

Table 4.3-11 Future Land Use Demand in 2015

		2006		2015	
		ha	%	ha	%
1	Residential	1,787	37.0	3,290	42.4
2	Commercial	29	0.6	207	2.7
3	Business	24	0.5	152	2.0
4	Government	52	1.1	82	1.1
5	Military	280	5.8	280	3.6
6	Industry	4	0.1	129	1.7
7	Institutional	46	0.9	182	2.3
8	School / Clinics	78	1.6	204	2.6
9	Religious	20	0.4	29	0.4
10	Sport Field/Public Facility	22	0.4	54	0.7
11	Road / Transport	426	8.8	1,488	19.2
12	Grassland/ Agricultural	2,060	42.7	1,662	21.4
	Total	4,827	100.0	7,759	100.0

4.3.4 Population Distribution Plan

The population distribution plan is based on the following policies:

Population is principally distributed in proportion to the habitable area that is defined as residential area plus 30 % of agricultural land, grassland and open space.

Population density is determined based on the existing population density and characteristics of each zone as shown in Table 4.3-12.

Table 4.3-13 shows the population distribution plan in 2015. (Also see Figure 4.3-3)

Table 4.3-12 Land Use Characteristics by Zones

Payam	No.	Area (ha)	Name of Zone	Level	Land Use Characteristics
Juba	1	30.14	GOSS Government Ministries with Nakasongola Community	Good	Many GOSS buildings are located. This zone becomes future Government Center of GOSS, however, Nakasongala informal settlement is located in this zone. Tukul houses are conglomerated in the residential area of this zone. Therefore population density will not be promoted without transformation of housing type. The residential area is just adjacent to the GOSS complex, and utility service improvement including electricity and water is easy to carry out. Together with or prior to the utility improvement, collector road improvement is required.
	2	33.71	Foreign Missions with Grass Land	Good	Radio Juba, governmental offices, and some foreign missions such as Red Cross and UNDP are located. Also relatively high-standard housings are located. Almost 2/3 of the area is grassland with few small buildings. It seems possible to convert the open space belonging to Radio Juba into other land use. Other than business and commercial functions, cultural facilities such as theater and library are also possible in this zone. The area far from the May St. has a possibility to develop for housing.
	3	71.49	University of Juba with Nyakama Community	Poor	University-of-Juba-related facilities such as dormitories, guest houses are located. Nyakama community is located in the center of this zone. Although open space is found in this zone, land use conversion is considered difficult due to the memorial grave yard of the late president. Population absorption in the area facing the May St. is also difficult, because commercial facilities such as gas stand and hotel are located already and population absorption at Juba University site is also difficult. However, utility service improvement seems to be easy due to the well arranged road network.
	4	205.9	Grasslands with Tongping Community	Poor	Mostly this area consists of grassland with a few houses. Tongping Community, very poor community, is located in this zone. A low-density residential area is formed in this zone where UNDP compound exists. This zone has a great possibility of population absorption through housing area development because of the abundant vacant lands and inadequate condition for business functions to locate. However, since collector roads are not developed, improvement of road network and utility services are required. Proximity to the central district make it easy to improve the utility services.
	5	144.9	Mostly Grasslands	Poor	Mostly this area consists of grassland with a few houses. Foreign missions such as USAID and UNDP are located in this zone. A low-density residential area is formed in this zone where governmental houses and international organization compound exist. This zone has a great possibility of population absorption through housing area development because of the abundant vacant lands and inadequate condition for business functions to locate. However, since collector roads are not developed, improvement of road network and utility services are required. Proximity to the central district enables easy improvement of utility services.
	6	80.64	Ministerial Quarters, Amarat Community	Better	Ministerial Quarters with Amarat Community. There are still many grasslands in this zone. Offices such as government buildings and multi-donor complex, low-density government houses are located along main road. It is well presumable that accumulation of those business functions proceed. This zone has a possibility of population absorption through housing area development. However, since collector roads are not developed, improvement of road network are required for utility services. Proximity to the central district enables easy improvement of utility services.
	7	63.19	Foreign Missions with 1st Class Residences	Better	Foreign Missions UNHCR and UNWFP are located there. In addition to this, 1st Class Residences are located. Developed road network exists in this zone. Alteration of housing class will be the prerequisite for high-density habitation. Well arranged collector road network enables prompt utility service improvement.
	8	32.46	Buluk, Zendia Thoura Communities	Poor	Buluk, and Zendia Thoura Communities are located here. Police offices and residences and ordinary houses are located in this zone. Formal areas with well arranged collector road network and informal areas without well arranged collector road network co-exist. Alteration of housing class will be the prerequisite for high-density habitation. Proximity to the central district enables easy improvement of utility services. Improvement of road network in informal area are required for utility services.

No.	Area (ha)	Name of Zone	Level	Land Use Characteristics
9	64.08	Game and Commercial Communities	Better / Poor	Game and Commercial Community is generally poor and many displaced peoples reside. This zone is a built-up area including hospital and schools occupying large tract of land. Formal areas with well arranged collector road network and informal areas without well arranged collector road network co-exist. Population density will not become high without transformation of housing type. Proximity to the central district enables easy improvement of utility services. Improvement of road network in informal area are required for utility services.
10	40.62	University of Juba with Mayo Community	Poor	University of Juba with Mayo and Nimra Talata Communities is located in this zone. Road network in this zone is well arranged. Tukul houses and ordinary houses are co-existing in the northern part of this zone. Population density will not become high without transformation of housing type. Proximity to the central district enables easy improvement of utility services. Improvement of road network in informal area are required for utility services.
11	42.97	Azala and Neem Community	Poor	Azala and Neem Communities categorized as very poor are located in this zone. Road network in this zone is well arranged. Tukul houses and ordinary houses are co-existing in the northern part of this zone. Population density will not become high without transformation of housing type. Proximity to the central district enables easy improvement of utility services. Improvement of road network in informal area are required for utility services.
12	43.21	New Business District	Better	Road network is not developed. Governmental offices and new international donor agency offices are located along the main road in this zone. The areas with tukul houses and low-density governmental housing areas are existing. Open spaces are also existing near the airport. Though open spaces exist, the capacity of population absorption in those spaces is not so much expected due to the high potential for business functions along the airport access road. Since collector roads are not developed, improvement of road network and utility services are required. Proximity to the central district enables easy improvement of utility services.
13	42.28	Dressers Line Community	Poor	Dressers Line Community categorized as very poor is located in this zone. There are two schools and hospitals. Road network in this zone is very bad. Most part of the housing areas are classified into informal area with conglomeration of tukul houses, though low-density governmental housing areas have been formed along May St. Population density will not become high without transformation of housing type. Proximity to the central district enables easy improvement of utility services.
14	82.56	Jalaba and Gabat Community	Better	There are many business offices located along major roads. Julaba and Gabat Communities are within in this zone. Warehouses and market are located in Gabat District. Low-density housing area have been formed in Julaba, on the contrary, informal residential areas with tukul houses exist in Gabat. Population density will not become high without transformation of housing type or housing class in Julaba. A little room for population absorption capacity is found in Gabat from the viewpoint of population density, though suitable areas for housing are limited because of the swampy areas. There is a possibility to improve utility services without collector road development, because depth of the plot from frontage road is shallow.
15	58.61	Central Business District including Police Quarters	Better	There located are state ministries, government facilities, hospitals, churches, mosque and business offices in this area. Low-density housing areas are also formed. Road network in this zone is well developed. Population density will not become high without transformation of housing type. Proximity to the central district enables easy improvement of utility services.
16	47.3	Cinema and Missia Community	Better	Cinema Community, which consists of many IDPs from various areas, is located in this zone. Road network is generally developed. There are some informal settlements in Missia Community. Educational facilities and church occupy large tract of land. Though some part of Cinema and Missia are sparsely populated, population density will not become high without transformation of housing type or housing class. Proximity to the central district enables easy improvement of utility services. Improvement of road network in informal area are required for utility services. Population absorption is rather difficult without the alteration of housing type in some part of Missia where tukul houses are conglomerated.

Payam	No.	Area (ha)	Name of Zone	Level	Land Use Characteristics
Juba	17	42.95	Malakal Community	Better	Malakal Community is located in this zone. Road network in this zone is generally developed. Since ordinary houses are densely located, population density will not become high without transformation of housing type.
	18	718.9	Airport and Grasslands	Poor	Airport is located in this zone. Most of the remaining area are grasslands. Noise problem is assumable in this zone due to the proximity to the airport. The land is more suitable for industries than housing. Therefore, population absorption capacity in future is not so much expected.
	19	46.06	Jebel Nyoka	Low-est	Western half of this zone is functioning as CBD. However, there are some squatter settlements along the Nile River. It is desirable that open spaces and unoccupied lands are used for urban functions that harmonize river and greenery zones, therefore population absorption capacity is not much expected.
	20	78.07	West Bank of Nile River	Better	In the northern part of this zone are located government offices, factories, and water works and electricity companies. The remaining areas along the Nile River are glass lands and orchards. Collector roads are not well developed. Commercial and business functions are expected for this zone in future. Large population absorption capacity is expected in case of housing. Since collector roads are not developed, improvement of road network and utility services are required. Proximity to the central district make it easy to improve the utility services.
	21	145.4	West Bank of Nile River	Better	Large cemetery is located in this area. Educational facilities, factories, and storage are located. Orchards and open spaces are located along the Nile River. Presently lease holders of those areas are subleasing the lands and temporary hotels and depot are constructed. It is desirable that open spaces and unoccupied lands are used for urban functions that harmonize river and greenery zones. Large population absorption capacity is expected in case of housing. Since collector roads are not developed, improvement of road network and utility services are required. Proximity to the central district make it easy to improve the utility services.

Payam	No.	Area (ha)	Name of Zone	Level	Land Use Characteristics
Kator	1	17.42	Konya Konya Market	Stand-ard	Center of Kator, Administrative office is located here. Small stalls and shops are conglomerating at the market. Housing areas, where ordinary houses are densely located, have been formed. Road network is well developed, though road condition is very bad. This zone is close to the central area of the town and collector road network is well developed. Therefore utility services are relatively easy to improve. Population density will not become high without transformation of housing type.
	2	46.04	Malakia Area	Stand-ard	Malakia Community zone is located here. Road network is well developed but road condition is very bad. Residential areas with small ordinary houses have been formed. This zone is close to the central area of the town and collector road network is well developed, therefore utility services are relatively easy to improve. Population density will not become high without transformation of housing type.
	3	33.93	Aklabara A Area	Better	Aklabara A Community zone is located here. Road network is well developed but road condition is very bad. Residential areas with conglomeration of small ordinary houses and tukul houses are formed. This zone is close to the central area of the town and collector road network is well developed, therefore utility services are relatively easy to improve. Population density will not become high without transformation of housing type.
	4	29.86	Aklabara B Area	Better	Aklabara B Community zone is located here. Road network is well developed but road condition is very bad. Residential areas with conglomeration of small ordinary houses and tukul houses are formed. This zone is close to the central area of the town and collector road network is well developed, therefore utility services are relatively easy to improve. Population density will not become high without transformation of housing type.

Payam	No.	Area (ha)	Name of Zone	Level	Land Use Characteristics
Kator	5	38.91	Aklabara C Area	Better	Aklabara C Community zone is located here. Road network is well developed but road condition is very bad. Residential areas with conglomeration of small ordinary houses and tukul houses have been formed. This zone is close to the central area of the town and collector road network is well developed, therefore utility services are relativley easy to improve. Population density will not become high without transformation of housing type.
	6	78.59	Kator (East) & Kassava	Upper & Low	Kator & Kassava Communities are located here. Kassava Community is spersely populated. Road network is well developed in Kator though road condition is very bad. Residential areas, where ordinary houses and tukul houses are co-existing, have been formed in Kator area. Utility services are relativley easy to improve. Most of the Kassava area are glassland, where collector road network is not developed. Population density will not become high without transformation of housing type in Kator. On the contrary, it is likely that commercial/business, and recreation functions will compete for land in Kassava where large tract of open spaces exists. In Kassava, collector road improvement shall be given the first priority to other utility service improvement.
	7	60.26	Kator (Central)	Upper	Kator Community zone is located here. Road network is well developed in Kator but road condition is very bad. Residential areas where ordinary houses and tukul houses are co-existing have been formed. Since collector roads are developed, it seems easy to improve utility services. Population density will not become high without transformation of housing type.
	8	51.36	Kator (West)	Upper	Kator Community zone is located here. Residential areas where traditional tukul houses dominate have been formed. Road network is well developed in Kator but road condition is very bad. Population absorption is possible by extention of urban area.
	9	50.81	Miro	Upper	Miro Community zone is located here. Road network is not developed in this zone. Such tukul housing area show relatively low housing density compared with other residential areas with tukul houses. Military base camps are located in the southwest part of this zone. Open spaces are also much remaining. Population absorption is well possible through extension of urban area.
	10	174.9	Lologo	Low	Lologo Community is located here. Road network is not developed. Residential areas with traditional tukul houses are generally formed. Open spaces also exist. Population absorption is well possible through housing development, because of many open spaces and glasslands exist, and low potential for business funcions due to long distance to/from the town center.
	11	829.2	Military Camp Area	Upper	Most of area are military camp. There exist large tract of undevelopped area. Large new urban development is possible and capacity of population absorption is quite large.
	12	340.00	Lologo (New Development Area)	-	IDP transit camp is placed in southern end. There are many IDPs. Large new urban development is possible and capacity of population absorption is quite large.

Payam	No.	Area (ha)	Name of Zone	Level	Land Use Characteristics
Munuki	1	51.77	Kuwait & Munuki Island	Better	Kuwait & Munuki Island Communities are located here. Most of the area is already developed. The road network is generally developed but road condition is very bad. Road network in Munuki Island is not well arranged. Housing area with ordinary houses has been formed in Kuwait area. In Munuki Island area, residential area with tukul houses and some open spaces exist. Therefore, Munuki Island area is expected to absorb population. Since collector roads are not developed, improvement of road network and utility services are required.
	2	94.1	Munuki A	Poor	Muniki A Community is located here. There are still many grasslands. The road network is generally good but condition is very bad. Therefore, Munuki A area is expected to absorb population. Improvement of utility services are required.

Payam	No.	Area (ha)	Name of Zone	Level	Land Use Characteristics
Munuki	3	228.7	Munuki B	Poor	Muniki B Community is located here. There are still many grasslands. The road network is generally good but condition is very bad. Therefore, Munuki B area is expected to absorb population. Improvement of utility services are required.
	4	168.6	Munuki C	Poor	Muniki C community is located here. There are still many grasslands. The road network is generally good but condition is very bad. Therefore, Munuki C area is expected to absorb population. Improvement of utility services are required.
	5	44.99	Mauna (East)	Poor	Darsalam and Mauna Community located here. Most area is already developed by traditional houses. Road network is not developed. Population density will not become high without transformation of housing type. Improvement of road network and utility services are required.
	6	61.64	Darsalam	Poor	Darsalam Community is located here. Most of the area are already developed for traditional tukul houses. Road network is not developed. Improvement of road network and utility services are required.
	7	40.95	Jebel	Poor	Jebel Communities are located here. Most area have been already developed by traditional houses. Road network is not developed. There seems to be a little possibility of population absorption. Population density will not become high without drastic transformation of housing type. Improvement of road network and utility services are required.
	8	58.69	Seminary	Better	Seminary Community is located here. The area has been partially developed for traditional houses. Road network is not developed. There seems to be a possibility of population absorption. Improvement of road network and utility services are required.
	9	97.93	Mauna and Nyakoron (West)	Poor	Mauna and Nyakoron West Communities are located here. The area is partially developed by traditional houses. Road network is not developed. Along Wei Road, commercial activities are observed. There seems to be a possibility of population absorption. Improvement of road network and utility services are required.
	10	66.47	Nyakoron (North)	Better	Commercial activities as Custom Market are located here. Road network within this zone is not developed. Population density will not become high without transformation of housing type. Improvement of road network and utility services are required.
	11	45.54	Nyakoron (East)	Poor	Nyakoron (East) Community is located here. The area is partially developed for traditional houses. Road network is not developed. Residential areas with traditional tukul houses have been formed. Population density will not become high without transformation of housing type. Improvement of road network and utility services are required.
	12	65.59	Nyakoron (South)	Poor	Nyakoron (South) Community is located here. The area is developed for traditional tukul houses. Road network is not developed. Population density will not become high without transformation of housing type.
	13	85.05	Nyakoron (West)	Poor	Nyakoron (West) Community is located here. Residential areas with traditional tukul houses are formed. Population density will not become high without transformation of housing type. Road network is not developed. Along Yei Road, commercial functions are located. Population absorption is possible. Improvement of road network and utility services are required.
	14	170	Nyakoron New Urban Development Area	-	Although the area is designated as a residential area, vast glassland exists at present. It seems that population absorption in this zone is possible. Improvement of road network and utility services are required.
	15	150	Jebel New Urban Development Area	-	The western part of this zone was allocated to WFP, USAID and private hotel business industry. It seems that population absorption in this zone is possible. Improvement of road network and utility services are required.
	16	520	Gudele New Urban Development Area	-	Although the area is designated as a residential area, vast glassland exists at present. It seems that population absorption in this zone is possible. Improvement of road network and utility services are required.

Table 4.3-13 Population Distribution Plan in 2015

Payam	No.	Area (Ha)	Habitable Area	Population in 2006	Population in 2015
Juba	1	30.14	5.82	2,438	2,438
	2	33.71	7.58	959	959
	3	71.49	29.78	3,942	3,942
	4	205.9	78.55	9,312	26,767
	5	144.9	29.13	4,986	14,128
	6	80.64	39.37	2,099	6,048
	7	63.19	44.04	4,587	5,213
	8	32.46	23.61	6,504	4,528
	9	64.08	40.49	11,433	11,433
	10	40.62	27.04	4,516	5,500
	11	42.97	37.77	7,835	5,873
	12	43.21	28.94	4,414	3,904
	13	42.28	16.26	6,254	5,208
	14	78.86	50.16	4,954	5,403
	15	58.61	36.39	3,102	5,624
	16	47.3	32.34	6,375	6,389
	17	42.95	37.22	5,816	5,961
	18	709.62	168.44	7,636	10,496
	19	36.23	12.04	1,690	1,563
	20	64.15	18.62	1,895	1,208
	21	101.51	19.20	2,190	1,703
S-Total		2,034.82	782.79	102,938	134,000
Kator	1	17.42	8.36	4,563	2,204
	2	46.04	37.79	10,736	10,598
	3	33.93	28.00	4,301	4,301
	4	29.86	26.87	4,963	4,963
	5	38.91	31.72	6,209	6,209
	6	65.66	43.46	6,555	6,555
	7	60.26	44.48	8,702	8,702
	8	51.36	36.04	4,275	5,559
	9	50.81	44.68	6,165	6,165
	10	165.06	86.83	7,972	15,012
	11	829.2	65.00	4,850	23,049
	12	514.40	259.52	0	13,260
	S-Total		1,902.91	712.75	69,291
Munuki	1	51.77	33.98	5,208	5,208
	2	94.1	73.28	5,595	12,233
	3	228.7	150.42	9,368	29,731
	4	168.6	59.81	6,107	19,287
	5	44.99	42.62	4,464	5,507
	6	61.64	42.75	6,234	8,013
	7	40.95	29.98	3,313	5,324
	8	58.69	41.34	1,769	3,713
	9	97.93	53.31	9,489	9,794
	10	66.47	59.07	9,681	8,531
	11	45.54	44.03	4,263	4,263
	12	65.59	65.77	8,776	8,798
	13	85.05	62.03	3,504	8,845
	14	170.00	129.76	0	21,994
	15	150.00	114.50	0	19,500
	16	520.00	396.92	0	47,905
S-Total		1,950.02	1,399.57	77,771	219,000
Rajaf	-	-	-	-	50,000
Total		-	-	250,000	510,000

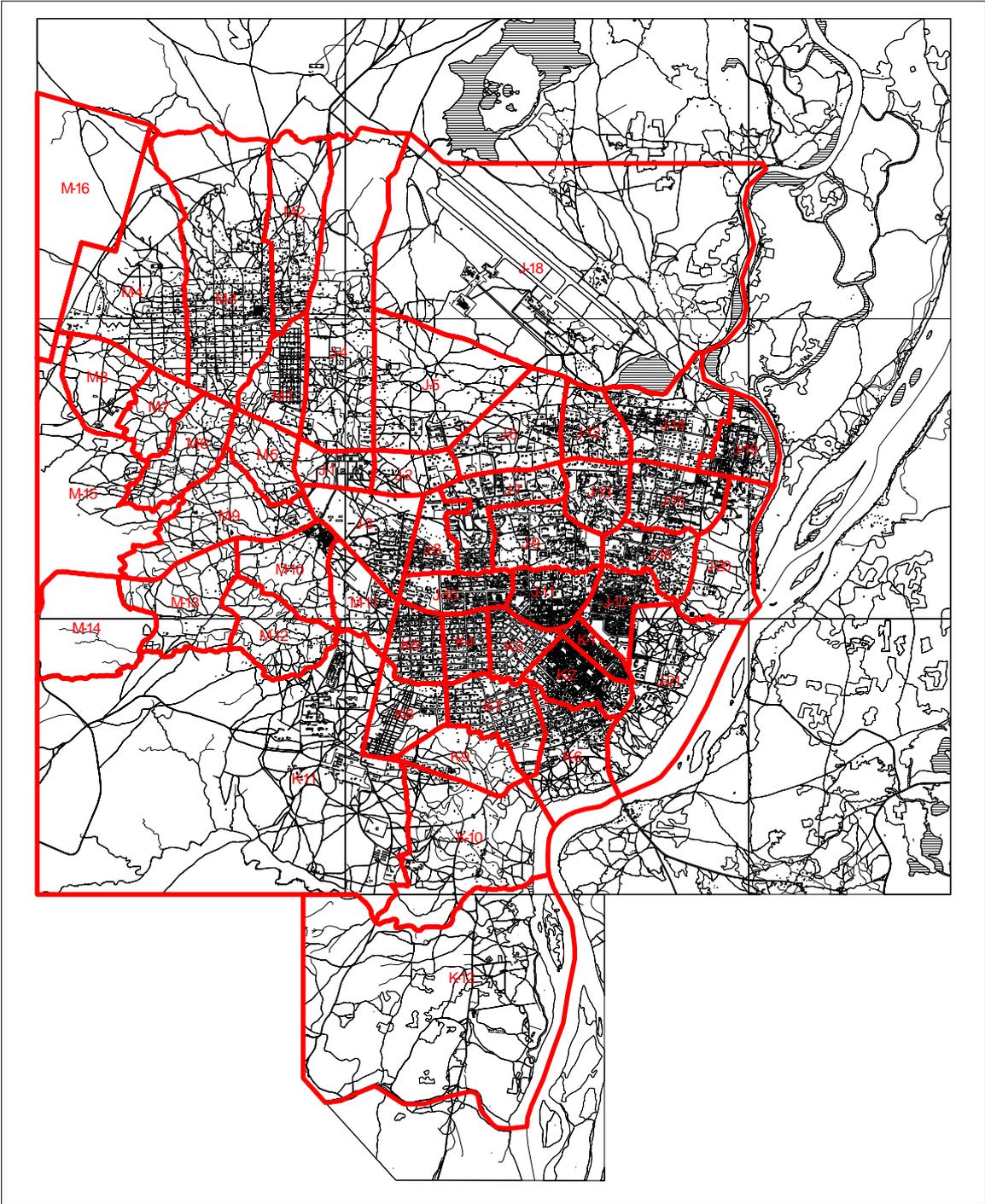


Figure 4.3-3 Zoning of the Study Area

4.4 PLANNED DISTRIBUTION OF URBAN FUNCTIONS

4.4.1 Strategy of Spatial Structure

(1) Spatial Development Pattern

Flexibility

Considering the uncertainty of the long range population forecast for Juba Town area on one hand, and the fact that the recent rapid population increase needs to be reckoned on the other, the future spatial development pattern shall have the flexibility to cope with the uncertainties.

Compactness

In consideration of financial capacity, compact formation of an urban area that requires less resource consumption, imposes less environmental burden and allows efficient infrastructure investment is desirable.

Concentric and belt-type spatial pattern

The present typical Juba area is composed mainly of a concentric urbanized area spreading from the old town area encompassing a radial and circular road network. The circular road covers the urbanized area of Juba Town, while the circular roads are not formed or incomplete. The spatial development pattern shall be considered based on this present pattern.

As a future spatial pattern, belt-type development is recommendable where the extension of town areas along the transport corridor will take place. Formation of the town area will be guided in this pattern along the corridors and cores that will be formed and fostered at the head or middle of the axis in the long term. Those cores and present urban cores are expected to work together by sharing the urban functions and contribute to the expansion of the entire urban area.

This type of development pattern has the following advantages:

- Development of town area will be characterized by high flexibility.
- Planned development of the urban area can be attainable.
- Efficient infrastructure investment will be possible.
- Existing stocks in the present urbanized area will be efficiently utilized.
- Public transport service on the axis can be profitable.
- Preservation of natural environment can be more implementable.

(2) Town Area

The ways to estimate the future town area can largely be classified into i) macroscopic approach where the necessary town area is basically estimated by future population and population density, and ii) sectoral approach where land demands by purpose eg. housing, commerce, or industry, are estimated individually and compiled up.

The Town Boundary Area defined in 1972 has an acreage of approximately 50 sq.km. Consequently the present gross population density of Juba within the Town Boundary area is estimated at about 40 persons/ha, and the population density within habitable land (excluding land for roads, airport, utilities, and buildings for other purposes) is estimated at about 65 persons/ha.

The population density of built-up areas excluding lands for other than houses, such as for factory, school, and parks, is commonly considered to be 80 to 100 persons/ha as a standard. Given the foregoing, the capacity of Town Boundary area is quite large.

The basic principle considers that future population up to 2015 would be housed and accommodated within the present Town Boundary area from the viewpoint of population density and efficiency of investment and Governmental budgetary constraints. Of course, the possibility of new development outside of the present Town Boundary is not denied in this context.

The development of the eastern bank of the River Nile for the industrial estates, inland depot, coupled with the envisaged new river port utilizing preferable condition for navigation is promising. However, due to the large investment costs required for infrastructures, including the construction of a new port, roads and bridge across the Nile, power grid, water/sewerage system and improvement of swampy land condition, the development of the area is deemed to be effectively realized provided that surrounding condition is improved.

(3) Transport Corridor and Transport Nodes

As mentioned earlier, the function of regional transport hub in Juba Town area should be enhanced in due consideration of its status as the capital city and the center of policy, economy, and culture. Also transport corridors should be formed as a future urban structure for the extension of urban area to cope with the anticipated large population increase in the future. Already the present Juba Town area has the expanse beyond the walking radius to cater for a population of 250,000, and articulated core areas have been formed and bus terminals are located in those cores. The future transport system is also expected to solve the present transport network problem and enhance mobility.

From the foregoing background, the main role of the transport corridors and transport nodes may be cited as follows:

- Forming the future urban structure,
- Inducing urbanization, and
- Enhancing the regional transport hub function.

Urban structure formation

Present transport network is insufficiently formed to meet the expansion of urban area in the long range, although circular road in the built-up area and radial roads are provided. Formation of dispersed transport nodes and circular roads network is especially necessary for the dispersion of traffic movement pattern concentrating to/from the town center and improvement of accessibility in circular direction.

Urbanization inducement

The roads from Juba Town area radiate to Yei, Uganda, Maridi and Rumbek, Kajo Keji and Uganda, and Terekeka. In addition, roads stretch beyond the River Nile, toward Torit and Kenya, Nimule and Uganda, and Bor and Malakal in a radial direction.

Out of these roads linking Juba Town area, the road to Terekeka passes through the low-land swampy area in the north of town, providing unfavourable condition for urban development. Among three radial roads beyond the Nile, the road to Bor and Malakal also passes through a considerable length of swampy area and it is considered that it will take many years and much investment before proper passage is realized. On the other hand, the other two roads have a security problem that cannot possibly be solved within a short range period. Conclusively therefore, these three roads that radiate beyond the River Nile are deemed to be a development axis that can only be realized after the favourable turn of circumstances.

Essentially, the development axis until 2015, the target year of the Master Plan, will be based on the other radial roads within the present Town Boundary area. However, the development should be discreetly implemented along the road to Kajo Keji, and Uganda because of the communal farm land in that area.

Enhancement of regional transport hub function

Juba Town area, the center of the region, is currently functioning as the hub of international and regional freight and passenger movement with provision of such services through Juba International Airport, the River Port, and existing road network. Such transport facilities, together with supplementary access transport infrastructure and means, shall be upgraded.

The Juba International Airport is located close to the urban area, about 2km distance to the town center. The relocation of Juba Airport is currently discussed by the Government of Southern Sudan, with due consideration on functional improvement, countermeasure to noise problems, and maximum utilization of land potential. Since the size and importance of the airport is a focal point as the premise for formulating Master Plan, relocation of the airport is a subject of paramount importance.

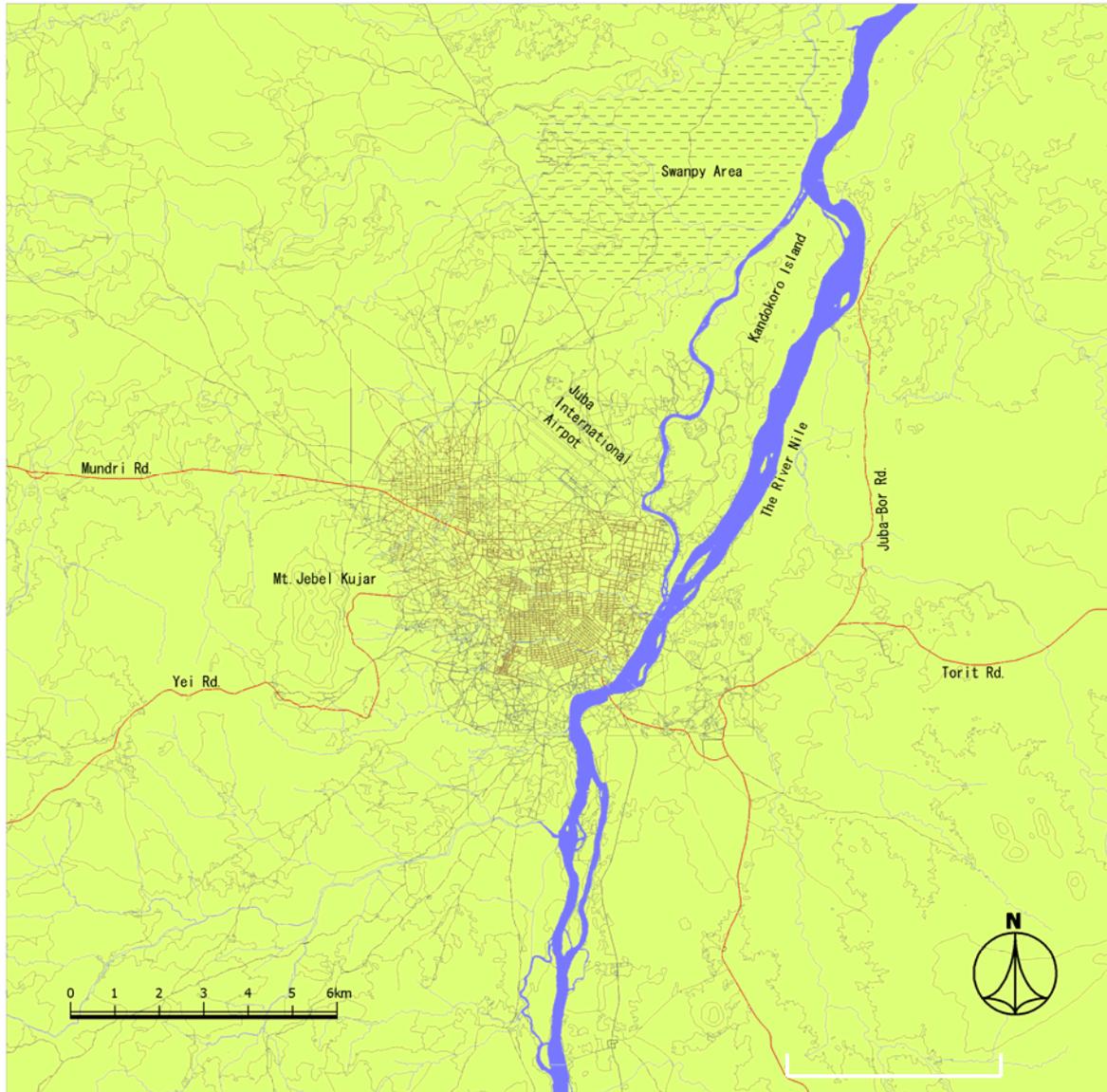
(4) Development Direction

The features of development by directions are summarized below.

Direction	Features of Development
To north	It is costly to develop against best land for agriculture and is unsatisfactory to prepare the terrain subject to flooding beyond the artificial barrier of airport.
To west	Urbanization costs for water and sewage systems would be high owing to topography and the hydro-geology of the area except for the areas along the trunk road to Mundri.
To south	Urbanization costs will be moderate because of the topography and the hydro-geology of the areas.
To east	The land is flood-prone and having agricultural potential with natural barrier of the River Nile.

In addition to above features, existing land use that are not easily modifiable and management capacity of administration are also considered for the urbanization.

The recommended directions for urbanization are those to northwest, south, and south-west.



Source: SPOT Satellite Image (31st Dec. 2005)

Figure 4.4-1 Topographic Feature of Juba and Surrounding Area

4.4.2 Distribution of Urban Functions

The basic zoning principles for the allocation of lands by land use and transport corridors as the spatial composition elements are the following.

(1) Commercial Area

The following principles of the distribution of commercial function in Juba Town area are considered.

- Exchange of information and capitals and transport of commodities are basically separated.
- Trading and business entities are allocated to the center of the town so that the merit of concentration can be fully utilized. Supplementary business districts will be allocated at the transport core in consideration of urban area expansion in the long term.
- Along the May St., government offices, commercial and business entities will be located together with the improvement of the road and public transport services.
- Business and commercial entities will be assigned harmoniously to the green area along the River Nile as a Green Complex. Some service and amusement facilities will be also included in this complex.
- The area along the route between old town and the Juba Airport has a large potential for business activities, therefore new business complex will be formed.
- As wholesale and distribution entities entail freight movement, they will be located at the regional transport network hub points and near the industrial estates for ease of freight movement linked to production together with inland depot.

(2) Industrial Area

Although the industrial activities in Juba Town area are underdeveloped at present, certain development is expected from now on because of the large demand for commodities prompted by the large population increase and strategic location of industries including oil related industries.

- Strategic key industries in the long horizon such as labor intensive industries and oil related industries will be located at the industrial estate near the regional transport corridor or nodal point. Riverfront industrial estate is also likely to be developed along with the development of the permanent river port.
- Modern light industries linked to production and living activities in town will be assigned to the areas along trunk roads and the periphery of the town area with good accessibility to the customers.

(3) Housing Area

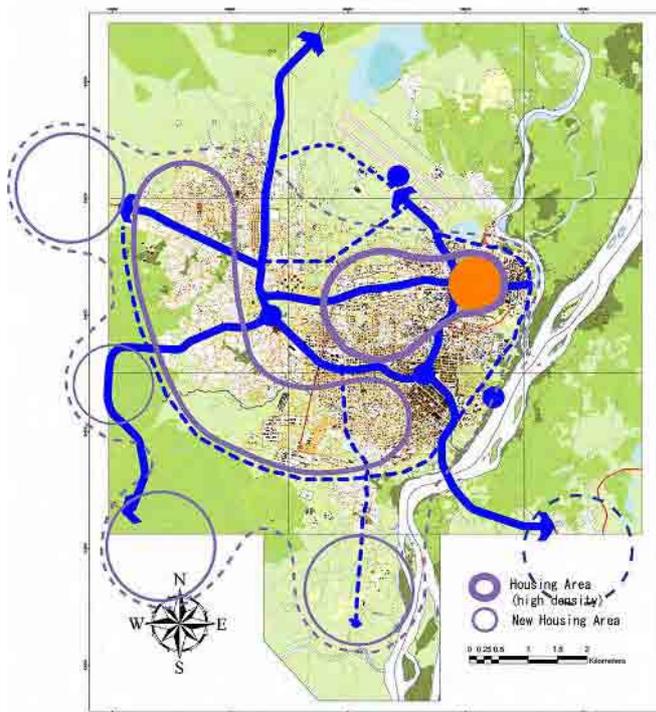
Rapid expansion of housing demand is already being experienced and is further expected to increase in Juba Town area basically resulting from the relocation of the capital and inflow of IDPs and refugees in addition to the natural population increase. The prompt development and arrangement of housing area to cope with such population increase is definitely required. As mentioned earlier, basically, extension of urban area outside the Town Boundary should be realized in accordance with the development direction already mentioned above. Also dense habitation should be pursued ensuring high social infrastructure standards.

(4) Farmland and Green Tracts of Land

- There are quite few or almost no officially designated parks or green tracts of lands in Juba Town area. Self-supportive farmlands are dispersedly located near the community zones in the outer area of Juba Town. In addition to the farms, orchards are located along the River Nile that provide a good scenery and recreation atmosphere.

The green tracts of land in Juba Town shall be sustained in principle and the envisaged locations should correspond to the urban structure.

Zoning plan and land use plan are discussed further in the following section.



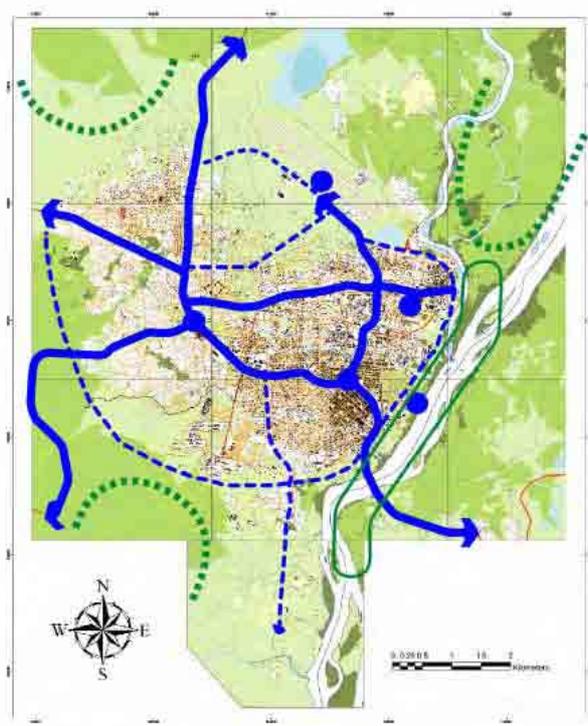
a) Housing Area



b) Commercial Area



c) Industrial Area



d) Green Area

Figure 4.4-2 Presumption of Urban Function Zoning

4.4.3 Land Use Plan

4.4.3.1 Residential Area

The future residential areas in Juba are planned to be classified as follows:

- a. Existing residential area
 - Informal residential area
 - Formal residential area
- b. New development area

(1) Informal Residential Area

Juba Town is composed of the 3 municipalities of Juba, Kator and Munuki. In Juba Town, almost 50 % of the existing residential areas are informal settlements, which are Drewhere Ssers Line, Tongping, Nyakama, Gusene, and Nakasongola in Juba, Lologo and Kassava in Kator, and Dasalam, Mauna, and Nyokuton in Munuki. In most of these informal settlements, basic social services such as water and sanitation, road network and public transport, and electricity are not provided appropriately. Therefore, it is proposed to reconstruct these informal areas by the introducing a land readjustment scheme. Figure 4.4-3 shows the basic concept of the land adjustment scheme, which is characterized by no-relocation of inhabitants and the provision of parks, playgrounds and other public facilities.

Figure 4.4-4 shows the informal residential area that is required to be reconstructed under land adjustment schemes.

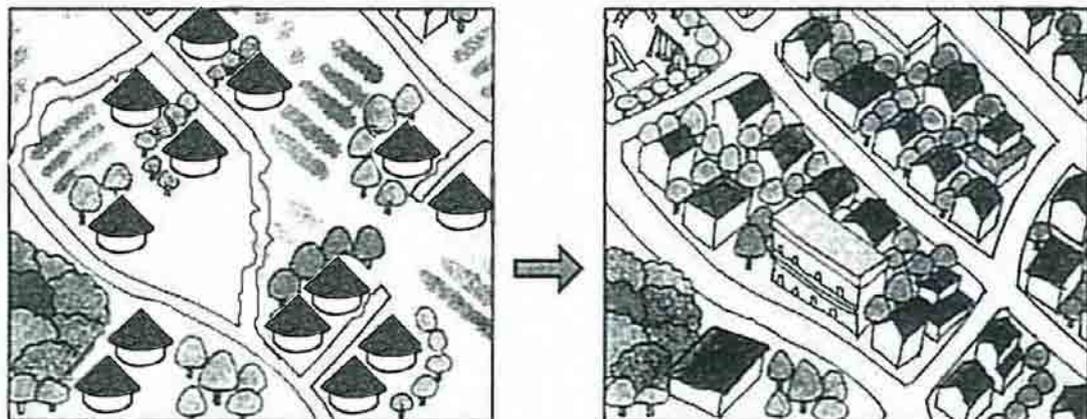


Figure 4.4-3 Land Readjustment Scheme

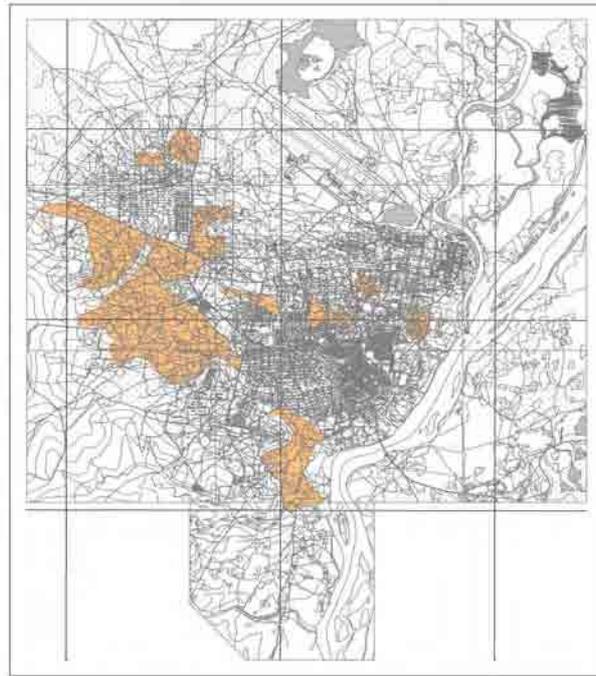


Figure 4.4-4 Informal Residential Areas to be Reconstructed

(2) Formal Residential Areas

The remaining 50 % of the existing residential areas are formal settlements, which are characterized by good provision of spaces and infrastructures. However, these residential areas are stagnated under very poor infrastructure conditions due to negligence of the maintenance activities for more than 20 years. The reconstruction of these areas will be principally promoted and supported by private sector participation.

However, rehabilitation of the physical infrastructure of district distributors and local roads shall be carried out as soon as possible in order to promote and enhance reconstruction of the formal residential area.

(3) New Settlement Area

New settlements will be mainly adopted for IDP's and returnees. It is proposed to be planned under livelihoods approach that could be described as follows:

- Strategy that they adopt to be self-supported,
- Capital asset that they possess to maintain those livelihood, and
- Their preferred outcomes in terms of their long-term settlement

In Juba, a new settlement is based on the standard parcel as presented in Figure 4.4-5 and Table 4.4-1. After discussions with the officials in the Ministry of Physical Infrastructure, the basic parcel size is selected as Class 2 (20m x 20m). The livelihood community model is formulated as shown in Figure 4.4-6 and Figure 4.4-7.

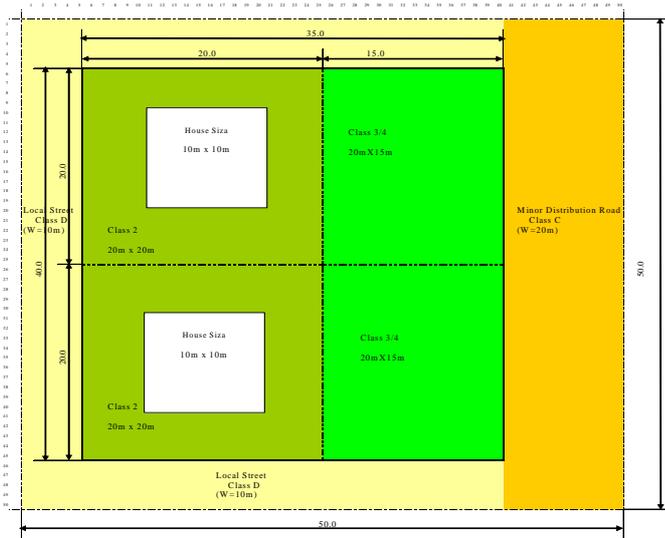


Figure 4.4-5 Parcel Size in Juba

Table 4.4-1 Typical Standards

Class	Size
House size	10m x 10m
Parcel Size	
Class 1	25m x 25m: Upper Class
Class 2	20m x 20m: Middle Class
Class 3 & 4	20m x 15m: Lower Class

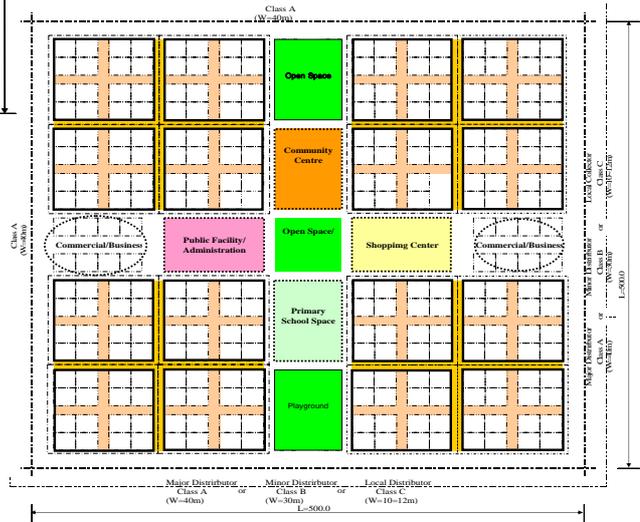


Figure 4.4-6 Basic Plan of Block (500m x 500m)

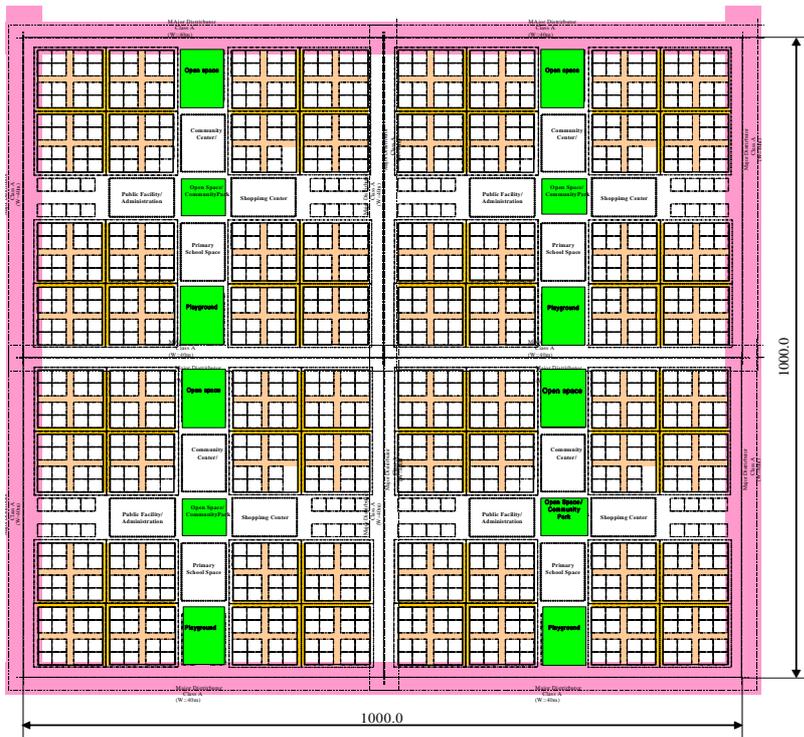


Figure 4.4-7 Basic Model of District for IDP's and Returnees
(Consisting of 4 Blocks as shown in Figure 4.4-6: 1km x 1km = 100 ha)

As a result of the comprehensive examinations of land availability and appropriateness, the area and location of the new settlements are selected as follows:

Table 4.4-2 Location and Area of New Settlement (See Figure 4.4-8 for location)

Name		Location	Area
1	North Bari New Settlement Area	North of Juba Town	250 ha
2	Munuki West New Settlement Area	West of Munuki	250 ha
3	Nyakoron South New Settlement Area	South of Nyakuron	250 ha
4	Lologo South New Settlement Area	South of Lologo Residential Development Area	450 ha
5	East Bank of the Nile River New settlement Area	East Bank of Nile River	110 ha

4.4.3.2 Central Business District

The Central Business District (CBD) is principally planned to serve not only Juba Area but also the whole South Sudan in order to provide imported daily foods, branded consumer goods, electrical appliances, and computer and its equipment. The present CBD is very small to serve future needs of commercial and business activities for the whole South Sudan. The future CBD will expand to the west along May Road to the Ministries Area. The area around the business district will accommodate most of the South Sudan Government functions, the Central Equatorial State Government functions, foreign missionaries, supermarkets, cinemas, and high grade commercial centers.

4.4.3.3 Other Commercial Areas

There are two (2) types of other commercial areas such as follows:

- Neighborhood commercial area
- District commercial area

(1) Neighborhood Commercial Area

The neighborhood commercial area is basically required to serve the neighborhood community to purchase daily food and consumer goods. Therefore, this commercial area should be provided within the community area.

As shown in the new settlement concept in Figure 4.4-9, the neighborhood commercial center will be located within a walking distance of 500 meters or less for inhabitants.

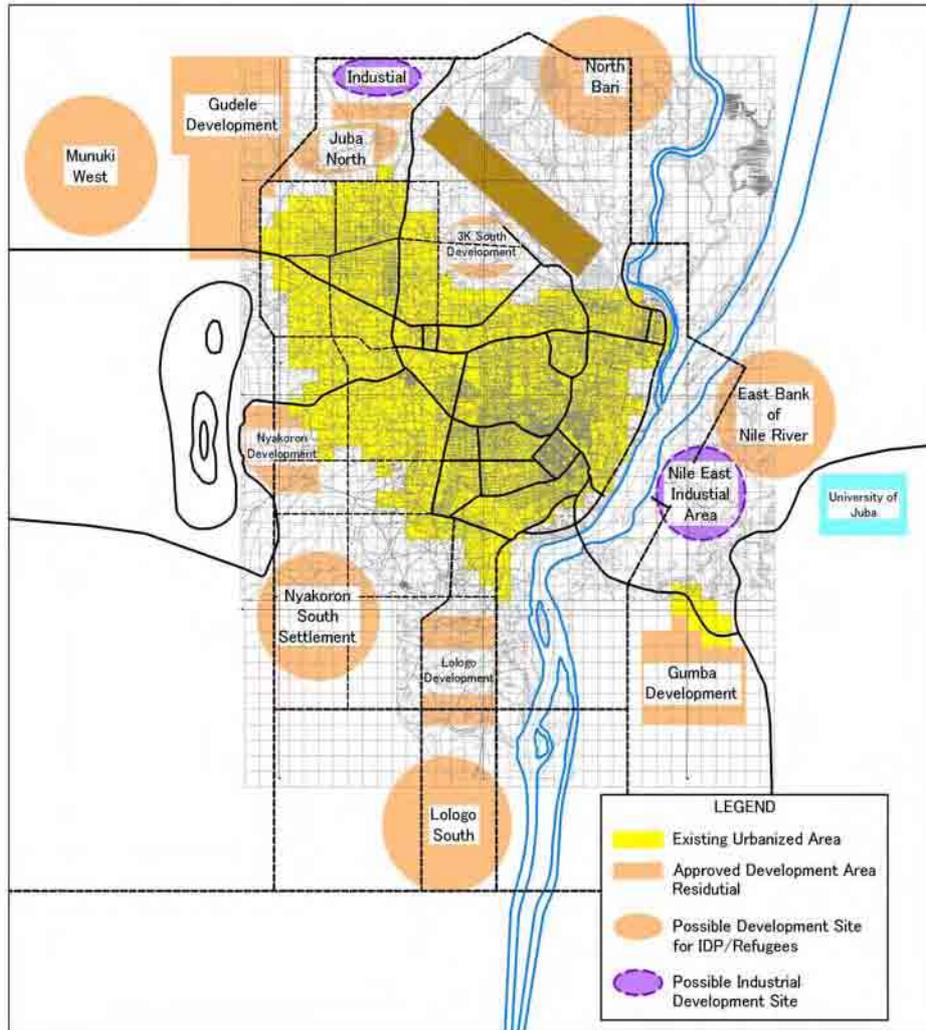


Figure 4.4-8 Location of New Settlement Areas

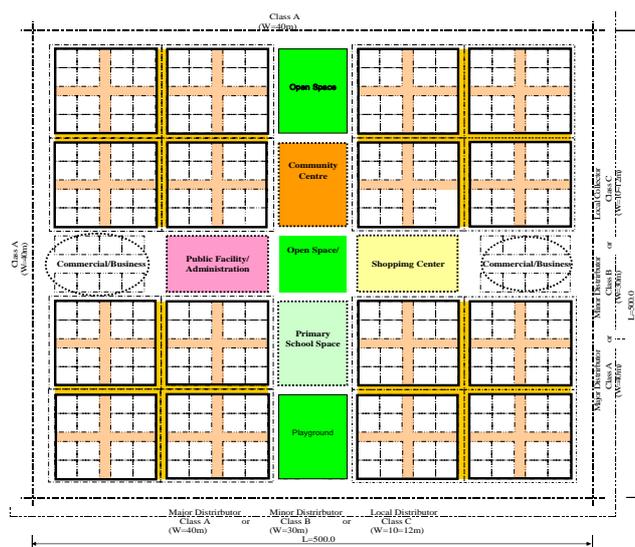


Figure 4.4-9 Concept of Neighborhood Commercial Center

(2) District Commercial Area

The district commercial area is principally provided for residents in the district area to purchase consumer goods, electrical goods, furnitures and family goods. The district commercial areas are principally provided as one place within each municipality, Juba Market in Juba, Konya Konya Market in Kator, and Customs Market in Munuki.

In future, the population in Juba is expected to increase to two (2) times of the present population and at the same time household income is also expected to increase more than two (2) times of the present one. As a result, the district commercial areas should be increased to for four (4) times of the present one.

The locations of these commercial areas are proposed for:

- Juba Market together with central business district
- Konya Konya Market
- Unity Street Corridor Market
- Nyakoron Market (Relocation of Customs Market)
- Commercial area in new settlement areas

4.4.3.4 Industrial Area

The industrial development objectives in South Sudan are identified as follows:

- 1) Contribute to the fulfillment of basic needs
 - Supply of essential consumer goods, input and means of production
 - Direct and indirect job creation
 - Development of micro and small industries
- 2) Import substitution industry development
- 3) Promote the development of labor intensive technologies
 - Development of human resources
 - Development of capacity for technological innovations

The type of industry is as follows:

- 1) Agro-processing industry
 - Mango, watermelon, pineapple, meat
- 2) Textile, clothing, shoe industries
 - Cotton textile, clothing manufacturing
- 3) Wood product, furniture, etc.
- 4) Small scale industries such as repair of vehicles and machineries

The allocation of the industrial area is planned considering the following;

- 1) New industries are to be located at the east of Nile River, where there are many vacant areas at present.
- 2) In the west of the airport, the heavy industrial area has been planned and approved. However, considering the approach of airplanes, it is recommended to convert it to light type industry area.
- 3) The small scale industry in the town area will be maintained at present level.

4.4.3.5 Institutional Areas

The institutional areas include the following facilities;

- 1) Primary, secondary, and tertiary schools
- 2) Hospitals, clinics and health center
- 3) Sports center, etc.

(1) Primary, Secondary and Tertiary Schools

A primary school should principally be located in each neighborhood community for easy access by school children. Therefore, a primary school should be provided within the community area.

As explained in the new settlement concept, the neighborhood commercial center will be located within 500-meters area of the residences.

Since Juba is the capital of South Sudan, higher educational facilities, such as university and vocational and/or polytechnic schools, will be required in future. Regarding Juba University, two campuses, which are Juba Campus and Nile River East Campus should be rehabilitated and reconstructed. The other vocational and/or polytechnic schools shall be allocated along May Road Corridor.

(2) Hospitals, Clinics and Health Centers

There are two (2) types of health care facilities in Juba.

- 1) Large scale health care facilities such as large scale hospital
- 2) Community-based health care facilities

Regarding the large scale hospital, the present commercial area of Customs Market shall be converted to a large scale hospital. As for the community-based health centers, they shall be reconstructed in each of the communities in Juba Area.

(3) Sports, and Cultural Center

There are two (2) types of sports facilities:

- 1) Large scale sports facilities as football stadium
- 2) District level and Community based sports fields

Regarding the large scale sports stadium, it is proposed to construct a new stadium where football games and athletic games can be played. The location of a new sports stadium is proposed at Gudele Development Area.

As for the district level sport centers, the present sports grounds in Juba shall be reconstructed, while the community-based sports and playgrounds shall be reconstructed in each of the communities in Juba Area.

4.4.3.6 Green Areas

To create a symbiotic town of the Juba Area, where the inhabitants could enjoy the greenery and water bodies in the close vicinity from their living quarters, green corridors along Nile River and several creeks to Nile River should be maintained and improved. These will serve as the eco-corridor of the city. Around the proposed new development areas, a belt of greenery will be created to serve as an eco-river that will protect the town from flooding in rainy season. The proposed green areas are in Figure 4.4-10.

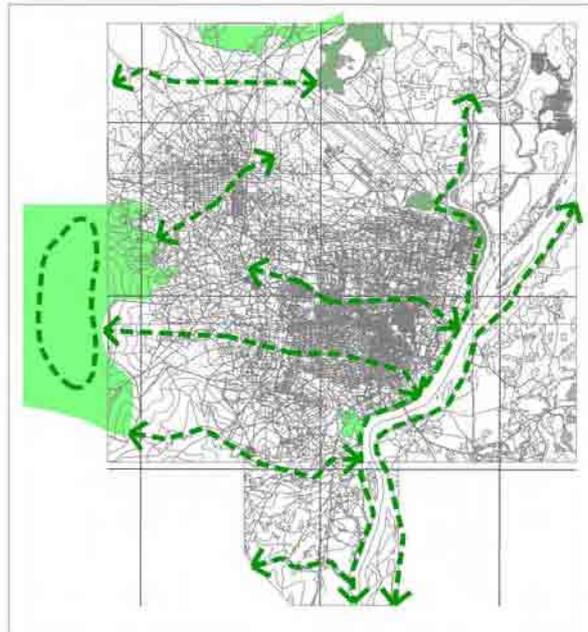


Figure 4.4-10 Proposed Green Areas

4.4.3.7 Proposed Land Use Plan

Based on the above-mentioned planning concepts and preliminary discussions made with Government Officials of GOSS and Sate Government, the proposed land use plan in 2015 is illustrated in Figure 4.4-11.

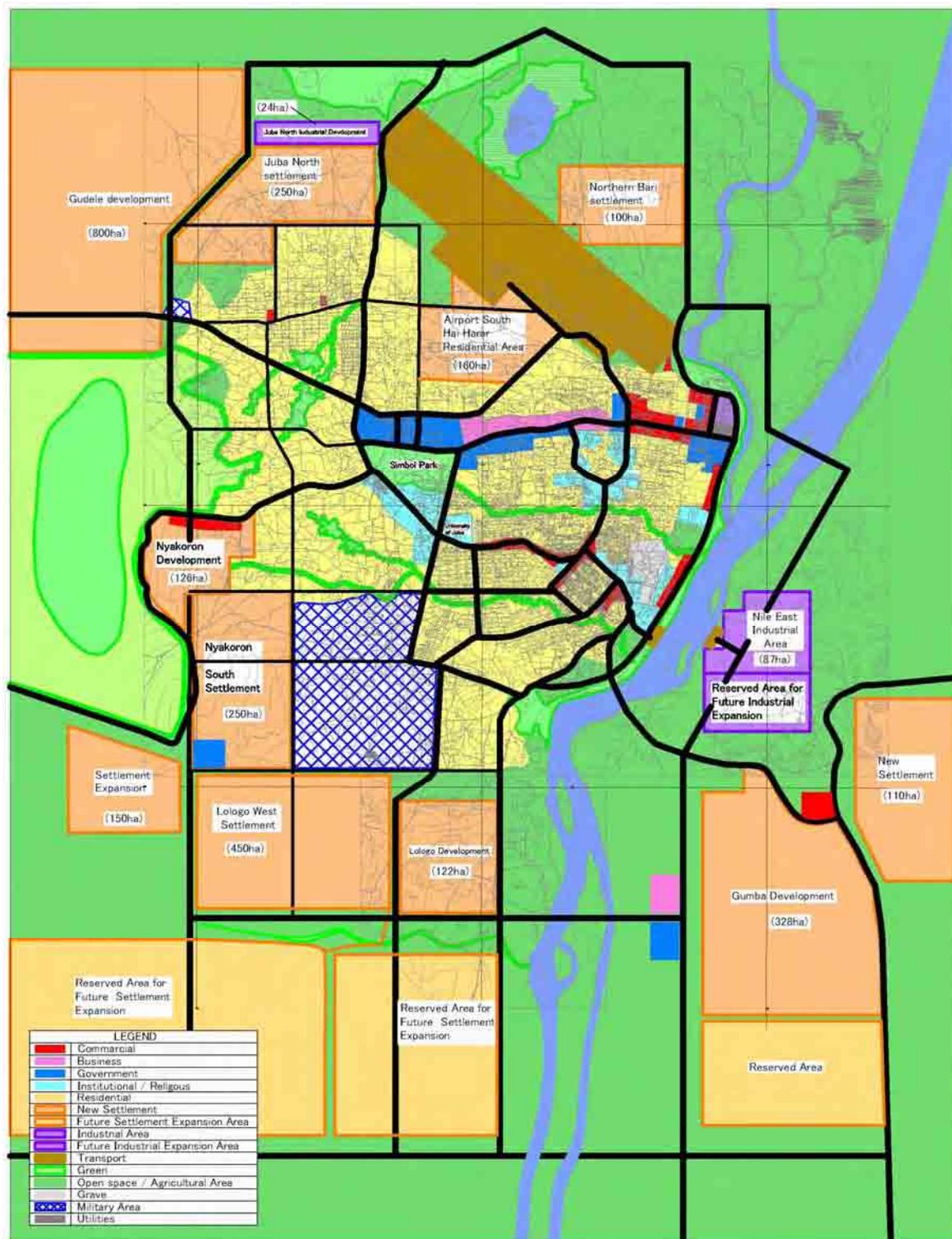


Figure 4.4-11 Land Use Plan in 2015 (Draft)

4.5 SOCIAL AND ENVIRONMENTAL CONSIDERATION

4.5.1 Environmental Management System in the Southern Sudan

4.5.1.1 Current Status of EIA Law and Relevant Projects

(1) Generals

The basic legislation pertaining to environmental issues in the Southern Sudan is of a sector-based character. Its greatest portion falls on the legal treatment of issues related to agriculture, forestry, fisheries, public health and animal resources. For instance, the Environmental Health Act of 1975, the Food Protection Act of 1975, the Wildlife Act of 1986, the Pesticide Act of 1974, the Seeds Act of 1990 and the Planning Act of 1974 represent all sector-based laws. A comprehensive environmental law has not been established yet.

The organization in charge of environmental issues in Southern Sudan is the Ministry of Environment, Wildlife Conservation and Tourism of the Government of Southern Sudan (GOSS). Certainly, the State of Central Equatoria counts on a Ministry of Environment; however, no branch or regional office has been established in Southern Sudan. Therefore, the Ministry of Environment of GOSS is the only authority in environmental matters in that area.

(2) EIA Legislation

The State of Central Equatoria

The EIA legislation in the Central Equatoria State is also essentially of a sector-based character. In this sense, for an example, the Environmental Health Act of 1975 confers power attributions for the implementation of pollution control in the Central Equatoria State to three different organs. The Payam Council plays a unique role in the conservation and improvement of the surrounding environment. The said council is given legally such a responsibility because the environmental degradation is largely considered as local.

The Government of Southern Sudan

The Government of Southern Sudan at the moment has not either drafted a law with the title of “Environmental Law” or elaborated a specific policy in the field. Indirectly, it has laid down a plan in the so-called “200 Days Action Plan” for the Government of Southern Sudan to be implemented in cooperation with USAID by the end of 2006.

(3) EIA Procedure

EIA represents an official evaluation whose objective is to measure the likely effect of a proposed policy, evaluate the influence of programmers' activities on the environment, and design and propose alternatives and methods to be adopted in order to protect the environment.

The EIA concept and included procedures apply from the moment of inception to operation, integrating as well the corresponding assessment analysis pertaining to the specific project.

The State of Central Equatoria

There is no current EIA procedure applicable in the Central Equatoria State. The only available system is integrated by the sector-based laws around the Environmental Health Laws of the 1975 Act.

The Government of Southern Sudan

The Government of Southern Sudan does not count, at the moment, on the said EIA procedure. In the near future, however, the corresponding EIA procedure shall be developed for the Ministry of Environment, Wildlife Conservation and Tourism in the Government of Southern Sudan. The laws stipulating the said EIA procedure shall constitute the guidelines for the entire project to be operated in the whole region in Southern Sudan.

(4) Roles and Responsibility of GOSS and State

The Ministry of Environment is to provide scientific information about the state of environment and the natural resource base of Southern Sudan and develop a national policy and legal framework in order to enhance environmental performance. The Ministry of Environment is also to develop better processes for environmental monitoring and implementation of "environmental impact assessments" on the occasion of any governmental, non-governmental or private sector projects. Furthermore, the Ministry is to implement the policies and laws for the protection of environment.

(5) JICA' Environmental and Social Consideration Guidelines

JICA's guidelines cover 31 items in social, natural and pollution areas. In particular, these guidelines indicate that announcement and discussion pertaining to the corresponding master plan is important for considering environmental aspects. To be more concrete, stakeholder meetings with relevant organizations should be held. In fact the Study Team held presentations for GOSS and Central Equatoria State, and exchanged opinions from the point of view of sustainable development considerations.

The outline of the corresponding procedure pertaining to the said guidelines is shown below:

Table 4.5-1 Outline of JICA's Environmental and Social Consideration Guideline

Stage	Items and Procedures
a) Preliminary Study	Check critical condition in sensitive areas, and confirm required EIA procedures in the GOSS
b) Master Plan	<ul style="list-style-type: none"> -Implementation of initial environmental examination (IEE) through simple site survey and literature survey -Grasp outline of master plans by sectors, such as transport, water supply, sanitation, power and public facilities -Implementation of preliminary environmental impact assessment through IEE (prediction of environmental impacts for main projects by sector in 2015) -Preparation of scoping report for full-scale EIA for each project by sector -Preparation of mitigation measures from the point of view of sustainable development -Discussion of above-mentioned pre-EIA, scoping report and proposed mitigation measures with relevant organizations, mainly the Ministry of Environment, Wildlife Conservation and Tourism
c) Feasibility Study	<ul style="list-style-type: none"> - Implementation of full-scale or small-scale EIA as follows through scoping report -Preparation mitigation measures and environmental management plan -Holding stakeholders meetings in the project site -Announcement of EIA report and receiving non-objection-certification (NOC) from relevant organizations and communities
d) Designing	<ul style="list-style-type: none"> - Revision of EIA report -Holding stakeholders meetings -Implementation of appropriate land acquisition and compensation measures
c) During Construction	<ul style="list-style-type: none"> -Implementation of environmental monitoring based on the environmental management plan -Holding periodical environmental meetings with relevant organizations and communities
d) Post Construction	<ul style="list-style-type: none"> -Environmental inspection by relevant organizations such as the Ministry of Environment -Implementation of environmental monitoring based on the environmental management plan and publication of an environmental monitoring report

(6) Relevant Environmental Projects Supported by Other Donors

GOSS, in cooperation with USAID, established the Southern Sudan National Environmental Assembly (SSNEA) and trained over 250 participants from all ministries in 2005.

The Ministry of Environment, in cooperation with USAID, is preparing a project for establishing an environmental policy by the end of 2006. The Ministry of Environment will prepare an environmental law including EIA law and environmental policy guidelines. On the other hand, in relation to logistics and capacity building, United Nations Environment

Programme (UNEP) has committed itself with GOSS to develop such concepts during 2006. An outline of the current environmental projects is shown in the following table:

Table 4.5-2 Environmental Projects Supported by Other Donors

Project Area	Donor	Period	Contents
EIA Training	USAID	2005	EIA training for over 250 participants from all ministries
Policy Making	USAID	Jul. 2006 -Dec. 2006	Environmental policy
Post War Environmental Assessment of Southern Sudan	UNEP	2006	Capacity building, establishment of an environmental information center and preparation of instruments (PC, printer, monitoring instruments and other)

4.5.1.2 The Land Acquisition / Resettlement Law and Procedure

(1) The State of Central Equatoria

In the Central Equatoria State, individuals can acquire land after having settled in that particular area for about 20 years. Such individuals have the right to obtain a residential certificate and can apply for a land lease in that town, upon fulfilling the conditions needed. One of these conditions is to be a Sudanese citizen, have developed the land area, and have resided in that place for over 6 months.

The procedure for the acquisition of land for resettlement is very simple. Upon applying to the Ministry of Infrastructure and Land of the State, the concerned authority in the Ministry evaluates whether the required conditions are fulfilled by the applicant in order to decide the granting of the authorization for land acquisition.

(2) The Government of Southern Sudan

The process for land acquisition in the Government of Southern Sudan is complex though. The CPA stipulates that the land belongs to the Community where the land in question is located. For this, the government of the Southern Sudan is in a position to be able to resettle some people, if considered it as opportune. The State where these people come from should be considered to ease the process and explain the reason of the resettlement in that particular state. If such individuals are government employees, GOSS shall then apply to the government of Central Equatoria to consider them in the resettlement program.

4.5.2 Social and Environmental Characteristics of the Study Area

4.5.2.1 Objectives and Methodology for the IEE

(1) Objectives

Initial Environmental Examination (IEE) means a study that includes prediction and assessment of environmental impacts and preparation of mitigation measures on the basis of conclusions obtained from literature data and simple field surveys.

Objectives for the IEE are as follows:

- Before conducting the environmental and social consideration activities in compliance with the Government of Southern Sudan’s EIA law, which is under the preparation by USAID, the proponent should have a clear picture of the current environmental status in the Juba region in order to predict eventual impacts.
- The proponent shall illustrate the required mitigation measures based on the IEE results, or adopt alternatives including the rejection of the project.
- The proponent should consider environmental and social baseline survey through this study report based on the IEE.

(2) Target Items for the IEE

IEE has been carried out based on the conclusions obtained from exploratory and literature survey. Items for the IEE may be as mentioned below in Table 4.5-3. These items include those described in the Government of Southern Sudan’s EIA Guidelines.

Table 4.5-3 IEE Items

Items	
Social Environment	1. Involuntary resettlement 2. Local economy, employment and livelihood 3. Land use and local resources utilization 4. Existing social infrastructures and services 5. Local communities 6. Benefit and damage misdistribution 7. Gender 8. Children’s rights 9. Cultural heritage 10. Local conflicts of interests 11. Public sanitation 12. Infectious diseases such as HIV/AIDS 13. Water usage and rights 14. Traffic accidents <div style="text-align: right;">- to be continued -</div>

Items	
Natural Environment	15. Global warming 16. Biota and ecosystems 17. Geographical features 18. Soil erosion 19. Underground water 20. Hydrological situation 21. Coastal zone (mangroves, coral reefs, tidal flats, etc.) 22. Climate 23. Landscape
Pollution	24. Air pollution 25. Water pollution 26. Soil contamination 27. Waste 28. Noise and vibration 29. Ground subsidence 30. Offensive odors 31. Bottom sediment in sea and rivers

4.5.2.2 Current Environment Status and Issues

(1) Outline of the IEE

The JICA Study Team and environmental specialists in the Ministry of Environment, Wildlife Conservation and Tourism of the Government of Southern Sudan have carried out the corresponding IEE.

(2) Background of Juba Town

Juba Town was established in 1930 as the Headquarters of Mongalla Province. In 1945, it became the capital of Equatoria Province; in 1972, the capital of the Southern Region; in 1983, the capital of Equatoria Region; in 1991, the capital of Equatoria State; and in 1994, Juba Town became the capital of Bahr el Jebel State. In 2006 Bahr el Jebel State was renamed as Central Equatoria State and Juba became the capital of both the State and Southern Sudan. The population of Juba Town reached about 250,000 as a result of urban-ward migration initiated by a combination of various factors. With the influx of IDPs and returnees, the population of Juba is likely to reach soon the level of 500,000. Logically, these people need infrastructures and land to settle down.

(3) Current Status and Issues

Most of the documents and data regarding environmental considerations have been lost during the war in Juba Town. Therefore, quantitative data is not existent at the moment. As mentioned in “Table 4.5-2 Environmental Projects Supported by Other Donors,” GOSS is preparing an information center for the analysis of the current environmental situation. The above-mentioned current environmental status is prepared by simple site survey and interviews with relevant organizations.

Current Status through the IEE is as follows:

Involuntary resettlement

This type of resettlement occurs when residents tend to have settled in an illegal residential quarter or in a slum, either within or out of the town. The government intends to relocate such individuals in order to implement its road or demarcation plans. Occasionally, even a whole neighborhood located in an area allotted to specific projects may be moved. Hence the resettlement of such individuals may be considered as involuntary, and departmental measures concerning housing and demarcation of new sites are placed under the responsibility of the government.

Local economy, employment and livelihood

Juba is a cosmopolitan town located in the center of Equatoria. Living standards have been improving day after day since the end of the war that affected the region. Although security measures seem to have been put in place, the local economy is not yet improving, as it is deprived of self-employment initiatives undertaken by necessary microeconomic entities. As a result, the general economic performance in the town leaves much to be desired.

The socio-economic status of the town is very low in all of aspects, even when considering the large size of families, the low income of households, or the low level of health education. The main economic activity visible in Juba Town is the sale and purchase of goods around wholesalers and retailers in the urban small markets.

The majority of the people work as street vendors, porters, artisans and peasants. Some are self-employed active in small trading activities that contributes towards the development of the employment sector. The government employees at the State level represent about 40% of the population, without taking into consideration the armed forces and the students.

Land use and local resources utilization

The land use, and other local resources use, is based mainly on the use of the communal grazing area and the water in the River Nile. However, the cattle cannot produce enough milk because of the low level of the pastures of the communal grazing area. As this communal resource does not belong to any individual proprietors, it is left unmanaged.

The water present in the Study Area is also affected by pollution, as all the solid waste from residential areas is directly disposed into the River Nile.

Social infrastructure and local decision-making institutions

Markets, schools, prison, police, hospitals, churches, mosques, roads and government offices constitute the social infrastructures of Juba Town. In return, the judiciary, county councils and the councils of ministers represent the local decision making institutions of the city.

Local communities

The relationship among local communities in Juba is positive, as these communities have been sharing their happiness and sorrows through long bad times. No particular anti-social feeling among the said groups is perceived today.

The people living in squatter areas do it against their wish, forced by the circumstances to lead that type of unfavorable life. As a result of the war, those people completely lost all their properties. They have nothing to count on to run their own lives.

Internally Displaced People (IDP), as well as the returned soldiers, may soon pose a problem, as the town has not prepared any plan for their resettlement due to the presence of the Lord Resistance Army (LRA), which renders the said resettlement of IDP difficult. As long as they are assisted by their own families, returned soldiers will not represent any fundamental issue for the communities. Gathered in isolated groups with no control in their behavior though, they may imply a serious trouble for other community members.

In return, the expected influx of IDP and refugees back to Juba is expected to increase likely the production of resources such as agriculture products, grazing land building materials, and fuel wood.

Benefit and damage misdistribution

The benefit to be obtained from land distribution is the new possibility for land lease or the allotment of land in that particular area within the town. Staying in a squatter area is of benefit to their occupants because, when the area is requested for land use practice one day, economic and other compensation will be given to them by the government in order to construct in a new building zone.

Gender

Gender seems not to be a main issue in Juba Town. According to the results obtained from some interviews, housewives and unmarried women appear to understand and accept that different roles and duties are to be played by members of both sexes.

Children's rights

Children's rights seemingly do not constitute a main issue in Juba Town.

Cultural heritage

The best-known cultural heritage in Juba Town is the rock called "Pita" in Juba na Bari. The community of Juba na Bari claims to depend spiritually on this rock for the protection of its members during difficult times. Community members perform their traditional rituals before this rock in request of good harvest and rains. Furthermore, there is a forest in Kworijik Luri called "Yubo na ko sabur," which is apparently considered by all community members as "a forest that needs to be respected because the person who decides to cut its trees will die". Additionally, the so-called "guri" at Rajaf, Kolia is also to be respected. Finally, cemeteries are also part of the cultural heritage of the town.

Local conflicts of interests

Conflicts of interest in the local area turn around the use of land. The government wanted to control the land that, according to the Comprehensive Peace Agreement (CPA), in fact belongs to the communities. It is stipulated in the said CPA that, if the government needs certain land for any developmental purpose, the specific request is to be formulated to the concerned community, but never for just individual projects. Conflicts occur on certain occasions when the governments refuse to contact the concerned stakeholders and these decide in their common council meetings another purpose for that particular land.

Public sanitation

Despite improvements in the service delivery in Juba Town, there is not yet public sanitation in common places. Previous initiatives to improve this situation failed, which created a major problem for guaranteeing the maintenance of safe drinking water. Waterborne diseases are common and constitute the major cause of morbidity and mortality in the area. Most of the people practice traditional opened defecation in the fields, open spaces and, sometimes, near the public market, as some individuals sleep there.

In Juba, private household latrines are limited. Open defecation is a general practice. Not only this, the town even does not own any conservancy car to take the solid and liquid waste and bring it to the dumping site outside the town at Amadi along the Yei Road.

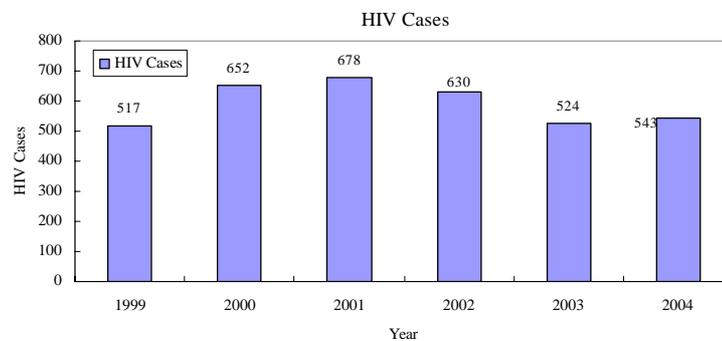
Additionally, the impact of effluents from toilets is being absorbed into the underground zones and the boreholes. In fact, one third of the boreholes are already polluted. All in all, pollution of shallow aquifers in Juba represents a major threat to the sustainability of drinking water supplies in many residential areas of Juba Town. The threat is particularly high because

the hydro-geological conditions permit a rapid flow of contaminated water into aquifers and wells that taps them.

Infectious diseases such as HIV/AIDS

This disease is observed frequently in Juba Town because of the open character of this city facing to neighboring countries such as the Democratic Republic of Congo, Uganda and Kenya. The town's socio-economic conditions also increase the frequency of this disease.

Now that peace has been declared, many bars and lodges in which people suffering from HIV/AIDS interact with other locals have opened in Juba. However, only around 500 cases are reported in the whole Sudan every year, according to the Statistical Yearbook for the Year 2004.



Source: Statistical Yearbook for the Year 2004

Figure 4.5-1 HIV Cases for the 1998 – 2004 Years

Water usage and rights

In Juba, as water is an abundant resource, all people may make use of it. Anybody who wishes to take water for land use or any other purpose is allowed without receiving any particular questions whatsoever. Community members recognize that water is a free gift from God that they are allowed to use freely. Anybody has the right to bathe or wash his clothes in the river.

Traffic accidents

Traffic accidents are very frequent in Juba Town because of the poor condition of roads, the generalized driving under the influence of alcohol, and the presence of untrained drivers coming from Yei and other areas along the Juba Town.

Global warming

The phenomenon of global warming has not particularly observed here.

Biota and ecosystems

Big trees and shrubs proper of the savanna area represent mainly the vegetation of this area. According to Sudan's vegetation map, the Juba area constitutes an "Edaphic grassland mosaics with trees" vegetation community. More than 10 years ago, this area was a rich forest. However, during the wartime, the people cut down all big trees to provide with fuel wood for cooking, which caused

the destruction of Juba's ecosystem. This also caused the moving away of small wildlife including birds that were not specifically protected at that time. Some of the medicinal trees were also lost by being cut as firewood.

Geographical features

Juba Town is located at between 4 and 5 degrees latitude north and the 31 degrees 30 minutes and 31 degrees 45 minutes longitude east. It is on the west bank of the River Nile on predominantly rocky ground that is raised slightly above the flood plain at about 450 to 540 meters above the sea level.

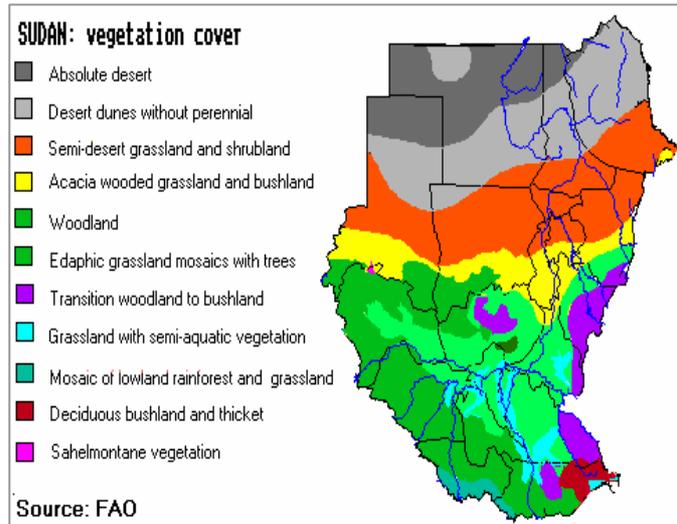


Figure 4.5-2 Vegetation Map of Sudan

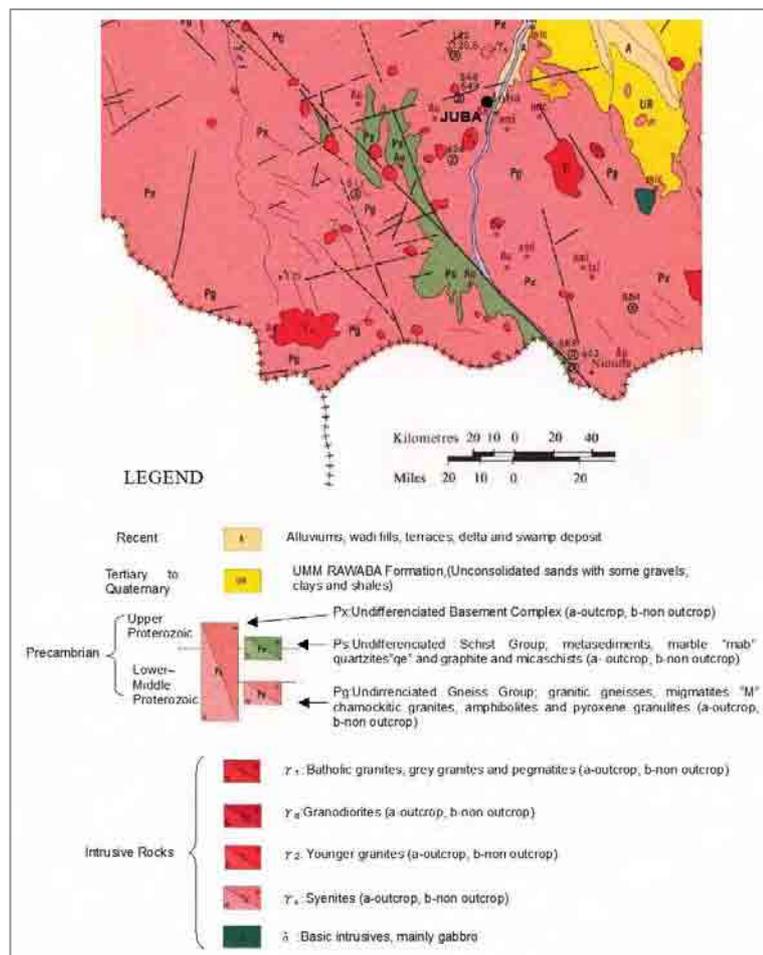


Figure 4.5-3 Geological Map in Juba and Surrounding Area

Soil erosion

The issue of soil erosion is a very serious one in Juba Town. The topsoil is lost due to erosion, exposing the outcrop and affecting negatively any favorable cultivation in the town, which was not the case 20 years ago.

Underground water

The groundwater level in Juba Town is generally found at 5-6 meters below the ground surface, and it is inferred to flow gently towards the north because of the local topography. Therefore, Juba has good amount of underground water in the shallow aquifers. The thickness of these deposits can reach several tens of meters. Although the horizontal and vertical extent of alluvial deposits is very limited, their hydro-geological importance is usually very high. The water quality in these aquifers is excellent. In some residential areas like Munuki water table is at a shallow depth less than 15 meters to ground surface, without reaching the weathered upper base rock zone.

Hydrological situation

Juba Town is lying along the River Nile, and some streams are inflowing from Juba Town to the Nile, such as Khorbou and Labulyet. Existence of some streams means that several small basins exist in the Juba Town. All streams do not have steady surface water without rainfall. However, those streams may come rushing down in a torrent after heavy rain. Mainstreams and their basins are shown in the figure below.

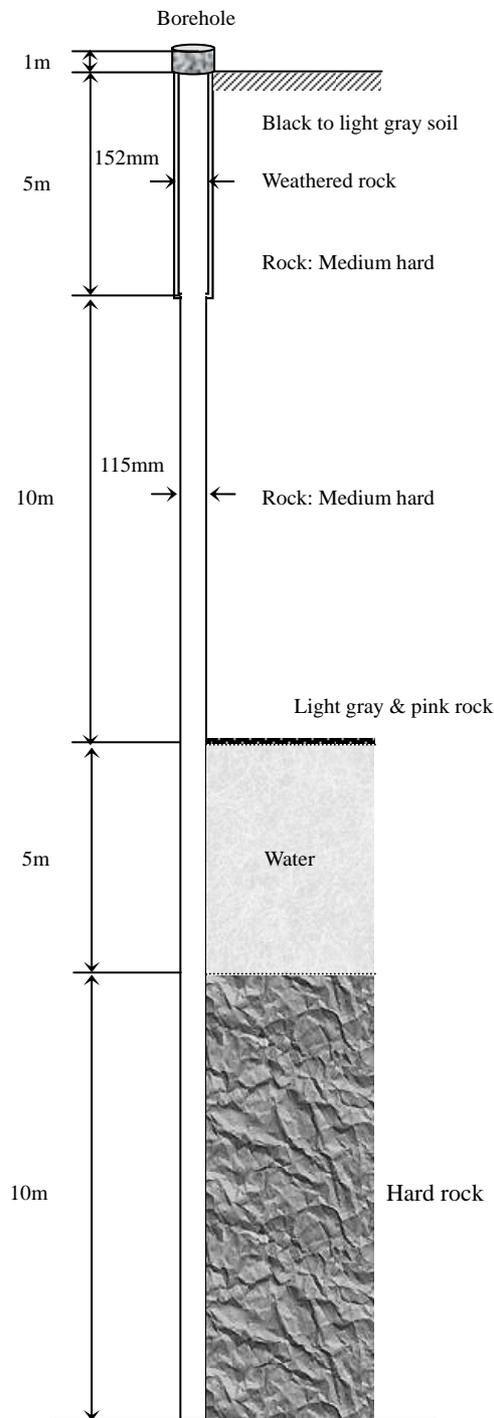


Figure 4.5-4 Hydraulic Condition in Munuki

Data source: Urban Water Corporation
 Data borehole drilled 2-3/9/2002
 State water level 4.9m
 Yield approximately 3,000 l/hr
 Borehole depth – 30m

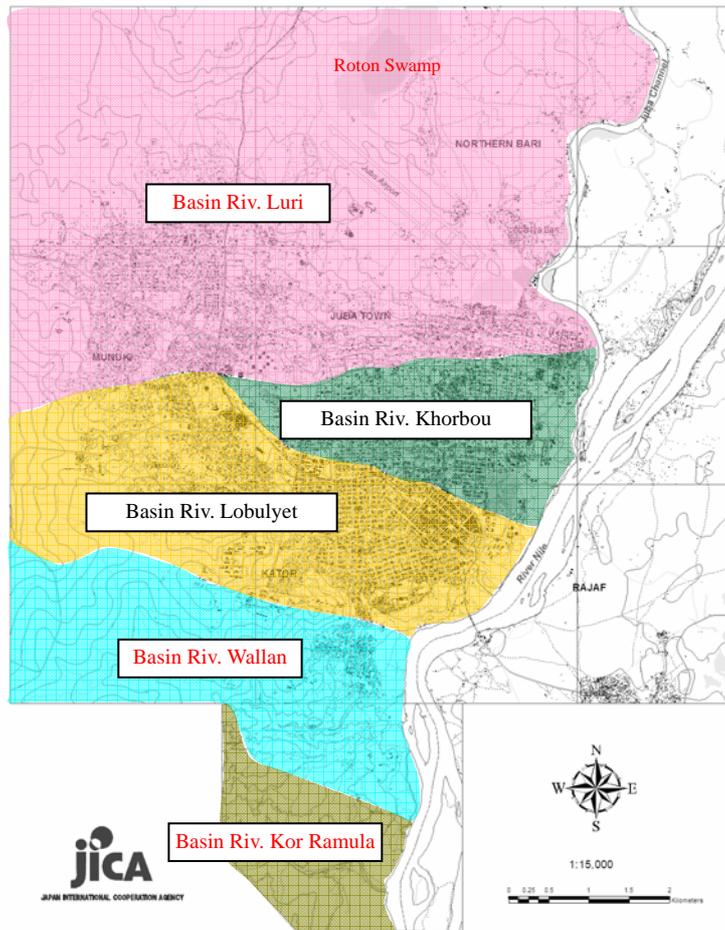


Figure 4.5-5 River Basins in Juba

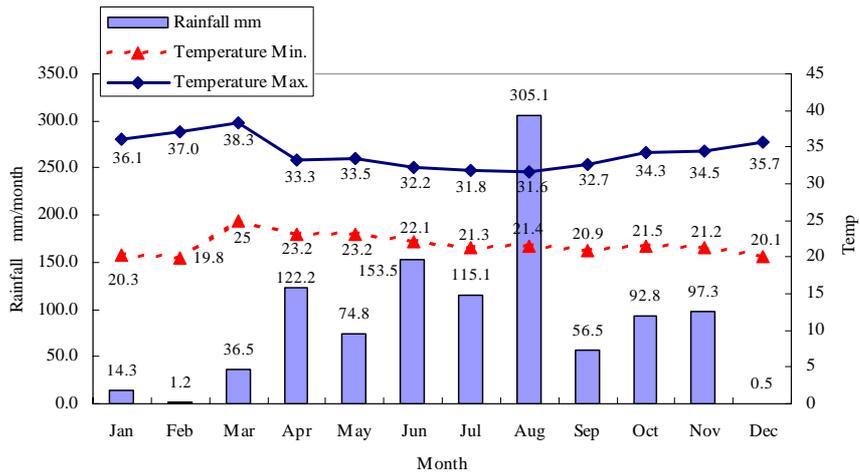
21 Coastal zone (mangroves, coral reefs, tidal flats, etc.)

There is neither coastal zone nor sensitive habitat in the river.

22 Climate

Climatologically there are two main seasons; wet and dry, with the mean annual minimum and maximum temperatures being 19.8° C and 38.3°C, respectively, in 2004.

The whole rhythm of physical life in the area depends on the rainfall and its distribution over the year. The rainy months are from April to October, while the volume of rain mounts rapidly in the period, attains its maximum between July and August, and rapidly diminishes in October. Concerning rainfall, Juba has a yearly total of 1,000 mm, while during the wet season the rainfall amount ranged between 75-305mm/month in 2004.



Data source: Statistical Year Book for The Year 2004 / Khartoum 2005

Figure 4.5-6 Monthly Average Temperature and Precipitation

23 Landscape

The common landscape in Juba Town is categorized into three or four types: An urban area in the center of Juba Town; a surrounding agricultural area along the Tukul house, the River Nile and its riverbank; and a plain and hilly area in the western area of Munuki Payam and the southern area of Kator Payam. The Nyarkeniyi (Jebel Lodu) to the north, Krok (Jebel Kujur) and Nyarjua to the west, Logwek (Rejaf) and Longe to the south, and Bilinyang and Luluriet hills to the east give shape of conspicuous hilly landscape.



Hilly Area along the Yei Road in Munuki



Agricultural Area in suburb of Juba Town



River Nile and bank area around port



Urban Area in Juba Town

24 Air pollution

The only pollutants in the air are the dust particles blown by the wind, and smoke in the dry season from the burning of grass in the outskirts. It seems that the busiest road in terms of traffic volume is the Juba Town Road. Its traffic is less than 7,000 vehicles for 12 hours in daytime though. Therefore, it should be enjoying a relatively clean air quality at the moment.

25 Water pollution

Water pollution in Juba Town originates mainly from domestic waste and open defecation along streambeds. These wastes are directly carried into the river and pollute its water. In the case of underground water, the latrines have polluted about one third of the boreholes in the Munuki residential area and also in some parts of Juba Town. Such discharged water contains fecal coliform bacillus, which is cause of waterborne diseases such as cholera, amebic dysentery, hepatitis and others. This is especially so because inhabitants are using the water from the River Nile and existing bore holes for drinking and cooking.

26 Soil contamination

There are no specific findings available about soil contamination in Juba Town at the moment.

27 Solid waste

Generally speaking, per-capita volume of solid waste in Sudan is approximately 1kg/day. However, it seems that it is in fact less than 0.5kg/day since industrial and commercial activities are quite limited today. There is no waste collection system in Juba Town at the moment.

Major components of household waste are natural garbage, plastic bags and empty plastic bottles. Such solid waste is spreading over open spaces near communities and dry riverbeds, and is washed away into the River Nile.

Industrial solid waste is produced mainly by restaurants, campsites and markets, and collected by private garbage collection trucks that transport it to designated or un-designated dumping sites in Amadi area, Munuki Payam. The said industrial waste is mainly composed of general garbage and construction waste.

It is to be underlined that there are few waste pickers in the dumping sites available, which means that the recycle system does not exist yet in Juba Town.

28 Noise and vibration

Noise and vibration levels are not high in the Study Area and come only from big generators and loud speakers. It appears that the road with a highest traffic level is the Juba Town Road, with likely less than 1,000 vehicles per 12 hours at daytime. Its sound level should be less than 65dB(A).

²⁹ Ground subsidence

The groundwater subsidence is not perceptible in Juba Town because there is no pumping up of large volumes of water from the underground. Further, most of water resources come from the River Nile.

³⁰ Offensive odors

There is a reduced level of offensive odors perceptible at the moment.

4.5.3 Social and Environmental Considerations in Formulation of Infrastructure Development Plan

4.5.3.1 Outline of Development Plan by Sectors

This Study is covering transport, water supply, sanitation, power and public facilities, as well as other complementary projects to follow. In relation to transportation systems, plans for road networks, river ports, airports and railway stations have been formulated in Chapter 5. In connection with water supply systems, an intake water and treatment plant is planned in Lologo quarter, Kator Payam upstream of the River Nile in Juba Town. Taking into consideration sanitation issues, a landfill site is planned in the same location as the existing dumping site, and a sewage plant is located in the northern area of Juba Airport along the River Nile. With regard to power sector systems, small power generation systems will be installed before the construction of a hydraulic power generation system that will cover all the southern part of Sudan fifteen years later. Details on these issues and their corresponding public facilities are mentioned in Chapter 5. In addition, in connection with public facility systems, building construction activities will not likely result in any serious impact. Hence prediction of environmental impacts concerning public facilities has not become an issue selected here.

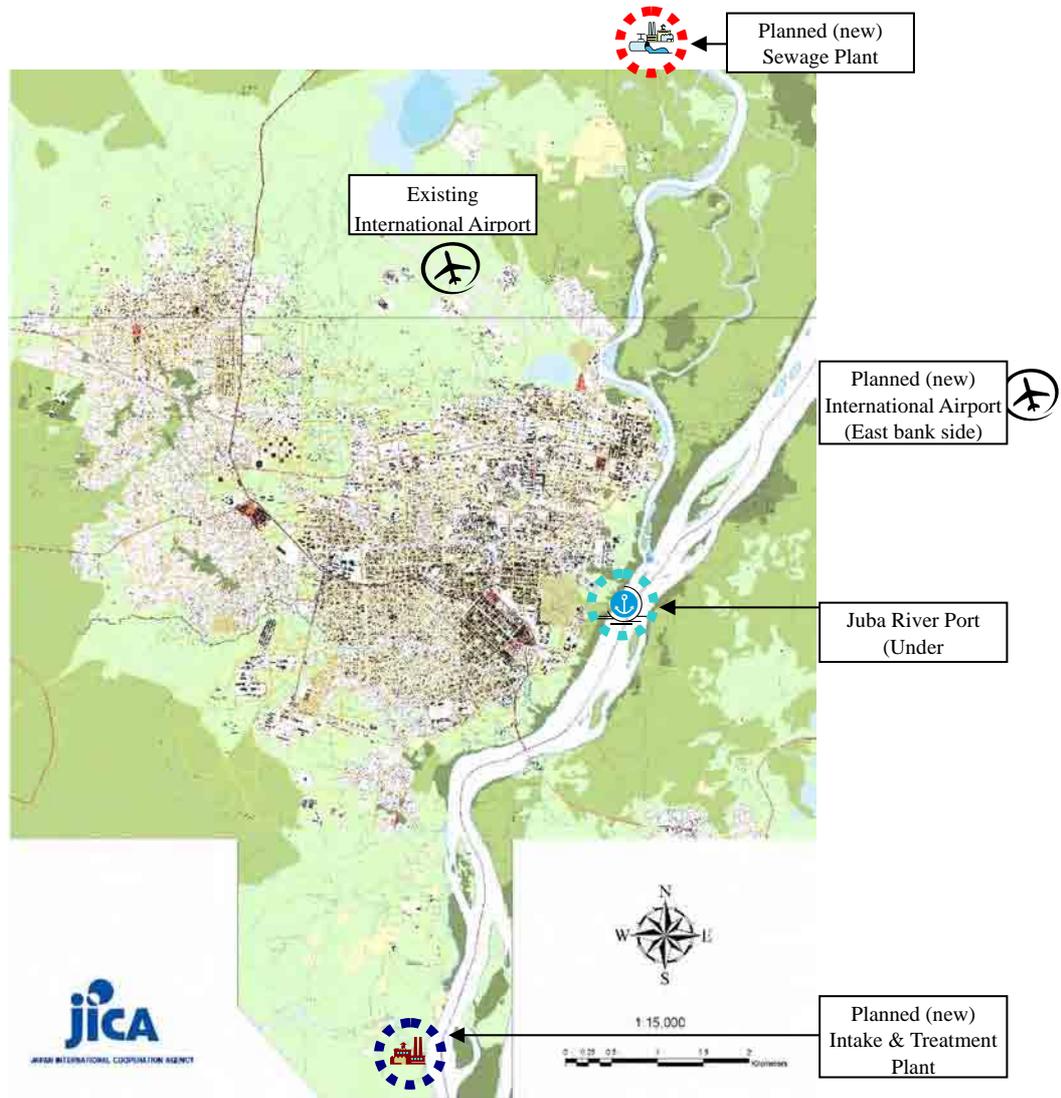


Figure 4.5-7 Location of Planned Major Facilities and Infrastructure

4.5.3.2 Predicted Major Environmental and Social Impacts by Areas

In the master plan mentioned above, the activities pertaining to each sector are not yet specified. However, a preliminary environmental impact assessment is always to be carried out in connection with the Strategic Environmental Assessment (SEA). This pre-EIA avoids any critical adverse impacts in the upstream stage of the plan, while serving to prepare an effective and environment-friendly plan.

Based on general transport, water supply, sanitation and power sector-related activities, the preliminary environmental impact assessments by sectors appearing below were conducted. Such activities do not pose any serious negative impact on public facilities, for which this issues is not considered as a target sector for Pre-EIA.

(1) Predicted Major Impacts by Sectors

The outline of major predicted positive and negative impacts by sectors are as follows:

Table 4.5-4 Outline of Predicted Impacts for Transport Sector (Mainly Road Projects)

	Items	Rating	Predicted Impacts
Social Environment	1. Involuntary resettlement	B	The road rehabilitation project implying the expansion of current roads or the construction of new ones may provoke involuntary resettlement against inhabitants living along the existing road. Especially adverse impact should be significant in squatter areas located in Juba commercial areas, cinema district, MTC, Tongping, Jebel Nyoka, Game, Lologo, Manuna, and Nyokuron, 1 st Class.
	2. Local economy, employment and livelihood	E	Transport public works will create employment, and most of workers will be hired in Juba Town. Furthermore, their consumption will take place in the same residential area. Increase of transport infrastructure will support their livelihood basically. Hence this development plan and other complementary relevant projects will influence positively all community members.
	3. Land use and local resources utilization	D	The road rehabilitation project implying the expansion of current roads or the construction of new ones may cut farm production of potatoes and maize along the existing road.
	4. Existing social infrastructures and services	D	Water supply pipes are found beside the main and collector road, and religious facilities and cemeteries are also located along the existing road. The temporary campsite area has the vastest tomb, and one of the biggest Catholic church St. Teraja is located in the Kator quarter and All St. Aglika Catholic church is located in the Missia quarter. The school is also located along the road. The road rehabilitation project implying the expansion of current roads or the construction of new ones may affect negatively the said infrastructures and services.
	5. Local communities	B	Juba Town is organized into 3 Payams and 40 quarters. As it is mentioned in Chapter "1. Involuntary Resettlement," squatter areas occupied by IDP can be found in some quarters. The road rehabilitation project implying the expansion of current roads or the construction of new ones may provoke involuntary resettlements, because residence of IDP is limited in Juba Town.
	6. Benefit and damage misdistribution	E	Transport public works will create employment, and most of workers will be hired in Juba Town. Furthermore, their consumption will take place in the Juba Town. Hence such projects will influence positively all community members. Traveling cost and time will be reduced, and such benefits will be distributed fairly.
	7. Gender	D	Few activities to provoke adverse impact may be observed.
	8. Children's rights	D	Few activities to provoke adverse impact may be observed.
	9. Cultural heritage	D	Although the former president tomb monument is located in the ministry complex, there is no world heritage or national monument in Juba Town.
	10. Local conflicts of interests	D	Juba Town is organized into 3 Payams and 40 quarters. As it is mentioned in Chapter "1. Involuntary Resettlement," squatter areas occupied by IDP can be found in some quarters. The benefit of transport projects will be distributed fairly to all inhabitants in Juba. Hence it is predicted that local conflicts will not occur among local communities.
	11. Public sanitation	E	Generally road rehabilitation will promote social infrastructure development such as water supply and sewage pipe, therefore transport projects will give positive impacts.
	12. Infectious diseases such as HIV/AIDS	B	While transport projects will create jobs, prostitution is likely to increase, which may facilitate contacts of HIV/AIDS-infected people and workers and the spread of STD and other infectious diseases.
	13. Water usage and rights	E	Generally, transport projects will promote social infrastructure development systems, such as water supply pipes. Therefore, transport projects will result in a positive impact on all community members.
	14. Traffic accidents	E	Existing main roads do not take account of any pathway for pedestrians. Further, as vehicles drive on road shoulders due to the bad road condition of carriageways, pedestrians cannot walk by the road. Hence a pathway should be designed in the road as a part of the rehabilitation project.
Natural Environment	15. Global warming	C	Volume of greenhouse gases will increase as growing traffic volume levels do. However, on the other hand, the road network formulation and improvement will save fuel consumption. Therefore, these two factors may be compensated mutually.
	16. Biota and ecosystems	D	Being an urban zone, protected conservation areas such as national parks, forest reserves and game reserves are not found in the Study Area. Natural vegetation is limited along the River Nile. Hence most of the Study Area does not count on any precious fauna and flora. Few rare and endangered species such as listed by IUCN and CITES may be found in the area. However, Nile crocodiles belonging to the IUCN list find their habitat in the River Nile may be affected negatively.
	17. Geographical features	D	Juba Town and the surrounding area are located in the large Bahr al Jebel alluvial plain that tends to incline from south-southwest to north-northeast. A gentle slope generally characterizes the area, where outcrops of hard and firm crystalline rocks can be found. The most outstanding outcrop of rocks is Jebel Kuruk with an altitude of 744 meters above MSL, and of 3 kilometer-long width and 1 kilometer-long length located to the west of the Juba Town and forming the natural boundary of the Juba Town area. There is no further geographical feature.
	18. Soil erosion	D	The cutting of the slope and the creation of an embankment zone without implementation of countermeasures may result in soil erosion.
	19. Underground water	D	Existing wells make it possible to access 10 to 30 meter-depth underground water. Few activities to provoke adverse impact may be observed.
	20. Hydrological situation	D	Few activities to provoke adverse impact may be observed.

- to be continued -

Items		Rating	Predicted Impacts
	21. Coastal zone (mangroves, coral reefs, tidal flats, etc.)	D	There are no mangroves or tidal flats for habitats along the River Nile.
	22. Climate	D	No activities to provoke adverse impact are observed.
	23. Landscape	D	No activities to provoke adverse impact are observed.
Pollution	24. Air pollution	B	In relation to the ambient air quality, dust, NOx, CO and SOx levels may increase as a result of growing traffic volumes.
	25. Water pollution	D	No activities to provoke adverse impact are observed.
	26. Soil contamination	D	No activities to provoke adverse impact are observed.
	27. Waste	D	Workers' activities may increase solid waste and night soil from their base camp to surrounding areas during construction works.
	28. Noise and vibration	B	Present traffic noise and vibration is inferred under 60dB(A) and 50 dB. As road conditions will be improved by paving, increase of traffic volume will also increase noise and vibration pollution seriously.
	29. Ground subsidence	D	No activities to provoke adverse impact are observed.
	30. Offensive odors	D	No activities to provoke adverse impact are observed.
	31. Bottom sediment in sea and rivers	D	No activities to provoke adverse impact are observed.

Table 4.5-5 Outline of Predicted Impacts for Water Supply Sector

Items		Rating	Predicted Impacts
Social Environment	1. Involuntary resettlement	D	Most of water supply pipes will be set up beside existing main and collector roads. Elevated tanks and an intake and treatment plant will be constructed along the River Nile in a zone that is not a residential area. Hence few resettlements are likely to occur as a result of the water supply development program.
	2. Local economy, employment and livelihood	E	Water supply public works will create employment, and most of workers will be hired in Juba Town. Furthermore, their consumption will take place in the same residential area. Setting up of water supply infrastructure will support their livelihood basically. Hence this development plan and other complementary relevant projects will influence positively all community members.
	3. Land use and local resources utilization	D	Due to its increase of population, water demand in Juba Town will likely increase from 11,400 m ³ /day in 2005 to 27,600 m ³ /day in 2015. (water volume demand: 60 l/day/person, and flow is 205.5 million m ³ /day) This water demand volume represents less than 0.1 % of the flow of the River Nile. Therefore, this is to provoke almost no impact against the River Nile and surrounding areas in the basin. Most of water supply pipes will be set up beside existing main and collector roads. Elevated tanks and an intake and treatment plant will be constructed along the River Nile in a zone that is not a residential area. Hence there are likely few adverse impacts to occur as a result of land use and local resources utilization.
	4. Existing social infrastructures and services	D	Most of water supply pipes will be set up beside of existing main and collector roads. Elevated tanks and an intake and treatment plant will be constructed along the River Nile in a zone that is not a residential area. Hence few resettlements are likely to occur as a result of the water supply development program.
	5. Local communities	D	Water supply development programs and relevant projects will give benefit to all communities. Hence there is no negative impact against local communities to be observed.
	6. Benefit and damage misdistribution	D	Water supply public works will create employments, and most workers will be hired in Juba Town. Furthermore, their consumption will take place in the Juba Town. Hence such water supply development programs and relevant projects will influence positively all community members and provide with a general, positive impact.
	7. Gender	E	Traditionally, women and children perform daily water transport works from wells to homes. The setting up of water supply networks will redress women and children's daily heavy work. Hence
	8. Children's rights	E	water supply projects will represent a positive impact.
	9. Cultural heritage	D	Although the former president tomb monument is located in the ministry complex, there is no world heritage or national monument in Juba Town.
	10. Local conflicts of interests	B	Inhabitants living in places where few water resources are available, such as Kator Payam, need to purchase drinking water out of the River Nile from water transporters. The water supply project may make them quit their transport work. Such workers may complain.
	11. Public sanitation	E	Generally speaking, water supply development and other complementary relevant projects will promote social infrastructure development, such as sewage pipes. Therefore, these projects will represent a positive impact for all community members.

- to be continued -

	Items	Rating	Predicted Impacts
	12. Infectious diseases such as HIV/AIDS	B	While water supply public projects will create jobs, prostitution is likely to increase, which may facilitate contacts of HIV/AIDS-infected people and workers and the spread of STD and other infectious diseases.
	13. Water usage and rights	D	As already mentioned in Chapter “3. Land use and local resources utilization,” the intake water volume variation is not likely to affect negatively water usage rights.
	14. Traffic accidents	D	No activities to provoke adverse impact are observed.
Natural Environment	15. Global warming	D	Power generators running on diesel oil will be used as power sources for pumping up intake water from the River Nile. Even though gases will be exhausted from power generators, it is predicted that this impact will not be serious.
	16. Biota and ecosystems	D	Being a developed area and because natural vegetation is limited along the River Nile, protected conservation areas such as national parks, forest reserves and game reserves are not found in the Study Area. However this natural vegetation area does not have any particular ecotone with various fauna and flora habitats. Swamp vegetation is not found in the riverside. Few rare and endangered species such as listed by IUCN and CITES may be found in the area. However, Nile crocodiles belonging to the IUCN list find their habitat in the River Nile may be affected negatively.
	17. Geographical features	D	There is no particular geographical feature in the Juba Town.
	18. Soil erosion	D	The cutting of the slope and the creation of an embankment zone without implementation of countermeasures may result in soil erosion.
	19. Underground water	D	Few activities to provoke adverse impact may be observed.
	20. Hydrological situation	D	Few activities to provoke adverse impact may be observed.
	21. Coastal zone (mangroves, coral reefs, tidal flats, etc.)	D	There are no mangroves or tidal flats for ecotone habitats along the River Nile.
	22. Climate	D	No activities to provoke adverse impact are observed.
23. Landscape	D	No activities to provoke adverse impact are observed.	
Pollution	24. Air pollution	D	Power generators running on diesel oil will be used as power sources for pumping up intake water from the River Nile. Even through NOx, SOx, CO and SPM will be emitted from power generators, it is predicted that this impact is not likely to be serious.
	25. Water pollution	B	The water supply project will provoke discharge water of the same amount than if supplied automatically. It is possible that organic matter, fecal coliform bacteria and toxic matter may pollute such discharged water. Thus, the water supply project will require a sewage or treatment plant to minimize water pollution.
	26. Soil contamination	D	No activities to provoke adverse impact are observed.
	27. Waste	D	No activities to provoke adverse impact are observed.
	28. Noise and vibration	D	No activities to provoke adverse impact are observed.
	29. Ground subsidence	D	No activities to provoke adverse impact are observed.
	30. Offensive odors	D	No activities to provoke adverse impact are observed.
31. Bottom sediment in sea and rivers	D	No activities to provoke adverse impact are observed.	

Table 4.5-6 Outline of Predicted Impacts for Sanitation Sector (Construction of Landfill Site and Sewage Plant)

	Items	Rating	Predicted Impacts
Social Environment	1. Involuntary resettlement	B	Generally speaking, landfill sites and sewage plants are normally constructed in suburb areas in order to avoid significant social adverse impacts. In the case of Juba Town, squatter areas occupied by IDP are located in suburb areas such as the Lologo quarter, Nyakoron, or the northern part of Munuki. Therefore, the construction of a landfill site and a sewage plant may provoke certain involuntary resettlements.
	2. Local economy, employment and livelihood	E	Public works will create jobs, and most of workers will be hired in Juba Town. Furthermore, their consumption will take place in the same residential area. Setting up of water supply infrastructure will support their livelihood basically. Hence this development plan and other complementary relevant projects will influence positively all community members.
	3. Land use and local resources utilization	D	At least, 30 hectares will be required for the construction of a sewage plant and a landfill site. These facilities will be constructed in a suburb area in order to avoid disturbance to any residential area or farms. Hence the sanitation project is not likely to provoke any significant adverse impact on land use and local resources utilization issues.
	4. Existing social infrastructures and services	D	These facilities will be constructed in a suburb area in order to avoid disturbance to any residential area. Although there is a vast cemetery in the west bank of Juba Payam (J-21), most of the social infrastructure, such as religious facilities, schools, hospitals, power line and water supply pipes are not located in the said suburb area. Hence the project is not likely to provoke any significant adverse impact.
	5. Local communities	D	The sanitation project will represent a considerable benefit to all community members. Hence there is no likely negative impact for the local communities to emerge.
	6. Benefit and damage misdistribution	E	Public works regarding sanitation projects will create jobs, and most workers will be hired in Juba Town. Furthermore, their consumption will take place in the Juba Town. Hence such sanitation projects will influence positively all community members and provide with a general and positive impact.
	7. Gender	D	No activities to provoke adverse impact are observed.
	8. Children's rights	D	No activities to provoke adverse impact are observed.
	9. Cultural heritage	D	Although the former president tomb monument is located in the ministry complex, there is no world heritage or national monument in Juba Town.
	10. Local conflicts of interests	D	There are a few waste material pickers in existing informal dumping site such as Nyakoron quarter along the Yei Road. However they are not organizing market in Juba Town, therefore sanitation projects are not likely to give serious impact to them.
	11. Public sanitation	E	These sanitation project activities will result in a considerable increase of awareness levels on sanitary issues.
	12. Infectious diseases such as HIV/AIDS	B	While public works regarding sanitation projects will create jobs, prostitution is likely to increase, which may facilitate contacts of HIV/AIDS-infected people and workers and the spread of STD and other infectious diseases.
	13. Water usage and rights	D	No activities to provoke adverse impact are observed.
	Natural Environment	14. Traffic accidents	D
15. Global warming		D	Few activities to provoke adverse impact may be observed.
16. Biota and ecosystems		D	Being a developed area and because natural vegetation is limited along the River Nile, protected conservation areas such as national parks, forest reserves and game reserves are not found in the Study Area. However this natural vegetation area does not have any particular ecotone with various fauna and flora habitats. Swamp vegetation is not found in the riverside. Few rare and endangered species such as listed IUCN and CITES may be found in the area. However, Nile crocodiles belonging to the IUCN list find their habitat in the River Nile may be affected negatively, as the construction of a sewage plant is expected along the River Nile.
17. Geographical features		D	There is no particular geographical feature in the Juba Town.
18. Soil erosion		D	The cutting of the slope and the creation of an embankment zone without implementation of countermeasures may result in soil erosion.
19. Underground water		D	Few activities to provoke adverse impact may be observed.
20. Hydrological situation		D	Few activities to provoke adverse impact may be observed.
21. Coastal zone (mangroves, coral reefs, tidal flats, etc.)		D	There is no mangroves and tidal flats for ecotone habitats along the River Nile.
22. Climate	D	No activities to provoke adverse impact are observed.	

- to be continued -

Items		Rating	Predicted Impacts
	23. Landscape	D	No activities to provoke adverse impact are observed.
Pollution	24. Air pollution	D	No activities to provoke adverse impact are observed.
	25. Water pollution	B	Sewage plant: It is estimated that the loading volume of BOD of the sewage plant will be approximately 3,312 t/day from Juba Town to the River Nile. It is also estimated that water quality of the River Nile might be around 5.01 mg/l, which is almost the same value as the current level. Further, the current loading ratio will be approximately 0.34%, which implies that no serious impact is expected. (Discharged water volume from Juba to the River Nile: 27,600m ³ /day; discharged density of BOD effluents: 120mg/l; present BOD value of the River Nile (approximately): 5 mg/l) Landfill site: Effluents from the landfill site may provoke water pollution in the inflow and underground waters.
	26. Soil contamination	B	Sludge needs to be periodically removed from the sewage plant. However, this sludge is just organic matter, not toxic substance, and the volume of the said sludge is likely to be limited. In relation to the landfill site, soil contamination will be produced from the toxic waste solid originated.
	27. Waste	D	Although certain sludge will be discharged from the sewage plant into the dumping site, the volume of sludge is likely to be limited and it will not represent any relevant toxic substance. Hence this is not likely to provoke any significant negative impact.
	28. Noise and vibration	D	No activities to provoke adverse impact are observed.
	29. Ground subsidence	D	No activities to provoke adverse impact are observed.
	30. Offensive odors	B	Although certain odors will be emitted from the sewage plant, it may be said that roofs and walls of the buildings themselves will cover such a plant. Therefore, the impact of offensive odors provoked is not likely to be significant for surrounding residents. However, the landfill site is likely to provoke a strong smell if no appropriate countermeasures are adopted.
	31. Bottom sediment in sea and rivers	D	No activities to provoke adverse impact are observed.

Table 4.5-7 Outline of Predicted Impacts for Power Sector (Construction of Thermal Power Station)

Items		Rating	Predicted Impacts
Social Environment	1. Involuntary resettlement	B	Generally speaking, small power stations are normally constructed near residential areas to avoid significant social adverse impacts. In the case of Juba Town, squatter areas occupied by IDPs are located in suburb areas such as the Lologo quarter, Nyakoron, or the northern part of Munuki. Additionally electric feeder line networks and transformer stations will be set up in Juba Town. The construction of a small power station may cause some involuntary resettlements.
	2. Local economy, employment and livelihood	E	Public works will create employment, and most of workers will be hired in Juba Town. Furthermore, their consumption will take place in the same residential area. Setting up of water supply infrastructure will support their livelihood basically. Hence this development plan and other complementary relevant projects will influence positively all community members.
	3. Land use and local resources utilization	D	Generally, small plot same as housing will be required for the construction of a small power station in order to satisfy the power demand existing in the residential quarters. This power station will be constructed near residential area to avoid disturbance to any residential area or farms. Hence the power station project is not likely to provoke any significant adverse impact about on land use and local resources utilization issues.
	4. Existing social infrastructures and services	D	The power station will be constructed near residential area to avoid disturbance to any residential area. The power station project is not likely to provoke any significant adverse impact.
	5. Local communities	D	The power station project will represent a considerable benefit to all community members.
	6. Benefit and damage misdistribution	E	Public works regarding power station projects will create jobs, and most workers will be hired in Juba Town. Furthermore, their consumption will take place in the Juba Town. Hence such power station projects will influence positively all community members and provide with a general, positive impact.
	7. Gender	D	No activities to provoke adverse impact are observed.
	8. Children's rights	D	No activities to provoke adverse impact are observed.
	9. Cultural heritage	D	Although the former president tomb monument is located in the ministry complex, there is no world heritage or national monument in Juba Town.
	10. Local conflicts of interests	D	No activities to provoke adverse impact are observed.

- to be continued -

Items		Rating	Predicted Impacts
	11. Public sanitation	E	The supply of electricity will promote public sanitation projects. Therefore, these power station projects are to result in a general, positive impact to all community members.
	12. Infectious diseases such as HIV/AIDS	B	While public works regarding power station projects will create jobs, prostitution is likely to increase, which may facilitate contacts of HIV/AIDS-infected people and workers and the spread of STD and other infectious diseases.
	13. Water usage and rights	D	No activities to provoke adverse impact are observed.
	14. Traffic accidents	E	The supply of electricity will make it possible the installation of traffic facilities such as signals and streetlights, which will contribute to the reduction of traffic accidents. Hence these power supply projects will result in a positive impact for all community members.
Natural Environment	15. Global warming	B	The operation of a thermal power station will produce a certain volume of greenhouse gases such as CO ₂ .
	16. Biota and ecosystems	D	Being a developed area and because natural vegetation is limited along the River Nile, protected conservation areas such as national parks, forest reserves and game reserves are not found in the Study Area. However this natural vegetation area does not have any particular ecotone with various fauna and flora habitats. Swamp vegetation is not found in the riverside. Few rare and endangered species such as listed IUCN and CITES may be found in the area. However, Nile crocodiles belonging to the IUCN list find their habitat in the River Nile may be affected negatively, as the construction of a power generation plant is expected along the River Nile.
	17. Geographical features	D	There is no particular geographical feature in the Juba Town.
	18. Soil erosion	D	The cutting of the slope and the creation of an embankment zone without implementation of countermeasures may result in soil erosion.
	19. Underground water	D	Few activities to provoke adverse impact may be observed.
	20. Hydrological situation	D	Few activities to provoke adverse impact may be observed.
	21. Coastal zone (mangroves, coral reefs, tidal flats, etc.)	D	There is no mangroves and tidal flats for ecotone habitats along the River Nile.
	22. Climate	D	No activities to provoke adverse impact are observed.
	23. Landscape	D	No activities to provoke adverse impact are observed.
Pollution	24. Air pollution	B	A certain volume of exhaust of CO, SO _x , NO _x and SPM (Suspended Particle Matters) will be discharged to ambient air. These exhausts may result in air pollution.
	25. Water pollution	D	No activities to provoke adverse impact are observed.
	26. Soil contamination	D	No activities to provoke adverse impact are observed.
	27. Waste	D	No activities to provoke adverse impact are observed.
	28. Noise and vibration	B	Noise and vibration levels superior to 75 dB (A) and 60 dB, respectively, will be emitted from power generation facilities. These levels exceed World Health Organization's guidelines for residential areas. This is likely to result in a serious adverse impact if the power generation is constructed near a residential area.
	29. Ground subsidence	D	No activities to provoke adverse impact are observed.
	30. Offensive odors	D	No activities to provoke adverse impact are observed.
31. Bottom sediment in sea and rivers	D	No activities to provoke adverse impact are observed.	

(2) Critical Environmental Impacts

Adverse environmental impacts by sector and item are mentioned above. In this section, critical environmental impacts by sector and common issues are described below.

Critical environmental impacts by sector

In the transport sector, road rehabilitation in order to improve and expand the current network will represent a significant social impact to inhabitants living along the existing road, especially in the squatter area in which IDP are being gathered from other quarters of the Juba

Town. Formally recognized inhabitants have right to receive compensation from governmental authorities since they are taxpayers. It is suspected though that IDP may not receive any compensation whatsoever given the fact that they are illegal occupants, and not taxpayers. For this, road widening/construction works should be avoided in such areas.

In regards to the sanitation sector, any effluents from a landfill site without treatment will result in water pollution in rivers and underground waters. This would also likely provoke waterborne diseases such as cholera and amebic dysentery.

The Juba Town Council designated a dumping site at Amadi along the Yei Road. It is an appropriate site for establishing a dumping site since there is no residential area in the vicinity. However, some streams are running around the site toward the Juba Town and the River Nile. It is thus required to consider the hydrological situation for setting up a new landfill site at least.

In connection with the power sector, a thermal power station plant will emit a certain volume of exhaust emissions, which will provoke significant impacts in terms of greenhouse gases and ambient air quality. In order to select an appropriate location for that plant, the proponent should consider climate conditions and land use plan.

Common issues for urban development

- Infectious diseases such as HIV/AIDS

Even though urban development activities improve inhabitants' livelihood, it is also said that populated areas without proper health education may result in the spread of infection diseases. HIV/AIDS is particularly one of the most serious infection diseases in Sudan and African countries in general. Therefore, appropriate education and mitigation measures to be introduced by proponent are required for workers and inhabitants.

- Resettlement / Land Use Planning

As mentioned in the section pertaining to critical impacts, urban development projects are likely to result in land acquisition and resettlements or setting back of residences.

The Juba Town has numerous IDP areas in every quarter. Such persons find themselves in a weak position there from the point of view of social and economic considerations. Most of them are public employees or farmers living in the traditional Tukulu house. Although they are not paying any land lease fee, they seem not to have any particular conflict with formally recognized inhabitants in their communities. The said formally recognized inhabitants recognize that IDP are members of their families and have sympathy for their struggle during

the war. For this, IDP can move freely around the Juba Town where lifelines and farmlands are available. Hence it seems logical not to propose any different treatment among inhabitants for the set up of any particular land use plan.

4.5.3.3 Items to be Surveyed and Monitored by Stages

As mentioned in the section “Environmental Legislation,” the GOSS has not yet elaborated any EIA law or guidelines. In this sense, survey items based on JICA’s Guidelines are shown below in the EIA baseline survey stage.

The proposed baseline surveys for the EIA are shown in the following table:

Table 4.5-8 Baseline Survey Items and Monitoring Items for All Sectors (Project Base)

Items		Baseline Survey
Social Environment	1. Involuntary resettlement	a) Counting the number of houses b) Holding a stakeholders meeting (explanation of project outline, confirmation of no-objection)
	2. Local economy, employment and livelihood	Social survey through interviews with inhabitants (job, income, family structure, cash crop and quantity of output and other related considerations)
	3. Land use and local resources utilization	a) Making a land use map b) Confirmation of natural conditions in rivers and forests (river flow, water quality and hydrological circumstances)
	4. Existing social infrastructures and services	a) Counting social infrastructures such as schools, religious facilities, graveyards, water supply pipes and meeting places b) Holding a stakeholders meeting
	5. Local communities	Social survey through interviews with inhabitants (character of communities and their history, major conflicts and reasons, major industry and other related considerations)
	6. Benefit and damage misdistribution	Holding a stakeholders meeting
	7. Gender	Social survey through interviews with inhabitants (traditional daily works by gender)
	8. Children’s rights	Social survey through interviews with inhabitants
	9. Cultural heritage	a) Social survey through interviews with inhabitants (local cultural heritage, graveyards and sanctuaries) b) Confirmation of registered cultural heritage at Juba Town Council
	10. Local conflicts of interests	a) Holding a stakeholders meeting b) Social survey through interviews with inhabitants
	11. Public sanitation	Social survey through interviews with inhabitants
	12. Infectious diseases such as HIV/AIDS	a) Interviews and literature survey with persons in charge at the Ministry of Health b) Social survey through interviews with inhabitants and medical doctors
	13. Water usage and rights	Social survey through interviews with village leaders (location of wells, pump displacement and water quality)
	14. Traffic accidents	a) Interviews and literature survey at the Ministry of Infrastructure and police department b) Interviews with rental car shop owners
Natural Environment	15. Global warming	Not required
	16. Biota and ecosystems	a) Interviews and literature survey with persons in charge of wildlife issues at the Ministry of Mineral b) Fauna and flora surveys by specialists
	17. Geographical features	a) Interviews and literature survey at the Geology Department of the Ministry of Minerals b) Geological surveys by drilling
	18. Soil erosion	Interviews and literature survey at the Geology Department of the Ministry of Minerals
	19. Underground water	a) Interviews and literature survey at the Geology Department of the Ministry of Minerals and the Urban Water Corporation b) Measurement of underground water quality and depth in wells at the Juba Town
	20. Hydrological situation	Interviews and literature survey at the Geology Department of the Ministry of Minerals

- to be continued -

Items		Baseline Survey
	21. Coastal zone (mangroves, coral reefs, tidal flats, etc.)	Not required
	22. Climate	Interviews and literature survey at the Geology Department of the Ministry of Minerals (Statistical data: Statistical Year Books for specific years)
	23. Landscape	Taking pictures to reflect the present conditions, such as scene landscape, in major residential areas
Pollution	24. Air pollution	a) Interviews and literature survey at the Ministry of Environment b) Measurement of ambient air quality by gas detector tube method
	25. Water pollution	a) Interviews and literature survey at the Juba Town Council and Urban Water Corporation b) Measurement of river water and underground water quality by pack test kit
	26. Soil contamination	Interviews and literature survey at the Ministry of Environment (history of land use and industries)
	27. Waste solid	a) Surveys regarding solid and liquid waste (quantity, quality and collection system) b) Interviews and literature survey at the Juba Town Council
	28. Noise and vibration	Measurement of ambient and traffic noise in the Juba Town (by using sound level meter: Equivalent noise for 12 hours)
	29. Ground subsidence	Interviews and literature survey at the Ministry of Environment
	30. Offensive odors	Sensory tests on the site
	31. Bottom sediment in sea and rivers	Interviews and literature survey at the Ministry of Environment (history of land use and industries)

4.5.3.4 Proposed Mitigation Measures by Sectors

(1) Considerable Issue and Sustainable Mitigation Measure in the Near Future

As present environmental issues are mentioned in former sections, the most relevant issue in Juba Town is the water cycle management for urban development. To be more concrete, an appropriate formulation of water supply network and sanitation system is expected to result in a sustainable development of the Juba Town.

Natural resources of the River Nile are particularly a precious property for Juba Town's economical and social promotion and development. Therefore, it is considered that keeping a water usage cycle (intake water, consumption water and discharge water) through environment-friendly means is one of the mandatory conditions for sustainable development. A sewage system and a solid waste management without pollution are key components of the Master Plan. Concretely, in regards to the sewage system, the density of BOD (Biochemical Oxygen Demand) in discharged water should not exceed 120 mg/l. Similarly, effluents from the landfill site should be treated.

(2) Proposed Mitigation Measures by Sector

1) Common Mitigation Measures

The proposed common mitigation measures for all sectors are as listed in Table 4.5-9.

Table 4.5-9 Proposed Common Mitigation Measures for All Sectors

Items		Mitigation Measures (All Sectors)
Social Environment	1. Involuntary resettlement	1-1. No selection of residential areas for new road project site 1-2. Holding of stakeholders meeting 1-3. Establishment of a complaint window by the relevant bodies 1-4. Appropriate compensation for land acquisition
	2. Local economy, employment and livelihood	2-1. Hiring of inhabitants as construction workers
	3. Land use and local resources utilization	3-1. In the case of cutting the water vein for drinking water, set up of a new well by the proponent
	4. Existing social infrastructures and services	4-1. Construction of road in right of way (including diversion during construction) 4-2. Holding of stakeholders meeting 4-3. Reconstruction of social infrastructure in the case of displacement
	5. Local communities	5-1. Holding of stakeholders meeting 5-2. Establishment of a complaint window by the relevant bodies
	6. Benefit and damage misdistribution	6-1. Hiring of inhabitants as construction workers 6-2. Employment service for inhabitants who are affected by projects
	7. Gender	Not required in the Juba Town
	8. Children's rights	Not required in the Juba Town
	9. Cultural heritage	9-1. Avoid cultural sites, sanctuaries and tombs for project site
	10. Local conflicts of interests	10-1. Holding of stakeholders meeting 10-2. Creation of alternative jobs for inhabitants affected by projects
	11. Public sanitation	Not required in Juba Town
	12. Infectious diseases such as HIV/AIDS	12-1. Healthcare education for workers and inhabitants 12-2. Control of prostitution by the police department
	13. Water usage and rights	13-1. In the case of cutting the water vein for drinking water, set up of a new well by the proponent
	14. Traffic accidents	14-1. Education on traffic rules for workers and inhabitants 14-2. Staffing of traffic control during construction
Natural Environment	15. Global warming	Not required except for the power sector (See section on "thermal power generation")
	16. Biota and ecosystems	16-1. Avoid sensitive areas and relevant species habitats for project site (particularly, a detailed fauna and flora baseline survey is required in the EIA) 16-2. Transplant of relevant species from the project site to other areas, or creation of similar habitats in other areas 16-3. Minimization of felling trees, such as road site trees, community's forests and mango trees
	17. Geographical features	Not required in Juba Town
	18. Soil erosion	18-1. Setting up of slope protection measures and periodical monitoring and maintenance
	19. Underground water	19-1. In the case of cutting the water vein for drinking water, set up of a new well by the proponent
	20. Hydrological situation	20-1. Setting up of an appropriate drainage system without resulting in severe impacts from an hydrological point of view
	21. Coastal zone (mangroves, coral reefs, tidal flats, etc.)	Not required in Juba Town
	22. Climate	Not required in Juba Town
Pollution	23. Landscape	23-1. Minimization of tree felling 23-2. Adoption of earth color for buildings and plants (no use of strong colors)
	24. Air pollution	24-1. Sprinkling water near residential areas to reduce suspended particle matter during construction
	25. Water pollution	24-2. Setting up of treatment facilities of discharged water for base camp during construction
	26. Soil contamination	25-2. No use of polluted soil from borrow pit and quarry during construction
	27. Waste Solid	27-1. Education on waste separation and appropriate disposal for workers during construction
	28. Noise and vibration	28-1. Fixing of work time (limited work time in the daytime) 28-2. Avoidance of residential areas for the construction of yards or relevant plants
	29. Ground subsidence	Not required in the Juba Town
	30. Offensive odors	30-1. Appropriate management of solid and liquid waste from base camp and project site
	31. Bottom sediment in sea and rivers	Not required in Juba Town

2) Transport Sector

Pollution control

Generally speaking in terms of ambient air quality, levels of dust, NO_x, CO and SO_x will increase as traffic volumes will grow as well. Emissions from vehicles pose here a particular

problem, as the vehicles currently running in the Juba Town are quite old. The urban development will promote commercial activities and industries, which will increase commuters inside and outside of the Juba Town.

The main transporter for commuting in African countries is the mini bus. The same trend is visible in the Juba Town. The fare of mini bus is very reasonable and mini bus is a convenient transport means for commuting. However, an increase in the number of mini buses will result in traffic congestion and air and noise pollution in the center of the town. Further, such congestion may lead to traffic accidents and waste of time for commuters. Therefore, the following strategic countermeasures are required in the master plan:

- Formulation of an effective road network for reducing congestion levels and saving fuel
- Preparation of an environment-friendly public urban transportation system (example: bus network system by low emission vehicle: LEV)
- Layout of a bus bay and a bus terminal with sufficient capacity outside of the center of the Juba Town
- Traffic control measures (examples: No entry of heavy vehicles and mini-buses in the daytime and setting up one way road directions and a road pricing system)
- Set up of regulations (examples: establishment of vehicle emission standards and vehicle inspections or overloading regulations)
- Appropriate induction of land use (ex: commercial or industrial areas should be located along the trunk roads, newly constructed by-passes and main road system)
- Implementation of environmental monitoring systems (periodical monitoring of ambient air quality by gases tube and noise by sound level meter)

Traffic safety

Increases in traffic volumes is also likely to result in traffic accidents since driving manners are generally hasty and not very polite. On the other hand, citizens do not have basic knowledge on traffic rules. Therefore, the following measures are required:

- Implementation of appropriate traffic education (example: education on traffic rules and manners for drivers at driving schools and pedestrians at primary schools)
- Implementation of periodical traffic safety campaigns by inhabitants and speed inspections by police officers
- Provision of traffic safety facilities and instruments (example: sign boards, sidewalks separated from carriageway, zebra zones, humps for speed reduction, streetlights, signal lights and other complementary initiatives)

Creation of greenbelts along roads and conservation of bio-diversity

Roads in African countries have not only a transportation function but also serve as the places for communication in the culture of these communities. In fact, many people enjoy conversation with their friends and relatives under the trees located along the road. Furthermore, such greenbelts along roads give a favorable psychological effect on road users and inhabitants. Therefore, existing roadside trees should be conserved as an appropriate means for sequence landscape, communication place, providing shade and psychological effect against pollutions.

A flood area and a swamp located in the northern area of Juba Town represent the ecotone that has a colony of migrating birds and the habitat of mammals, amphibians and aquatic birds. The road network should thus avoid such an area from the viewpoint of conserving biodiversity in the zone. A detailed baseline survey for fauna and flora is also required in the EIA or feasibility study.

3) Water Supply Sector (including sewage system)

As mentioned in former sections, the safety water supply is probably the most important, urgent and expected outcome needed in Juba Town. A safety water supply is to improve, not only inhabitants' livelihood, but also their health condition. However, a water supply system without a proper discharged water treatment plant may result in water pollution in the River Nile. The following specifications are required to establish water supply facilities and a sewage plant:

- Location for the intake and treatment plant should be in an upstream zone, while the sewage plant should be located in a zone located in the downstream of the intake water place. This way, both plants would not affect each other.
- BOD of the discharged water after treatment from the sewage plant should not exceed 120mg/l (day average according to Japanese standards for effluent waters).
- In regards to the selection of location for the sewage plants, locations in or near the residential areas should not be selected in order to avoid the occurrence of offensive odors that might be carried by the wind. In addition to this, the river mouth should also be avoided since such an area has an ecotone and a colony of migrating birds. More specifically, the river mouth possesses an habitat of phragmites, vegetation, mammals, amphibians and aquatic birds.

4) Sanitation Sector (mainly solid waste management and construction of landfill site)

Currently, private companies are collecting garbage for contracted customers. A public solid and liquid waste collection system has not been established yet. With regards to dumping

sites, the Juba Town Council has designated a public dumping site at Amadi along Yei Road. It is an appropriate site for establishing a dumping site since there is no residential area in the vicinity. However, some streams are running around the site toward the Juba Town and the River Nile. Therefore, the following environmental and social measures should be considered:

- To establish a public solid and liquid waste collection system
- Capacity development and education systems for citizens carried out by the relevant organizations
- To select a suburb area distant from residential area in order to avoid offensive odors, infection diseases and water pollution
- To carry out an appropriate operation of the landfill site by covering it, for instance, with soil everyday

5) Power Sector

GOSS has been planning a hydraulic power plant in the stream of the River Nile for fifteen years. However, in connection with the implementation of a hydraulic power plan, numerous discussions have to take place, and different permissions need to be obtained from neighboring countries and relevant organizations. Therefore, the small diesel power generation is planned for the mid-term in this master plan.

- As any small diesel power station emits a certain volume of greenhouse gases, the GOSS should shift its priorities for the long term towards low emission power sources, such as hydraulic power, natural gases, solar energy and nuclear energy.
- With regards to the site selection for the thermal power generation plant, the proponent should take into consideration the predominant wind direction, as well as the density of pollutants, CO, SO_x, NO_x and TPM (Total Particle Material), emitted by the plants, and choose the appropriate location in an attempt to minimize adverse impacts.

6) Public Facilities

No significant impact is likely to be observed in this area. However, the following considerations are required for the protection of the social environment:

Installation of incinerators in medical facilities

Medical wastes may include toxic materials and polluted infectious viruses. Such medical waste should be thus separated from general waste, and be disposed accordingly.

Adoption of barrier-free infrastructures for people with special needs
Installment of barrier-free infrastructures, such as slopes, layout map of transportation, balustrades and special toilets are required for the elderly, physically handicapped and returned soldiers injured during the war. Additionally, the illustration of appropriate signboards, languages, or size of logos, among other related considerations, should be taken particularly into account for their easy understanding.

4.5.3.5 Recommendation

Basically speaking, it may be said that urban development processes are expected to provoke a significantly adverse impact on the environment. Environmental loads depend on the volume of fuel consumption, materials and water consumption and waste of solid and liquid gases. Even though this is an unavoidable phenomenon, adoption of strategic measures described in the former sections should mitigate very considerably the said serious impacts in the near future. Furthermore, implementation of the following activities and projects is required as soon as possible:

(1) Establishment of a Comprehensive Environmental Law

In cooperation with USAID, GOSS is now preparing an environmental policy that should be completed by the end of this year, as well as a comprehensive environmental law including EIA law, waste management law, environmental standard law, establishment of relevant organization and delegation of authority regulations. Preparation of EIA guidelines by sectors is particularly the most important activity for the promotion of environmental considerations in Southern Sudan.

(2) Capacity Development Regarding Environmental Management

Also in cooperation with USAID, GOSS has been already conducting a general training regarding EIA in collaboration with the Southern Sudan National Environment Agency (SSNEA) organized with 250 participants from all ministries. After preparation of EIA guidelines, each ministry should establish its own environmental section and carry out the corresponding capacity development program for them.

(3) Establishment of an Environmental Information Center

Environmental information available on issues such as the degree of air, water, noise, fauna and flora is limited at the moment due to the losses experienced during the war. A full understanding on the environmental status is the first step for strategic environmental management. Thus establishment of a specialized library and a chemical laboratory for air and water quality, and provision of instruments such as personal computers, air and water analysis tools, are absolutely required.

(4) Environmental Education and Environmental Awareness Campaign

Environmental education for citizens is an indispensable activity for the formulation of an urban development program in respect of the environment. Such an initiative is also effective to prevent infection diseases such as waterborne disease. Government and relevant organizations, in cooperation with supporting institutes, should educate people by carrying out environmental awareness campaigns in the area of waste, natural resources, recycling activities and other similar issues.

(5) For a Sound Urban Development

According to a UN report, in sub-Sahara countries, approximately 72% of citizens in capital area are living in slums. By this term it is understood that low-income people live in the places with a low level of social infrastructure and services. Such slums are likely to spread along the radial roads not only towards outskirts but also towards the center of the city. In the case of Juba Town, street children or IDP may create in the near future slums in areas currently occupied by IDP. Slum areas may become the nest of crimes and hamper sound development. The supply of low-cost housing and the creation of jobs are the major solution to prevent citizens from gathering in such slums. Therefore, the following strategic considerations are required in the upstream plan:

A systematic resettlement plan for IDP

According to results obtained from the interviews with personnel of the Ministry of Environment, more than 20% of the population in Juba is IDP. Their residences are located everywhere, even in the center of Juba Town. The master plan should be prepared taking into consideration that the population in the residential areas in the center of Juba Town may increase considerably. However, as mentioned above, IDP areas may change and exert a significant influence on the location of slums. Hence, a systematic resettlement plan is required for renewal of land use. Thus temporary residences should be prepared during construction of residential buildings, and should be used as revolving temporary residences. Furthermore, IDP groups should be divided into different permanent resettlements, if concerned IDP agree with the plan, since mixed groups generally do not result in the emergence of slums.

An effective utilization of unused land

Unused land should be used effectively, as public space, such as playground or parks, and should not be occupied by IDP or homeless persons. Use of public facilities, such as parks and playgrounds, is also likely to increase eventually witnesses and observers resulting in the prevention of emergence of slums.