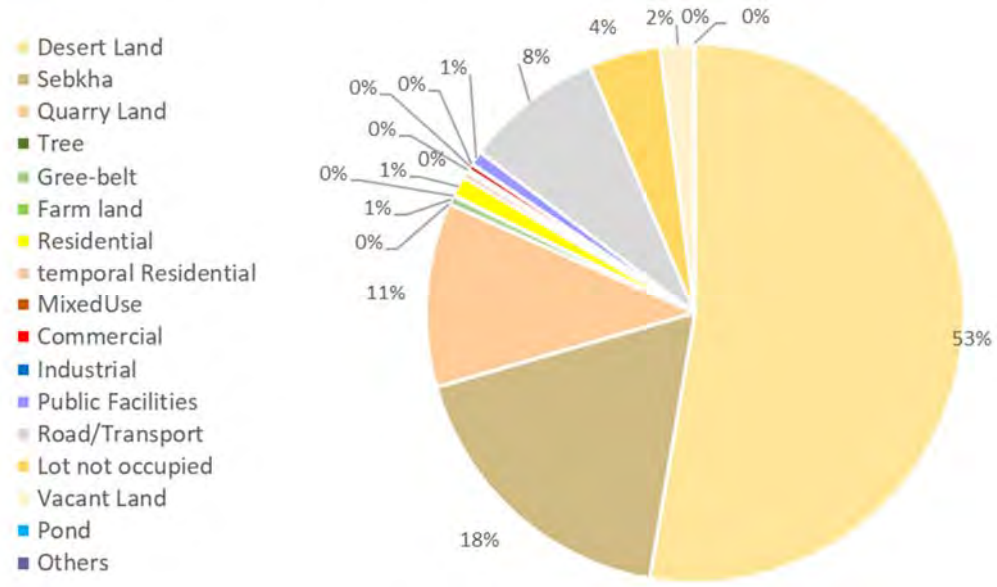
According to the land use survey on planning area for the Model PLU in May 2017, the composition of existing land use was identified as shown in Figure II-4.



Source: JICA Study Team

Figure II-4 Existing Land Use of the Planning Area for the Model PLU

The survey result reveals that the total land of the planning area is around 51,763 ha, and its predominant land use is a natural area including desert, other natural arid lands, Sebkha (salty flat wetland) and quarry lands (mainly sand and shellfish) by 81.7% out of the planning area. On the other hand, another major land use in the urbanized land use is “Road and Transport” (8 %) because of the large occupation of the Nouakchott-Oumtounsy International Airport. Composition of the existing land use in the planning area is shown in Figure II-5 below.



Source: JICA Study Team

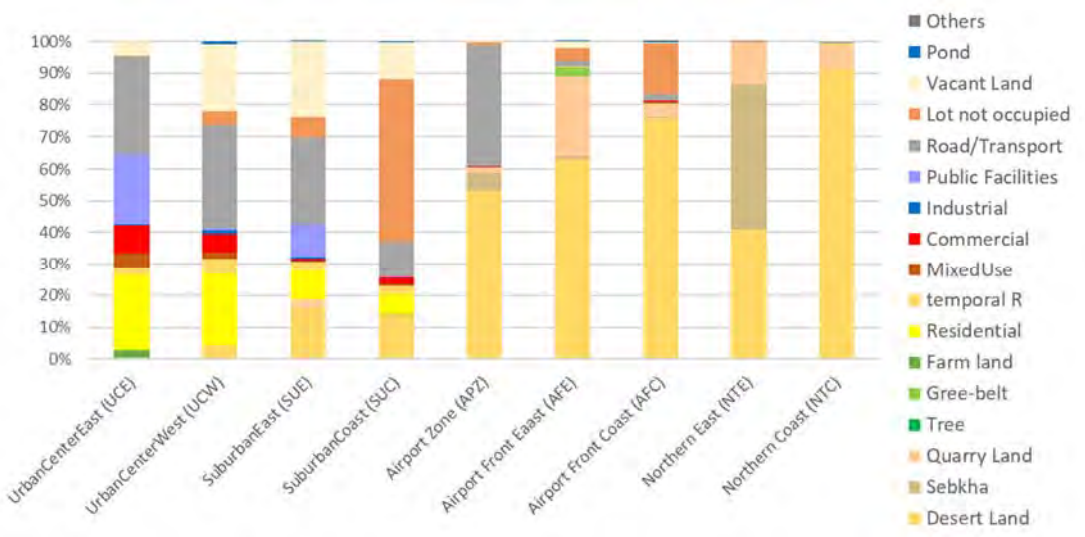
Figure II-5 Composition of Existing Land Use

This land use composition differs according to defined urban areas characterized by nine blocks as 1. Urban Center East (UCE), 2. Urban Center West (UCW), 3. Suburban East (SUE), 4. Suburban Coast (SUC), 5. Airport Zone, 6. Airport Front East (AFE), 7. Aiport Front Coast (AFC), 8. Northern East (NTE), and 9. Northern Coast (NTC), as shown in Table II-5 and Figure II-6. As distinct land use characters of the planning area apart from residential use include: public use (22%) by the Governmental facilities is predominant in the UCE, vacant use in the subdivisions of the SUE, and Sebkha land in the NTC by 46%.

Table II-5 Composition of Existing Land Use by Urban Blocks

Urban Block	Desert Land	Sebkha	Quarry Land	Tree	Gree-belt	Farm land	Residential	temporal Residential	MixedUse	Commercial	Industrial	Public Facilities	Road/ Transport	Lot not occupied	Vacant Land	Pond	Others	total
UrbanCenterEast (UCE)	0.0	0.0	0.0	0.0	0.0	26.5	231.3	18.7	44.1	87.3	2.0	210.2	293.8	4.1	44.1	0.0	0.0	**962.2**
UrbanCenterWest (UCW)	25.4	0.0	0.0	0.0	0.0	0.0	125.7	25.1	12.7	32.7	5.6	4.9	180.5	23.6	117.5	5.8	0.0	**559.5**
SuburbanEast (SUE)	313.1	0.0	51.9	0.0	0.0	0.0	172.7	52.2	10.4	12.5	8.9	199.5	525.6	122.6	461.7	0.3	0.0	**1,931.4**
SuburbanCoast (SUC)	210.0	0.0	0.0	0.8	5.7	0.0	90.2	41.7	9.1	32.1	1.1	3.1	167.1	768.8	177.8	4.6	0.0	**1,512.4**
Airport Zone (APZ)	3,951.4	407.1	138.6	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.3	2,817.2	59.2	28.0	0.0	0.0	**7,403.5**
Airport Front Eaast (AFE)	6,194.8	92.8	2,479.4	0.0	262.1	0.0	9.2	17.5	0.6	0.1	0.0	7.4	159.2	395.9	210.1	5.8	0.0	**9,834.7**
Airport Front Coast (AFC)	4,000.5	15.8	229.6	1.4	0.0	0.0	1.0	0.8	26.2	10.9	0.0	10.4	98.9	849.9	18.9	6.1	2.7	**5,273.0**
Northern East (NTE)	7,846.1	8,722.8	2,490.6	0.0	0.0	0.0	0.0	2.8	0.0	3.1	0.0	0.3	40.2	9.6	0.0	0.0	0.0	**19,115.6**
Northern Coast (NTC)	4,735.1	0.0	379.6	0.0	0.0	0.0	0.0	25.9	0.0	0.0	0.0	0.0	28.0	0.0	1.8	0.0	0.0	**5,170.4**
Total	**27,276.4**	**9,238.5**	**5,769.6**	**2.2**	**267.8**	**26.5**	**630.0**	**184.8**	**103.1**	**180.4**	**17.6**	**436.1**	**4,310.7**	**2,233.8**	**1,059.9**	**22.6**	**2.7**	**51,762.7**

Source: JICA Study Team



Source: JICA Study Team

Figure II-6 Composition of Existing Land Use by Urban Blocks

II-3.3 Current Status and Trends of Urban Development

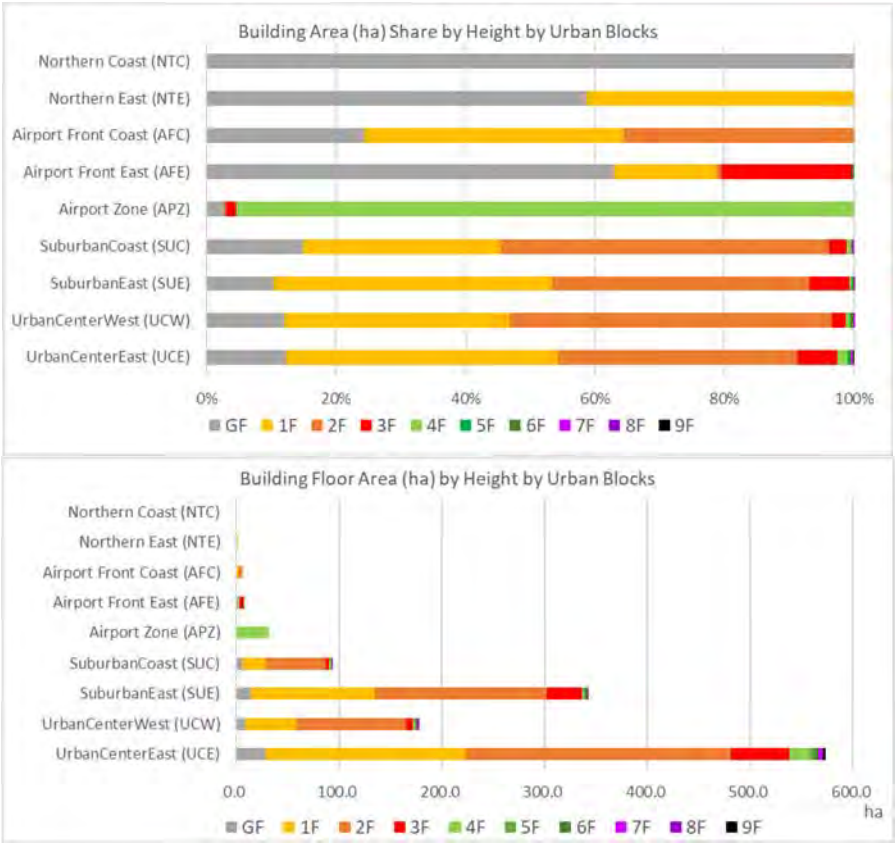
(1) Building height conditions in the Planning Area

Building height is one of the important elements to be addressed by urban form control and management, because it is fundamental to the capacity of urban activities (numbers of floors), and is a key index of safety and comfortable environmental conditions. In the planning area, low-rise buildings (GF,1-2F) occupies 92% share of the total building areas. It is observed that the 3-floor buildings accounted for 6% in the Urban Center East (UCE) which is one of the city centers of Nouakchott. The buildings with "over 9-floor" are limited to the area of UCE block. Table II-6 and Figure II-7 shows the number of buildings by height and by location.

Table II-6 Composition of Existing Buildings by Height and by Urban Blocks

Urban Block Name	Building Area per Building Height (ha)										
	GF	1F	2F	3F	4F	5F	6F	7F	8F	over 9F	Total
UrbanCenterEast (UCE)	28.75	97.20	86.09	14.27	3.83	0.70	0.57	0.51	0.14	0.24	**232.31**
UrbanCenterWest (UCW)	8.59	24.96	35.62	1.59	0.32	0.15	0.30	0.06	0.03	0.00	**71.62**
SuburbanEast (SUE)	14.46	60.18	55.62	8.61	0.37	0.25	0.30	0.00	0.01	0.00	**139.80**
SuburbanCoast (SUC)	5.65	11.51	19.25	1.04	0.28	0.01	0.07	0.07	0.00	0.00	**37.88**
Airport Zone (APZ)	0.18	0.00	0.02	0.10	6.19	0.00	0.00	0.00	0.00	0.00	**6.48**
Airport Front East (AFE)	2.40	0.60	0.03	0.77	0.00	0.01	0.00	0.00	0.00	0.00	**3.80**
Airport Front Coast (AFC)	0.65	1.07	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**2.67**
Northern East (NTE)	0.10	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.17**
Northern Coast (NTC)	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.66**
Grand Total	**61.44**	**195.58**	**197.58**	**26.37**	**10.99**	**1.13**	**1.24**	**0.65**	**0.18**	**0.24**	**495.40**

Source: JICA Study Team



Source: JICA Study Team

Figure II-7 Composition of Existing Buildings by Height and by Urban Blocks

(2) Current Trend of Urban Development

In the planning area, there are various types of plans and projects. These including land subdivision projects which is a predominant urban development method practiced in Mauritania, tourism-related development in the coastal area, and several large-scale infrastructure projects. Major projects in the planning area are described below. Figure 3.6 shows the overall condition of the current urban development in the planning area.

Land subdivision projects

The land subdivision is a primary method to provide housing plots to the citizens by the government. Land parcels are equipped with space for infrastructure (access roads, public facilities areas, necessary utility stations) although not fully completed at the time of delivery (unpaved secondary roads, unbuilt public facilities, etc.). Although it is envisaged in the Law that upper plans (PLU or PAD should be prepared before implementing the land subdivision projects, many subdivision projects have been authorized and implemented in the decade. In the planning area, there are over 2,500 plots allocated through the past subdivision projects.

Many of these land plots have been still vacant as the average occupancy indicates only 37% out of a total number of plots. This is not relative to when the subdivisions were implemented; in old-time or recent days; although Article 80 of the Law stipulates return of the plot to the seller as a pre-emptive right in case of no usage of the land within three years.

Table II-7 shows the condition of existing land subdivision areas in the planning area.

Table II-7 Condition of Subdivision Areas in the Planning Area

Ref No. (Fig2.5)	Number of Plot	No of Plot Occupied	OCR (%)	Average Area			Subdivision Area (ha) in PLU		
				(sqm/plot)	Max	Min	Total	Road Area	Share
1	949	654	69 %	912	15,012	211	123.2	40.2	33 %
2	1,336	561	42 %	375	3,780	24	70.2	21.8	31 %
3	964	603	63 %	177	4,884	98	24.2	7.7	32 %
4*	187	94	50 %	1,247*	11,027	86	35.2	11.5	33 %
5	79	36	46 %	909	2,116	436	12.4	5.1	41 %
6	53	6	11 %	623	974	420	4.2	0.9	21 %
7	1,018	864	85 %	702	6,000	145	106.7	35.4	33 %
8	1,639	1,047	64 %	714	24,365	300	185.6	66.0	36 %
9	270	53	20 %	330	2,008	239	13.4	4.0	29 %
10	757	211	28 %	791	49,998	150	88.3	25.1	28 %
11	995	509	51 %	561	19,093	286	90.0	35.7	40 %
12	543	467	86 %	951	23,614	91	119.0	51.7	43 %
13	2,491	896	36 %	790	22,150	187	312.4	120.8	39 %
14	1,031	905	88 %	707	6,573	294	118.3	46.9	40 %
15	755	0	0 %	515	28,988	100	46.6	18.7	40 %
16	200	122	61 %	660	800	500	22.2	8.7	39 %
17	1,088	0	0 %	612	1,920	589	47.0	16.2	35 %
18	--	--	--	--	--	--	460.0	--	--
19	2,408	33	1 %	736	19,800	450	288.0	107.7	37 %
20*	23	4	17 %	28,410*	64,811	2,800	81.2	18.4	23 %
21	2,545	932	37 %	379	16,280	56	160.0	60.5	38 %
Total/Av	19,331	7,997	41 %	--	--	--	2,408.0	703.0	29 %

Note: *= This plot is for industry use. Other plots include other non-residential uses such as public facilities, park.
Source: JICA Study Team (GIS estimation) based on the CAD drawings (MHUAT, MET)

Large-scale land concessions

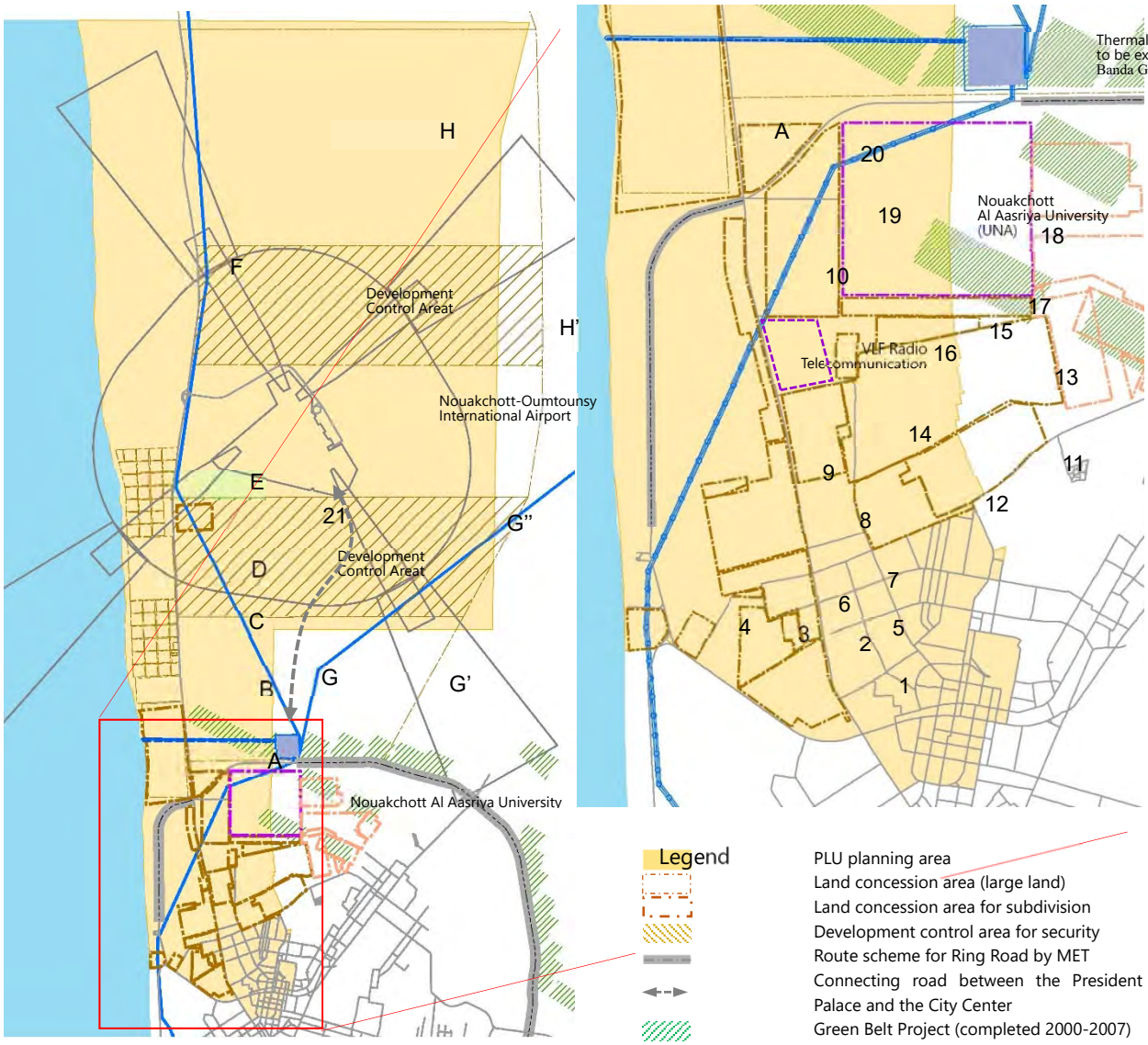
There are several large-scale land concessions in the Planning Area. These are large national land properties deeded by the concessions to private sector entities, including the Foreign Direct Investments (FDIs). Although information is limited, boundaries for some of the major concessions are identified especially in the newly extended northern areas as listed in Table II-8.

Table II-8 List of Large-scale Concession Areas in the Planning Area

Temporal Code	Concession & Subdivision Areas (ha)					Developed or Under Developing Property		
	Within PLU Planning Area			Outside of PLU	Total	Project Area (ha)	Occupancy	Reference to Project Areas
		Others	Total					
A	669	0	669	0	669	200	30%	Ribat Al Bahr Development
B	200	0	200	0	200	4	2%	
C	542	0	542	0	542	25	5%	Resort Hotel Development
D	501	0	501	0	501	0	0%	
E	649	0	649	0	649	0	0%	
F	30	0	30	0	30	30	100%	International Convention Center
G	2,880	6,437	9,317	3,590	12,907	360	3%	Power Plant, Subdivision 21
--	0	7,480	7,480	970	8,450	1,990	24%	Nouakchott Airport Airforce
H	12,550	6,170	18,720	2,090	20,810	0	0%	
Total	18,021	20,087	38,108	6,650	44,758	2,609	6%	

Source: JICA Study Team (GIS estimation), Note: F (conb&sub), F'(Others), F"(Outside of PLU)

The coastal area proximity to Nouakchott-Oumtounsy International Airport has been deeded and implemented by the resort or housing projects including the Ribat al Bahr development financed by the Islamic Corporation for the Development of the Private Sector (ICD), a development financial institution of Saudi Arabia.



Source: Relevant Authorities (MHUAT, MET, SOMELEC edited by JICA Study Team

Figure II-8 Overall Condition of the Current Urban Development in the Planning Area.

Infrastructure projects

Two energy sector projects are planned and expected to be implemented. The Banda GAS Project seeks implementation of a power plant expansion, gas pipeline, and a high-voltage power line construction (225 kV) in the planning area. It also seeks construction of the ring road and a road linking the Presiden Palace located at the International Airport to the city center.

Greenbelt project (1992, 1995, 2000, 2007)

Although the construction of Greenbelt is the past projects supported by international organizations (Belgium, FAO, WEP), there is a strong demand to expand the area of the project. The greenbelt is

considered as an important element to prevent the sand encroachment to the urban area of Nouakchott. However, many parts of the greenbelts have been encroached by the new urbanization, including official subdivisions by the government. This is largely caused by the lack of consensus among the government bodies.

Airport city development project (2018)

The Government has embarked the urban development surrounding of Nouakchott-Oumtounsy International Airport in order to enable it to be an economic center as high potential area capable of stimulating sustainable urban development of the future city. MHUAT as one of responsible authorities for urban development has scheduled the procurement of consultancy services for the study to develop the International Airport area as an airport city development in the year of 2018.

The study aims to formulate a master plan for the airport city including defining the target area in Phase I and to draw architectural development in Phase II, of which developments include an economic activity center, commercial business center (hotel, shopping center, etc) taking account of environmental open space creation.

(3) Opinions from Relevant Stakeholders (Tevragh Zeina Commune)

According to the workshop as a part of public consultations held in the commune of Tevragh Zeina on May 2nd, 2018. The followings were key opinions in the workshop.

- Mobility and transportation: They suggested necessary improvement of the quality of services of public transportation for bus and taxi which would boost ridership of them.
- Green and recreational spaces: They indicated current demand of recreational and greenery space, especially suggested necessary development of coastal area public spaces with walkway.
- Flooding issues: They suggested the importance of flood management by the government by certain measures whether the site prone flooding should be improved properly for settlement or prevented from urbanization by certain regulation.
- Densification: They emphasized the importance of densification in combination with green area creation and social diversity formulation of the community.

II-3.4 Planning Issues

The following issues are identified in the light of the planning of the model PLU in terms of physical development conditions, as well as the institutional situations.

(1) Physical Issues

Effective application of land uses classes to realize urban functions proposed by SDAU

- Scrutinizing the spatial development framework shown by SDAU for density of urban activities,
- Enhancing/managing the existing land use pattern represented by the current urbanization trends by determining whether they should be promoted or controlled,
- Introducing effective land uses classes for contemporary urban function and activities to be promoted into appropriate areas (Urban Center, Sub-urban Center, etc.)

Formulation of hierarchical road network to link arterial roads proposed by SDAU

- Introducing effective road network in the urbanized areas including those disordered subdivisions and densely built-up areas,

- Formulating appropriate road-side land use to maximize the potential urban activities (commercial and business), especially along the public transport corridors,
- Securing land and use for large transportation facilities (bus terminals, logistics centers, workshops for public transportation, etc.), and
- Securing appropriate parking space by both on-street and off-street types in accordance with the land use.

Ensuring the land for public use

- Identifying lands for basic public facilities in appropriate places with certain capacities (primary and secondary schools, hospitals, parks, etc.) to meet the future demands.

Ensuring protection of environmentally vulnerable areas

- Securing protection of lands/areas environmentally vulnerable identified and/or designated by SDAU through biding power of PLU, and
- Introducing appropriate spatial planning measures taking account of vulnerable lands/areas such as the coastal area, hazard-prone areas with Sebkha lands and desert areas potentially affected by climate change

Enhancing implementation measures of urban development

- Application of available tools such as PAD and ZAC by designating the areas for them in order to promote formulation of attractive and competitive urban cores through appropriate public and private partnerships, and
- Introducing appropriate measures for infrastructure provision in new urban development areas.

A matrix of major physical issues is presented in Table II-9.

Table II-9 Major Physical Issues to be Addressed by PLU in the Planning Area

PLU Planning Area	Spatial Planning Issues to be Addressed				
	SDAU Function by Appropriate Land Use	Local Road Network Formulation	Public Use Land Provision	Environmental Vulnerable Area	Enhancing Implementation Measures
Urban Center Blocks	●	○	○	○	●
Suburban Blocks	◎	●	●	◎	●
Airport-front Blocks	●	◎	◎	●	◎
Northern Blocks	○	○	○	●	○

Legend: ●= primary subject to be addressed ◎= secondarily subject, ○ = tertiary subject
Source: JICA Study Team

(2) Institutional issues

Rational application of regulations to address various levels of urban issues

- Sharing appropriate role and range of regulations among General Urban Regulation (RGU), SDAU, PLU, and PAD to cover various levels of urban issues (urban growth control, urban activities' volume, urban form, etc.), and

- Sharing appropriate role and range of regulations by areas, among common regulations applied to all jurisdictive area of Nouakchott, area-based regulations in and across communes, and specific regulations dedicated to specific areas reflecting local contexts

Enhancement of urban growth and management tools to materialize urban development goals proposed by SDAU

- Introduction of effective measures to promote urban growth in order to prevent disordered urban sprawl and to achieve efficient public services, and
- Promotion of desirable measures for densification of urban areas in order to achieve formation of the "Compact City".

Introduction of appropriate land use zoning classification and it's regulations to address local socio-economic needs

- Adequate composition of land use classes in consideration of contemporary use classes (e.g. mixed use as an essential use for "compact city") and local trend of land uses (e.g. street-based commercial and business), and
- Consideration of use regulations addressing prevention of contemporary urban nuisances expected to take place in the near future, as well as local and conventional urban nuisances.

Formulation of appropriate form regulations

- Provision of effective regulations and incentives to guide required density through control of CUF, COS, and height control, and
- Formulation of attractive landscape in relevant areas through specific regulations such as height, color, materials control.

Enhancement of regulations in other sectors for synergy effects of urban development control and management

- Strengthening urban sector legal instruments (e.g. building code, land or property transaction regulation, rent-house regulations, environment assessment regulation, infrastructure easement, traffic control, and regulations, etc.), and
- Strengthening other sector legal instruments (e.g. coastal management and protection, agricultural land promotion and protection, hazard protection, etc.).

A matrix of major physical issues is presented in Table II-10.

Table II-10 Major Institutional Issues to be Addressed by PLU in the Planning Area

PLU Planning Area	Control and Management Issues to be Addressed					
	Urban Growth Management and Control		Use Regulation by Zoning Class	Urban Form Regulation	Enhancement of Relevant Sector Regulations	
	Growth Boundary	Density			Urban Sector	Other Sectors
Urban Center Blocks	○	●	●	●	●	○
Suburban Blocks	◎	●	●	◎	●	◎
Airport-front Blocks	●	●	●	◎	◎	●
Northern Blocks	●	○	○	○	○	●

Legend: ●= primary subject to be addressed ◎= secondarily subject, ○ = tertiary subject
Source: JICA Study Team

II-4 Framework and Strategies

II-4.1 Setting Framework

(1) Target year

The planning of PLU is required to set a target year for its development, as Urban Code (Law N°2008-07) does not stipulate the range of planning target year for PLU. The planning target year can be set by 2030 years as 10 years frame taking account of the following considerations.

- PLU by mid-term range (10 years) as one of the implementation plans of SDAU as a long-term plan (20 years)
- Zoning as one of the main outputs of PLU requiring appropriate modification to fit with altered circumstances by urban socio-economy and environment change

(2) Population framework for PLU

Table II-11 indicates a future population of the target area of PLU, 142.5 thousand population for the year 2030 in accordance with the population framework of SDAU. The population distribution for PLU into each Urban Block is set in specific consideration with the followings as policies of the population distribution of SDAU.

- Population distributions in PLU would be given the priority to the area within Outer Ring Road by 2030, except developments without population such as tourism or industries
- The subdivisions with vacant plots or underdeveloped within Outer Ring Road would be key pacemaker of population distributions by 2030.

Table II-11 Target Population for Target Area for PLU

Urban Block	Existing 2017		2030 (Target Frame)		2040	
	Population	Density* (pop/ha)	Population	Density* (pop/ha)	Population	Density* (pop/ha)
Urban Center East (UCE)	21,942	22.8	19,160	19.9	51,610	53.6
Urban Center West (UCW)	15,835	28.3	20,440	36.5	31,730	56.7
Suburban East (SUE)	12,778	6.6	35,110	18.2	68,450	35.4
Suburban Coast (SUC)	3,875	2.6	34,090	22.5	70,580	46.7
Airport Front East (AFE)	3,126	3,126	26,740	2.7	56,400	5.7
Airport Zone (APZ)	0	0.0	0	0.0	0	0.0
Airport Front Coast (AFC)	0	0.0	7,000	1.3	24,270	4.6
Northern East (NTE)	0	0.0	0	0.0	0	0.0
Northern Coast (NTC)	0	0.0	0	0.0	0	0.0
Total	57,556	1.1	142,540	2.8	303,040	5.9

Density indicates "Gross Density" including public facilities, roads, open space and all land area within each Urban Block.
Source: JICA Study Team

(3) Employment Framework for PLU

Target employment in 2030

The targeted employment in 2030 is set based on the development framework of SDAU, and the employment distribution for PLU into each Urban Block is set in specific considerations with the followings as policies of employment distribution of SDAU.

- Employment distributions in PLU are considered by potential economic developments in the northern part of the target area of PLU beyond Outer Ring Road where tourism development in the coastal area and new industry or business development surroundings of the Oumtounsy International Airport are expected.
- Those developments would generate employees who would be able to commute from existing urban settlements, where new town developments with a residential function would be followed after 2030 except minimum settlement close to working areas.

Table II-12 Target Employment for Target Area for PLU

Urban Block	Existing 2017		2030 (Target Frame)		2040	
	Employment	Density (emp/ha)	Employment	Density (emp/ha)	Employment	Density (emp/ha)
Urban Center East (UCE)	19,080	19.8	86,280	89.7	94,500	98.2
Urban Center West (UCW)	22,858	40.9	26,280	47.0	27,750	49.6
Suburban East (SUE)	4,450	2.3	9,420	4.9	11,910	6.2
Suburban Coast (SUC)	4,634	3.1	8,370	5.5	10,640	7.0
Airport Front East (AFE)	0	0	13,470	1.4	25,480	2.6
Airport Zone (APZ)	0	0.0	610	0.1	5,390	0.7
Airport Front Coast (AFC)	0	0.0	7,970	1.5	32,710	6.2
Northern East (NTE)	0	0.0	0	0.0	0	0.0
Northern Coast (NTC)	0	0.0	0	0.0	0	0.0
Total	51,022	1.0	152,400	2.9	208,380	4.0

Density indicates “Gross Density” including public facilities, roads, open space and all land area within each Urban Block.
Source: JICA Study Team

2) Target employment distribution by sector in 2030

According to the existing employment in 2017 by the JICA Study Team estimation, the majority of employment is shared by the tertiary sector called as service industries. Although some factories are dispersed in the target area, a certain amount of other sector employment has not appeared except fishery employment surroundings of the fishery port. Taking account of expected urban development as Airport City and coastal tourism, employment in future (2030) is expected by the gradual change of composition of employment.

Table II-13 Target Employment Distribution by Sector for Target Area for PLU

Urban Block	Exisitng Employment by Sector (2017)				Employment by Sector 2030				Employment by Sector 2040			
	Primary	Secondary	Tertiary	total	Primary	Secondary	Tertiary	Total	Primary	Secondary	Tertiary	Total
UrbanCenterEast (UCE)	0	191	18,890	19,080	0	0	86,280	86,280	0	0	94,500	94,500
UrbanCenterWest (UCW)	1,829	457	20,572	22,858	1,580	0	24,700	26,280	1,110	0	26,640	27,750
SuburbanEast (SUE)	0	445	4,005	4,450	0	750	8,670	9,420	0	1,190	10,720	11,910
SuburbanCoast (SUC)	0	93	4,541	4,634	0	420	7,950	8,370	0	850	9,790	10,640
Airport Front Eaast (AFE)	0	0	0	0	0	670	12,800	13,470	0	2,550	22,930	25,480
Airport Zone (APZ)	0	0	0	0	0	60	550	610	0	1,080	4,310	5,390
Airport Front Coast (AFC)	0	0	0	0	0	0	7,970	7,970	0	0	32,710	32,710
Northern East (NTE)	0	0	0	0	0	0	0	0	0	0	0	0
Northern Coast (NTC)	0	0	0	0	0	0	0	0	0	0	0	0
Total	1,829	1,186	48,008	51,022	1,580	1,900	148,920	152,400	1,110	5,670	201,600	208,380

Source: JICA Study Team

(4) Spatial Framework

Environment Vulnerability for Urbanization

Taking account of the strategic orientation of the SDAU describing "prohibit, control and support urbanization in risk areas", vulnerable lands with potential natural hazards should be considered in sustainable urbanization manner. Environment vulnerability analysis aims to identify inappropriate lands as inundation prone areas (or Sebkha) to be avoided by urban development and to also clarify supply-side land capacity.

Low land areas in the target area of PLU area were identified and quantified as shown in Table 4.1.3. The topographic condition by contour lines (ground level) indicates the distribution of lower lands under 0 meter (altitude above the sea level). Large low lands are spread in the northern part of the target area, especially surroundings in the north-east part and spotted area in the south part of Oumtounsy International Airport. On the other hand, linear low lands like rivers in the target area are stretched from the north-east part to south-west close to the coastal area, where the low land at the end of the linear low land is considered by the site plan of Ribat al Bahr new town introducing a lake.

Another environmental consideration is "Green Belt" in the target area where two long-term projects from 1975 (17 years) and from 2000 (7 years) by plantation by shrubs for sand dune stabilization were implemented and trees have grown partially as mature trees. Theses green belt should be protected as non-urbanized areas.

Coastal Protection Area (CPA): The coastal area of the entire country in Mauritania was designated by the coastal protection zone (minimum 100 m to 200 m) in order to protect shoreline natural environment and consider littoral erosion by ocean waves.

Other Spatial Elements as Constraints for Urbanization

Other spatial elements in the target area of PLU of which natural environmental protection or man-made facilities' controls are considered as follows.

- Airport Safety Overlay Zone[5] (ASOZ): The surrounding areas of Oumtounsy International Airport is designated by several surfaces (approach, takeoff, conical and others) for safety access by aircraft, where land use and buildings are regulated by this zone. However, these land could allow urbanization if building height is within regulation and building use allows noise condition.
- Easement of energy infrastructure-1 (HVLP): High-voltage overhead lines (225 kV) were planned by SOMELEC in the target area with easement width of them, to which buffer area (60 m width) along lines could be applied as an international standard.
- Easement of energy infrastructure-2[6] (GL): The gas pipeline with 120 m buffer easement was planned from the Banda offshore oil field to the onshore gas processing plant in the target area.
- Built Up Area: This area covers not only existing built-up area (all building uses) but also planned or under construction subdivisions.

[5] Air space protection plan, Nouakchott New International Airport Construction 2015 / MET

[6] Banda Field Development – Gas Project / Environmental Impact Assessment 2013 /SOMELEC

Land Availability Assessment for New Urbanization

Land availability assessment examines lands enabling to urbanize without environmental constraints or man-made activities controls (large infrastructure easement, etc) above mentioned. In case of the lands in the target area without any constraints, the net available lands without occupations including subdivision plans and other development plans are estimated as 12,175 ha as a whole. On the other hand, the gross available lands with the condition of the conical surface as the widest zone in Airport Safety Overlay Zone are estimated as 22,468 ha.

Table II-14 Land Suitability by Assessment of Vulnerable Land in the Target Area

Urban Block	Land with Constraints for Urbanization (ha)								Available Land			Total Target Area
	Environment Vulnerability (ha)			Airport (ASOZ)		Energy Infra	Built Up Area	Multi-factors Area				
	Under 0 m level	CPA	Green Belt	Aiport/ Approach/ Takeoff	Other Control Areas	HVL/GPL	Subdivision/ Others		With Conditions	**Without Constraints**	Total	
Urban Center East (UCE)	12.1	0.0	0.0	0.0	0.0	0.0	882.6	0.0	0.0	44.3	44.3	939.0
Urban Center West (UCW)	105.5	19.3	0.0	0.0	0.0	4.3	375.7	30.9	0.0	23.2	23.2	558.9
Suburban East (SUE)	238.1	0.0	0.0	0.0	0.0	4.7	1,489.2	45.6	0.0	168.3	168.3	1,945.9
Suburban Coast (SUC)	195.5	94.4	0.0	0.0	0.0	39.5	255.6	3.1	0.0	924.8	924.8	1,512.9
Airport Front East (AFE)	2,645.9	0.0	243.6	309.2	2,566.2	152.3	72.2	205.4	2,566.2	3,640.0	6,206.2	9,834.7
Airport Zone (APZ)	4,093.7	0.0	0.0	1,206.5	1,841.0	61.9	0.0	5.5	1,841.0	194.9	2,035.9	7,403.5
Airport Front Coast (AFC)	181.2	231.7	0.0	280.86	2,312.7	13.4	33.0	130.7	2,312.7	2,089.5	4,402.2	5,273.0
Northern East (NTE)	14,709.9	0.0	0.0	473.1	1,073.6	148.4	0.0	20.4	1,073.6	2,690.2	3,763.8	19,115.6
Northern Coast (NTC)	40.9	158.7	0.0	27.7	2,499.3	0.0	0.0	44.2	2,499.3	2,399.6	4,898.9	5,170.4
Total	22,222.9	504.1	243.6	2,297.4	10,292.9	424.4	3,108.2	485.8	10,292.9	12,174.8	22,467.6	51,754.0

Source: JICA Study Team

According to the strategic orientation of SDAU, the urban blocks of NTE and NTC in the northern part of the target area beyond APZ (airport zone) are defined as non-urbanization areas for natural environmental protection and/or reserved development areas. In this condition, potential areas for urbanization are examined as 7,085 ha where population absorption capacity would be around 425,000 population in case of density by 60 population per hectare.

II-4.2 Development Strategy and Land Requirements

(1) Spatial Development Strategy in accordance with SDAU

Based on the urban blocks defined in sention I-3, spatial development strategies in the target area are set by each urban block in accordance with the strategic orientations of SDAU giving urban functions and roles with environmental considerations. Table II-15 shows SDAU strategic orientations as the spatial development strategies of the target area applied to the urban blocks.

Table II-15 Spatial Development Principle by Urban Block in PLU Target Area

SDAU Strategic Orientation		SDAU Strategy applied to Urban Blocks of PLU								
		Urban Center		Suburban		Airport Front		Airport	Northern	
		UCE	UCW	SUE	SUC	AFE	AFC	APZ	NTE	NTC
1. Limit Urban Sprawl and Intensify Urban Area	1-1 Controlled urbanization in risk area	--	--	●	○	●	○	--	--	--
	1-2 Intense City	●	○	○	○	●	--	--	--	--
	1-3 Public transit-led urban development	●	●	●	●	●	●	--	--	--
	1-4 Metropolitan gateway	--	--	--	--	●	--	--	--	--
	1-5 Polarization of urban extensions	--	--	--	○	●	○	--	--	--
	2-1 Reinforce green belt	--	--	○	--	●	--	--	--	--

SDAU Strategic Orientation		SDAU Strategy applied to Urban Blocks of PLU								
		Urban Center		Suburban		Airport Front		Airport	Northern	
		UCE	UCW	SUE	SUC	AFE	AFC	APZ	NTE	NTC
2. Build a New Relationship with Nature	2-2 Promote coaster area (public spaces)	--	●	--	●	--	●	--	--	○
	2-3 Create green and blue network	○	○	○	○	○	○	--	○	○
	2-4 Four green poles	○	--	--	--	●	--	--	--	--
	2-5 Small scale green and public spaces	○	○	○	○	○	○	--	--	--
	2-6 Leisure place in desert	--	--	--	--	--	--	--	--	--
3. Promote Economic Radiation	3-1 Promote and secure economic poles with public transit	●	●	●	●	--	○	--	--	--
	3-2 Economic network with Outer-ring Road	--	--	--	--	●	--	--	--	--
	3-3 Support economic growth of sectoral poles	--	--	--	●	●	●	●	--	--
	3-4 Promote local employment within neighborhoods	--	○	○	--	--	--	--	--	--
	3-5 Promote economic diversification	--	--	--	--	--	--	--	--	--

Legend: ● = primary strategy to be addressed ○ = strategy as supplemental or partial subject, -- = strategy not applied
Source: JICA Study Team

II-4.3 Future Land Requirement by Land Use Category for the Target Area

(1) Residential Areas

Current settlement status examined

The land requirement for residential areas in the target area should be based on two measures of land intensification of the target area. In other words, the residential land needs to be provided by "densely urbanized newly" and "existing density improvement".

Table II-16 also indicates existing net population densities within lands of residential use and mixed-use residential. Average net density (in residential areas including infrastructure, open space, others) is 117 populations per hectare, while the highest density in residential use is 218 pop/ha in Urban Center West Block and 17 pop/ha in Suburban East (Meti Aut) as the lowest.

Density distribution is one of fundamental planning element in PLU future urbanization in accordance with the SDAU basic policy of "Densification" to accommodate future population demand by the compact urban form. From this point of view, higher density allocation is required inevitably to be set appropriately in each urban bock except vulnerable areas by natural hazard-prone areas and artificial control areas for the population distribution in the target area.

Table II-16 Existing Settlement by Several Types of Residential Areas in the Target Area

Urban Block	Population 2017	Existing Settlement (including Subdivisions)					Subdivisions*2		
		Residen-tial (ha)	Temp-oral (ha)	Mixed Use (ha)	total (ha)	Density (pop/ha)	Occupied*3 Population	Population 2040*4	Density (pop/ha)
Urban Center East (UCE)	21,942	231.3	18.7	44.1	294.1	74.6	0	0	--
Urban Center West (UCW)	15,835	125.7	25.1	12.7	163.5	96.9	11,675	16,290	50.8

Suburban East (SUE)	12,778	172.7	52.2	10.4	235.3	54.3	9,656	32,817	21.8
Suburban Coast (SUC)	3,875	90.2	41.7	9.1	141.0	27.5	7,732	12,026	38.8
Airport Front East (AFE)	3,126	9.2	17.5	0.6	27.3	114.3	3,860	8,331	34.4
Airport Zone (APZ)	0	0.0	0.0	0.0	0.0	0.0	0	0	1.0
Airport Front Coast (AFC)	(n.a)*1	1.0	0.8	26.2	28.0	--	0	11,853	17.1
Northern East (NTE)	(n.a) *1	0.0	2.8	0.0	2.8	--	0	0	--
Northern Coast (NTC)	(n.a) *1	0.0	25.9	0.0	25.9	--	0	0	--
Total	57,556	630.0	184.8	103.1	918.0	62.7	32,923	81,317	26.5

Note: *1 There is no population statistical data, although there are some settlements. *2 Subdivisions include existing and planned sites. *3 Occupied population was estimated based on occupied lots by buildings in each subdivision site with the average number of household (4.7). *4 Population in 2040 was estimated by the number of expected lots of each planned subdivision in 2040 (70 % occupancy out of total lots).
Source: JICA Study Team

It is also observed that existing subdivision areas including plans regard their density as lower density settlement development (30~50 pop/ha) in comparison with an international standard, where these developed or underdeveloped areas occupy a large portion of existing settlements in the target area within the Outer-ring road.

Proposed Distribution Of Residential Areas

The residential areas are estimated and set as shown in Table II-17, based on the desirable future density target range by according to two degrees by medium-density, low-density, other settlements by mixed-use settlement. The land requirement of land use is defined by two types of the requirement by 1) new additional land requirement and 2) conversion from other existing land uses to residential use, of which this method is applied to all other Tables for land use requirements.

Mixed residential use is considered by existing land use distribution pattern in the target area, where commercial and business activities have been observed in many residential areas as mixed-use (residential with commercial, business and small-scale shops, restaurants, etc) by vertical or horizontal building use. In addition, mixed-use will play an important role in absorbing future population demand through conversion of existing mono-type residential areas potential for future mixed use.

Table II-17 Land Requirement for Residential Area (ha)

Urban Block	2017 Total	Residential Areas (ha) 2030					Additional Requirement (ha)
		Low-density	Medium	High	Mixed	Total	
Urban Center East (UCE)	294.1	0.0	71.9	25.5	159.7	257.1	-37.0
Urban Center West (UCW)	163.5	76.7	115.0	6.8	119.2	317.7	154.2
Suburban East (SUE)	235.3	219.4	219.4	11.7	117.0	567.6	332.3
Suburban Coast (SUC)	141.0	426.1	170.5	0.0	56.8	653.4	512.4
Airport Front East (AFE)	27.3	133.7	167.1	35.7	44.6	381.0	353.7
Airport Zone (APZ)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Airport Front Coast (AFC)	28.0	119.0	0.0	0.0	17.5	136.5	108.5
Northern East (NTE)	2.8	0.0	0.0	0.0	0.0	0.0	-2.8
Northern Coast (NTC)	25.9	0.0	0.0	0.0	0.0	0.0	-25.9
Total	918.0	974.9	743.8	79.7	514.8	2313.3	1395.3

Note: Target density assumption for a residential area

Type of residential area	Population/ha	Reference
Low-density Residential	40-50	Referring existing density + addition
Medium-density Residential	80-100	Ditto

High-density Residential	150 – 300	Collective housing to be introduced
Mixed Use Residential	60 – 80	Multi-story with 2-3 floor residential

Source: JICA Study Team

(2) Zones of Tertiary Sector Employment

The employment framework of tertiary sector involves the employment of commercial, business, public administration and institution as service industry sector. Area requirements for the tertiary sector are estimated based on the existing land use types of "Commercial and Business", "Mixed Use" and "Public Facilities" as shown in Table I-18. This is based on the desirable future density target range of relevant uses.

It should be noted that there are some gaps between available statistics including the household survey data and existing land use where small settlement and commercial business land uses are identified in the northern part of Nouakchott. The figures of existing employment indicate that area and employment by assumptions.

Table II-18 Land Requirement for Tertiary Sector Area (ha)

Urban Block	Land Area (ha) 2017				Employment		Employment 2030	Land Requirement (ha)				Additional (ha)
	C&B	Mixed	Public	total	2017	Emp/ha		C&B	Mixed	Public	Total	
Urban Center East (UCE)	87.3	44.1	210.2	341.6	18,890	55.3	86,280	151.0	129.4	196.1	476.5	134.9
Urban Center West (UCW)	32.7	12.7	4.9	50.3	20,572	408.9	24,310	82.7	34.0	6.1	122.8	72.5
Suburban East (SUE)	12.5	10.4	199.5	222.3	4,005	18.0	8,670	46.2	29.5	200.0	275.7	53.4
Suburban Coast (SUC)	32.1	9.1	3.1	44.4	4,541	102.4	7,950	42.4	15.1	4.0	61.5	17.1
Airport Front East (AFE)	0.1	0.6	7.4	8.1	(162)	--	12,800	68.3	19.2	9.1	96.6	88.5
Airport Zone (APZ)	1.8	0.0	0.3	2.0	(200)	--	550	3.3	0.0	4.4	7.7	5.7
Airport Front Coast (AFC)	10.9	26.2	10.4	47.4	(237)	--	7,970	39.9	31.9	13.3	85.0	37.6
Northern East (NTE)	3.1	0.0	0.3	3.5	(17)	--	0	0.0	0.0	0.0	0.0	-3.5
Northern Coast (NTC)	0.0	0.0	0.0	0.0	0	--	0	0.0	0.0	0.0	0.0	0.0
Total	180.4	103.1	436.1	719.6	48,008	66.7	148,530	433.7	259.1	433.0	1,125.8	406.2
Total including assumption	--	--	(439.1)	(719.6)	(48,624)	67.6						

Note: Target employment density assumption

Existing Land Use Type for Tertiary Sector	Employment/ha
Commercial and Business	250 ~ 100
Mixed Use (residential & commercial business)	50 ~ 100
Public Facilities	20 ~ 220

Source: JICA Study Team

(3) Industrial Area

The industrial areas are estimated and set according to the spatial framework and employment framework of SDAU and detailed employment framework of the target area based on the assumption of unit employment by existing land use condition examination. Target land requirements are shown in Table II-19 based on the desirable future density target range by industrial type. Especially Airport City development is expected to introduce new industrial areas.

- INZ: Industrial Zone: This area is expected to be introduced in order to accommodate industrial investment needs targeting mainly Foreign Direct Investment where institutional arrangement such as Special Economic Zone (SEZ) needs to be considered.
- QIN: Quasi-industrial area: This area as planned areas to be concentrated by industries includes not only industrial use but also other use by residential, commercial & business and

other land use category. Industrial type is targeting to promote small-medium scale industry for local or domestic investment.

Table II-19 Land Requirement for Industry Area (ha)

Urban Block	Existing Employment (2017)			Industrial Sector Employment 2030	Land Requirement 2030 (ha)			Additional (ha)
	Land (ha)	Emp (S)	Emp (S) /ha		Industrial Zone	Quasi-industry	Total	
UrbanCenterEast (UCE)	2.0	191	97.5	0	0	0	0	-2
UrbanCenterWest (UCW)	5.6	457	81.1	390	0	4	4	-2
SuburbanEast (SUE)	8.9	445	50.3	750	0	8	8	-1
SuburbanCoast (SUC)	1.1	93	81.4	420	0	4	4	3
Airport Front Eaast (AFE)	0.0	0	0.0	670	13	0	13	13
Airport Zone (APZ)	0.0	0	0.0	60	1	0	1	1
Airport Front Coast (AFC)	0.0	0	0.0	0	0	0	0	0
Northern East (NTE)	0.0	0	0.0	0	0	0	0	0
Northern Coast (NTC)	0.0	0	0.0	0	0	0	0	0
Total	17.6	1,186	310.2	2,290	15	16	30	13

Note 1: Existing employment 2017 for the secondary sector is assumed by the existing land use and the household survey results.
Note 2: Emp (S) = Secondary sector employment
Note 3: Target employment density assumption

Type of industry	Employment/ha	Reference
Industrial Zone	50-80	Newly developed
Quasi-industrial Area	100-200	Including existing area

Source: JICA Study Team

II-4.4 Key Public Facilities

(1) Education Facilities

Estimated land requirements for educational facilites are shown in Table II-20.

Table II-20 Land Requirement for Education Facilities 2030

Urban Block	Enrollment 2017		Number of CR		Enrollment 2030*		ES 2030 (CR)		SS 2030 (CR)		Land Requirement (ha)	
	ES	SS	ES	SS	ES	SS	Improve**	Develop**	Improve	Develop	ES	SS
UrbanCenterEast (UCE)	3,511	3,291	79	136	3,066	2,874	79	0	136	0	0.0	0.0
UrbanCenterWest (UCW)	2,534	2,375	0	0	3,270	3,066	0	65	0	61	2.2	2.0
SuburbanEast (SUE)	2,044	1,917	6	0	5,618	5,267	6	106	0	105	3.5	3.5
SuburbanCoast (SUC)	620	581	0	0	5,454	5,114	0	109	0	102	3.6	3.4
Airport Front East (AFE)	500	469	0	0	4,278	4,011	0	86	0	80	2.9	2.7
Airport Zone (APZ)	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Airport Front Coast (AFC)	0	0	0	0	1,120	1,050	0	22	0	21	0.7	0.7
Northern East (NTE)	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Northern Coast (NTC)	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Total	9,209	8,633	85	136	22,806	21,381	85	389	136	370	13.0	12.3

Note1: ES: Elementary School, SS: Secondary School, CR: Classroom,
Note2: School requirement is estimated by the following conditions:
- Net enrollment rate: 100 % in 2030 (SCAPP 2016-2030)
- Existing school capacity could be expanded by multi-story facilities (double capacity). (Imp: expansion of capacity)
- A number of schools to be built with area 4000 m^2, two floors, 24 classrooms per school.
- One classroom accommodates 50 pupils.

Source: JICA Study Team

(2) Health facilities

Estimated land requirements for health facilites are shown in Table II-21.

Table II-21 Land Requirement for Health Facilities 2030

Urban Block	Existing 2017 (unit)				Health Facilities 2030(unit)				Additional Requirement (ha)			
	HPT	HCA	HCB	HP	HPT	HCA	HCB	HP	PHT	HCA	HCB	HP
Urban Center East (UCE)	5	1	1	1	0	0	0	2	0.0	0.0	0.0	1.0
Urban Center West (UCW)	0	0	0	1	0	0	0	5	0.0	0.0	0.0	2.5
Suburban East (SUE)	0	0	0	0	0	0	3	6	0.0	0.0	3.0	3.0
Suburban Coast (SUC)	0	0	0	0	0	1	2	6	0.0	2.0	2.0	3.0
Airport Front East (AFE)	0	0	0	0	0	1	2	2	0.0	2.0	2.0	1.0
Airport Zone (APZ)	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Airport Front Coast (AFC)	0	0	0	0	0	0	0	3	0.0	0.0	0.0	1.5
Northern East (NTE)	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Northern Coast (NTC)	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Total	5	1	1	2	0	2	7	24	0.0	4.0	7.0	12.0

Note

Administrative Catchment	Type of Health Facilities	Ref.	Unit: Area (ha/site)
Level II (Wilaya)	Hospital	HPT	2.00
Level III (Moughataa)	Health Center A	HCA	1.25
	Health Center B	HCB	0.4
	Health Post	HP	0.02

Source: JICA Study Team

(3) Park, sports, and open spaces

Estimated land requirements for sports and recreational facilites are shown in Table II-22 and that for parks and open-spaces are shown in Table II-23..

Table II-22 Land Requirement for Sports and Recreational Facilities 2030

Urban Block	Existing 2017 Stadium	Number of Sports and Playground Facilities 2030				Additional Land Requirement (ha)				
		PSTD	DP	NP	PP	PSTD	DP	NP	PP	total
Urban Center East (UCE)	1	0	1	4	19	0.0	0.6	1.5	1.9	4.1
Urban Center West (UCW)	0	0	1	4	20	0.0	0.7	1.6	2.1	4.4
Suburban East (SUE)	0	0	2	7	35	0.0	1.2	2.8	3.5	7.5
Suburban Coast (SUC)	0	1	2	7	34	1.2	1.1	2.7	3.4	8.5
Airport Front East (AFE)	0	1	2	5	27	1.2	0.9	2.1	2.7	6.9
Airport Zone (APZ)	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0
Airport Front Coast (AFC)	0	0	0	1	7	0.0	0.2	0.6	0.7	1.5
Northern East (NTE)	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0
Northern Coast (NTC)	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0
Total	1	2	10	29	143	2.4	4.8	11.4	14.3	32.9

Note

Type of Facilities	Ref	Standard Requirement (Population per facilities)	Unit Area (s.q.m)
Public Stadium Center	PSC	100,000	12,000

District Center	DC	15,000	5,000
Neighborhood Center	NC	5,000	4,000
Pocket Place	PP	1,000	1,000

Source: JICA Study Team

Table II-23 Land Requirement for Park and Open Spaces 2030

Urban Block	Existing 2017 (ha)		Number of Parks by Type 2030				Additional Land Requirement (ha)				
	GP	GB	CP	DP	NP	PP	CP	DP	NP	PP	Total
Urban Center East (UCE)	39.7	0.0	0	1	4	16	0.0	0.6	1.5	1.3	3.5
Urban Center West (UCW)	12.4	0.0	0	1	4	17	0.0	0.7	1.6	1.4	3.7
Suburban East (SUE)	0.0	0.0	1	2	7	29	5.0	1.2	2.8	2.4	11.3
Suburban Coast (SUC)	0.0	5.7	1	2	7	28	5.0	1.1	2.7	2.3	11.2
Airport Front East (AFE)	0.0	262.1	1	2	5	22	5.0	0.9	2.1	1.8	9.8
Airport Zone (APZ)	0.0	0.0	0	0	0	0	0.0	0.0	0.0	0.0	0.0
Airport Front Coast (AFC)	0.0	0.0	0	0	1	6	0.0	0.2	0.6	0.5	1.3
Northern East (NTE)	0.0	0.0	0	0	0	0	0.0	0.0	0.0	0.0	0.0
Northern Coast (NTC)	0.0	0.0	0	0	0	0	0.0	0.0	0.0	0.0	0.0
Total	52.1	267.8	3	10	29	119	15.0	4.8	11.4	9.5	40.8

Note: GP = Green Open Space, GB = Green Belt

Type of Park	Ref	Standard Requirement (Population per facilities)	Unit Area (s.q.m)
City Park	CP	50,000	50,000
District Park	DP	10,000	5,000
Neighborhood Park	NP	5,000	4,000
Pocket Park	PP	1,200	800

Source: JICA Study Team

II-5 Sectoral Arrangements

II-5.1 Road network and Transport

SDAU shows the road network of the entire city forming the urban structure of 2040. Although the target year of the PLU is 2030, it will follow 2040 from the viewpoint of securing space for the future roads.

Detailed analysis is required after the PLU plan to determine other mobility modes such as road criteria and urban block based traffic management, parking system, pedestrian network and bicycle network.

Table II-24 shows the relationship between road network and land use considered in PLU.

Table II-24 General Role and Function for Road Network considering Land Use

Category of Road Network and Facilities to be considered in Statutory Plans			Referable Guide (example)				Land Use Category			
			Traffic Volume/day	Travel Lanes	Signal Intersection	Traffic Calming	CB	IND	PU	R
Road Network concerned mainly	SDAU	Arterial Road-I	Over 20,000	4 to 6	●	--	●	●	▲	○
		Arterial Road-II	4,000-20,000	2 to 4	●	--	●	●	▲	○
	PLU	Secondary Road with parking	4,000-20,000	2	●	○	●	▲	●	▲

		Secondary Road	1,500~4,000	2	▲	▲	●	○	●	●
	PAD, ZAC, PL	Tertiary Road	500 ~ 1,500	2	▲	▲	●	○	●	●
		Access Road to plot	> 500	1 to 2	○	●	--	--	▲	●
Parking System concerned mainly	PAD, ZAC, PL	On-street parking system	TCR < 0.70	with shoulder			▲	--	○	○
		Off-street parking area	TCR > 0.70	With condition			●	●	●	●
Other **MODE** concerned mainly	PAD, ZAC, PL	Pedestrian way			○*		●	--	●	▲
		Bicycle way			○*		○	--	●	▲
		Green Footpath			○*		○	--	●	●

Lgend: ●= desirable, ▲= possible with conditions, ○= not desirable or with conditions, -- = not applicable, CB=Commercial & Business, IND = Industry, PU = Public Use, R = Residential, TCR = Traffic Capacity Ratio (TCR = Actual traffic per day / Design Traffic Capacity per day), ○* = crossing point with traffic road

Source: JICA Study Team

Applied road classification of SDAU

Table II-25 shows the road standards adopted by PLU. Figure II-9 shows the road network by PLU created in according with SDAU

Table II-25 Road Classifications (SDAU) to be applied to the Target Area

Road Classification		Width of Road (m)	No. of Lane (no.)	BRT Lane (no.)	On-street Parking Lane (no.)	Side-walk (m)	Reference
	Sub-class						
Arterial Road	A1: Urban Road 1	38.0	6	2	0 (shoulder 2)	3.0	NR1 / NR2
	A2: Urban Road 2	31.5	4 / 6	--	0 (shoulder 2)	3.0	
	A3: Urban Road 3	31.0	4	2	0 (shoulder 2)	3.0	NR2
	A4: Urban Road 4	24.5	4	--	0 (shoulder 2)	3.0	Ring Roads/Airport Link road, Airport City Road
	A5: Rural Road 1	16.0	2	--	0 (shoulder 2)	3.0	
Secondary Road	S1: Urban Road 1	33.5	4	--	2	3.0	45°angle parking
	S2: Urban Road 2	27.5	4	--	2	3.0	Parallel parking
	S3: Urban Road 3	24.5	4	--	0 (shoulder 2)	3.0	
	S4: Urban Road 4	16.0	2	--	0 (shoulder 2)	3.0	
	S5: Rural Road 5	16.0	2	--	0 (shoulder 2)	3.0	
Tertiary Road	T1: Urban Road 1	10.0	2		0 (shoulder 2)	3.0	
	T2: Rural Road 1	10.0	2		0 (shoulder 2)	3.0	

Note: NR = National Road
Source: JICA Study Team

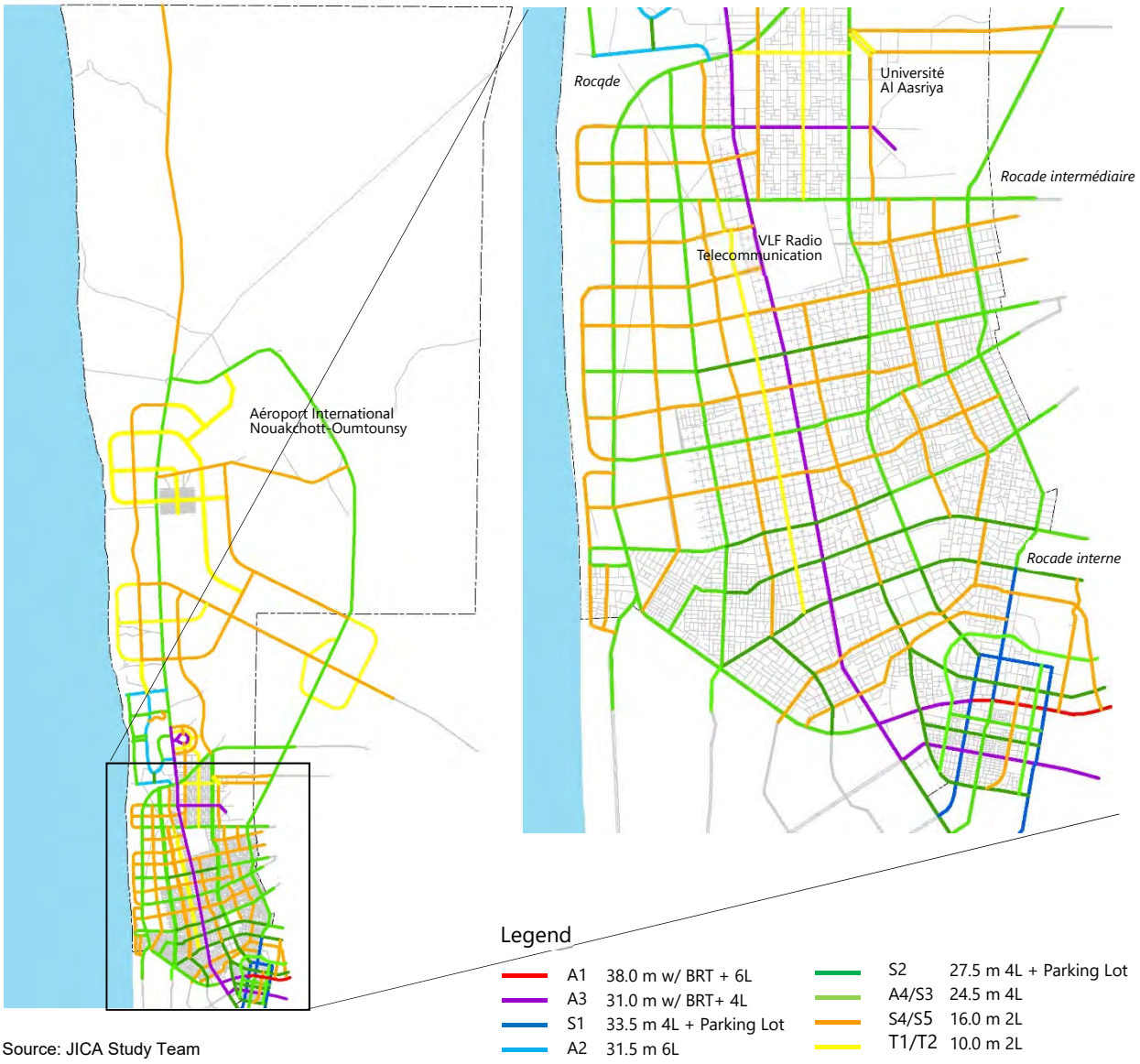


Figure II-9 Proposed SDAU Road Network in the Target Area 2040

(3) BRT system in the target area

In order to secure space for the BRT system expressed in the policy of SDAU, The route of BRT is designated in PLU. The above road network already assumes introduction of BRT. It is necessary to set the location of stations and maintenance facilities.

Figure II - 10 shows the outline of the BRT system adopted in the PLU.

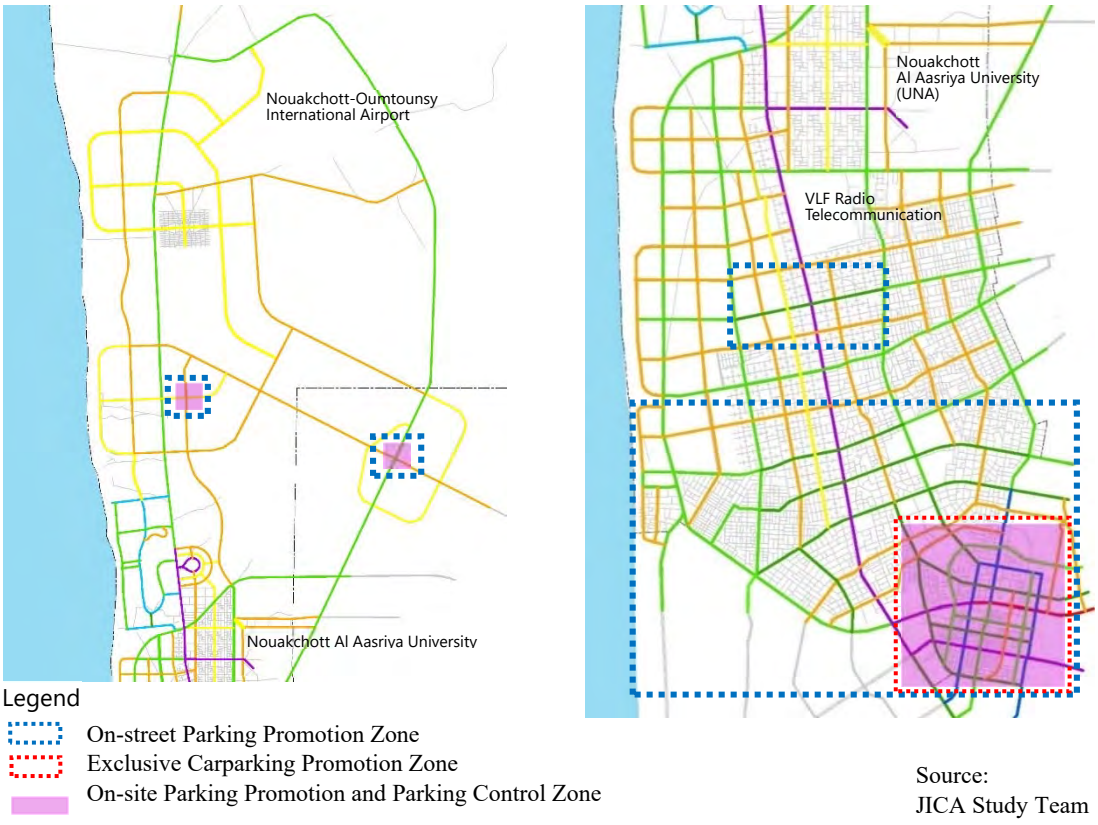
Source: JICA Study Team

Figure II-10 BRT System Development in the Target Area

(4) Parking System in the Target Area

Regarding parking, PLU included on-site and off-site parkings, as well as installation of parking lot management system as described in SDAU.

Figure II - 11 shows the outline of parking system development in the target area of PLU.



Source:
JICA Study Team

Figure II-11 Conceptual Parking System Development in the Target Area

II-5.2 Other Infrastructure Developments in the Target Area

(1) High-voltage Power Lines

SOMELEC has the program for national high-voltage (225kv) power lines'(HVPL) construction in Nouakchott by 2030, where the planned on-shore gas processing plant next to the existing thermal power plant close to Nouakchott Al Aasriya University (UNA) distributes three power lines as parts of the national grids penetrating the target area by three directions to the north-east, the north-west and south-west. Appropriate urban development needs to consider the planned alignments of HVPL avoiding negative impacts on surroundings of and their infrastructure security. The easement of HVPL may require buffer by 60 m at least certain in both sides.

(2) Gas Pipelines

Banda Field Development Gas Project has proposed the gas pipeline construction in combination with off-shore infrastructure (75 km) and on-shore infrastructure in Nouakchott, where the planned on-shore gas pipeline (5.6 km) is expected to connect with a planned gas processing plant next to the existing thermal power plant close to Nouakchott Al Aasriya University (UNA). Appropriate urban development needs to consider the pipeline alignment to secure safety of the pipeline. The easement of gas pipeline may require certain buffer by 60 m at least in both sides. Table II-26 shows the high-voltage power lines in the target area.

Table II-26 Trunk Energy Infrastructure Development in the Target Area

Urban Block	Trunk Energy Lines (km)	
	High-voltage Power Line (225kv)	Gas Pipeline (km)
Urban Center East (UCE)	--	--
Urban Center West (UCW)	1.4	--
Suburban East (SUE)	4.8	--
Suburban Coast (SUC)	4.0	--
Airport Front East (AFE)	15.5	3.7
Airport Zone (APZ)	5.6	--
Airport Front Coast (AFC)	1.9	1.9
Northern East (NTE)	14.5	--
Northern Coast (NTC)	--	--
Total	47.7	5.6

Source: JICA Study Team

(3) Drinking Water

Water supply system development for the target area will be programmed based on the water supply development plan of SDAU indicated in section 6.1.3.

(4) Wastewater Sanitation and Storm Water Drainage

Sewerage system development for the target area will be programmed based on the sanitation and wastewater treatment development plan of SDAU indicated in section 6.2.2. Drainage system for the target area will be programmed based on the rainwater drainage network development plan of SDAU indicated in section 6.3.3.

II-6 Zoning Plan

II-6.1 Urban Growth Management

As an essential function of PLU to bind socio-economic activities, urban growth management is critical to be defined and designated in the zoning plan of PLU to materialize the spatial structure or land use plan of SDAU. The following measures should be incorporated into the zoning plan of the target area. Table II-29 illustrates concrete measures as the urban growth management tools.

(1) Urban Growth Boundaries

The plan of PLU requires to designate certain boundaries as tools of binding power of which the urbanization area as a fundamental element of the plan should be defined. According to the development framework of the target area in line with the land use plan of SDAU, urban growth boundary-1 for urbanization by 2030 will play an inevitable role in controlling and managing the urbanization limit, while growth boundary-2 for future urbanization by 2040 should be also defined by the certain boundary in the zoning plan.

(2) Natural Environment Protection

The area outside of the urban growth boundaries could be defined by the natural environmental protection area including natural desert land, bush areas, coastal area and low lands (Sebkha) in the norther part of Nouakchott. In this area any change of the lands and its development is not allowed in principle.

Table II-27 Urban Growth Measures in the Target Area

Growth Control Measure	Purpose	Target Year	Urban Growth Control Measure		
			Land Use Zoning Application	Development Permit /Planning Certificate	Infrastructure Development
Urban Growth Boundary-1	To control and manage urbanization within designated boundary	2030	• Applicable and inevitable to designate zones	• Permit and certificate within the boundary	• Infrastructure to be promoted within the boundary
Urban Growth Boundary-2	To reserve lands for future urbanization	2040	• Not required	• No permit and issuing planning certificate	• Not allowed by any development before 2030
Conservation Area	To protect and conserve vulnerable environmental areas	2040	• Not applicable except specific overlay zoning for environmental protection areas	• Strict control and regulation are required in combination with environmental sector regulation	• Prohibited except national level infrastructure

Source: JICA Study Team

II-6.2 Designation of Land Use Zoning

(1) Classification of Zoning

The zoning system for PLU aims to materialize the elements proposed by SDAU. The advantage of using the zoning system is quick and easy operation of judging the application of buildings largely due to the check list style assessment enabled by zoning regulations associated with each zone class. The classifications proposed for the model PLU consist of six broad classes covering 17 sub-classes shown in Table II-30. A brief description follows.

CLASS I: Rural (+2 sub-classes)

The PLU planning area covers a wide range of land uses not only for the urban area to be developed in the future but also for other lands including desert and agriculture land. The Class-I of "Rural" consists of "Desert and arid area (DA) and "Agriculture (AG)" to be retained and developed.

- DA would be a target of greening works.
- AG will be designated to the areas where agricultural production is possible by existence of easier access to water for agricultural use.

CLASS II: Residential (+4 sub-classes)

Class-II consists of "Low-density Residential (RL)", "Medium-density Residential (RM)", "High-density residential (RH)", and "Mixed-use (MX)". The Class-II also allows grocery shops, etc. and cottage style industries.

- RL is to retain low density settlement to secure favorable living environment areas.
- RM will be applied in principle to settlements to be densified with multi-story residential buildings.
- RH is also aiming at densification of the area located especially in the urban centers which have larger potential for development of taller buildings.
- MX is also categorized at CLASS II as it is a residential area in combination with commercial and business floors or part of a land parcel in medium density settlements.

CLASS III: Commercial and Business (+3 sub-classes)

Class-III consists of "Urban Center Commercial & Business (UCB)" and "Neighborhood Commercial & Business (NCB)".

- UCB is to be developed and improved as a dominant area for high-medium density commercial and business activities typically called as CBD (Central Business District) in the capital city.
- NCB is for areas such as the sub-centers of Nouakchott with medium density commercial and business activities to accommodate local markets and small-scale cottage industries.
- CCB (Corridor Commercial & Business) is for areas along primary urban roads allows medium dense development within a certain width in both sides from the road center (e.g. 50-100m).

CLASS IV: Public Use

Class-IV consists of "Key Public Facilities" with a code abbreviation for public use and "Key Higher Education (KHE)".

- Coding for Key Public Facilities in the existing and future areas represented by annotation of major facilities which identifies types of the facility. These include basically large- scale public facilities such as government offices, institutions, transportation terminals, airports, utilities stations, and cemeteries based on the necessity to designate them.
- KHE is also included in this class as it requires large-scale land block and provides large impact on the activities of surrounding areas as well as traffic conditions.

CLASS V: Industry (+2 sub-classes)

The Class-V consists of "Industrial Zone (INZ)" and "Quasi-Industrial (QIN)".

- INZ is to be designated for development or improvement of areas for industrial purposes, allowing heavy or light industries uses only. The area needs to be equipped with adequate infrastructure at a suitable location with certain distance from other purposes.
- QIN is another type of industrial land use class, allowing mixed use with others such as commercial and business. Typical facilities include logistics, and research and development (R&D) facilities of industries. it also aims to promote local small-medium scale enterprises (SMEs).

CLASS VI: Green and Open Spaces (+4 sub-classes)

Class VI consists of "Tourism and Recreation Leisure (TRL)", "Park, Sports and Open Space (PSO)", "Nature, Forest and Green (NFG)", and "Water Surface (WS).

- TRL aims to encourage and promote attractive tourism area where facilities and infrastructure should be carefully developed to avoid deterioration of natural environment which is a source of attraction for sustainable tourism and leisure activities.
- PSO will be designated for parks and sports recreation uses. At the same time, PSO will be utilized to raise the level of urban amenity typically brought by landscape and environmental control. (e.g. river-side green, seafront green, etc.). PSO will be designated at the areas where green buffer should be introduced typically at the areas where living environment needs to be secured.
- NFG aims at protection of green environment which is expected to bring favorable effects to moderate climate of the city, typically by the green belt to prevent entering of sandy wind to the city and easing the desertification of the fringe of the built-up areas.
- WS is to protect natural water surface areas including wetlands where inundation takes place frequently or water is ponded permanently.

It should be noted that these classifications are applicable to other planning areas for PLU in Nouakchott, as the planning area of the model PLU contains almost all the zoning classification from the city center to rural and natural area.

Table II-28 Proposed Zoning Classification for the Target Area

Zoning Class	Zoning Sub-class	Code		Reference
		No./Abbre	color	
Class I: Rural (100)	1.Desert / Arid Land	110: DA		Including bush, grass, coast
	2.Agriculture land	120: AG		
Class II: Residential (200)	3.Low-density Residential	210: RL		Refer to Table 2.x (height)
	4.Medium-density Density Residential	220: RM		Refer to Table 2.x (height)
	5.High-density Density Residential	230: RH		Refer to Table 2.x (height)
	6.Mixed Use	240: MX		C&M with Residential
Class III: Commercial and Business (300)	7.Urban Center Commercial&Business	310: UCB		
	8.Neighborhood Commercial&Business	320: NCB		
	9.Corridor Commercial&Business	330: CCB		
Class IV: Industry (400)	10.Industrial Zone	410: INZ		Industrial Park, High-tech Park
	11.Quasi-Industrial Area	420: QIN		Light industry + (R, C&B)
Class V: Public Use (500)	12.Key Public Facilities	510: code	KG	See code list in below
	13.Key Higher Education	520: KHE		
	14.Tourism and Leisure Area	610: TRL		
	15.Park, Sports, and Open Space	620: PSO		Including "Green Belt"

Class VI: Recreation & Open Space (600)	16.Nature, Forest Area and Green	630: NFG		
	17.Water Surface	640: WS		Including wetland (Sebkha)

Class/Sub-	Code	Description
Key Public Facilities (510)	KG	Key Government / Institutions / Administration / Embassy / Security / Military by large site
	KS	Key compulsory schools (elementary / secondary)
	KH	Key health sector facilities with large site (national and referral hospital, specific hospital)
	KU	Key utilities (large site for plant facilities for water supply, sewerage treatment, disposal)
	KSC	Key socio-cultural facilities (large mosque, large cemetery, etc)
	KTF	Key transportation facilities with large site (terminal, large depot, other transport facilities)
	AP	Airport facilities

Note: Each code is shown in each Zone on the map of PLU
Source: JICA Study Team

(2) Land Use Regulations by Zone Class

One of the essential functions of zoning system is to regulate urban activities of private sector by guiding or promoting to invest in a manner to create appropriate living and working environment in accordance with the concept and urban structure of the proposed SDAU. This is achieved by grouping compatible land uses together in zoning districts stipulated by the classification, while separating or buffering incompatible uses.

The use regulation consists of three categories as follows.

Permitted use

Permitted uses are those buildings or building complexes in a lot property allowed to construct as a matter of right in the designated zoning classification and would be authorized by a simple check in the regulatory administration offices. The authorization work involves no discretionary parts if the applied project complies with design standards of building or construction codes.

Conditional use permit

Conditional uses would be listed in the zoning regulations for each zoning classification. Conditional uses shall be authorized on discretionary basis; only authorized if the applied project is compatible with neighboring land uses, tailored to meet the capacity of infrastructures at the site, and does not violate the objectives of the zoning regulations. Conditions may be attached to the approval documents issued for permission. The procedure for the assessment of conditions would be an essential part in scrutinizing the permission process.

Prohibited use

Prohibited uses consist of those which are not allowed to build in the designated land use class. These are specified in the zoning regulations.

Table II-29 shows the composition of use regulations with three categories mentioned above. Further discussion will be required to reflect local perceptions on nuisance or annoying type of activities at each land use classes, along with their scale.

Table II-29 Land/Building Use Regulation by Zoning Classification (tentative)

Urban Activities by Type of Land use / Building Use	Use Regulation by Zoning Classification												
	110	120	210	220	230	240	310	320	330	410	420	520	610
Residential Detached house, Semi-detached house													

Urban Activities by Type of Land use / Building Use		Use Regulation by Zoning Classification												
		110	120	210	220	230	240	310	320	330	410	420	520	610
	Apartment, collective housing			B										
	Detached house with small shop/office		A	A	A	A								
Commercial & Business	General retail shop, restaurant, coffee shop					B	B							
	Business and service office						B				B			
	Wholesale/storage with office or without office						B							
	Traditional/modern market (fresh food, fish, etc)													
	Hotel, guest house, other business accommodation													
	Entertainment facilities (bar, nightclub, game, etc)						B							
	Theater, movie, convention hall						B							
Industry / Agriculture	Craft shop / small factory without toxicity, chemical													
	Factory with noisy, malodorous production													
	Factory with toxicant production													
	Car repair workshop/garage													
	Transportation terminal / logistic terminal													
	Livestock barn, slaughterhouse, agro-workshop													
Public	Large hospital, large laboratory, and institution													
	Vocational center, university or college													
	Cultural facilities (library, museum, gallery, etc)													
	General school (nursery, primary, secondary)													
	Sports facilities (gymnasium, club-house, etc.)													
	Religious facilities (mosque, church, etc)													
	Health and social welfare (health-post, clinic, etc)													

Legend: Prohibited use, conditional permit (planning permission), permitted use / allowable
Note: A<50 sqm, B < 500 sqm, C > 500 sqm
110: Desert/arid land, 120: Agriculture land, 210: Low-density residential, 220: Medium-density residential, 230: High-density residential, 240: Mixed-use, 310: Urban Center Commercial & business (C&B), 320: Neighbourhood C&B, 330: Corridor C&B, 410: Industrial Zone, 420: Quasi-Industrial area, 520: Higher-education, 610: Tourism and leisure area
Source: JICA Study Team

(3) Urban Form Regulations

Another essential scope of the zoning system is to regulate urban form through regulating the shape of buildings, such as height, volume, materials and colors, in order to formulate favorable streetscape in terms of safety, aesthetic, and micro-climate aspects. This is achieved by dimensional requirements for building design in the designated zoning class. This will also contribute to regulating the density of the area.

The building form regulations in the Law 2008 stipulates two elements: 1) lot coverage coefficinet (COS[7]), and 2) floor area coefficient (CUF[8]). There are supplemental physical regulations provided by exiting General Urban Regulation 1987 and Titane City PLU, including setback lines, fences, and parking space requirements. The followings show the policy of model PLU to adopt urban form regulations, namely: CUF, COS and height control for each zoning classification.

[7] Coefficient d'Occupation des Sols (COS)
[8] Coefficient d'Utilisation Foncière (CUF)

Urban Form Control System

Urban form control in combination with building form and site form is achieved effectively by two tier control measures of 1) control and regulation for each building unit and 2) overlay form control or development control for area-wide building ensemble in certain harmonious urban or rural areas. These two control measures are applied to the target area taking account of urban characters to be promoted or conserved by them. Table II-30 illustrates the urban form control system.

Table II-30 Proposed Urban Form Control System and its Measures

Urban Form Control Target	Control Measure	Applied Measure	Reference
1. Single Building Unit	By zoning classification	1.1 Lot Coverage Coefficinet (COS)	Standard control and regulation measures by each zoning classification
		1.2 Floor Area Coeffcient (CUF)	
		1.3 Building Height Control (BHC)	
		1.1 Property Lot Size	
		1.5 Building Lines Control (BLC)	
2. Building Ensemble / Area	By overlay zoning	2.1 Significant historical cultural urban or rural scenery control and regulation	Specific or exclusive control and regulations based on Overlay Zoning adding regulations on relevant zoning classification
		2-2 Coastal scenery control and regulation	
		2-3 Airport safety overlay control and regulation	
No relation to urban form control		2-4 Natural hazard control and regulation	
		2-5 Nature environment protection control and regulation	

Source: JICA Study Team

Lot coverage coefficinet (COS)

The Coefficient of Occupation of Soils (COS) is the ratio between the built surface and the surface of the ground. The SOC aims to regulate the building area on a parcel opposite the floor area of the building's ground floor. According to the existing occupation conditions reviews in the target area, 98% of the plots have a SOC of less than 30% while only 0.3% of the plots have a COS greater than 40%.

Taking into account the role of the COS as a densification tool, it is proposed to increase the COS through zoning and regulation of the PLU in the spaces where this is necessary on the basis of the future densities proposed by the management plan. from the SDAU. Table II-31 indicates the proposed COS for each zoning class.

Table II-31 Proposed Standard Lot Coverage Coefficient (COS)

Zoning Classification	Control Range of Lot Coverage Coefficient (COS) by Zones							
	30%	40%	50%	60%	70%	80%	90%	100%
II Residential	RL		--	--	--	--	--	--
	--	RM			--	--	--	--
	RH: (high-rise building w/Cond1)			RH (other height of building)			--	--
	--	MX				--	--	--
III Commercial and Business (C&B)	--	--	--	UCB			--	--
	--	--	--	NCB			--	--
	--	--	--	CCB			w/Cond2	
IV Industrial	INZ			--	--	--	--	--
	QIN				--	--	--	--

Note 0: RL = Low-density residential, RM = Medium-density residential, RH = High-density, MX = Mixed use, UCB = Urban center commercial and business, NCB = Neighborhood commercial and business, CCB = Corridor commercial and busines, INZ = Industrial Zone, QIN = Quasi-Industrial

Note 1: w/Cond1 = In cases of COS (30/40%) are applied to the case of high rise residential building.

Note 2: w/Cond2= The indicated rate of COS is allowed by the conditions in case of "Corner Lot" and provision of "Parking Space" (e.g. underground carpark) or "fire-resistance building structure and treatment"

Note 3: COS = Lot Coverage Coeffcient

Source: JICA Study Team

Floor area coeffcient (CUF)

CUF as one of the essential tools for density control aims to regulate volume of building space (floor) by allowable range of total floor area of the building. According to examinations of existing building height condition of the target area, lower buildings are majority in the target area by two floors (41%) and only ground floor (33%), although number of floors is not equivalent to CUF. CUF as essential densification tool of settlement is proposed to increase the ratio of CUF in necessary locations (zoning) based on the SDAU density framework. Table II-32 illustrates proposed CUF by each zoning classification.

Table II-32 Proposed Standard Floor Area Coefficient (CUF)

Zoning Classification	Control Range of Floor Area Ratio (CUF) by Zones							
	60%	80%	100%	200%	300%	400%	500%	800%
II Residential	RL		--	--	--	--	--	--
	--	--	RM			--	--	--
	--	--	--	--	RH		--	--
	--	--	MX				--	--
III Commercial and Business (C&B)	--	--	--	UCB				
	--	--	--	NCB				--
	--	--	--	CCB				--
IV Industrial	INZ			--	--	--	--	--
	QIN				--	--	--	--

Note: RL = Low-density residential, RM = Medium-density residential, RH = High-density, MX = Mixed use, UCB = Urban center commercial and business, NCB = Neighborhood commercial and business, CCB = Corridor commercial and busines, INZ = Industrial Zone, QIN = Quasi-Industrial
Source: JICA Study Team

Building height control

Building height control as one of the most visible controls in urban form controls aims to regulate absolute building height by allowable range of number of floors of the building. As mentioned in the previous section, lower buildings are majority in the target area by two floors (41%) and only ground floor (33%).

Although building height is relating to CUF control measure, this measure would play a more considerable role in securing strict building height within desirable urban areas where specific town scape is required to be formulated or maintained. And also building height control is proposed generally to increase the height in necessary locations (zoning) based on the SDAU density framework. Table II-33 illustrates proposed CUF by each zoning classification.

Table II-33 Proposed Standard Building Height Control

	Range of Building Height (by Floor, absolute height is as reference)													
No. of Floor	**R+1F**	**+2F**	**+3F**	**+4F**	**+5F**	**+6F**	**+7F**	**+8F**	**+9F**	**+10F**	**+11F**	**+12F**	**+13F**	**+14F**
(Building height m)	6.0	9.0	12.0	15.0	18.0	21.0	23.0	25.0	29.0	32.0	35.0	38.0	41.0	43.0
II Residential	RL	--	--	--	--	--	--	--	--	--	--	--	--	--
	--	RM			--	--	--	--	--	--	--	--	--	--
	--	--	--	RH						--	--	--	--	--
	--	MX			--	--	--	--	--	--	--	--	--	--

III Commercial and Business (C&B)	--	UCB								*w/C1*	*w/C2*			
	--	NCB				--	--	--	--	--	--	--	--	--
	--	CCB			--	--	--	--	--	--	--	--	--	--
IV Industrial	INZ		--	--	--	--	--	--	--	--	--	--	--	--
	QIN			--	--	--	--	--	--	--	--	--	--	--
Reference	--	--	--	A*	B*	C*	--	--	--	D*	--	E*	--	F*

Note: RL = Low-density residential, RM = Medium-density residential, RH = High-density, MX = Mixed use, UCB = Urban center commercial and business, NCB = Neighborhood commercial and business, CCB = Corridor commercial and business, INZ = Industrial Zone, QIN = Quasi-Industrial

Note1: A*= A walk-up building applies to under 4th floor. *B=A building over 4th floor is required by the lift. (Decree 205-2007). C*= A building more than a 20 m height is treated by the high-rise building in combination with necessary equipment for fire-fighting. (Decree 205-2007), *D= Height of the minaret of Saudi Mosque (around 30m) or other famous mosques, *E = standard fire ladder truck (35m~40m).

Note 2: w/Cond1= The range of building height considers to harmonize cultural land scape of the Saudi Mosque of the minaret (D*).

Note 3: w/Cond2 = The range of building height considers difficulties to cope with fire in high-rise buildings by ordinal fire-fighting ladder truck (E*)

F = The highest existing building height in Nouakchott in the city center. (R + 14F)

Source: JICA Study Team

Lot size and building lines control

Land lot size plays also one of the important roles in formulating settlement density. Existing conditions in the target area shows that average lot size in case of the subdivisions areas ranges from around 170 m^2 to 1,300 m^2. Standard range of plot size for each zone classification is proposed to be widen by introduction of smaller lot size taking account of the SDAU density framework. Table II-34 proposes to set standard lot size to apply to each zoning classification in consideration with existing standard of the General Urban Regulation 1987 (RGU) and international standards.

Building lines as building setback measures within a property lot aims to be reasonably constructed, occupied and used for building purposes without danger to the health, safety of the occupants, security, and considering fire-resistance and micro-climate ventilation. Table II-34 shows proposed CUF by each zoning classification.

Table II-34 roposed Standard Lot Size and its Building Lines

Typical Lot Size		Building Lines by Standard Range of Land Lot Size							
		200 m^2	350 m^2	500 m^2	700 m^2	1000 m^2	1500 m^2	3000 m^2	5000 m^2 over
Road frontage (m)		3.0	3.0	4.0	4.0	5.0	6.0	7.0	9.0
Setback:	Rear (m)	1.0	1.5	1.5	2.0	2.0	3.0	3.0	5.0
	Side (m)	1.0 (0.0)*	1.5	1.5	2.0	2.0	3.0	3.0	5.0
II Residential		--	--	RL				--	--
		RM							
		RH (low-rise building.)		--	--	RH:(high-rise building.)			
		MX					--	--	--
III Commercial and Business (C&B)		UCB							
		NCB							--
		CCB						--	--
IV Industrial		--	--	--	--	--	INZ		
		QIN						--	--
Reference		A*	B*			C*			

Note 0: RL = Low-density residential, RM = Medium-density residential, RH = High-density, MX = Mixed use, UCB = Urban center commercial and business, NCB = Neighborhood commercial and business, CCB = Corridor commercial

and busines, INZ = Industrial Zone, QIN = Quasi-Industrial
Note1: In case of common wall building, side building line is no interval or buffer between two different properties.
Note2: A* as minimum lot size is stipulated in the General Urban Regulation 1987 (RGU) for ordinal dwelling zone.
Note3: B* as minimum lot size in RGU for medium dwelling zone
Note4: C* as minimum lot size in RGU for industrial and commercial zone
Source: JICA Study Team

II-6.3 Zoning Application to the Target Area

(1) Principles for Zoning Application to the PLU Target Area

According to the zoning measures and elements described in the previous section, the following principles are taken when these measures apply to the target area in order to achieve desirable urban activities based on the spatial framework of SDAU, taking account of existing physical conditions and the development framework and sector developments of PLU.

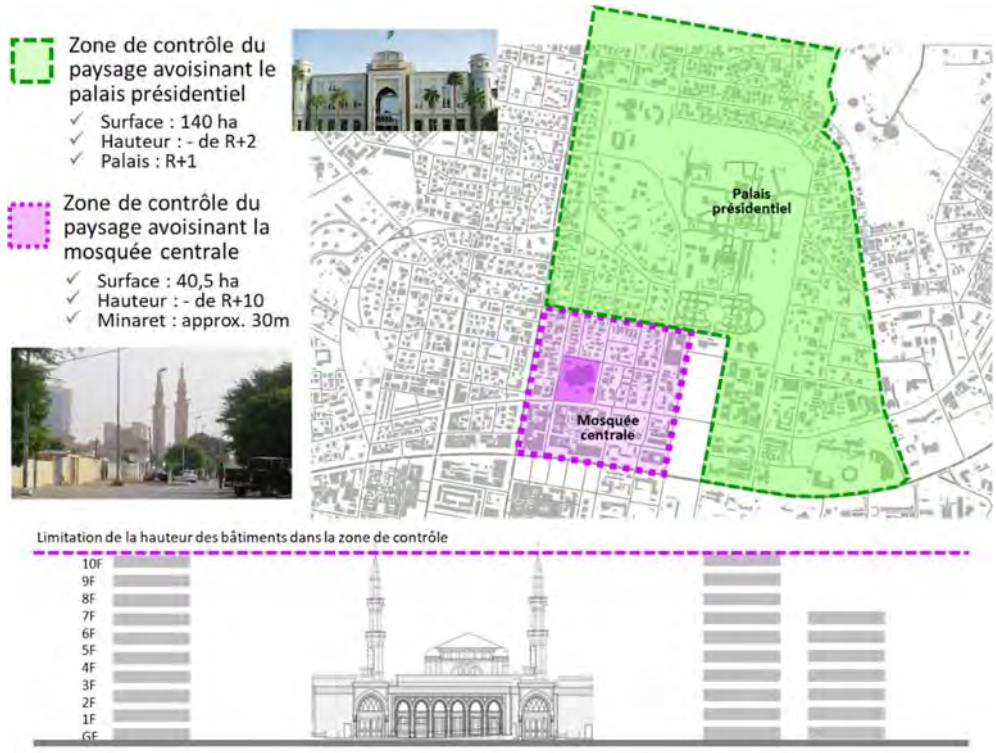
- Appropriate zoning measures are applied to certain areas of the target area in consideration with types of control measures (growth boundary, land use zone, key road designation, key public facilities designation and others) excluding the airport city planning area where designation of important urbanization elements (urban growth boundaries, key roads, conservation area) are applied.
- Potential areas (e.g. airport city, coastal concession areas) could be managed by other applicable statutory plans (PAD, ZAC, etc) by designation of these area
- Land use zoning plan is mainly applied to the area within Outer Ring Road in line with strategy of SDAU implementation program of urban development by 2030.
- The planning for Airport City is expected to follow the proposed zoning plan of the target area when they formulate the master plan and detailed plan as expected ZAC or PAD schemes.
- The urban blocks of Norther East and Northern Coast are defined as non-development areas by conservation of natural and coastal environment.

(2) Overlay Zoning Application to Specific Areas in the Target Area

Overlay zones aim to formulate specific standards and regulations for specified areas, by adding exclusive or additional regulations on the designated base zones. Whenever a requirement of an overlay zone conflicts with a requirement of the underlying base zone, the overlay zone requirement will be superior to base zone controls. These controls sometimes are based on the other sector regulations such as environment protection, security and infrastructure. The following key overlay zonings in the target area are proposed to apply to the specific areas.

Urban Center Townscape Control Zone

- **Purpose:** to protect and promote attractive cultural and social townscapes consisting of the surrounding area of Saudi Mosque and Presidential Palace
- **Applicable measure:** Specific height control zone can be introduced into certain influenced areas by the height regulation under the target monuments of the mosque and the palace.



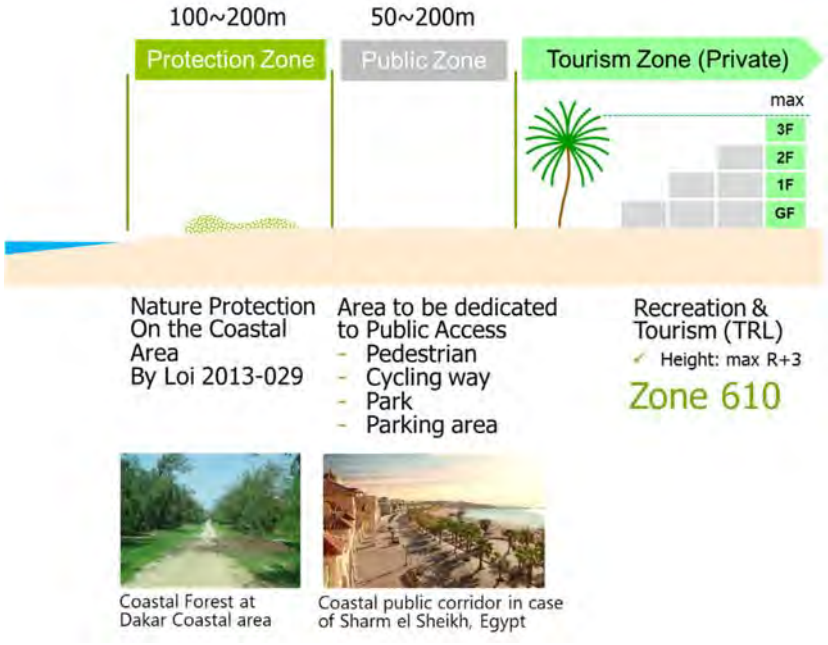
Source: JICA Study Team

Figure II-12 Proposed Urban Center Townscape Control Zone in the Target Area

Coastal Area Landscape Control Zone

- **Purpose:** to protect and enhance attractive natural landscapes of the coastal area along all coastal lines in the target area, and to secure access to the coast for public (citizen).
- **Applicable measure:** Specific height control zone can be introduced into certain influenced areas along the coast by the height regulation in combination with the regulation of coastal protection by the law of Ministry of Fishery and Maritime Economy[9].

[9] Law of Loi N° 95-009 Code of Commercial Maritime, Decree n° 2006-92 public maritime domain



Source: JICA Study Team

Figure II-13 Coastal Area Landscape Control Zone in the Target Area

Natural Hazard Prone Area

- **Purpose:** to prohibit settlement or urban development for safe and sustainable urbanization and to avoid potential natural hazard (flood, inundation, etc) in lower lands or wetlands.
- **Applicable measure:** Strict development control in this zone for any type of construction and land alteration.

Natural Environment Protection Zone

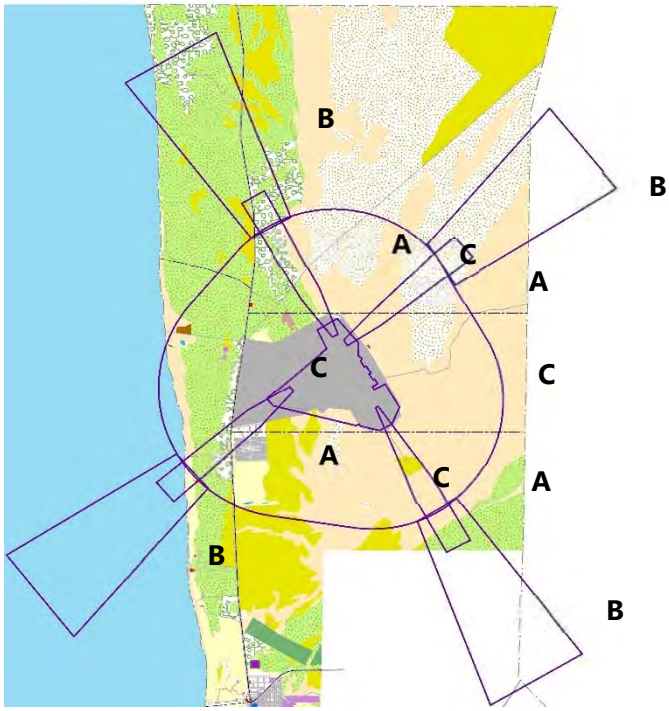
- **Purpose:** to protect natural environment as a part of environmental measures coping with climate change adaptation, biodiversity protection, and other environmental issues.
- **Applicable measure:** Strict development control in this zone for any type of construction and land alteration.

Airport Safety Overlay Surface Zone

- **Purpose:** to secure and protect safety of airspace and to avoid negative impact (noise pollution) or accident of aircraft of the air surface on the settlement at the ground.
- **Applicable measure:** Specific height and land use control zone based on the existing airport safety overlay surface zone of Nouakchott-Oumtounsy International Airport.

Zone Type	Height Control		Land Use Zone Classification					
	minimum	maximum	100	200	300	400	500	600
A	R+3F (12m)	14 m*	--	--	--	△	△	--
B	140m*	over 140m	--	--	△	●	△	--
C	--	R+14F(43m)	--	--	△	●	△	--

Note1: ●＝permitted, △ = conditional permit, -- = prohibited
Note2: Maximum height for A zone is at the place just outside of the Aiport property, therefore, far distant from the airport becomes larger height maximum value upto the end point of the A zone (140 m maximum)
Note3: 100: Rural, 200: Residential, 300: Commercial Business, 400: Industrial, 500: Public Use, 600: Recreation & Open Space



Source: JICA Study Team

Figure II-14 Airport Safety Overlay Surface Zone of Nouakchott-Oumtounsy International Airport in the Target Area

II-6.4 PLU Zoning Plan

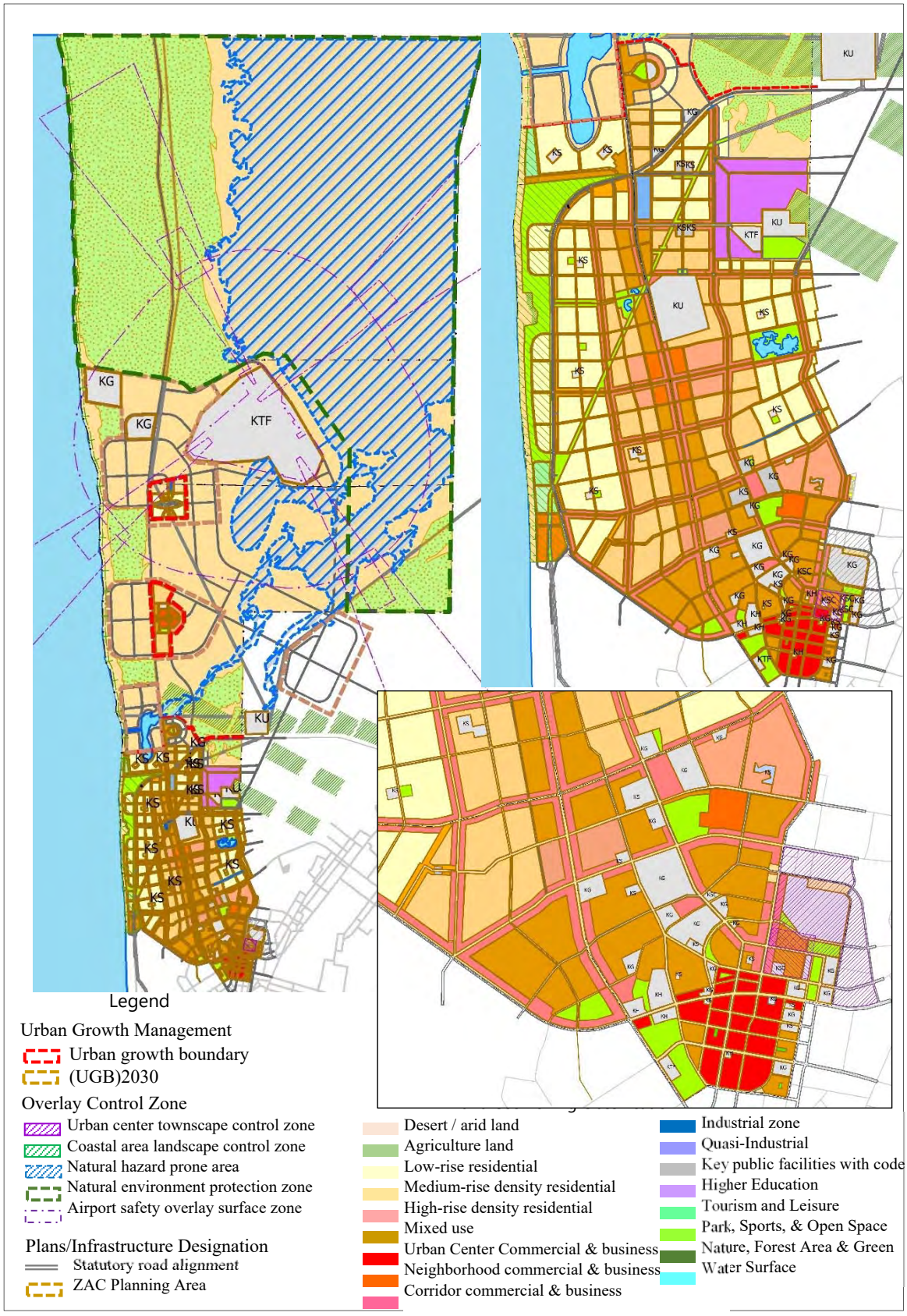
On the basis of the elements described in the previous sections, the PLU zoning plan is shown in Figure II-15 below. It is a compressed representation for the report, the original being at the scale 1/5 000th. The components of the PLU zoning plan are described in Table II-35 below.

Table II-35 Proposed Elements (legend) to be Delineated in the Zoning Map

Category	Legend	Note	Category	Legend	Note
Urban Growth Management	UGB 2030	Urban growth boundary 2030	Land Use Zone Classification	TRL	Tourism and Leisure
	RA 2040	Reserved area by 2040		PSO	Park, Sports, & Open Space
Land Use Zone Classification	DA	Desert / arid land		NFG	Nature, Forest Area & Green
	AG	Agriculture land		WS	Water Surface
	RL	Low-rise residential	Overlay Control Zone	UCTC	Urban center townscape control zone
	RM	Medium-rise density residential		CALC	Coastal area landscape control zone
	RH	High-rise density residential		NHPA	Natural hazard prone area
	MX	Mixed use		NEP	Natural environment protection zone

	UCB	Urban Center Commercial&business		ASOS	Airport safety overlay surface zone
	NCB	Neighborhood commercial & business		Road	Statutory road alignment
	CCB	Corridor commercial & business	Urban Development and Infrastructure	(PAD)	(PAD proposed area)
	INZ	Industrial zone		ZAC	ZAC proposed area
	QIN	Quasi-Industrial		(PIF)	(Development action area)
	(code)	Key public facilities with code		(RU/RBU)	(Redevelopment area)
	HE	Higher Education			

Source: JICA Study Team



Source: JICA Study Team

Figure II-15 Proposed Land Use Zoning Plan for the Target Area

II-7 Recommendations for Future Implementation

II-7.1 Effective Implementation of PLU

(1) Provision of Statutory Plan of PLU for Approval

This Chapter 7 for PLU is required to be edited by legitimate form of the report of PLU for approval by the government authority as the statutory plan. The official document of the PLU plan based on the document of Chapter 7 will be arranged and provided in cooperation with counterparts of Taskforce Members.

(2) Awareness Promotion of Zoning Regulation

Effective implementation of zoning regulations would require both side efforts of administration and citizen. In case of citizen side, effective implementation would depend on sufficient understandings and cooperative activities by citizen in the target area covering all of stakeholders, especially private companies in construction sectors by planners, designers, engineers and other experts. Once the zoning is approved and promulgated, awareness program of zoning regulation would be inevitable especially for the relevant area of the regulation.

(3) Monitoring and Evaluation, Modification of PLU

Zoning regulations, especially designated areas of zones or overlay zoning should cope appropriately with rapid socio-economic changes. Monitoring is one of the important activities to implement effectively regulations through necessary evaluation and its modification including public announce of the modification.

II-7.2 Institutional Setup for Implementation of PLU

(1) Effective organizational arrangement and human resource development

Number of works for permission, inspection and monitoring for building construction would be incremented in conjunction with increase of population and socio-economic activities. Organizational arrangement including skilled experts development and establishment of taskforce units would be required to enhance those activities for effective implementation of development regulations and controls.

(2) Model PLU Applicability to Other Areas (Communes)

This PLU plan is expected to be a good model for other area or communes without PLU plan to manage and control urban developments through its application of methodology, technique and regulations. And the PLU plan for the target area should also be made efforts to improve and upgrade the function and role of the model plan.

(3) Updating Urban General Regulation

The plan for zoning controls and regulations for the target area considers physical and socio-economic characters of the target area. Therefore, regulations and control measures may need some modification to apply to different areas, while some regulations and controls in similar area to the target area could be applicable.

On the other hand, existing General Urban Regulation 1983 applied to entire areas of Nouakchott involves mixed measures by not only common regulations enabling to apply others but also different regulations not to be able to apply to other areas. Therefore, this regulation requires to be updated

and reorganized as more common and standardized regulations and controls enabling to apply every areas or communes.