5. Infrastructure and Tourist Facility Requirement for Priority Tourism Areas

5.1. Land Use

5.1.1. Assessment of Location of Tourism Zones

(1) Tourism Potential

Tourism accommodations for marine and beach resort tourism need to be located, in principal, along the coast line with sand beach. Since the Indian Ocean has a strong tidal wave, coral reefs offshore are indispensable to secure a calm sea.

(2) Accessibility

Along the coastal line, there are several access roads except to the Lamu Tourism Area. Table 4. 9 shows each access road and airport and air strip along the coast line. The new tourism promotion zones should be located so as to keep a better access from the existing access roads.

Table 4. 9 Access Roads and Airport/Air Strip along the Coast Line

	Road		Airport
	Route	Conditions	
Shimoni	A14, D543	A14 is in good condition, but D543 is in poor condition with gravel.	x
Diani	A14, E965	A14 and E965 is in good condition with pavement.	O
Likoni	A14, C109	A14 is in good, but D543 is in poor condition with gravel.	x
Kilifi	B8, E921	B8 and E921 are in good condition with pavement.	O
Malindi	B8, E897	B8 and E897 are in good condition with pavement.	O
Lamu	C112	Main access is air transport at this moment.	O

Note: O - Existing, X - Not existing
Source: JICA Study Team

(3) Environmental Conservation

Rich mangrove forests and many swamp areas are found along the coast line. In particular, the coral reef along Wasini Island is ecologically identified as a very important natural asset. Development with large land reclamation must not take place in the mangrove forests and swamp areas. Some forests in this area are well known as "Holy Forests" and have been carefully maintained for decades by the local people. They must not be developed without the consent of the people.

(4) Present Land Use and Landscape

This area is dominantly covered by mangrove forests, swamps and forests along the coastal line. In the inland area, large cash crop farms such as coconuts, cashew nuts, fruits and sugar cane are found in certain places.

(5) Impacts on the Local Community

Most of the people in the coastal area are Muslim, which have strictly maintained their own traditions and customs for a long time. Special attention must be paid to the Muslim culture and customs when tourism development is carried out.

5.1.2. Designation of the Zones

Based on the above assessment, tourism zones, tourism promotion zones, tourism development control zones and local reserve zones are proposed as indicated below.

(1) Tourism Zone and Tourism Promotion Zone

Twenty three of the new tourism promotion zones are proposed. They are :

- For the Southern part of the coast Shimoni, two places at Funzi bay, Diani South and Shelly beach
- For the central part of the coast, Kilifi North, Watamu, Watamu North and Mambrui North, and
- For the Lamu area, Lamu West, two places at Manda South, Manda East and two places at Pate West.

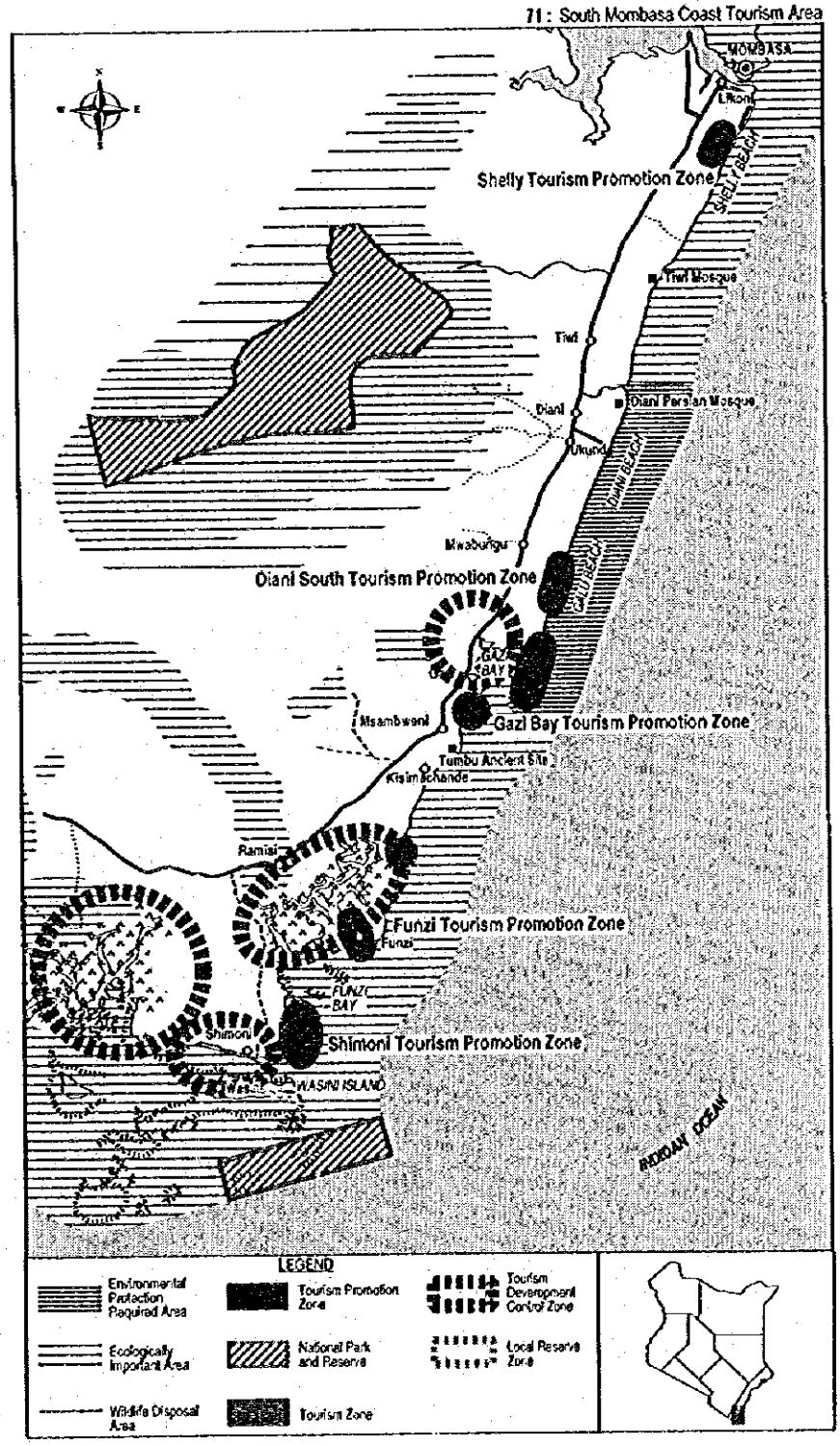
(2) Tourism Development Control Zone

The following areas are proposed as the tourism development control zone :

- Wasini Island and the channel between Wasini Island and Shimoni - Funzi bay
- The Northern part of Manda Island, and
- The mangrove forests area along the coastal line.

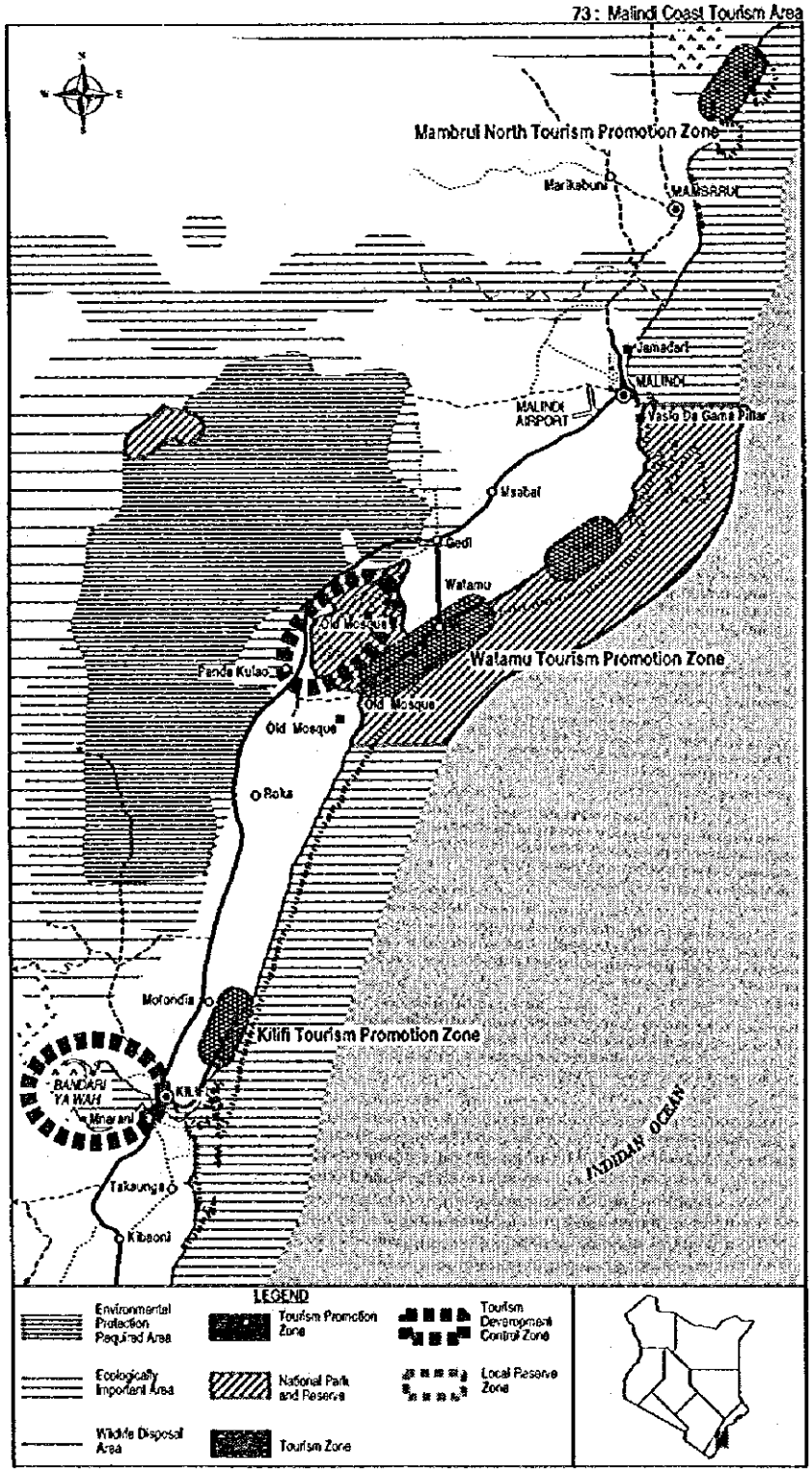
These zones are indicated in Figure 4. 4, Figure 4. 5 andFigure 4. 6.

Figure 4. 4 Tourism Promotion Zone in the South Mombasa Tourism Area



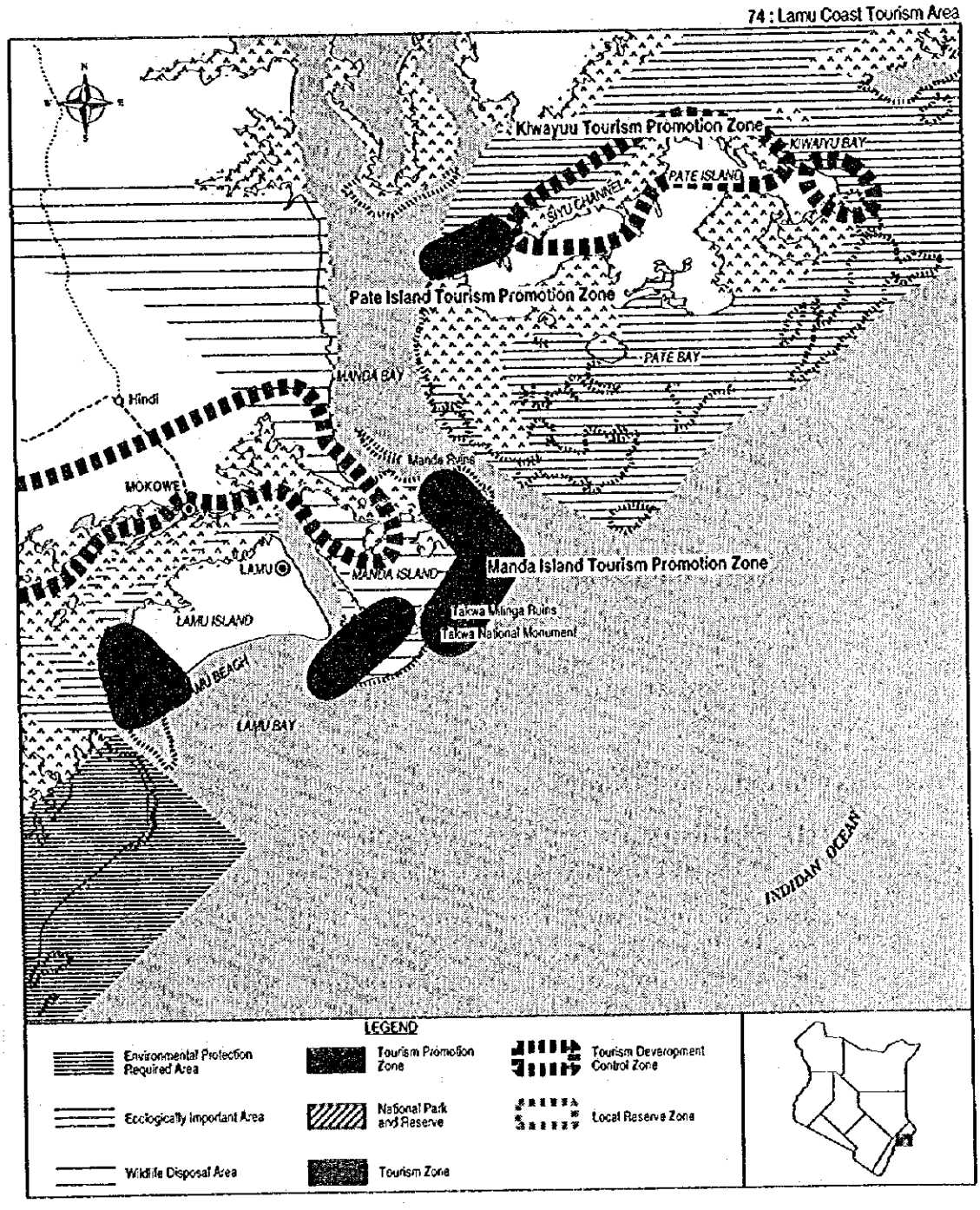
Source: JICA Study Team

Figure 4. 5 Tourism Promotion Zone in the Malindi Coast Tourism Area



Source: JICA Study Team

Figure 4. 6 Tourism Promotion Zone in the Lamu Coast Tourism Area



Source: JICA Study Team

5.1.3. Implications for the Development of Tourism Facilities and Infrastructure

For the Coastal Tourism Region, several environmental considerations must be taken into account when development projects are carried out. Turtle's breeding area, mangrove forest conservation and sea water pollution control measures will be included in the facilities and infrastructure plans in the tourism and tourism promotion zone.

5.2. Tourism Facilities

5.2.1. Tourism Products Related Facilities

(1) Tourism Products in the South Mombasa Coast, Malindi Coast and Lamu Coast Tourism Areas

Based on Table 4. 3, the tourism products for the South Mombasa Coast, Malindi Coast and Lamu Coast Tourism Areas are summarised in Table 4. 10.

(2) Tourism Products Related Facilities in South Mombasa Coast, Malindi Coast and Lamu Coast Tourism Areas

Based on the previous Table 4. 10, the tourism products related facilities to be developed for the South Mombasa Coast, Malindi Coast and Lamu Coast Tourism Areas are summarised in Table 4. 11.

5.2.2. Accommodation Facilities

(1) Distribution of Accommodation Facilities in the South Mombasa Coast, Malindi Coast and Lamu Coast Tourism Areas

In accordance with the framework presented in Table 4. 2, the required number of rooms are determined with the same method as the distribution of the accommodation facilities for the Coastal Tourism Region. However, considering the characteristics of tourism resources, the large scale of development and its importance, room requirements by classes have been estimated by categorising three cases of target markets.

a. Average Market Case

For this case, the same method as in the previous chapters is applied. The share of high, medium and low are 32%, 35% and 33%, respectively. These percentages are applied for Shimoni and Wawsini, Funzi, Gazi and the Lamu/Shela promotion zones.

b. Mass Market Case

For this case, shares of 20%, 50% and 30%, respectively, are applied for promotion of mass tourism with rather moderate facilities in Tiwi, Diani, Galu, Kilifi, Watamu and the Malindi Promotion Zones.

c. Quality Market Case

The quality market case targets tourists, who are expected to be in the higher expenditure category, with a style of qualified eco-tourism and luxurious beach resort. The shares by accommodation classes are set with 37%, 49% and 14%, respectively. These are applied in the case of Manda Island and Pate Island Promotion Zones.

(2) Cost Estimates

In accordance with the framework presented in Table 4. 2, the required number of rooms are determined. Based on the above mentioned cases and methods, total cost for accommodation facilities in the South Mombasa Coast, Malindi Coast and Lamu Coast Tourism Areas are calculated as shown in Table 4. 12. However, in Shimoni and Wasini, Funzi, Gazi Manda Island and Pate Island Promotion Zones, where cottage or rather light sturucture development is widely expected, construction cost is estimated at 70% of the average case. Total cost by 2010 is estimated at approximately 624.3 million K£, 842.0 million K£ and 319.8 million K£ for the South Mombasa Coast, Malindi Coast and Lamu Coast, respectively.

Table 4. 10 Formulation of Programmes and Projects of Tourism Products in the South Mombasa, Malindi Coast and Lamu Coast Tourism Areas (1)

No.	Products	Description	Location	Resources to be Utilised	Necessary Programme and Project	
					Institutional/ Promotional Programmes	Infra. & Facility Project
Coastal Tourism Region						
CO-HP-2	Mnarani Historical Park Development	Promoting visitors by improving historical site and attaching tourist facilities	Malindi	Mnarani Ruins		Ruins Conservation Project, Visitor Facilities Development
CO-HP-3	Gedi Historical Park Development	Promoting visitors by improving historical site and attaching tourist facilities	Malindi	Gedi Ruins		Ruins Conservation Project, Visitor Facilities Development
CO-HP-4	Mgangani Historical Park Development	Promoting visitors by improving historical site and attaching tourist facilities	Malindi	Mgangani Ruins		Ruins Conservation Project, Visitor Facilities Development
CO-HP-5	Vasco da Gama Pillar Park Development	Promoting visitors by improving historical site and attaching tourist facilities	Malindi	Vasco da Gama Pillar, sea, cliff		Visitor Facilities Development
CO-HP-6	Jamandan Historical Park Development	Promoting visitors by improving historical site and attaching tourist facilities	Malindi	Jamandan Ruins		Ruins Conservation Project, Visitor Facilities Development
CO-HP-10	Conservation of Traditional Village Landscape	Conserving traditional rural landscape with traditional style houses to utilise them as a tourism attraction	South Mombasa	Villages along the south Mombasa Coast	Village Conservation Programme	
CO-HP-11	Conservation of Lamu Old Town	Conserving old Islamic townscape of Lamu old town to utilise it as a tourism attraction	Lamu	Lamu old town	Building Conservation Programme	
CO-MU-2	Development of New Museum at Lamu	Developing a new museum at Lamu town	Lamu	Old colonial architecture		Museum Improvement, Visitor Facilities Development
CO-NP-1	Improvement of Shimba Hill National Park	Providing visitor supporting facilities	South Mombasa	Shimba Hill National Park	Pricing Programme	Tourist Centre, Visitor Amenity Facilities
CO-NP-2	Arabuko Sokoke National Park	Providing visitor supporting facilities	Malindi	Arabuko Sokoke National Park	Pricing Programme	Visitor Amenity Facilities
CO-NP-3	Improvement of Tsavo East National Park	Providing visitor supporting facilities	Malindi	Tsavo East National Park	Pricing Programme	Visitor Amenity Facilities
CO-NP-6	Improvement of Malindi Marine National Park	Providing visitor supporting facilities	Malindi	Malindi Marine National Park		Tourist Centre
CO-WF-2	Improvement of View Point at Malindi					Tourist Wayside Facility Area Development
CO-VA-1	Promotion of Robinson Crusoe Tour	Promoting new tour as a eco-tourism	South Mombasa	Islands	Formulation of tour	Visitor Amenity Facilities
CO-SP-1	Introduction of Mangrove Safari at Manda Island	Promoting new tour as a eco-tourism	Lamu	Mangrove, forest, wildlife	Formulation of tour route	Walking Path and Dock Development Project
CO-SP-3	Introduction of Shimoni Cruise	Introducing cruising tour by providing marina facilities	South Mombasa	Sea, islands, fishing	Formulation of Cruising route	Marina Development Project
CO-SP-4	Introduction of Kuli Cruise	Introducing cruising tour by providing marina facilities	Malindi	Sea, islands, fishing	Formulation of Cruising route	Marina Development Project
CO-SP-5	Introduction of Lamu Cruise	Introducing cruising tour by providing marina facilities	Lamu	Sea, islands, fishing	Formulation of Cruising route	Marina Development Project
CO-SP-6	Promotion of Funji Diving	promoting diving by providing related facilities	South Mombasa	Coral, fish	Divers Mariner Improvement Programme, Designation of Diving spots	
CO-SP-7	Introduction of Turtle's Breeding Watching	Promoting new tour as a eco-tourism	South Mombasa	Turtle	Mariner Improvement Programme, Designation of watching spots	
CO-SP-9	Promotion of Kuli Creek Boat Safari	Promoting new tour as a eco-tourism	Malindi	Mangrove, forest, wildlife	Formulation of tour	
CO-SP-10	Introduction of Turtle's Breeding Watching	Promoting new tour as a eco-tourism	Malindi	Turtle	Mariner Improvement Programme, Designation of watching spots	
CO-SP-11	Introduction of Mangrove Safari at Manda Island	Promoting new tour as a eco-tourism	Lamu	Mangrove, forest, wildlife	Formulation of tour route	Walking Path and Dock Development Project
CO-SP-12	Introduction of Turtle's Breeding Watching	Promoting new tour as a eco-tourism	Lamu	Turtle	Mariner Improvement Programme, Designation of watching spots	
CO-ST-2	Improvement of Tourist Amenity at Malindi	Creating appropriate atmosphere to tourists and providing information facilities	Malindi	Malindi City		Beautification
CO-ST-3	Improvement of Tourist Amenity at Lamu	Creating appropriate atmosphere to tourists and providing information facilities	Lamu	Lamu Town		Beautification

Note: "Pricing Programme" means that price differentiation among the national parks and reserves. For this end, further study will be necessary.

Source: JICA Study Team

Table 4. 10 Formulation of Programmes and Projects of Tourism Products in the South Mombasa, Malindi Coast and Lamu Coast Tourism Areas (2)

No.	Products	Description	Location	Resources to be Utilised	Necessary Programme and Project	
					Institutional/ Promotional Programmes	Infra. & Facility Project
CO-FU-2	Utilisation of Salt Water Fish at Malindi	Promoting tourism use of seafood		seafood	Fisherman Group's Tourism Participation Programme New Cuisine Development Programme Education Programme Goods Distribution Improvement Programme	Ice Supply Terminal, Training Facilities Development
CO-FU-5	Utilisation of Salt Water Fish at Diani	Promoting tourism use of seafood		seafood	Fisherman Group's Tourism Participation Programme New Cuisine Development Programme Education Programme Goods Distribution Improvement Programme	Ice Supply Terminal
CO-FU-6	Improvement of Swahili Seafood	Promoting tourism use of seafood		seafood	Fisherman Group's Tourism Participation Programme New Cuisine Development Programme Education Programme Goods Distribution Improvement Programme	Cold Stargge Project Training Facilities Improvement Project
CO-IN-1	Development of Diani/Tiwi New Beach Resort	Developing tourist base for long-term stay	South Mombasa	Diani beach, Tiwi Beach, coral	Land Use Control Programme (introduction of Tourism Promotion Zone),Commercial and Public facilities Development Programme	Infrastructure Provision Projects for Tourism Promotion Zones
CO-IN-2	Development of Funji Marine Resort	Developing tourist base for long-term stay with marine sports facilities	South Mombasa	Funji beach, coral, fish	Land Use Control Programme (introduction of Tourism Promotion Zone), Commercial and Public facilities Development Programme, Divers Manner Improvement Programme, Designation of Diving spots	Infrastructure Provision Projects for Tourism Promotion Zones
CO-IN-3	Development of Shimoni Marine Complex	Developing tourist base for long-term stay with marine sports facilities	South Mombasa	beach, Wasihini Island, coral	Land Use Control Programme (introduction of Tourism Promotion Zone), Commercial and Public facilities Development Programme, Divers Manner Improvement Programme, Designation of Diving spots	Infrastructure Provision Projects for Tourism Promotion Zones
CO-IN-7	Development of Kilifi Marine Resort	Developing new marine resort with marine sports facilities	Malindi	Kilifi Bay	Land Use Control Programme (introduction of Tourism Promotion Zone), Commercial and Public facilities Development Programme	Infrastructure Provision Project for Tourism Promotion Zone New Marina Development Project
CO-IN-8	Development of Watamu New Beach Resort	Developing tourist base for long-term stay	Malindi	Beach, coral, fish	Land Use Control Programme (introduction of Tourism Promotion Zone), Commercial and Public facilities Development Programme, Divers Manner Improvement Programme, Designation of Diving spots	Infrastructure Provision Projects for Tourism Promotion Zones
CO-IN-9	Improvement of Malindi Resort Complex	Developing tourist base for long-term stay with marine sports facilities	Malindi	Beach, coral, fish	Land Use Control Programme (introduction of Tourism Promotion Zone), Commercial and Public facilities Development Programme	Infrastructure Provision Projects for Tourism Promotion Zones
CO-IN-10	Development of Manda Marine Resort	Developing tourist base for long-term stay with marine sports facilities	Lamu	Beach, mangrove, wildlife	Land Use Control Programme (introduction of Tourism Promotion Zone), Commercial and Public facilities Development Programme	Infrastructure Provision Projects for Tourism Promotion Zones
CO-IN-11	Development of Lamu Beach Resort	Developing tourist base for long-term stay	Lamu	Beach, mangrove, wildlife	Land Use Control Programme (introduction of Tourism Promotion Zone), Commercial and Public facilities Development Programme	Infrastructure Provision Projects for Tourism Promotion Zones
CO-IN-12	Development of Pate Island Resort	Developing tourist base for long-term stay	Lamu	Beach, mangrove, wildlife	Land Use Control Programme (introduction of Tourism Promotion Zone), Commercial and Public facilities Development Programme	Infrastructure Provision Projects for Tourism Promotion Zones

Note: "Pricing Programme" means that price differentiation among the national parks and reserves. For this and, further study will be necessary.

Source: JICA Study Team

Table 4. 11 Proposed Tourism Products related Facilities in the South Mombasa Coast, Malindi Coast and Lamu Coast Tourism Areas (1)

No.	Products	Infra. & Facility Project	Major Facilities	Quantity	Unit Cost (,000 KE)	Cost (,000 KE)	Phasing			Remarks
							Short (- 2000)	Medium (2000-2005)	Long (2005-2010)	
Coastal Tourism Region										
CO-HP-2	Mnarani Historical Park Development	Ruins Conservation Project	Information and exhibits room	1	500	500			500	Site Museum (Construction)
		Visitor Facilities Development	Car parking, Cafeteria, Souvenir shop, Toilet, Rest facilities	1	150	150			150	Visitor Facility(Small)
CO-HP-3	Gedi Historical Park Development	Ruins Conservation Project	Information and exhibits room, Conservation of ruin	1	4,250	4,250		4,250		Site Museum (Construction) +Conservation of ruin
		Visitor Facilities Development	Car parking, Cafeteria, Souvenir shop, Toilet, Rest facilities	1	150	150		150		Visitor Facility(Small)
CO-HP-4	Mgangani Historical Park Development	Ruins Conservation Project	Information and exhibits room	1	500	500			500	Site Museum (Construction)
		Visitor Facilities Development	Car parking, Cafeteria, Souvenir shop, Toilet, Rest facilities	1	150	150			150	Visitor Facility(Small)
CO-HP-5	Vasco-da Gama Pillar Park Development	Visitor Facilities Development	Car parking, Cafeteria, Souvenir shop, Toilet, Rest facilities	1	150	150	150			Visitor Facility(Small)
CO-HP-6	Jamaidan Historical Park Development	Ruins Conservation Project	Information and exhibits room	1	500	500			500	Site Museum (Construction)
		Visitor Facilities Development	Car parking, Cafeteria, Souvenir shop, Toilet, Rest facilities	1	150	150			150	Visitor Facility(Small)
CO-MU-2	Development of New Museum at Lamu	Museum Improvement	Visitor's information office, Cultural/Natural information centre	1	3,750	3,750			3,750	Museum /(Small)(Construction)
		Visitor Facilities Development	Car parking, Cafeteria, Souvenir shop, Toilet, Rest facilities	1	150	150			150	Visitor Facility(Small)
CO-NP-1	Improvement of Shimba Hill National Park	Tourist Centre	Reception/information, Mini Museum, Cafeteria, Souvenir shop, Toilet, First aid room, Official use	1	225	225	225			Tourist Centre
		Visitor Amenity Facilities	Access road, Car parking, View house, Toilet, Rest facilities	2	50	100	100			Visitor Amenity Facility
CO-NP-2	Improvement of Arabuko Sokoke National Park	Visitor Amenity Facilities	Access road, Car parking, View house, Toilet, Rest facilities	2	50	100		100		Visitor Amenity Facility
CO-NP-3	Improvement of Tsavo East National Park	Visitor Amenity Facilities	Access road, Car parking, View house, Toilet, Rest facilities	5	50	250		250		Visitor Amenity Facility
CO-NP-5	Improvement of Malindi Marine National Park	Tourist Centre	Reception/Information, Mini Museum, Cafeteria, Souvenir shop, Toilet, First aid room, Official use	1	225	225	225			Tourist Centre
CO-WF-2	Improvement of View Point at Malindi	Tourist Wayside Facility Area Development	Restaurant, Snack stand, Souvenir shop, Drug store, Toilet, Gas station, Repair shop, Car parking	1	325	325	325			Wayside Facility
CO-VA-1	Promotion of Robinson Crusoe Tour	Visitor Amenity Facilities	Access road, Car parking, View house, Toilet, Rest facilities	3	50	150		150		Visitor Amenity Facility
CO-SP-1	Introduction of Mangrove Safari at Nanda Island	Walking Path and Deck Development Project		1	250	250		250		Walking path and deck
CO-BT-2	Improvement of Tourist Amenity at Malindi	Beautification	Sign board, Benches, Rubbish bin	1	75	75	75			Beautification(Medium City)
CO-BT-3	Improvement of Tourist Amenity at Lamu	Beautification	Sign board, Benches, Rubbish bin	1	75	75		75		Beautification(Medium City)

Source: JICA Study Team

Table 4. 11 Proposed Tourism Products related Facilities in the South Mombasa Coast, Malindi Coast and Lamu Coast Tourism Areas (2)

No.	Products	Infra. & Facility Project	Major Facilities	Quantity	Unit Cost (,000 KE)	Cost (,000 KE)	Phasing Short (~ 2000)	Phasing Medium (2000~2005)	Phasing Long (2005~2010)	Remarks
CO-FU-2	Utilisation of Salt Water Fish at Malindi	Ice Supply Terminal	Ice maker, Ice storage, Terminal office, Car parking	1	875	875	875			
		Training Facilities Development	Education, Administration & support	1	125	125	125			Training Facility
CO-FU-5	Utilisation of Salt Water Fish at Ozani	Ice Supply Terminal	Ice maker, Ice storage, Terminal office, Car parking	1	875	875	875			
			Historical Park			6,500	150	4,400	1,950	
			Museum			3,900	0	0	3,900	
			Natural Park			900	550	350	0	
			Wayside Facility			325	325	0	0	
			Visitor Amenity Facility			150	0	150	0	
			Attraction			0	0	0	0	
			Sports			250	0	250	0	
			Beautification			150	75	75	0	
			Food Utility			1,875	1,875	0	0	
			Total Cost of Promotion Zone in Coastal Tourism Region			14,050	2,975	5,225	5,850	

Source: JICA Study Team

Table 4. 12 Increase Number of Unit (Hotel/Lodge) and Estimated Cost

			-2000			2000-2005			2000-2010			Total		
			Increase No of Rms	%	Estimated Cost(mil.$)	Increase No of Rms	%	Estimated Cost(mil.$)	Increase No of Rms	%	Estimated Cost(mil.$)	Increase No of Rms	%	Estimated Cost(mil.$)
S. Mombasa Coast	Shimoni/Wasini	high	85	32	6.7	175	32	13.8	142	32	11.2	402	32	31.7
		med	94	35	4.0	194	35	8.1	159	35	6.7	447	35	18.8
		low	90	33	1.5	181	33	3.0	149	33	2.5	419	33	7.0
		total	269		12.2	550		24.9	450		20.4	1,269		57.5
	Funzi	high	21	32	1.6	102	32	8.0	190	32	14.9	312	32	24.6
		med	23	35	1.0	113	35	4.7	212	35	8.9	348	35	14.6
		low	22	33	0.4	105	33	1.8	198	33	3.3	325	33	5.5
		total	65		2.9	320		14.5	600		27.2	985		44.6
	Gazi	high	9	32	0.7	38	32	3.0	73	32	5.7	120	32	9.5
		med	11	35	0.4	42	35	1.8	81	35	3.4	134	35	5.6
		low	10	33	0.2	39	33	0.7	76	33	1.3	125	33	2.1
		total	30		1.4	120		5.4	230		10.4	380		17.2
	Tiwi/Diani/Galu	high	77	20	8.6	239	20	26.9	119	20	13.4	435	20	48.9
		med	193	50	11.6	600	50	36.0	300	50	18.0	1,093	50	65.6
		low	116	30	2.8	361	30	8.7	181	30	4.3	658	30	15.8
		total	386		23.0	1,200		71.5	600		35.8	2,186		130.3
	Total	high	192	26	17.7	554	25	51.7	524	28	45.3	1,269	26	114.6
		med	321	43	16.9	948	43	50.6	753	40	37.0	2,022	42	104.6
		low	237	32	4.8	687	31	14.1	603	32	11.4	1,527	32	30.4
		total	750		39.5	2,190		116.4	1,880		93.7	4,820		249.7
Malindi Coast	Kilifi	high	70	20	7.8	239	20	26.9	60	20	6.7	368	20	41.4
		med	175	50	10.5	600	50	36.0	150	50	9.0	925	50	55.5
		low	105	30	2.5	361	30	8.7	90	30	2.2	557	30	13.4
		total	350		20.9	1,200		71.5	300		17.9	1,850		110.3
	Watamu	high	318	20	35.8	199	20	22.4	119	20	13.4	637	20	71.6
		med	800	50	48.0	500	50	30.0	300	50	18.0	1,600	50	96.0
		low	482	30	11.6	301	30	7.2	181	30	4.3	963	30	23.1
		total	1,600		95.4	1,000		59.6	600		35.8	3,200		190.8
	Malindi	high	60	20	6.7	40	20	4.5	20	20	2.2	119	20	13.4
		med	150	50	9.0	100	50	6.0	50	50	3.0	300	50	18.0
		low	90	30	2.2	60	30	1.4	30	30	0.7	181	30	4.3
		total	300		17.9	200		11.9	100		6.0	600		35.8
	Total	high	448	20	50.4	478	20	53.7	199	20	22.4	1,124	20	126.5
		med	1,125	50	67.5	1,200	50	72.0	500	50	30.0	2,825	50	169.5
		low	677	30	16.3	722	30	17.3	301	30	7.2	1,701	30	40.8
		total	2,250		134.1	2,400		143.1	1,000		59.6	5,650		336.8
Lamu Coast	Lamu/Shela	high	16	32	1.8	48	32	5.4	63	32	7.1	127	32	14.3
		med	18	35	1.1	53	35	3.2	71	35	4.2	141	35	8.5
		low	17	33	0.4	49	33	1.2	66	33	1.6	132	33	3.2
		total	50		3.2	150		9.7	200		12.9	400		25.9
	Manda Isl.	high	0	37	0.0	131	37	10.3	486	37	38.3	617	37	48.6
		med	0	49	0.0	171	49	7.2	636	49	26.7	807	49	33.9
		low	0	14	0.0	48	14	0.8	178	14	3.0	226	14	3.8
		total	0		0.0	350		18.3	1,300		68.0	1,650		86.3
	Pate Isl.	high	0	37	0.0	37	37	2.9	75	37	5.9	112	37	8.8
		med	0	49	0.0	49	49	2.1	98	49	4.1	147	49	6.2
		low	0	14	0.0	14	14	0.2	27	14	0.5	41	14	0.7
		total	0		0.0	100		5.2	200		10.5	300		15.7
	Total	high	16	32	1.8	216	36	18.6	624	37	51.3	856	36	71.7
		med	18	35	1.1	273	45	12.4	804	47	35.1	1,095	47	48.5
		low	17	33	0.4	111	19	2.2	272	16	5.0	399	17	7.7
		total	50		3.2	600		33.3	1,700		91.4	2,350		127.9

Source: JICA Study Team

Table 4. 13 Increased Number of Units(Homestay/Tents and Others)

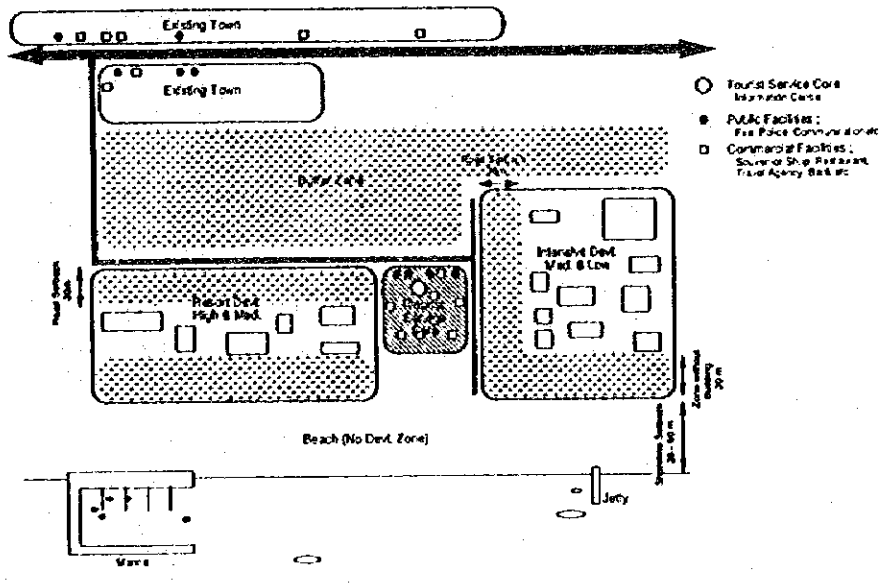
Tourism Area	Tourism Sub-Area	-2000 Increase No. of Units	2000-2005 Increase No. of Units	2005-2010 Increase No. of Units	Total Increase No. of Units
South Mombasa	Shimoni/Wasini	100	0	150	250
	Funzi	0	0	0	0
	Gazi	0	0	0	0
	Tiwi/Diani/Galu	0	0	300	300
	Total	100	0	450	550
Malindi	Kilifi	0	0	0	0
	Watamu	0	0	0	0
	Malindi*	-300	0	500	200
	Total*	-300	0	500	200
Lamu	Lamu/Shella	0	0	50	50
	Manda Isl.	0	0	0	0
	Pate Isl.	0	0	0	0
	Total	0	0	50	50
Total*		-200	0	1,000	800

Source: JICA Study Team

(3) Development Image of Tourism Promotion Zone

In the South Mombasa Coast, Malindi Coast and Lamu Coast Tourism Areas, several tourism promotion zones are proposed. A detailed site plan for these zones should be made at a further stage of the tourism development. However, a preliminary image of the sites is elaborated on with a view to present a typical development image of the beach resort type of the tourism promotion zone. This image is shown in Figure 4. 7.

Figure 4. 7 Image of Beach Resort Type Tourism Promotion Zone



Source: JICA Study Team

5.2.3. Tourist Service Facilities in South Mombasa Coast, Malindi Coast and Lamu Coast Tourism Areas

In the South Mombasa Coast, Malindi Coast and Lamu Coast Tourism Areas, the following tourist service facilities are proposed. In the South Mombasa Coast Tourism Area, approximately 0.3 million K£ are required for developing the tourist service facilities. Approximately 1.9 million K£ are required for the Malindi Coast Tourism Area and approximately 0.08 million K£ are required for the Lamu Coast Tourism Area.

Table 4. 14 Proposed Tourist Service Facilities in the South Mombasa Tourism Area

	No. of projects (places)	Location	Cost (Thousand K£)
Visitor Facilities Development Project	0		0
Visitor Amenity Facilities Project	1	Simba Hill NP	100
Tourist Centre Project	1	Simba Hill NP	225
Tourist Wayside Facility Area Development Project	0		0
City Beautification Project	0		0
Total			325

Note: All costs have been already included in Table 4.11.
Visitor facilities Development Projects for new museum are excluded.
Source: JICA Study Team

Table 4. 15 Proposed Tourist Service Facilities in the Malindi Coast Tourism Area

	No of projects (places)	Location	Cost (Thousand K£)
Visitor Facilities Development Project	0	Mnarani Ruins Gedi Ruins Mgangani Ruins Vasco da Gama Pillar Jamandari Ruins Kilifi Ruins	900
Visitor Amenity Facilities Project	2	Arabuko Sokoke NP Tsavo East NP	350
Tourist Centre Project	1	Malindi Marine NP	225
Tourist Wayside Facility Area Development Project	1	Malindi	325
City Beautification Project	1	Malindi	75
Total			1,875

Note: All costs have been already included in Table 4.11.
Visitor facilities Development Projects for new museum are excluded.
Source: JICA Study Team

Table 4. 16 Proposed Tourist Service Facilities in the Lamu Coast Tourism Area

	Number of Projects (places)	Location	Cost (Thousand K£)
Visitor Facilities Development Project	0		0
Visitor Amenity Facilities Project	0		0
Tourist Centre Project	0		0
Tourist Wayside Facility Area Development Project	0		0
City Beautification Project	1	Lamu	75
Total			75

Note: All costs have been already included in Table 4.11.
Visitor facilities Development Projects for new museum are excluded.
Source: JICA Study Team

5.3. Transport

5.3.1. Roads

The absense of a bridge at the cross-section of Kilindini Harbour (Mombasa) on route A14, which is the international trunk road between Mombasa and Tanzania, reduces the traffic functions of A14. At present, ferryboats service this portion.

The deterioration of the trunk road surfaces at many sections in this region are remarkable. They have been caused by insufficient maintenance and drainage countermeasures. The development of access roads from the arterial roads to the national parks and reserves is behind.

Taking the existing road conditions and the above tourism spatial structure based on the planning directions in the Coastal Tourism Region into account, the targets for road network development are as outlined below.

(1) Improving the Trunk Roads

As is the same in other tourism regions, the trunk roads comprise an important circulating and basic access route for tourist trips in the Coastal Tourism Region. This indicates that the improvement of such trunk roads as A109, A14 and B8 becomes a fundamental condition even for tourism development.

(2) Strengthening of Circular Roads

From a circular roads point of view, providing alternative routes seems difficult, since the Coastal Tourism Region has a rather narrow and long coastal area. However, improvement of C103 from Malindi to Tsavo, B8 connecting to Nairobi City via Tana River Primate National Reserve and Garissa have a rather important role and function. They would form the alternative routes for wide

circulation of tourist traffic between the Coastal and Central Tourism Regions.

(3) Improving Access Routes to Tourism Resources

As mentioned before, A14 and B8 provide major backbone roads, since all important tourism resources are located and connected to this road by end access roads. The improvement of these access roads becomes therefore essential for tourism development. The actual access roads to be improved or constructed are Shimoni (D 543), Funzi (E 568), Gazi Bay, South Diani (E965), Kilifi (E 921), Watamu (E 668, 899, 900), North Watamu and North Malindi (E897).

(4) Consideration for the Environmental Conservation

In case of road improvement much attention has to be paid not to disturb the current ocean environmental condition.

(5) Development of the Rest of the Area

As core and sub core tourism resources are located alongside the major tour routes in this tourism region, such near places as Malindi and Garsen (B8) are to be developed.

In addition to the projects proposed in "A Road Network Development Master Plan", the roads which need development from the viewpoint of tourism development comprise the following routes :

- Improvement (reconstruction) of Moi International Airport access (C110)
- Improvement (upgrading from earth to paved road) of Route D543, and
- Construction/Improvement of access routes to national parks and reserves.

5.3.2. Airports

In the Coastal Tourism Region there are four airports, which have scheduled flights. They are Moi International Airport at Mombasa, Malindi airport and the Lamu and Kiwayu airstrips. The majority of international chartered flights to Kenya are handled presently at the Moi International Airport.

The rehabilitation works of Moi International Airport as the Kenyan gateway are presently in progress and they have been finalised in summer 1995. The airport would be able to handle around 1.7 million passengers per year, up from the present capacity of about 0.9 million. Taking into account the increase of incoming tourists by air in accordance with the development of Malindi and

Lamu, the improvement of Malindi and Lamu airports will be necessary. Moreover, extension of the runway at Malindi Airport would become necessary in future, in order to accommodate medium jet services.

5.3.3. Ports (Marinas)

Marina development at the Indian Ocean coast will be necessary, because of the increase of marine leisure demand and marine tourism development, that is pleasure boats. Taking the tourism development strategy for the Coastal Tourism Region into consideration, the targets for ports (marinas) development are as follows :

- Formation of an Indian Ocean Cruise route (Lamu - Mombasa - Zanzibar - Madagascar - Seychelles), and
- Establishment of rapid sea transport services (Mombasa-Malindi-Lamu).

The proposed sites for marina development will be a part of Mombasa's old port, Kilifi, Malindi, Lamu and Shimoni. As Mombasa and Lamu have historical townscapes along the old port, the marina development as well as the old town redevelopment should be taken into consideration. The area for a marina would include the following facilities : mooring facilities (pier), slope for boat-lift, crane, boat-lifter, boat-yard, boat-house, club-house, information service facilities, training facilities, salvage boat, communication facilities, beacon, refuelling and water-supply facilities, repair shop, boat washing facilities, hotel and rest house.

5.3.4. Project Cost Estimations

(1) Estimated Unit Costs

a. Roads

Estimated unit costs for road works are refered to in Chapter 2.

b. Airports

Estimated unit cost for runway pavement improvement have been refered to in Chapter 2.

c. Ports (Marinas)

The construction cost per marina having the following facilities scale is estimated at about 37.5 million K£, estimated from examples

of marina development project costs in Japan. The assumptions for the marina scale and facilities are as follows :

- A ccommodation of 100 boats
- Mooring & lifting facilities : finger pier, slope, crane, boat-lifter
- Land facilities : club house, boat-yard, repair shop, car parking, lighting, refuelling, water-supply, electric-supply, garbage incineration facilities, and
- Others: rescue boat, beacon, others.

(2) Project Costs

Table 4. 17 shows the project costs based on the above estimated unit cost and the expenditure schedule from the viewpoint of tourism development in the Coastal Tourism Region.

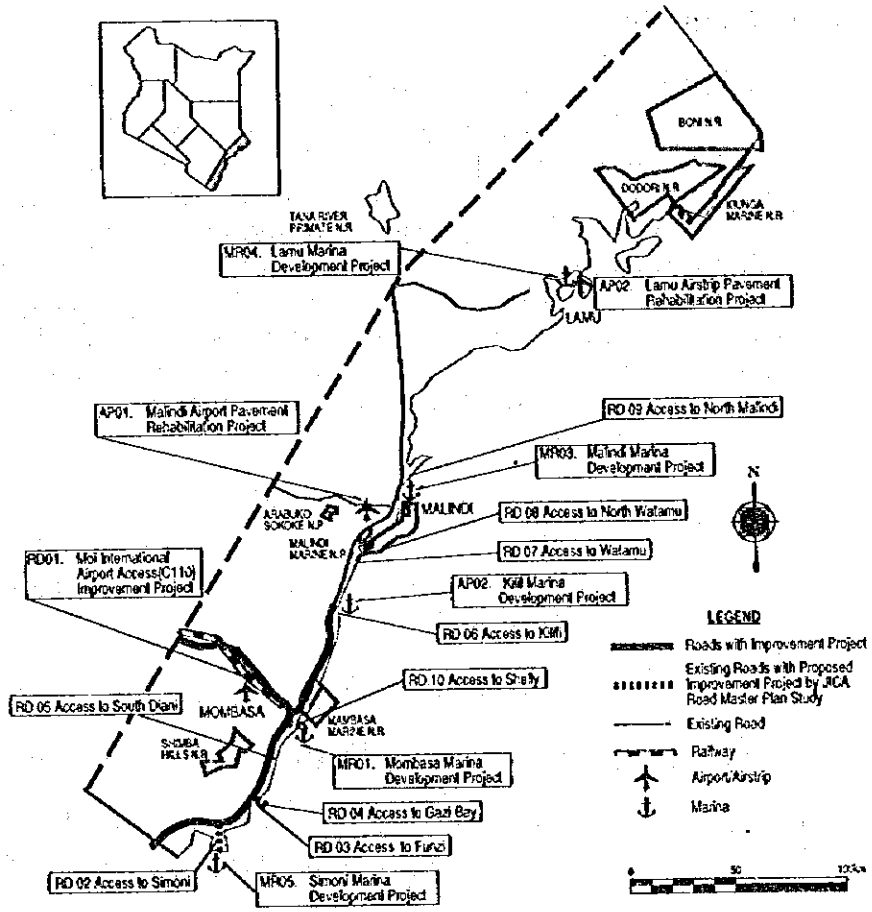
Figure 4. 8 shows the location of projects in the region.

Table 4. 17 Project Costs and Expenditure Schedule

	Project Name	Quality (Km)	Cost (Million K£)	Expenditure Schedule (million K£) -2000	-2005	-2010
RD.01	Moi International Airport Access (C110) Improvement	4.9	1.75	1.75		
RD.02	Access (D543) to Shimini Tourism Promotion Zone	12.5	0.5		0.5	
RD.03	Access (E568) to Funzi Tourism Promotion Zone	1	0.025		0.025	
RD.04	Access to Gazi Tourism Promotion	1	0.075		0.075	
RD.05	Access (E965) to South Diani Tourism Promotion Zone	10	0.5	0.5		
RD.06	Access (E921) to Kilifi Tourism Promotion Zone	8	0.325		0.325	
RD.07	Access (E688, 889, 900) to Watamu Tourism Promotion Zone	12	0.5	0.5		
RD.08	Accesss to North Watamu	6	0.375		0.375	
RD.09	Access (E892) to North Malindi Tourism Promotion Zone	7	0.3			
RD.10	Access to Shelly Tourism Zone Zone	5	0.3			0.3
						0.3
	Sub Total		4.65	2.75	1.3	0.6
AP.01	Malindi Airport Pavement	67,500m^2	10.75		10.75	
AP.02	Lamu Airstrip Pavement Regabilitation	16,000m^2	2.5	2.5		
	Sub Total		13.25	2.5	10.75	0
MR.01	Mombasa Marina Development		7.5			
MR02	Kilifi Marina Development		7.5			
MR.03	Malindi Marina Developemtn		7.5			
MR.04	Lamu Marina Development		7.5			
MR.05	Shimoni Marina Devlopment		7.5			
	Sub Total		37.5	0	0	0
	Total		55.4	5.25	12.05	0.6

Source: JICA Study Team

Figure 4. 8 Position of Projects in the Coastal Tourism Region



Source: JICA Study Team

5.4. Water Supply

5.4.1. Present Condition

Characteristics of the Coastal Tourism Region are summarised inTable 4. 18. The existing urban water supply system has been provided only in Lamu Town within the target zones. In the West Lamu and Pate zones community water supply systems exist. In the other zones, individual water supply systems have been adopted with groundwater as water source. In the Coastal Tourism Region, potentiality for groundwater is very high, but its quality is not suitable for portable water especially at shallow wells. The South Mombasa tourism area is located near to Msambweni, where urban water supply is planned by NWMP for enlargement of the existing facilities.

5.4.2. Forecast Water Demand

Water demand for the tourism zones and tourism accommodations is forecasted as shown in Table 4. 19.

5.4.3. Development Strategy for Water Supply

(1) In Case of Enlargement of the Urban Water Supply Scheme

Where the urban water supply scheme in the NWMP cannot absorb the required water for the target tourism zones, enlargement projects of the scheme are necessary. The relevant cost of the scheme for the tourism zones is included in the tourism development cost. The share of water demand in the tourism zones to total water demand in the whole area planned by the scheme is more than 10 %.

The Kilifi, Watamu and North Watamu zones at the Malindi Coast belong to this type (see Table 4. 19 (3/5)).

(2) In Case of Using the Urban Water Supply Scheme

Shimoni, Funzi Island and Funzi Bay zones in the South Mombasa tourism area belong to this type (see Table 4. 19(1/5)). The required water for these zones is planned to be supplied through a 19 km pipeline from the existing Msambweni urban water supply scheme on the condition, that target zones enlarge the capacity of the scheme by the year 2000.

The required water of the North Mambrui zone is planned to be supplied from the Mambrui urban water supply scheme as shown

in Table 4. 19 (3/5). This table indicates that enlargement of the scheme is necessary in 2000.

Water for the Shelly zone is planned to be supplied through a pipeline of 15 km from the Kaya Bombo reservoir, which is planned under the Mombasa urban water supply scheme as shown in Table 4. 19 (2/5).

The zones in the Lamu coast tourism area will use the Lamu urban water supply scheme as water source, since the quality of groundwater is very poor and potentiality of surface water is low. Additional water supply facilities for the zones are required and additional cost for these facilities are estimated for the tourism development (see Table 4. 19 (4/5) to (5/5)).

(3) Development of New Community Water Supply

In the following cases, the target tourism zone will plan new community water supply schemes, including water supply for residents surrounding the zone. The project cost of community water supply for tourism zones is estimated for the tourism development.

- Tourism zones, which are not covered by the existing or planned urban water supply scheme
- Tourism development pattern is the concentrated type
- Potential of water source is high enough, and
- There are no marked differences between project costs only for tourism accommodation or for the zone including residents.

South Diani and Gazi Bay zones belong to this type. The envisaged water source is groundwater from boreholes located at Mwaweche as shown in Table 4. 19 (2/5).

5.4.4. Urban Water Supply Scheme Related with Tourism Development

Planned urban water schemes and their costs related to each tourism zone are summarised in Table 4. 19 (1/5) to (5/5). The layout plans of the urban water schemes for Kilifi, Watamu, and Lamu are shown in Figure 4. 9 to Figure 4. 11

5.4.5. Proposed Project for Tourism Zone

The proposed project cost and its disbursement schedule for the region are shown in Table 4. 20.

The layout plan of the water supply projects for the zones in the South Mombasa tourism area is shown in Figure 4. 12. The layout plans for the zones in the Malindi Coast tourism area and in the Lamu Coast tourism area are shown in Figure 4. 13 and Figure 4. 14.

Table 4. 18 Characteristics of the Coastal Tourism Region

Tourism Area	Tourism Sub-Area		Existing Hotel/Lodge	2010 Hotel/Lodge	Type of Zone	Development Pattern	Existing Facilities	Urban Water Supply Scheme
S. Mombasa	Shimoni/ Wasini	Shimoni	0	850	Rural	C	-	-
		Others	31	450	Rural	S	-	-
		Total	31	1,300				
	Funzi	Funzi Isl.	0	300	Rural	C	-	-
		Funzi Bay	0	200	Rural	C	-	-
		Others	15	500	Rural	S	-	-
		Total	15	1,000				
	Gazi	Gazi Bay	20	350	Rural	C	Community	-
		Others	0	50	Rural	S	-	-
		Total	20	400				
	Tiwi/ Diani/Galu	S. Diani	2,514	3,200	Rural	C	Community	-
		Shelly	0	400	Rural	C	Community	-
		Others	0	1,100	Rural	S	-	-
		Total	2,514	4,700				
Malindi	Kilifi	Kilifi	150	1,800	Urban	C	NWCPC	P
		Others	0	200	Rural	S	-	-
		Total	150	2,000				
	Watamu	Watamu	600	2,000	Urban	C	NWCPC	P
		N. Watamu	0	1,400	Rural	C	NWCPC	P
		Others	0	400	Rural	S	-	-
		Total	600	3,800				
	Malindi	N. Mambri	0	500	Rural	C	-	-
		Others	1,200	1,300	Rural	S	-	-
		Total	1,200	1,800				
Lamu	Lamu/Shella	W. Lamu	0	200	Rural	C	Community	-
		Others	100	300	Rural	S	-	-
		Total	100	500				
	Manda Is.	S. Manda	0	300	Rural	C	-	-
		E. Manda	0	300	Rural	C	-	-
		Others	50	1,100	Rural	S	-	-
		Total	50	1,700				
	Pate Is.	Pate	0	300	Rural	C	Community	-
		Others	0	0	Rural	S	-	-
		Total	0	300				

Note:
- `*` Location of hotel/lodge is not identified
- C Tourism development pattern is the concentrated type
- S Tourism development pattern is the scattered type
- LA Managed by local authority
- NWCPC Managed by the National Water Conservation and Pipeline Coorporation
- `-` Public facilities are not existing
- Community Managed by community
- P Under construction/planning

Source : JICA Study Team

Table 4. 19 Inventory of Proposed Projects : Water Supply (1/5)

South Mombasa Tourism Area															
	Shimoni					Funzi Island					Funzi Bay				
	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total
Type of Area	Rural					Rural					Rural				
Existing Water Supply System	Individual					Individual					Individual				
- Capacity (1,000 m3/d)															
- Management Authority															
Urban Water Supply Scheme	Msambweni (Habitable Area : 103 km2)					Msambweni (Habitable Area : 103 km2)					Msambweni (Habitable Area : 103 km2)				
in the NWMP	MOWD					MOWD					MOWD				
- Served Area (km2)	1.00	2.00	2.50	3.00	3.00	1.00	2.00	2.50	3.00	3.00	1.00	2.00	2.50	3.00	3.00
- Served Population (1,000)	8.40	21.90	28.20	34.50	34.50	8.40	21.90	28.20	34.50	34.50	8.40	21.90	28.20	34.50	34.50
- Water Demand (1,000 m3/d)	1.298	3.394	4.411	5.427	5.427	1.298	3.394	4.411	5.427	5.427	1.298	3.394	4.411	5.427	5.427
- Population Density (pers./km2)	8,400	10,950	11,280	11,500		8,400	10,950	11,280	11,500		8,400	10,950	11,280	11,500	
- Overall per Capita (l/c/d)	154.52	154.98	156.42	157.30		154.52	154.98	156.42	157.30		154.52	154.98	156.42	157.30	
Tourism Development Plan															
- Number of Room	0	250	500	850	850	0	0	150	300	300	0	40	100	200	200
- Water Demand (1,000 m3/d)	0.000	0.330	0.673	1.158	1.158	0.000	0.000	0.202	0.409	0.409	0.000	0.053	0.135	0.273	0.273
for Tourism Accomodation	0.000	0.125	0.250	0.425	0.425	0.000	0.000	0.075	0.150	0.150	0.000	0.020	0.050	0.100	0.100
for Resident in tourism area*1	0.000	0.205	0.423	0.733	0.733	0.000	0.000	0.127	0.259	0.259	0.000	0.033	0.085	0.173	0.173
Proportion (%)*2	0.00	9.73	15.26	21.34	21.34	0.00	0.00	4.58	7.53	7.53	0.00	1.56	3.05	5.02	5.02
Proposed Project															
- Type of Water Supply System	Community(Public)					Community(Public)					Community(Public)				
- Type of Water Source	From Msambweni Urban Water Supply					From Msambweni Urban Water Supply					From Msambweni Urban Water Supply				
- Incremental Capacity (1,000 m3/d)	0.000	0.330	0.343	0.485	1.158	0.000	0.000	0.202	0.207	0.409	0.000	0.053	0.082	0.138	0.273
Project Cost (KS Million)*3		1.486	1.023	1.444	3.953			0.789	0.615	1.404		0.186	0.141	0.236	0.562

Remarks

*1 : Residential demand is calculated by [0.05 km2/100 rooms X No.of room X Population density x 150 l/c/d].

*2 : Proportion of water demand in the tourism area to one in the urban area.

*3 : Cost consists of construction, contingency, detail design & supervision and land.

*4 : Not included the construction cost of dams

Source : JICA Study Team

Table 4. 19 Inventory of Proposed Projects : Water Supply (2/5)

South Mombasa Tourism Area														
	South Diani				Shelly				Gazi Bay					
	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total
Type of Area	Rural					Rural					Rural				
Existing Water Supply System	Community					Community					Community				
- Capacity (1,000 m3/d)	1.00					Nil									
- Management Authority	NWCPC & Community					NWCPC					Community				
Urban Water Supply Scheme	Kwale town (Habitable Area : 78 km2)					Mombasa (Habitable Area : 198 km2)					Kwale Town(Habitable Area : 78 km2)				
in the NWMP	NWCPC					NWCPC					NWCPC				
- Served Area (km2)	0.28	0.72	0.93	1.14	1.14	35.82	50.26	58.90	67.54	67.54	0.28	0.72	0.93	1.14	1.14
- Served Population (1,000)	3.70	9.70	12.45	15.20	15.20	479.60	673.00	788.70	904.40	904.40	3.70	9.70	12.45	15.20	15.20
- Water Demand (1,000 m3/d)						100.256	151.634	177.228	202.823	202.823					
- Population Deisity (pers./km2)	13,214	13,472	13,387	13,333		13,389	13,390	13,390	13,391		13,214	13,472	13,387	13,333	
- Overall per Capita (l/c/d)						209.04	225.31	224.71	224.26						
Tourism Development Plan															
- Number of Room	2,514	2,600	3,000	3,200	3,200	0	0	200	400	400	20	50	170	350	350
- Water Demand (1,000 m3/d)	3.749	3.927	4.512	4.800	4.800	0.000	0.000	0.301	0.602	0.602	0.030	0.076	0.256	0.525	0.525
for Tourism Accomodation	1.257	1.300	1.500	1.600	1.600	0.000	0.000	0.100	0.200	0.200	0.010	0.025	0.085	0.175	0.175
for Resident in tourism area*1	2.492	2.627	3.012	3.200	3.200	0.000	0.000	0.201	0.402	0.402	0.020	0.051	0.171	0.350	0.350
Proportion (%)*2						0.00	0.00	0.17	0.30	0.30					
Proposed Project															
- Type of Water Supply System	Community(Public)					Community(Public) Boreholes(TIWI) &					Community(Public)				
- Type of Water Source	Groundwater (Boreholes) at Mwaweche					Kaya Bombo Reservoir (Planned)					Groundwater (Boreholes) at Mwaweche				
- Incremental Capacity	2.749	0.179	0.585	0.288	3.800	0.000	0.000	0.301	0.301	0.602	0.030	0.046	0.180	0.269	0.525
(1,000 m3/d)															
Project Cost (KE Million)*3	9.108	0.478	1.714	0.847	12.147			0.647	0.493	1.141	0.362	0.256	0.522	0.781	1.922

Remarks

*1 : Residential demand is calculated by [0.05 km2/100 rooms X No.of room X Population dencity x 150 l/c/d].

*2 : Proportion of water demand in the tourism area to one in the urban area.

*3 : Cost consists of construction, contingency, detail design & supervision and land.

*4 : Not included the construction cost of dams

Source: JICA Study

Table 4. 19 Inventory of Proposed Projects : Water Supply (3/5)

	Malindi Coast Tourism Area													
	Kilifi				North Mambrui				Watamu					
	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total
Type of Area	Urban					Rural					Urban				
Existing Water Supply System	Public (Kilifi Town)					Individual					Public(Watamu Town)				
- Capacity (1,000 m3/d)	2.45 (Sabaki Pipeline)										1.63				
- Management Authority	NWCPC										NWCPC				
Urban Water Supply Scheme	Kilifi Town (Habitable Area : 153 km2)					Mambrui Town (Habitable Area : 204 km2)					Watamu Town (Habitable Area : 99 km2)				
in the NWMP	NWCPC					NWCPC					NWCPC				
- Served Area (km2)	1.00	2.39	3.23	4.07	4.07	0.35	0.71	0.90	1.08	1.08	0.20	0.40	0.50	0.70	0.70
- Served Population (1,000)	12.50	32.00	43.25	54.50	54.50	3.20	6.83	8.65	10.48	10.48	2.10	5.40	7.30	9.20	9.20
- Water Demand (1,000 m3/d)	2.119	5.288	7.141	8.994	8.994	0.466	1.024	1.558	2.092	2.092	0.306	0.801	1.095	1.389	1.389
- Population Density (pers./km2)	12,500	13,389	13,390	13,391		9,143	9,621	9,616	9,701		10,500	13,500	14,600	13,143	
- Overall per Capita (l/c/d)	169.52	165.25	165.11	165.03		145.63	149.90	180.03	199.68		145.71	148.33	150.00	150.98	
Tourism Development Plan															
- Number of Room	150	450	1,600	1,800	1,800	0	400	500	500	500	600	1,600	1,900	2,000	2,000
- Water Demand (1,000 m3/d)	0.075	0.225	0.800	0.900	0.900	0.000	0.489	0.611	0.614	0.614	0.300	0.800	0.950	1.000	1.000
for Tourism Accomodation	0.075	0.225	0.800	0.900	0.900	0.000	0.200	0.250	0.250	0.250	0.300	0.800	0.950	1.000	1.000
for Resident in tourism area*1	Included in the Urban area					0.000	0.289	0.361	0.364	0.364	Included in the Urban area				
Proportion (%)*2	3.54	4.25	11.20	10.01	10.01	0.00	47.72	39.19	29.34	29.34	98.04	99.88	86.76	71.99	71.99
Proposed Project															
- Type of Water Supply System	Urban Water Supply Scheme(Public)					Community(Public)					Urban Water Supply Scheme(Public)				
- Type of Water Source	Sabaki Pipeline from Teza reservoir					From Mambrui Urban Water Supply					Sabaki Pipeline from Malindi				
- Incremental Capacity (1,000 m3/d)	-0.331	2.838	2.428	1.953	6.888		0.489	0.122	0.003	0.614	-1.024	0.995	0.444	0.344	0.759
Project Cost (KE Million)*3	8.625			9.650	18.275		1.814	0.384	0.000	2.198	5.038			5.263	10.300

Remarks

*1 : Residential demand is calculated by [0.05 km2/100 rooms X No.of room X Population dencity x 150 l/c/d].

*2 : Proportion of water demand in the tourism area to one in the urban area.

*3 : Cost consists of construction, contingency, detail design & supervision and land.

*4 : Not included the construction cost of dams

Source: JICA Study Team

Table 4. 19 Inventory of Proposed Projects : Water Supply (4/5)

	Malindi Coast Tourism Area					Lamu Coast Tourism Area									
	North Watamu					West Lamu					South Manda				
	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total
Type of Area	Rural					Rural					Rural				
Existing Water Supply System	Public(Watamu Town)					Community					Individual				
- Capacity (1,000 m3/d)	1.63														
- Management Authority	NWCPC					Community									
Urban Water Supply Scheme	Watamu Town (Habitable Area : 99 km2)					Lamu Town (Habitable Area : 4 km2)					Lamu Town (Habitable Area : 4 km2)				
in the NWMP	NWCPC					MOWD					MOWD				
- Served Area (km2)	0.20	0.40	0.50	0.70	0.70	0.67	1.52	2.03	2.54	2.54	0.67	1.52	2.03	2.54	2.54
- Served Population (1,000)	2.10	5.40	7.30	9.20	9.20	9.00	20.40	27.20	34.00	34.00	9.00	20.40	27.20	34.00	34.00
- Water Demand (1,000 m3/d)	0.306	0.801	1.095	1.389	1.389	1.691	3.752	5.034	6.317	6.317	1.691	3.752	5.034	6.317	6.317
- Population Density (pers./km2)	10,500	13,500	14,600	13,143		13,433	13,421	13,399	13,386		13,433	13,421	13,399	13,386	
- Overall per Capita (l/c/d)	145.71	148.33	150.00	150.98		187.89	183.92	185.07	185.79		187.89	183.92	185.07	185.79	
Tourism Development Plan															
- Number of Room	0	400	1,000	1,400	1,400	0	50	150	200	200	0	0	100	300	300
- Water Demand (1,000 m3/d)	0.000	0.200	0.500	0.700	0.700	0.000	0.075	0.226	0.301	0.301	0.000	0.000	0.150	0.451	0.451
for Tourism Accomodation	0.000	0.200	0.500	0.700	0.700	0.000	0.025	0.075	0.100	0.100	0.000	0.000	0.050	0.150	0.150
for Resident in tourism area*1	Included in the Urban area				0.000	0.000	0.050	0.151	0.201	0.201	0.000	0.000	0.100	0.301	0.301
Proportion (%)*2	0.00	24.97	45.66	50.40	50.40	0.00	2.01	4.48	4.76	4.76	0.00	0.00	2.99	7.14	7.14
Proposed Project															
- Type of Water Supply System	Urban Water Supply Scheme(Public)					Community(Public)					Community(Public)				
- Type of Water Source	From Watamu Urban Water Supply					From Lamu Urban Water Supply					From Lamu Urban Water Supply				
- Incremental Capacity (1,000 m3/d)	0.000	0.200	0.300	0.200	0.700	0.000	0.075	0.150	0.075	0.301	0.000	0.000	0.150	0.301	0.451
Project Cost (KS Million)*3		1.097	1.186	0.793	3.076		0.474	0.341	0.170	0.985			2.769	0.823	3.593

Remarks

*1 : Residential demand is calculated by [0.05 km2/100 rooms X No.of room X Population dencity x 150 l/c/d].

*2 : Proportion of water demand in the tourism area to one in the urban area.

*3 : Cost consists of construction, contingency, detail design & supervision and land.

*4 : Not included the construction cost of dams

Source: JICA Study Team

Table 4. 19 Inventory of Proposed Projects : Water Supply (5/5)

	Lamu Coast Tourism Area									
	East Manda					Pate				
	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total
Type of Area	Rural					Rural				
Existing Water Supply System	Individual					Community				
- Capacity (1,000 m3/d)										
- Management Authority						Community				
Urban Water Supply Scheme	Lamu Town (Habitable Area : 4 km2)					Lamu Town (Habitable Area : 4 km2)				
in the NWMP	MOWD					MOWD				
- Served Area (km2)	0.67	1.52	2.03	2.54	2.54	0.67	1.52	2.03	2.54	2.54
- Served Population (1,000)	9.00	20.40	27.20	34.00	34.00	9.00	20.40	27.20	34.00	34.00
- Water Demand (1,000 m3/d)	1.691	3.752	5.034	6.317	6.317	1.691	3.752	5.034	6.317	6.317
- Population Density (pers./km2)	13,433	13,421	13,399	13,386		13,433	13,421	13,399	13,386	
- Overall per Capita (l/c/d)	187.89	183.92	185.07	185.79		187.89	183.92	185.07	185.79	
Tourism Development Plan										
- Number of Room	0	0	100	300	300	0	0	100	300	300
- Water Demand (1,000 m3/d)	0.000	0.000	0.150	0.451	0.451	0.000	0.000	0.150	0.451	0.451
for Tourism Accomodation	0.000	0.000	0.050	0.150	0.150	0.000	0.000	0.050	0.150	0.150
for Resident in tourism area*1	0.000	0.000	0.100	0.301	0.301	0.000	0.000	0.100	0.301	0.301
Proportion (%)*2	0.00	0.00	2.99	7.14	7.14	0.00	0.00	2.99	7.14	7.14
Proposed Project										
- Type of Water Supply System	Community(Public)					Community(Public)				
- Type of Water Source	From Lamu Urban Water Supply					From Lamu Urban Water Supply				
- Incremental Capacity (1,000 m3/d)	0.000	0.000	0.150	0.301	0.451	0.000	0.000	0.150	0.301	0.451
Project Cost (KE Million)*3			0.553	0.681	1.234			8.237	0.681	8.918

Remarks

*1 : Residential demand is calculated by (0.05 km2/100 rooms X No.of room X Population dencity x 150 l/c/d).

*2 : Proportion of water demand in the tourism area to one in the urban area.

*3 : Cost consists of construction, contingency, detail design & supervision and land.

*4 : Not included the construction cost of dams

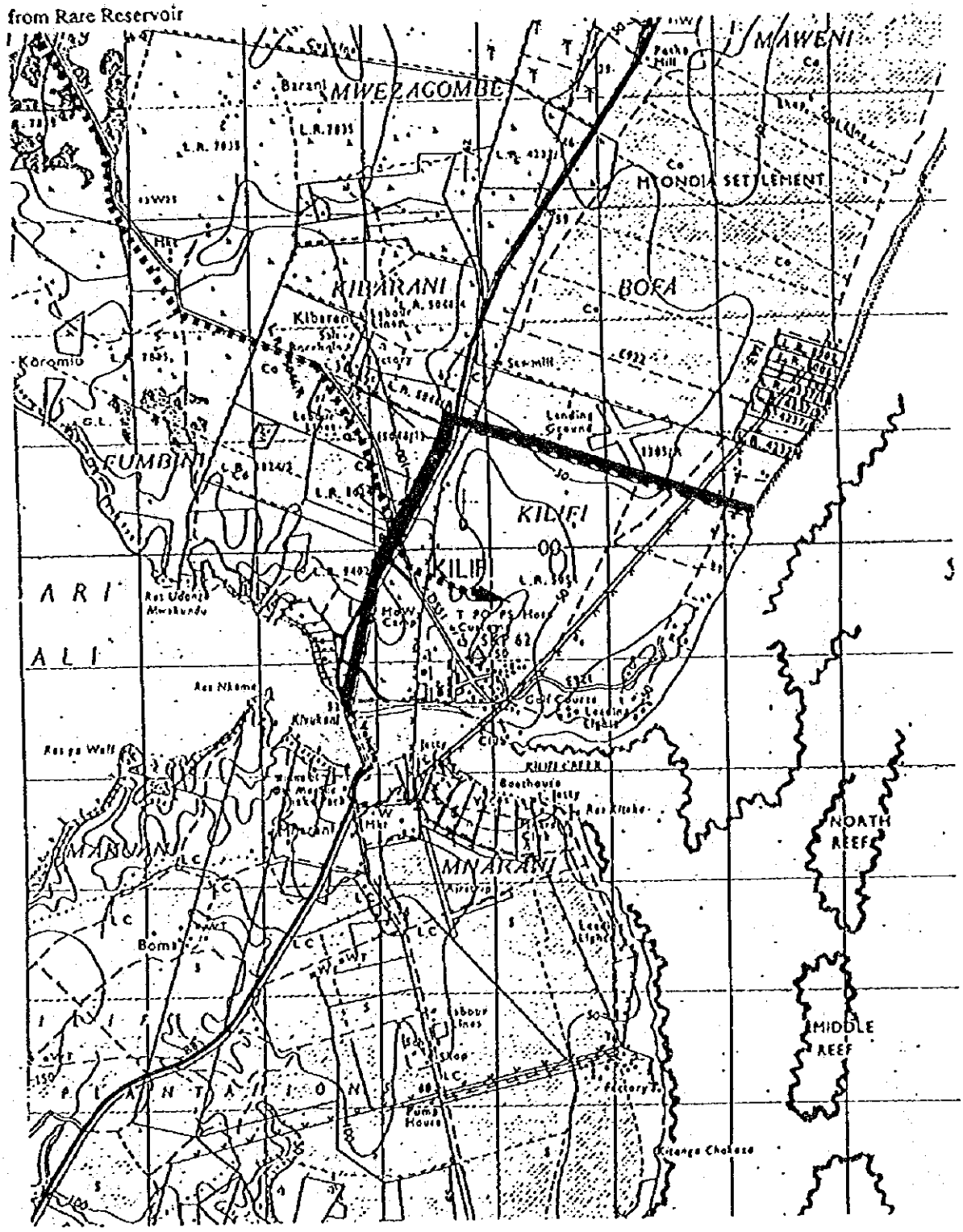
Source: JICA Study Team

Table 4. 20 Project Cost and Disbursement Schedule

Project Name	Quantity (1,000 m3/d)	Cost (K£ Million)	Disbursement Schedule (K£ Million) Urgent	2000	2005	2010
Community Water Supply Project						
1.Shimoni	1.16	3.953	0	2.325	1.628	0.000
2.Funzi Island	0.41	1.405	0	0.000	0.703	0.703
3.Funzi Bay	0.27	0.563	0	0.113	0.45	0.000
4.South Diani	4.80	12.153	9.110	2.285	0.000	0.758
5.Shelly	0.60	1.140	0	0.058	0.513	0.570
6.Gazi Bay	0.53	1.923	0.363	1.560	0.223	0.335
7.North Mambrui	0.61	2.198	0	1.758	0.440	0.000
8.West Lamu	0.30	0.985	0	0.985	0.000	0.000
9.South Manda	0.45	3.593	0	0.240	3.353	0.000
10.East Manda	0.45	1.235	0	0.000	1.235	0.000
11.Pate	0.45	8.918	0	0.000	2.973	2.378
Sub Total		38.063	9.473	9.323	11.293	5.954
Enlargement of Urban Water Supply Project						
12.Kilifi	0.83	1.810	0	0	1.610	0.200
13.Watamu	0.70	4.813	0	4.573	0.000	0.024
14.North	0.70	3.075	0	0.878	1.318	0.880
Sub Total		9.698	0	5.450	2.928	1.320
Total		47.760	9.473	14.773	14.220	9.295

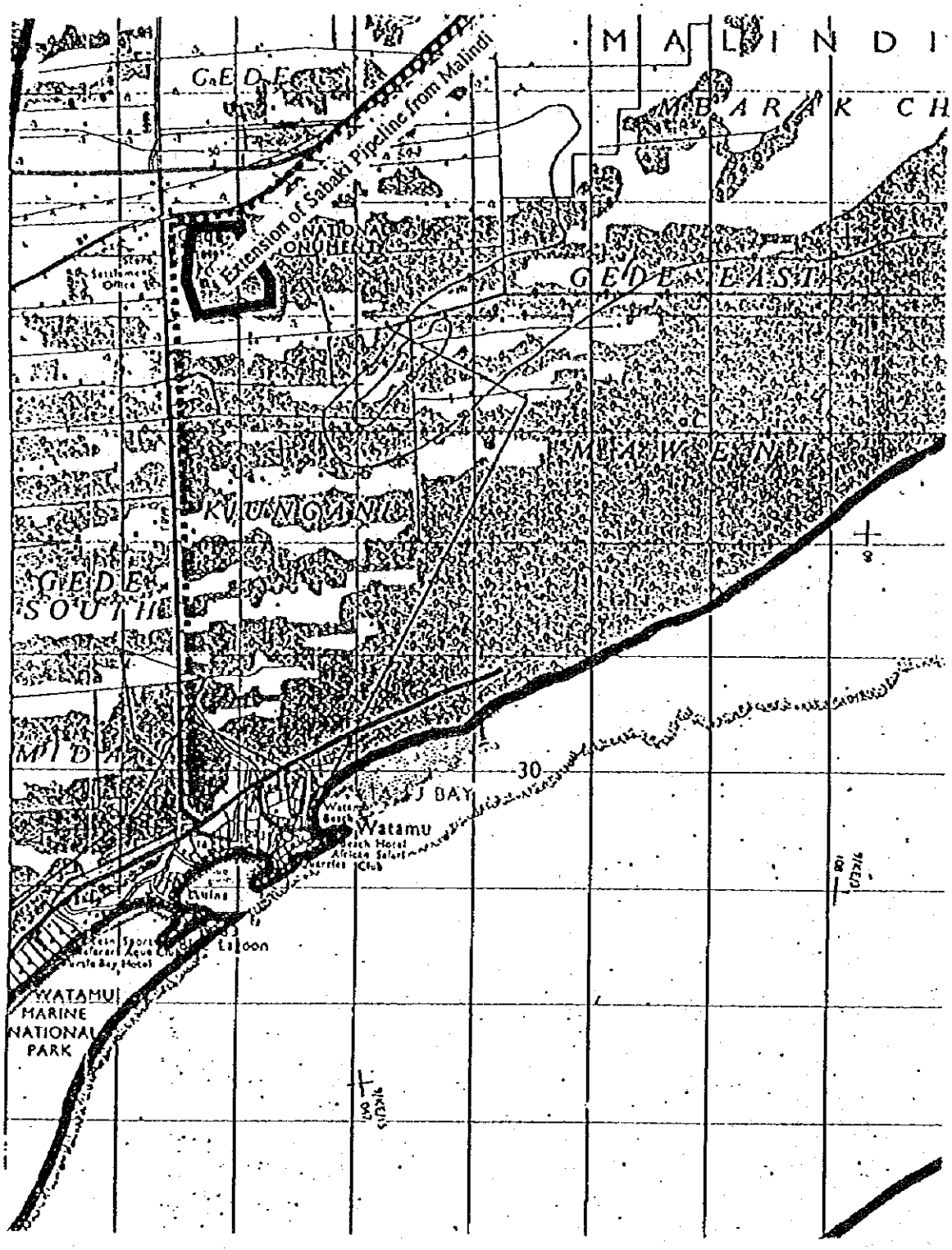
Source : JICA Study Team

Figure 4. 9 Water Supply Plan for the Tourism Promotion Zone in Kilifi



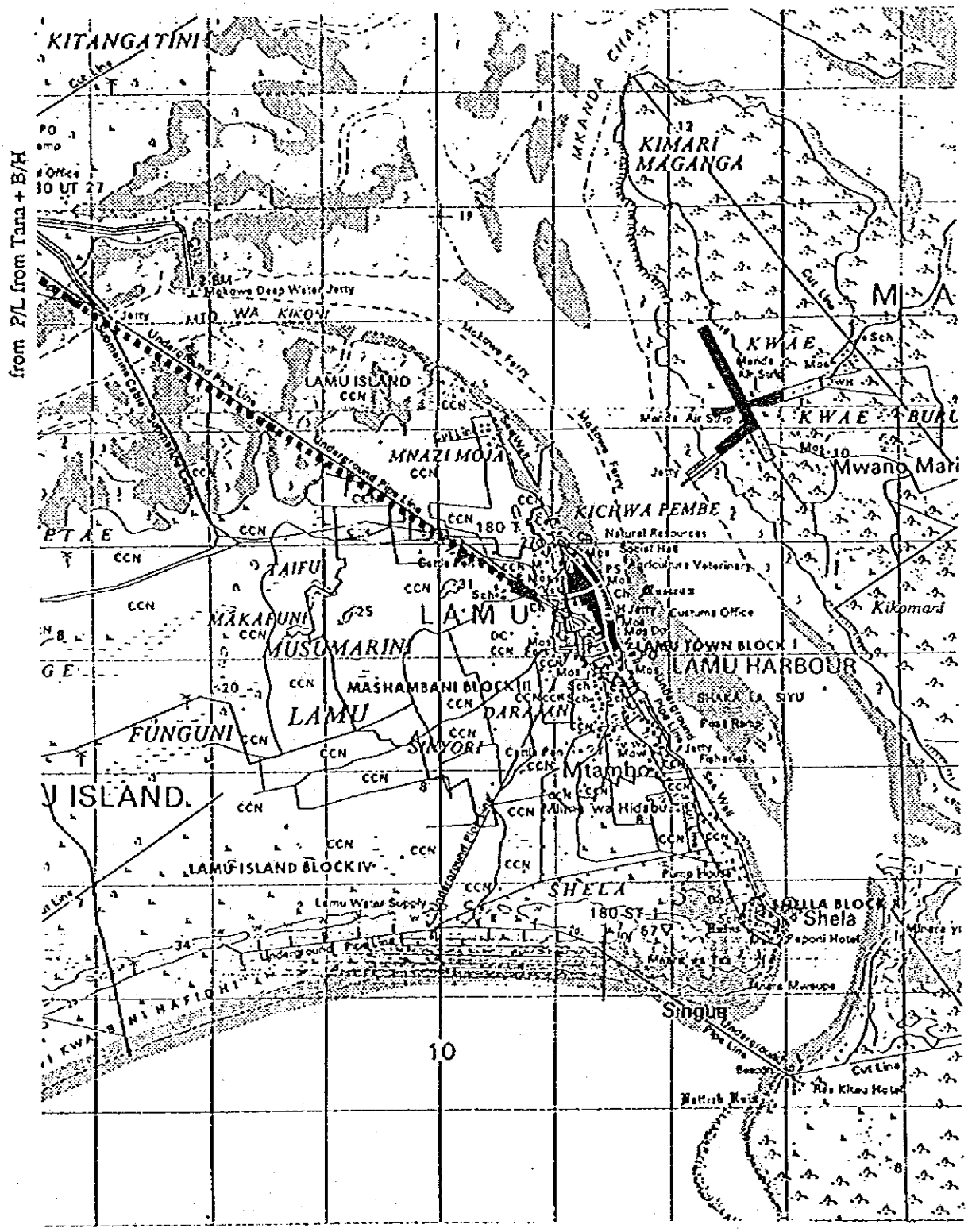
Source : NWMP

Figure 4. 10 Water Supply Plan for the Tourism Promotion Zone in Watamu



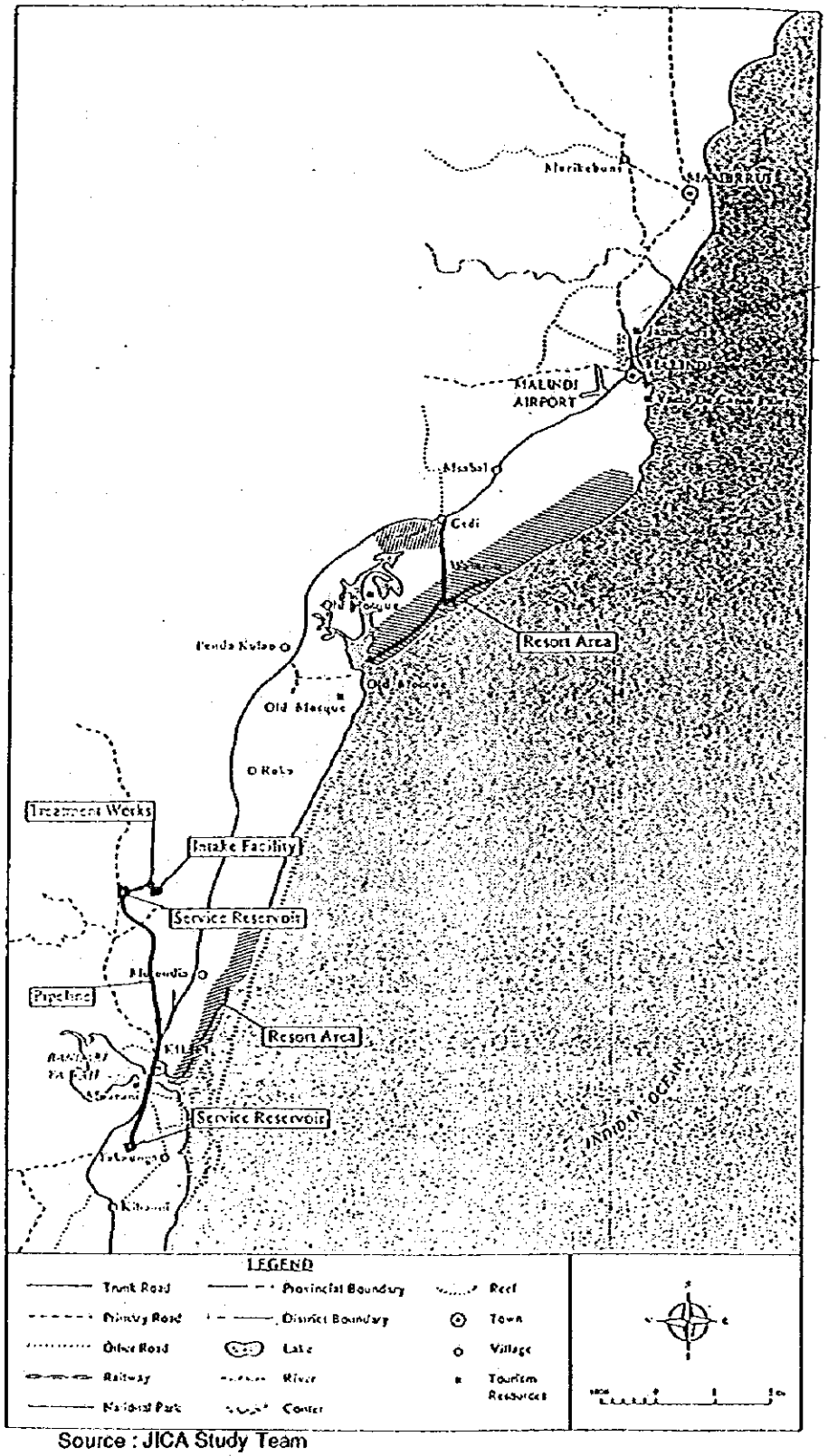
Source : NWMP

Figure 4. 11 Water Supply Plan for the Tourism Promotion Zone in Lamu



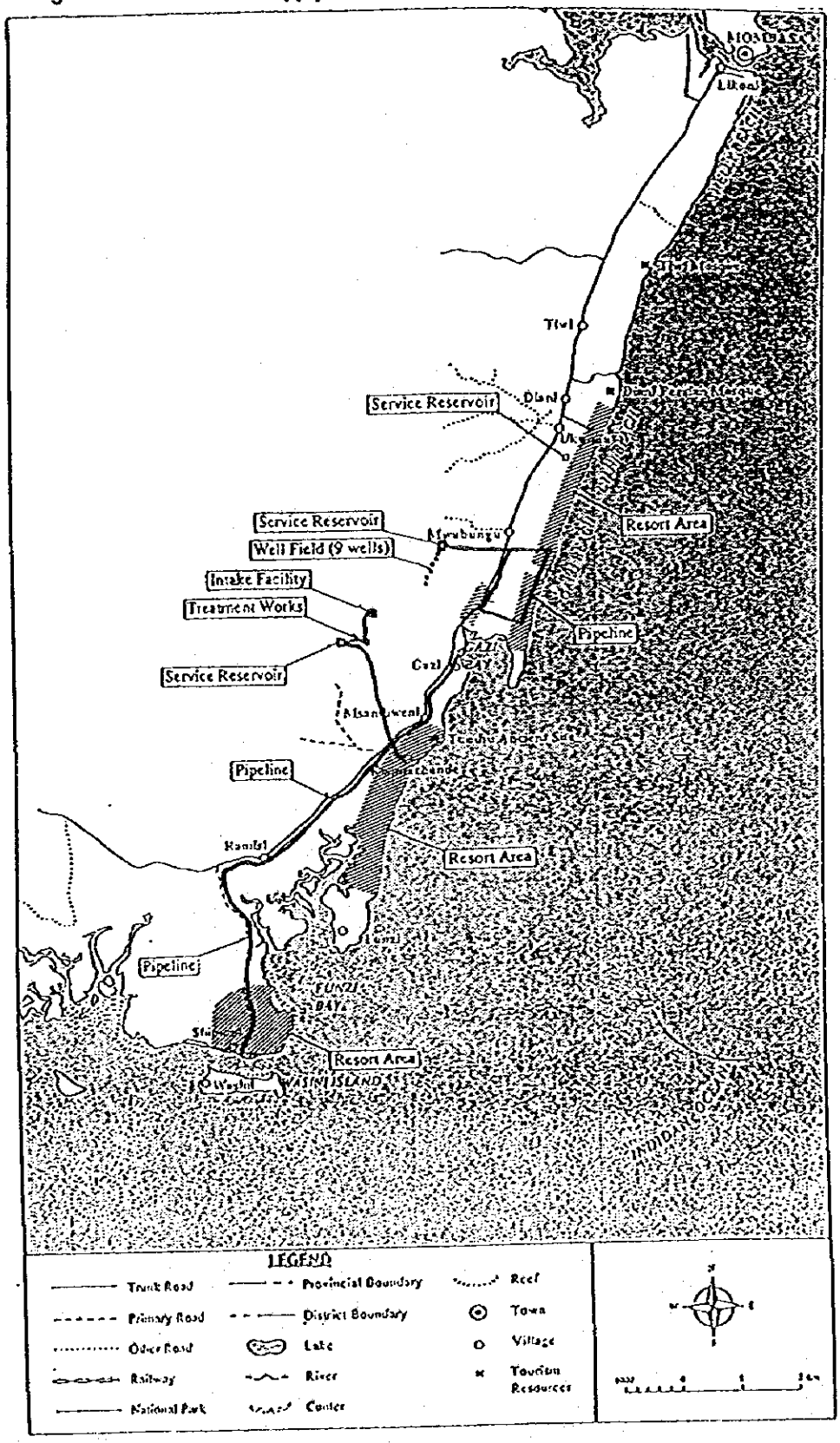
Source : NWMP

Figure 4. 12 Water Supply Plan for the Tourism Promotion Zone in Shimoni and Funzi



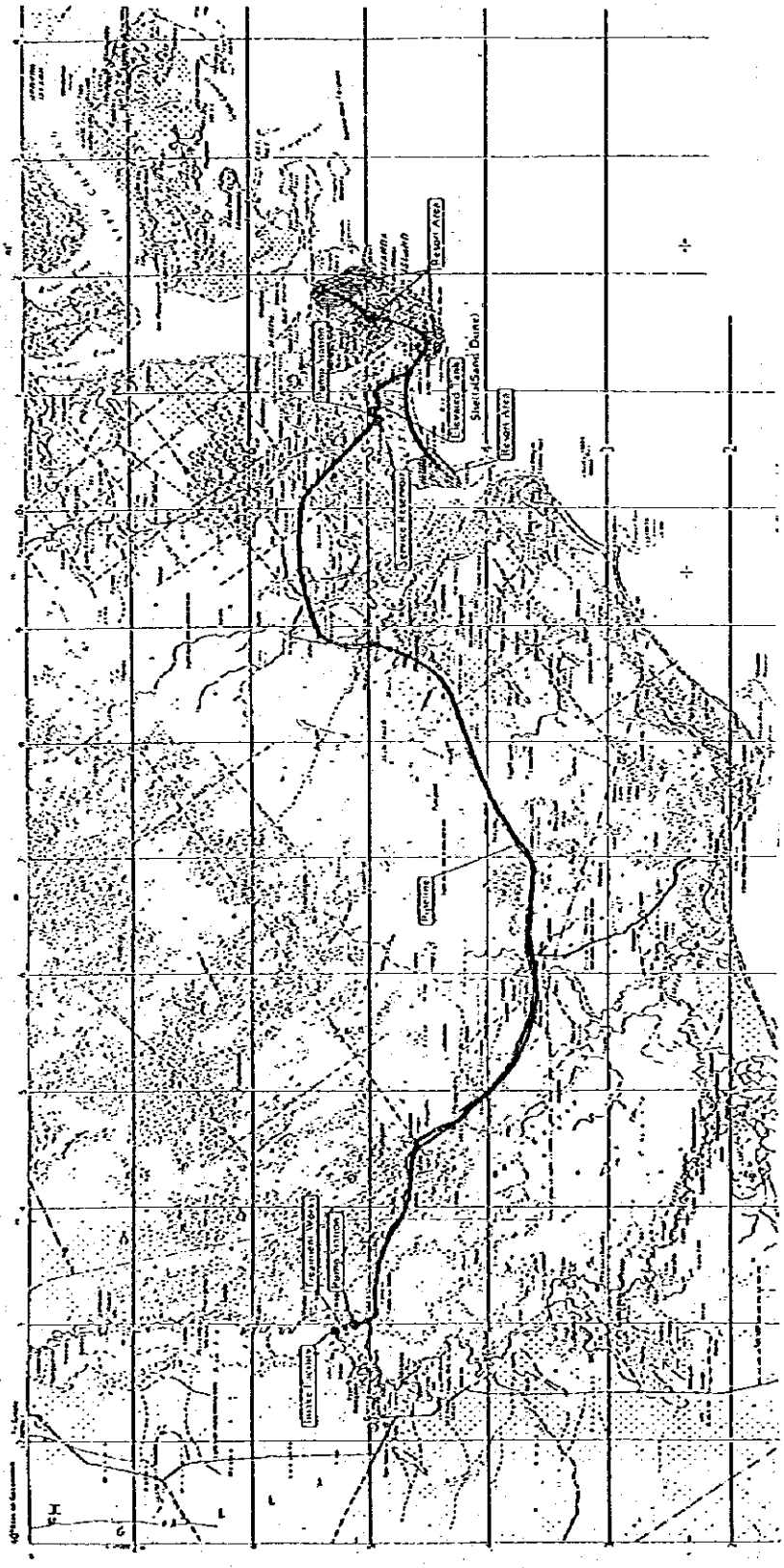
Source : JICA Study Team

Figure 4. 13 Water Supply Plan for the Tourism Promotion Zone in Malindi



Source : JICA Study Team

Figure 4. 14 Water Supply Plan for the Tourism Promotion Zone in Lamu



Source : JICA Study Tea

5.5. Sewerage and Solid Waste

5.5.1. Present Condition

The existing conditions of the sewerage system in the Coastal Tourism Region are summarised in Table 4. 21. A sewerage system with treatment facilities has been provided only in Mombasa, but its treatment method is a primary sedimentation tank. In the other zones, sewage has been treated individually or discharged through drainage facilities into the ocean without treatment.

The conditions of the solid waste disposal system are as insufficient as the one of the sewerage system as shown in Table 4. 22

5.5.2. Forecast Sewage and Solid Waste Yield

Sewage yield for the tourism zone and tourism accommodation is forecasted as shown in Table 4. 21. Solid waste yield is estimated in Table 4. 22.

5.5.3. Development Strategy for Sewerage and Solid Waste Disposal

The sewerage development strategy for each tourism zone will follow the same strategy as for water supply, in order to ensure environmental conservation in the tourism area.

Solid waste disposal systems in the region are classified into the following schemes according to the characteristics of each zone (see Table 4. 22).

(1) Urban Solid Waste Disposal Scheme

Solid waste in the Kilifi and Shelly zones will be absorbed into the existing and planned urban schemes, since the share of solid waste yield in the zone in the whole area covered by the scheme is less than 10 %.

(2) Enlargement of Urban Solid Waste Disposal Scheme

Solid waste in the Watamu and North Watamu zones can be absorbed by the existing urban scheme. However, an enlargement of the urban scheme is required, since the share of solid waste yield in the zone relative to the whole area covered by the scheme is more than 10 %.

(3) Community Solid Waste Disposal Scheme

The Shimoni, South Diani and North Mambrui zones will plan a new community solid waste disposal scheme, including residential areas in the outskirts of the zone, since the development scale is large (more than 500 rooms). The Pate zone has the existing community system and so it adopts the community scheme.

(4) Individual Solid Waste Disposal Scheme

Each hotel in Funzi Island, Funzi Bay, Gazi Bay, West Lamu, South Manda and East Manda zones will provide individually on-site solid waste disposal facilities, as the zone has no existing solid waste facilities and, moreover, the development scale of the tourism zones is small (less than 500 rooms).

5.5.4. Urban Sewerage and Solid Waste Disposal Scheme Related with Tourism Development

The planned urban sewerage and solid waste disposal schemes related to each tourism zone are summarised inTable 4. 21 and Table 4. 22. The project costs of urban schemes are excluded from the calculated tourism development cost, since the urban schemes are implemented not only for tourism, but also urban development.

5.5.5. Proposed Project for Tourism Zone

The proposed projects for each tourism zone are summarised in Table 4. 21 and Table 4. 22. The project cost and their disbursement schedule for the region are shown in Table 4. 23.

As for the sewage treatment method, the stabilization/aerated lagoon process is proposed for the urban and community sewerage systems. For individual systems, septic tanks able to treat both, night soil and gray water are proposed.

Solid waste in urban and community systems shall be disposed of by means of sanitary landfilling. Individual systems consists of garbage storage yard, on-site incinerator, pits and on-site composting facilities.

Table 4. 21 Inventory of Proposed Projects : Sewerage System (1)

	South Mombasa Tourism Area														
	Shimoni					Funzi Island					Funzi Bay				
	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total
Type of Area	Rural					Rural					Rural				
Existing Sewerage System	Individual					Individual					Individual				
- Capacity (1,000 m3/d)															
- Management Authority															
Urban Sewerage Scheme in the NWMP	Msambweni (Habitable Area : 103 km2) LA(Kwale)					Msambweni (Habitable Area : 103 km2) LA(Kwale)					Msambweni (Habitable Area : 103 km2) LA(Kwale)				
- Sewered Area (km2)	1.00	2.00	2.50	3.00	3.00	1.00	2.00	2.50	3.00	3.00	1.00	2.00	2.50	3.00	3.00
- Sewered Population (1,000)	8.40	21.90	28.20	34.50	34.50	8.40	21.90	28.20	34.50	34.50	8.40	21.90	28.20	34.50	34.50
- Sewage Yield (1,000 m3/d)	1.038	2.715	3.529	4.342	4.342										
- Population Density (pers./km2)	8,400	10,950	11,280	11,500		8,400	10,950	11,280	11,500		8,400	10,950	11,280	11,500	
Tourism Development Plan															
- Number of Room	0	250	500	850	850	0	0	150	300	300	0	40	100	200	200
- Sewage Yield (1,000 m3/d)	0.000	0.264	0.538	0.927	0.927	0.000	0.000	0.162	0.327	0.327	0.000	0.042	0.108	0.218	0.218
for Tourism Accomodation	0.000	0.100	0.200	0.340	0.340	0.000	0.000	0.060	0.120	0.120	0.000	0.016	0.040	0.080	0.080
for Resident in tourism area*1	0.000	0.164	0.338	0.587	0.587	0.000	0.000	0.102	0.207	0.207	0.000	0.026	0.068	0.138	0.138
Proportion (%)*2															
Proposed Project															
- Type of Sewerage System	Community (Public)					Community (Public)					Community (Public)				
- Type of Receiving Waters	Ocean					Ocean					Ocean				
- Incremental Capacity (1,000 m3/d)	0.000	0.264	0.274	0.388	0.927	0.000	0.000	0.162	0.165	0.327	0.000	0.042	0.065	0.110	0.218
Project Cost (KE Million)*3		0.528	0.541	0.763	1.831			0.321	0.326	0.646		0.084	0.129	0.217	0.431

Remarks

*1 : Residential Yield is calculated by [0.05 km2/100 rooms X No. of room X Population dencity x 150 l/c/d x 0.8].

*2 : Proportion of sewage yield in the tourism area to one in the urban area.

*3 : Cost consists of construction, contingency, detail design & supervision and land.

Source : JICA Study Team

Table 4. 21 Inventory of Proposed Projects : Sewerage System (2)

	South Mombasa Tourism Area															
	South Diani					Shelly					Gazi Bay					
	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total	
Type of Area	Rural					Rural					Rural					
Existing Sewerage System	Individual					Individual					Individual					
- Capacity (1,000 m3/d)																
- Management Authority	LA(Collection of night soil)															
Urban Sewerage Scheme in the NWMP	Kwale Town (Habitable Area : 73 km2)					Mombasa (Habitable Area : 198 km2)					Kwale Town(Habitable Area : 78 km2)					
	LA					LA					LA					
- Sewered Area (km2)	0.28	0.72	0.93	1.14	1.14	35.82	50.26	58.90	67.54	67.54	0.28	0.72	0.93	1.14	1.14	
- Sewered Population (1,000)	3.70	9.70	12.45	15.20	15.20	479.60	673.00	788.70	904.40	904.40	3.70	9.70	12.45	15.20	15.20	
- Sewage Yield (1,000 m3/d)						80.205	121.307	141.782	162.258	162.258						
- Population Density (pers./km2)	13,214	13,472	13,387	13,333		13,389	13,390	13,390	13,391		13,214	13,472	13,387	13,333		
Tourism Development Plan																
- Number of Room	2,514	2,600	3,000	3,200	3,200	0	0	200	400	400	20	50	170	350	350	
- Sewage Yield (1,000 m3/d)	2.999	3.142	3.610	3.840	3.840	0.000	0.000	0.241	0.481	0.481	0.024	0.060	0.205	0.420	0.420	
for Tourism Accomodation	1.006	1.040	1.200	1.280	1.280	0.000	0.000	0.080	0.160	0.160	0.008	0.020	0.068	0.140	0.140	
for Resident in tourism area*1	1.993	2.102	2.410	2.560	2.560	0.000	0.000	0.161	0.321	0.321	0.016	0.040	0.137	0.280	0.280	
Proportion (%)*2																
Proposed Project																
- Type of Sewerage System	Community (Public)					Community (Public)					Community (Public)					
- Type of Receiving Waters	Ocean					Ocean					Ocean					
- Incremental Capacity (1,000 m3/d)	2.999	0.143	0.468	0.230	3.840	0.000	0.000	0.241	0.241	0.481	0.024	0.037	0.144	0.215	0.420	
Project Cost (K$ Million)*3	5.759	0.250	0.904	0.447	7.360			0.461	0.461	0.922	0.046	0.070	0.276	0.413	0.805	

Remarks

*1 : Residential Yield is calculated by {0.05 km2/100 rooms X No. of room X Population density x 150 l/c/d x 0.8}.

*2 : Proportion of sewage yield in the tourism area to one in the urban area.

*3 : Cost consists of construction, contingency, detail design & supervision and land.

Source : JICA Study Team

Table 4. 21 Inventory of Proposed Projects : Sewerage System (3)

	Malindi Coast Tourism Area															
	Kilifi				North Mambrui				Watamu							
	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total	
Type of Area	Urban					Urban					Urban					
Existing Sewerage System	Individual					Individual					Individual					
- Capacity (1,000 m3/d)																
- Management Authority	LA										LA					
Urban Sewerage Scheme in the NWMP	Kilifi Town (Habitable Area : 153 km2)					Mambrui Town (Habitable Area : 79 km2)					Watamu Town (Habitable Area : 99 km2)					
	LA					LA					LA					
- Sewered Area (km2)	1.00	2.39	3.23	4.07	4.07	0.35	0.71	0.90	1.08	1.08	0.20	0.40	0.50	0.70	0.70	
- Sewered Population (1,000)	12.50	32.00	43.25	54.50	54.50	3.20	6.83	8.65	10.48	10.48	2.10	5.40	7.30	9.20	9.20	
- Sewage Yield (1,000 m3/d)	1.695	4.230	5.713	7.195	7.195	0.373	0.819	1.246	1.674	1.674	0.245	0.641	0.876	1.111	1.111	
- Population Density (pers./km2)	12,500	13,389	13,390	13,391		9,143	9,621	9,616	9,701		10,500	13,500	14,600	13,143		
Tourism Development Plan																
- Number of Room	150	450	1,600	1,800	1,800	0	400	500	500	500	600	1,600	1,900	2,000	2,000	
- Sewage Yield (1,000 m3/d)	0.075	0.225	0.800	0.900	0.900	0.000	0.391	0.488	0.491	0.491	0.240	0.640	0.760	0.800	0.800	
for Tourism Accomodation	0.060	0.180	0.640	0.720	0.900	0.000	0.160	0.200	0.200	0.200	0.240	0.640	0.760	0.800	0.800	
for Resident in tourism area*1	Included in the Urban area					0.000	0.231	0.288	0.291	0.291	Included in the Urban area					
Proportion (%)*2	4.42	5.32	14.00	12.51	12.51						98.04	99.88	86.76	71.99	71.99	
Proposed Project																
- Type of Sewerage System	Urban Sewerage Scheme (Public)					Community (Public)					Urban Sewerage Scheme (Public)					
- Type of Receiving Waters	Ocean					Ocean					Ocean					
- Incremental Capacity (1,000 m3/d)	1.695	2.535	2.057	1.582	7.870	0.000	0.391	0.098	0.003	0.491	0.485	0.796	0.355	0.275	1.911	
Project Cost (KE Million)*3	5.090	7.312	5.114	4.486	22.002		0.802	0.200	0.003	1.006	1.211	1.623	0.755	0.934	4.522	

Remarks

*1 : Residential Yield is calculated by [0.05 km2/100 rooms X No. of room X Population density x 150 l/c/d x 0.8].

*2 : Proportion of sewage yield in the tourism area to one in the urban area.

*3 : Cost consists of construction, contingency, detail design & supervision and land.

Source-: JICA Study Team

Table 4. 21 Inventory of Proposed Projects : Sewerage System (4)

	Malindi Coast Tourism Area					Lamu Coast Tourism Area									
	North Watamu					West Lamu					South Manda				
	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total
Type of Area	Rural					Rural					Rural				
Existing Sewerage System	individual					Community					individual				
- Capacity (1,000 m3/d)															
- Management Authority						LA									
Urban Sewerage Scheme	Watamu Town (Habitable Area : 99 km2)					Lamu Town (Habitable Area : 4 km2)					Lamu Town (Habitable Area : 4 km2)				
in the NWMP	LA					LA					LA				
- Sewered Area (km2)	0.20	0.40	0.50	0.70	0.70	0.67	1.52	2.03	2.54	2.54	0.67	1.52	2.03	2.54	2.54
- Sewered Population (1,000)	2.10	5.40	7.30	9.20	9.20	9.00	20.40	27.20	34.00	34.00	9.00	20.40	27.20	34.00	34.00
- Sewage Yield (1,000 m3/d)															
- Population Density (pers./km2)	10,500	13,500	14,600	13,143		13,433	13,421	13,399	13,386		13,433	13,421	13,399	13,386	
Tourism Development Plan															
- Number of Room	0	400	1,000	1,400	1,400	0	50	150	200	200	0	0	100	300	300
- Sewage Yield (1,000 m3/d)	0.000	0.484	1.276	1.664	1.664	0.000	0.060	0.181	0.241	0.241	0.000	0.000	0.120	0.361	0.361
for Tourism Accomodation	0.000	0.160	0.400	0.560	0.560	0.000	0.020	0.060	0.080	0.080	0.000	0.000	0.040	0.120	0.120
for Resident in tourism area*1	0.000	0.324	0.876	1.104	1.104	0.000	0.040	0.121	0.161	0.161	0.000	0.000	0.080	0.241	0.241
Proportion (%)*2															
Proposed Project															
- Type of Sewerage System	Community (Public)					Community (Public)					Community (Public)				
- Type of Receiving Waters	Ocean					Ocean					Ocean				
- Incremental Capacity (1,000 m3/d)	0.000	0.484	0.792	0.388	1.664	0.000	0.060	0.120	0.060	0.241	0.000	0.000	0.120	0.241	0.361
Project Cost (KS Million)*3		0.925	1.475	0.798	3.199		0.115	0.230	0.115	0.461			0.231	0.461	0.691

Remarks

*1 : Residential Yield is calculated by [0.05 km2/100 rooms X No. of room X Population dencity x 150 l/c/d x 0.8].

*2 : Proportion of sewage yield in the tourism area to one in the urban area.

*3 : Cost consists of construction, contingency, detail design & supervision and land.

Source : JICA Study Team

Table 4. 21 Inventory of Proposed Projects :Sewerage System (5)

	Lamu Coast Tourism Area									
	East Manda					Pate				
	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total
Type of Area	Rural					Rural				
Existing Sewerage System	Individual					Community				
- Capacity (1,000 m3/d)										
- Management Authority						LA				
Urban Sewerage Scheme	Lamu Town (Habitable Area : 4 km2)					Lamu Town (Habitable Area : 4 km2)				
in the NWMP	LA					LA				
- Sewered Area (km2)	0.67	1.52	2.03	2.54	2.54	0.67	1.52	2.03	2.54	2.54
- Sewered Population (1,000)	9.00	20.40	27.20	34.00	34.00	9.00	20.40	27.20	34.00	34.00
- Sewage Yield (1,000 m3/d)										
- Population Density (pers./km2)	13,433	13,421	13,399	13,386		13,433	13,421	13,399	13,386	
Tourism Development Plan										
- Number of Room	0	0	100	300	300	0	0	100	300	300
- Sewage Yield (1,000 m3/d)	0.000	0.000	0.120	0.361	0.361	0.000	0.000	0.120	0.361	0.361
for Tourism Accomodation	0.000	0.000	0.040	0.120	0.120	0.000	0.000	0.040	0.120	0.120
for Resident in tourism area*1	0.000	0.000	0.080	0.241	0.241	0.000	0.000	0.080	0.241	0.241
Proportion (%)*2										
Proposed Project										
- Type of Sewerage System	Community (Public)					Community (Public)				
- Type of Receiving Waters	Ocean					Ocean				
- Incremental Capacity (1,000 m3/d)	0.000	0.000	0.120	0.241	0.361	0.000	0.000	0.120	0.241	0.361
Project Cost (K$ Million)*3			0.231	0.461	0.691			0.231	0.461	0.691

Source: JICA Study Team

Remarks

*1 : Residential Yield is calculated by [0.05 km2/100 rooms X No. of room X Population dencity x 150 l/c/d x 0.8].

*2 : Proportion of sewage yield in the tourism area to one in the urban area.

*3 : Cost consists of construction, contingency, detail design & supervision and land.

Table 4. 22 Inventory of Proposed Projects : Solid Waste Disposal (1)

	South Mombasa Tourism Area														
	Shimoni					Funzi Island					Funzi Bay				
	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total
Type of Area	Rural					Rural					Rural				
Existing Solid Waste System	Individual					Individual					Individual				
- Management Authority	not existing					not existing					not existing				
Urban Solid Waste Collection &	Msambweni (Habitable Area : 103 km2)					Msambweni (Habitable Area : 103 km2)					Msambweni (Habitable Area : 103 km2)				
Disposal Scheme (Public)	LA					LA					LA				
- Served Area (km2)	1.00	2.00	2.50	3.00	3.00	1.00	2.00	2.50	3.00	3.00	1.00	2.00	2.50	3.00	3.00
- Served Population (1,000)	8.40	21.90	28.20	34.50	34.50	8.40	21.90	28.20	34.50	34.50	8.40	21.90	28.20	34.50	34.50
- Solid Waste Yield (ton/d)*1	2.52	8.76	12.69	17.25	17.25										
- Population Density (pers./km2)	8,400	10,950	11,280	11,500		8,400	10,950	11,280	11,500		8,400	10,950	11,280	11,500	
Tourism Development Plan															
- Number of Room	0	250	500	850	850	0	0	150	300	300	0	40	100	200	200
- Solid Waste Yield (ton/d)	0.000	0.885	1.944	3.591	3.591	0.000	0.000	0.203	0.405	0.405	0.000	0.054	0.135	0.270	0.270
for Tourism Accomodation	0.000	0.338	0.675	1.148	1.148	0.000	0.000	0.203	0.405	0.405	0.000	0.054	0.135	0.270	0.270
for Resident in tourism area*2	0.000	0.548	1.269	2.444	2.444	Not included					Not included				
Proportion (%)*3															
Proposed Project	Community (Public)					Individual					Individual				
- Type of Collection System	Separation, 2 times/week					Separation + Recycling					Separation + Recycling				
- Type of Disposal Method	Recycling + Sanitary Landfill					On-site Incinerator/Compost/Landfill					On-site Incinerator/Compost/Landfill				
- Incremental Capacity (m3/d)*4	0.000	1.580	1.891	2.942	6.413	0.000	0.000	0.362	0.362	0.723	0.000	0.096	0.145	0.241	0.482
- Required Area (ha)*4	0.000	0.096	0.115	0.179	0.390	0.000	0.000	0.022	0.022	0.044	0.000	0.006	0.009	0.015	0.029
Project Cost (K$ Million)		0.113	0.135	0.210	0.457			0.022	0.022	0.043		0.006	0.009	0.014	0.029

Remarks

*1 : Industrial and harzardous wastes are not included.

*2 : Residential Yield is calculated by [0.05 km2/100 rooms X No. of room X Population density x Unit yield (0.3,0.4,0.45,0.5 kg/c/d)].

*3 : Proportion of solid waste yield in the tourism area to one in the urban area.

*4 : It was estimated by the following assumptions ;

Rolled density of garbage is 560 kg/m3

Depth of landfill is 6.0 m

Project life time is 10 years.

Source : JICA Study Team

Table 4. 22 Inventory of Proposed Projects : Solid Waste Disposal (2)

South Mombasa Tourism Area																
	South Diani				Shelly					Gazi Bay						
	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total	Present	2000	2005	2010-	Total
Type of Area	Rural					Rural					Rural				
Existing Solid Waste System - Management Authority	Public(Open dumping) LA (Kwale)					Public(Controlled Tipping Method) LA(Mombasa)					Individual not existing				
Urban Solid Waste Collection & Disposal Scheme (Public)	Kwale Town (Habitable Area : 78 km2) LA					Mombasa (Habitable Area : 198 km2) LA					Kwale Town(Habitable Area : 78 km2) LA				
- Served Area (km2)	0.28	0.72	0.93	1.14	1.14	35.82	50.26	58.90	67.54	67.54	0.28	0.72	0.93	1.14	1.14
- Served Population (1,000)	3.70	9.70	12.45	15.20	15.20	479.60	673.00	788.70	904.40	904.40	3.70	9.70	12.45	15.20	15.20
- Solid Waste Yield (ton/d)*1						143.88	269.20	354.92	452.20	452.200					
- Population Density (pers./km2)	13,214	13,472	13,387	13,333		13,389	13,390	13,390	13,391		13,214	13,472	13,387	13,333	
Tourism Development Plan															
- Number of Room	2,514	2,600	3,000	3,200	3,200	0	0	200	400	400	20	50	170	350	350
- Solid Waste Yield (ton/d)	8.377	10.516	13.086	14.987	14.987	0.000	0.000	0.270	0.540	0.540	0.027	0.068	0.230	0.473	0.473
for Tourism Accomodation	3.394	3.510	4.050	4.320	4.320	0.000	0.000	0.270	0.540	0.540	0.027	0.068	0.230	0.473	0.473
for Resident in tourism area*2	4.983	7.006	9.036	10.667	10.667	Not included					Not included				
Proportion (%)*3						0.00	0.00	0.08	0.12	0.12					
Proposed Project - Type of Collection System	Community (Public) Separation, 2 times/week					Urban Solid Waste Scheme (Public) Separation, 2 times/week					Individual Separation + Recycling				
- Type of Disposal Method	Recycling + Sanitary Landfill					Recycling + Sanitary Landfill					On-site Incinerator/Compost/Landfill				
- Incremental Capacity (m3/d)*4	0.000	3.819	4.591	3.394	11.803	0.000	223.786	153.063	173.723	550.571	0.000	0.072	0.289	0.434	0.796
- Required Area (ha)*4	0.000	0.232	0.279	0.206	0.718	0.000	13.614	9.311	10.568	33.493	0.000	0.004	0.018	0.026	0.048
Project Cost (KS Million)		0.272	0.327	0.242	0.841		15.941	10.903	12.375	39.220		0.004	0.017	0.026	0.047

Remarks

*1 : Industrial and harzardous wastes are not included.

*2 : Residential Yield is calculated by [0.05 km2/100 rooms X No. of room X Population dencity x Unit yelid (0.3,0.4,0.45,0.5 kg/c/d)].

*3 : Proportion of solid waste yield in the tourism area to one in the urban area.

*4 : It was estimated by the following assumptions :

Rolled density of garbage is 560 kg/m3

Depth of landfill is 6.0 m

Project life time is 10 years.

Source : JICA Study Team

Table 4. 22 Inventory of Proposed Projects : Solid Waste Disposal (3)

	Malindi Coast Tourism Area													
	Kilifi				North Mambrui				Watamu					
	Present	2000	2005	2010	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total
Type of Area	Urban				Urban					Urban				
Existing Solid Waste System	Public(Open dumping)				Individual					Public(Open dumping)				
- Management Authority	LA				not existing					LA(Malindi)				
Urban Solid Waste Collection &	Kilifi Town (Habitable Area : 153 km2)				Mambrui Town (Habitable Area : 79 km2)					Watamu Town (Habitable Area : 99 km2)				
Disposal Scheme (Public)	LA				LA									
- Served Area (km2)	1.00	2.39	3.23	4.07	0.35	0.71	0.90	1.08	1.08	0.20	0.40	0.50	0.70	0.70
- Served Population (1,000)	12.50	32.00	43.25	54.50	3.20	6.83	8.65	10.48	10.48	2.10	5.40	7.30	9.20	9.20
- Solid Waste Yield (ton/d)*1	3.75	12.80	19.46	27.25	0.96	2.73	3.89	5.24	5.24	0.63	2.16	3.29	4.60	4.60
- Population Density (pers./km2)	12,500	13,389	13,390	13,391	9,143	9,621	9,616	9,701		10,500	13,500	14,600	13,143	
Tourism Development Plan														
- Number of Room	150	450	1,600	1,800	0	400	500	500	500	600	1,600	1,900	2,000	2,000
- Solid Waste Yield (ton/d)	0.075	0.225	0.800	0.900	0.000	1.310	1.757	1.888	1.888	0.810	2.160	2.565	2.700	2.700
for Tourism Accomodation	0.203	0.608	2.160	2.430	0.000	0.540	0.675	0.675	0.675	0.810	2.160	2.565	2.700	2.700
for Resident in tourism area*2	Included in the Urban area				0.000	0.770	1.082	1.213	1.213	included in the Urban area				
Proportion (%)*3	2.00	1.76	4.11	3.30	3.30					128.57	100.00	78.08	58.70	58.70
Proposed Project	Urban Solid Waste Scheme (Public)				Community (Public)					Urban Solid Waste Scheme (Public)				
- Type of Collection System	Separation, 2 times/week				Separation, 2 times/week					Separation, 2 times/week				
- Type of Disposal Method	Recycling + Sanitary Landfill				Recycling + Sanitary Landfill					Recycling + Sanitary Landfill				
- Incremental Capacity (m3/d)*4	0.000	16.161	11.897	13.906	41.964	0.000	2.339	0.798	0.234	3.371	0.000	5.143	2.732	2.589	10.464
- Required Area (ha)*4	0.000	0.983	0.724	0.846	2.553	0.000	0.142	0.049	0.014	0.205	0.000	0.313	0.166	0.158	0.637
Project Cost (KS Million)		1.151	0.847	0.991	2.989		0.167	0.057	0.017	0.241		0.366	0.195	0.184	0.745

Remarks

*1 : Industrial and hazardous wastes are not included.

*2 : Residential Yield is calculated by (0.05 km2/100 rooms X No. of room-X Population dencity x Unit yield (0.3,0.4,0.45,0.5 kg/c/d)].

*3 : Proportion of solid waste yield in the tourism area to one in the urban area.

*4 : It was estimated by the following assumptions ;

Rolled density of garbage is 560 kg/m3

Depth of landfill is 6.0 m

Project life time is 10 years.

Source : JICA Study Team

Table 4. 22 Inventory of Proposed Projects : Solid Waste Disposal (4)

	Malindi Coast Tourism Area				Lamu Coast Tourism Area									
	North Watamu				West Lamu				South Manda					
	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total
Type of Area	Rural					Rural					Rural				
Existing Solid Waste System	Public(Open dumping)					Individual					individual				
- Management Authority	LA(Malindi)					not existing					not existing				
Urban Solid Waste Collection & Disposal Scheme (Public)	Watamu Town (Habitable Area : 99 km2)					Lamu Town (Habitable Area : 4 km2)					Lamu Town (Habitable Area : 4 km2) LA				
- Served Area (km2)	0.20	0.40	0.50	0.70	0.70	0.67	1.52	2.03	2.54	2.54	0.67	1.52	2.03	2.54	2.54
- Served Population (1,000)	2.10	5.40	7.30	9.20	9.20	9.00	20.40	27.20	34.00	34.00	9.00	20.40	27.20	34.00	34.00
- Solid Waste Yield (ton/d)*1	0.63	2.16	3.29	4.60	4.60										
- Population Density (pers./km2)	10,500	13,500	14,600	13,143		13,433	13,421	13,399	13,386		13,433	13,421	13,399	13,386	
Tourism Development Plan															
- Number of Room	0	400	1,000	1,400	1,400	0	50	150	200	200	0	0	100	300	300
- Solid Waste Yield (ton/d)	0.000	0.540	1.350	1.890	1.890	0.000	0.068	0.203	0.270	0.270	0.000	0.000	0.135	0.405	0.405
for Tourism Accomodation	0.000	0.540	1.350	1.890	1.890	0.000	0.068	0.203	0.270	0.270	0.000	0.000	0.135	0.405	0.405
for Resident in tourism area*2	Included in the Urban area					Not included					Not included				
Proportion (%)*3		25.00	41.10	41.09	41.09										
Proposed Project	Urban Solid Waste Scheme (Public)					Individual					Individual				
- Type of Collection System	Separation, 2 times/week					Separation + Recycling					Separation + Recycling				
- Type of Disposal Method	Recycling + Sanitary Landfill					On-site Incinerator/Compost/Landfill					On-site Incinerator/Compost/Landfill				
- Incremental Capacity (m3/d)*4	0.000	0.964	1.446	0.964	3.375	0.000	0.121	0.241	0.121	0.482	0.000	0.000	0.241	0.482	0.723
- Required Area (ha)*4	0.000	0.059	0.088	0.059	0.205	0.000	0.007	0.015	0.007	0.029	0.000	0.000	0.015	0.029	0.044
Project Cost (KE Million)		0.069	0.103	0.069	0.240		0.007	0.014	0.007	0.029			0.014	0.029	0.043

Remarks

*1 : Industrial and hazardous wastes are not included.

*2 : Residential Yield is calculated by [0.05 km2/100 rooms X No. of room X Population density x Unit yield (0.3,0.4,0.45,0.5 kg/c/d)].

*3 : Proportion of solid waste yield in the tourism area to one in the urban area.

*4 : It was estimated by the following assumptions :

Rolled density of garbage is 560 kg/m3

Depth of landfill is 6.0 m

Project life time is 10 years.

Source : JICA Study Team

Table 4. 22 Inventory of Proposed Projects : Solid Waste Disposal (5)

	Lamu Coast Tourism Area									
	East Manda				Pate					
	Present	2000	2005	2010	Total	Present	2000	2005	2010	Total
Type of Area	Rural					Rural				
Existing Solid Waste System	Individual					Community				
- Management Authority	not existing					LA				
Urban Solid Waste Collection &	Lamu Town (Habitable Area : 4 km2)					Lamu Town (Habitable Area : 4 km2)				
Disposal Scheme (Public)	LA					LA				
- Served Area (km2)	0.67	1.52	2.03	2.54	2.54	0.67	1.52	2.03	2.54	2.54
- Served Population (1,000)	9.00	20.40	27.20	34.00	34.00	9.00	20.40	27.20	34.00	34.00
- Solid Waste Yield (ton/d)*1										
- Population Density (pers./km2)	13,433	13,421	13,399	13,386		13,433	13,421	13,399	13,386	
Tourism Development Plan										
- Number of Room	0	0	100	300	300	0	0	100	300	300
- Solid Waste Yield (ton/d)	0.000	0.000	0.135	0.405	0.405	0.000	0.000	0.436	1.409	1.409
for Tourism Accomodation	0.000	0.000	0.135	0.405	0.405	0.000	0.000	0.135	0.405	0.405
for Resident in tourism area*2	Not included					0.000	0.000	0.301	1.004	1.004
Proportion (%)*3										
Proposed Project	Individual					Community (Public)				
- Type of Collection System	Separation + Recycling					Separation, 2 times/week				
- Type of Disposal Method	On-site Incinerator/Compost/Landfill					Recycling + Sanitary Landfill				
- Incremental Capacity (m3/d)*4	0.000	0.000	0.241	0.482	0.723	0.000	0.000	0.779	1.737	2.516
- Required Area (ha)*4	0.000	0.000	0.015	0.029	0.044	0.000	0.000	0.047	0.106	0.153
Project Cost (K£ Million)			0.014	0.029	0.043			0.056	0.124	0.179
Remarks										

*1 : Industrial and harzardous wastes are not included.

*2 : Residential Yield is calculated by [0.05 km2/100 rooms X No. of room X Population dencity x Unit yeild (0.3,0.4,0.45,0.5 kg/c/d)].

*3 : Proportion of solid waste yield in the tourism area to one in the urban area.

*4 : It was estimated by the follwing assumptions ;

Rolled density of garbage is 560 kg/m3

Depth of landfill is 6.0 m

Project life time is 10 years.

Source: JICA Study Team

Source : JICA Study Team

Table 4. 23 Project Cost and Disbursement Schedule

(Sewerage System)

Project Name	Quantity (1,000 m3/d)	Cost (K£ Million)	Urgent	Disbursement Schedule (K£ Million) 2000	2005	2010
Community Sewerage Project						
1.Shimoni	0.93	1.835	0	0.540	1.295	0.000
2.Funzi Island	0.33	0.645	0	0.000	0.323	0.323
3.Funzi Bay	0.22	0.430	0	0.043	0.388	0.000
4.South Diani	3.84	7.360	5.758	1.143	0.000	0.460
5.Shelly	0.48	0.920	0	0.045	0.415	0.460
6.Gazi Bay	0.42	0.805	0.045	0.760	0.000	0.000
7.North Mambrui	0.49	1.008	0	0.805	0.203	0.000
8.North Watamu	1.66	3.198	0	0.183	2.103	0.913
9.West Lamu	0.24	0.460	0	0.115	0.345	0.000
10.South Manda	0.36	0.693	0	0.023	0.668	0.000
11.East Manda	0.36	0.693	0	0.000	0.693	0.000
12.Pate	0.36	0.693	0	0.000	0.230	0.463
Sub Total		18.735	5.803	3.658	6.655	2.620
Enlargement of Urban Sewerage Project						
13.Kilifi	0.90	1.193	0	0	1.060	0.133
14.Watamu	0.80	1.060	0	0.848	0.000	0.213
Sub Total		2.253	0	0.848	1.060	0.345
Total		20.988	5.803	4.550	7.715	2.965

(Solid Waste Disposal System)

Project Name	Quantity (m3/d)	Cost (K£ Million)	Disbursement Schedule (K£ Million) Urgent	2000	2005	2010
Community Solid Waste Disposal Project						
1.Shimoni	6.41	0.458	0	0.135	0.135	0.188
2.South Diani	11.80	0.840	0	0.105	0.490	0.245
3.North Mambrui	3.37	0.243	0	0.195	0.048	0.000
4.Pate	2.52	0.180	0	0.000	0.060	0.012
Sub Total		1.720	0	0.435	0.733	0.553
Individual Solid Waste Disposal Project						
6.Funzi Island	0.72	0.043	0	0.000	0.023	0.020
7.Funzi Bay	0.48	0.028	0	0.005	0.008	0.015
9.Gazi Bay	0.80	0.048	0	0.005	0.018	0.025
10.West Lamu	0.48	0.028	0	0.008	0.015	0.005
11.South Manda	0.72	0.043	0	0.000	0.015	0.028
12.East Manda	0.72	0.043	0	0.000	0.015	0.028
Sub Total		0.288	0	0.0018	0.123	0.148
Enlargement of Urban Solid Waste Disposal Project						
13.Watamu	3.38	0.345	0	0.245	0.075	0.025
4.North Watamu	3.38	0.243	0	0.070	0.103.	0.070
Sub Total		0.588	0	0.315	0.178	0.095
Total		2.595	0	0.768	1.033	0.795

Source: JICA Study Team

5.6. Power and Communication

5.6.1. Electricity

(1) Demand for Electricity by Tourism Development and Existing Plans

a. Demand Projection

In the Coastal Tourism Region, electricity demand is fast increasing. The share of tourism demand to the total regional demand is higher

than in other tourism regions. Table 4. 24 shows increasing demand and proportion by tourism up to the year 2010.

Table 4. 24 Demand Forecast by Tourism

Year	Existing	2000	2005	2010
No. of Room	9820	14650	22500	29150
Tourism Demand (MVA)	-	13.3	34.9	53.2
Total Regional Demand (MVA)	130	205	280	350
Share of Tourism Demand(%)	-	17.7%	23.3%	24.1%

Note: Figure of No. of rooms adopted rooms of Hotel / Lodge / Permanent Camp of Room requirement in Table 4. 2.
Source: JICA Study Team, National Power Development Plan

b. Review and Assessment of Existing Plans

The existing power supply in the Coastal Tourism Region is insufficient. The frequent power cuts cause problems to tourism. One of the reasons is the fact that the Kipevu thermal power station is old and now under repair.

In the short term, the construction of a new diesel power station (more than 140 MVA, separated to two phases) will be required to meet the increasing demand before the year 2000. Existing plans of KPLC are:

- Kipevu diesel power stations (2 sets of 75 MVA)
- Nairobi-Mombasa 220 kV transmission lines (3 circuits)
- Kilifi-Bura 132 kV transmission line (by 1998), and
- Diesel power stations (4 sets of 50 MW by the year 2010).

The Nairobi-Mombasa 220 kV transmission line, which is interconnecting Nairobi and Mombasa, will be required by the year 2004 as a backup during a drought season in the Central and Western Tourism Region.

(2) Basic Policy for Electricity Supply

a. South Mombasa Tourism Area

<u>Tiwi/Diani/Galu</u>

The distance between Mombasa and Msambweni is about 50 km. The existing distribution line doesn't have enough transfer capacity, and the power loss is too big to supply electricity reliably.

Therefore, a new 132 kV transmission line and substation will be required to meet the increasing demand not only

originating from tourism, but also for meeting total area demand.

Table 4. 25 Demand Forecast by Tourism

Year	Existing	2000	2005	2010
No. of Room	2580	3850	5600	8750
Increasing Demand by Tourism (MVA)	-	3.5	8.3	17.0

Remark: This demand includes Shimoni, Wasini, Funzi, Gazi, Tiwi, Diani and Galu.
Source: JICA Study Team

The demand forecasted by tourism is 17 MVA according to the above Table 4. 25. A new substation should have the capacity to cover the other industrial demand. The best location for a substation may be at Msambweni, which is located between Shimoni and Diani.

b. Malindi Coast Tourism Area

Kilifi

The existing 132 kV transmission line reaches Kilifi from Rabai substation. Distribution lines cover along the beach up to Fundisa, which is located in the North of Malindi.

Table 4. 26 Demand Forecast by Tourism

Year	Existing	2000	2005	2010
No. of Room	1950	4600	7800	9000
Increasing demand by Tourism (MVA)	-	7.3	16.1	19.4

Remark: This demand includes Kilifi, Watamu, Malindi area.
Source: JICA Study Team

Along the Northern beaches of Mombasa, Kilifi, Watamu, and Malindi, as shown in the above Table 4. 26, the demand forecast by tourism sector will increase to 19.4 MVA in the year 2010.

KPLC plans to extend the 132 kV transmission line from Kilifi to Bura through Garsen by 2000. The new location for the substation is Malindi as selected by KPLC. This new substation may supply reliable electricity around Malindi.

In order to meet the increasing demand, upgrading of transformer capacity at the existing Kilifi substation is proposed.

c. Lamu Tourism Area

Manda Island

The isolated diesel generators supply electricity on Lamu Island only. KPLC plans to extend the 132 kV transmission line from Kilifi to Bura through Garsen by the year 2000.

Table 4. 27 Demand Forecast by Tourism

Year	Existing	2000	2005	2010
No. of Room	150	200	900	2900
Increasing Demand by tourism(MVA)	-	0.1	0.8	7.6

Remark: This demand includes Lamu Coast Area.
Source: JICA Study Team

As shown in the above Table 4. 27, demand by the tourism sector will be 7.6 MVA in 2010. The demand forecast including industries will be more than 20 MVA in 2010.

On the other hand, the distance from Garsen to Lamu (Hindi) is 98 km. (This is too long to supply power by 33 kV distribution.) In consideration of the voltage drop and reliability of power supply, a 132 kV transmission line may be proposed from Garsen to Hindi.

The power supply to Lamu and Manda Islands may be distributed by submarine cables, which will be connected to the national grid. Electricity on the other islands will be supplied by isolated diesel generators.

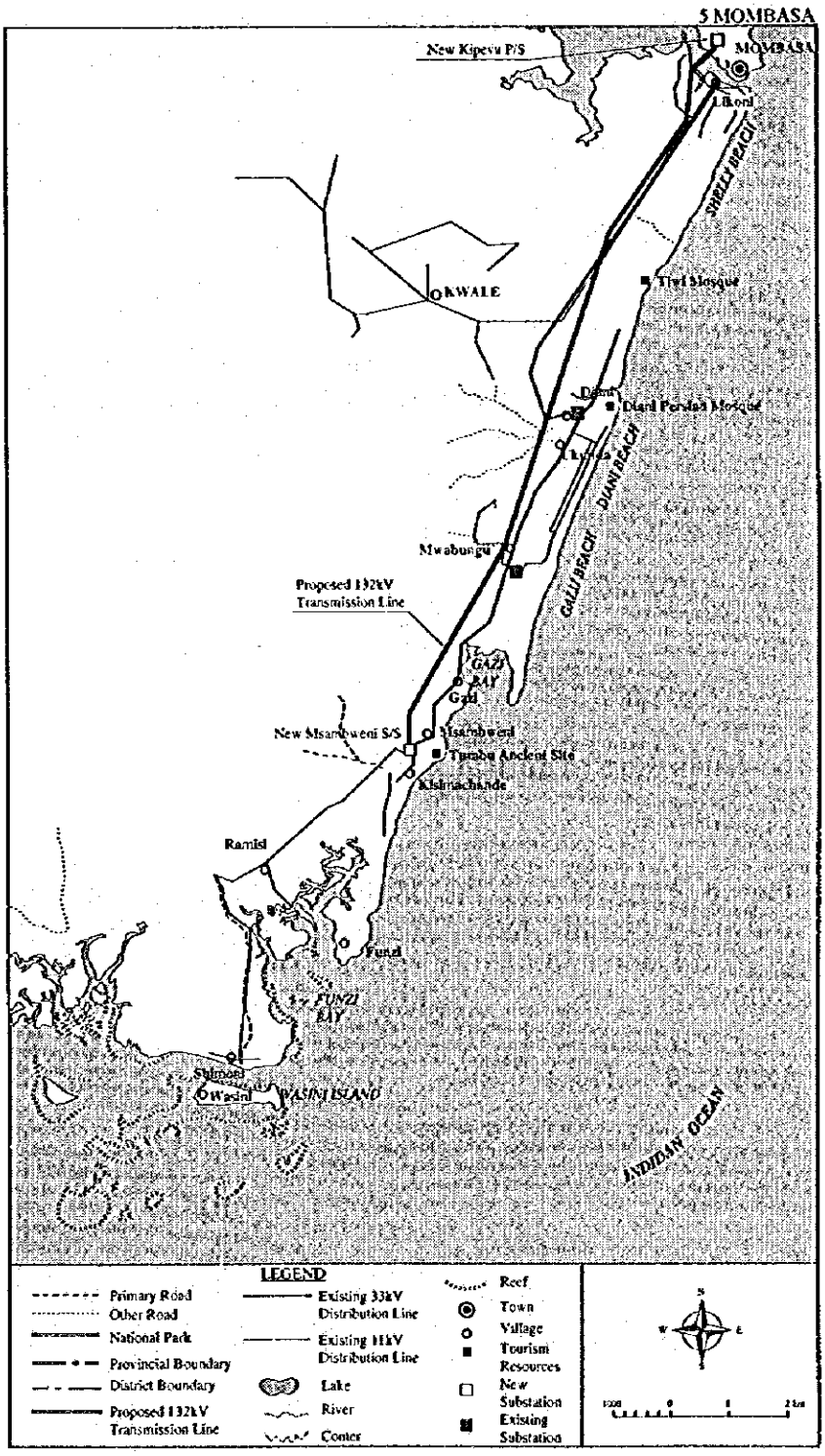
(3) Proposed Project

a. South Mombasa Tourism Area

Tiwi/Diani/Galu

Figure 4. 15 Mombasa shows the location of a new substation at Msambweni and the route of the 132 kV transmission line. The distribution line from Mombasa to Shimoni will be over loaded before the year of 2000. Therefore, in the medium term, this proposed project will be constructed by KPLC. The major components and cost are shown in Table 4. 28

Figure 4. 15 Power Supply Plan forSouth Mombasa Torism Area



Source: JICA Study Team

Table 4. 28 Project Cost

Project Name	Specifications	Quantity	Cost
132 kV transmission line	-1 circuit, ACSR 200 sq. mm	50 km	K£ 10,707,625
132/33 kV Substation	-132 kV Switch gear	1 set	K£ 2,078,625
	-132/33 kV Transformer (20 MVA)	1 No.	K£ 862,500
	-33 kV Switch gear	2 set	K£ 500,000
TOTAL			K£ 14,148,750

Source: JICA Study Team

b. Malindi Coast Tourism Area

Kilifi

Figure 4. 16 shows the location of the existing Kilifi substation. A new feeder and transformer will be added by this proposal. The estimated cost are as follows:

Table 4. 29 Project Cost

Project Name	Specifications	Quantity	Cost
Increasing capacity of 132 / 33 kV Transformer (Kilifi)	-132 kV Switch gear	1set	K£ 10,707,625
	- 132 / 33 kV Transformer (20 MVA)	1 No.	K£ 862,500
TOTAL			K£ 2,941,125

Source: JICA Study Team

c. Lamu Coast Tourism Area

Manda Island

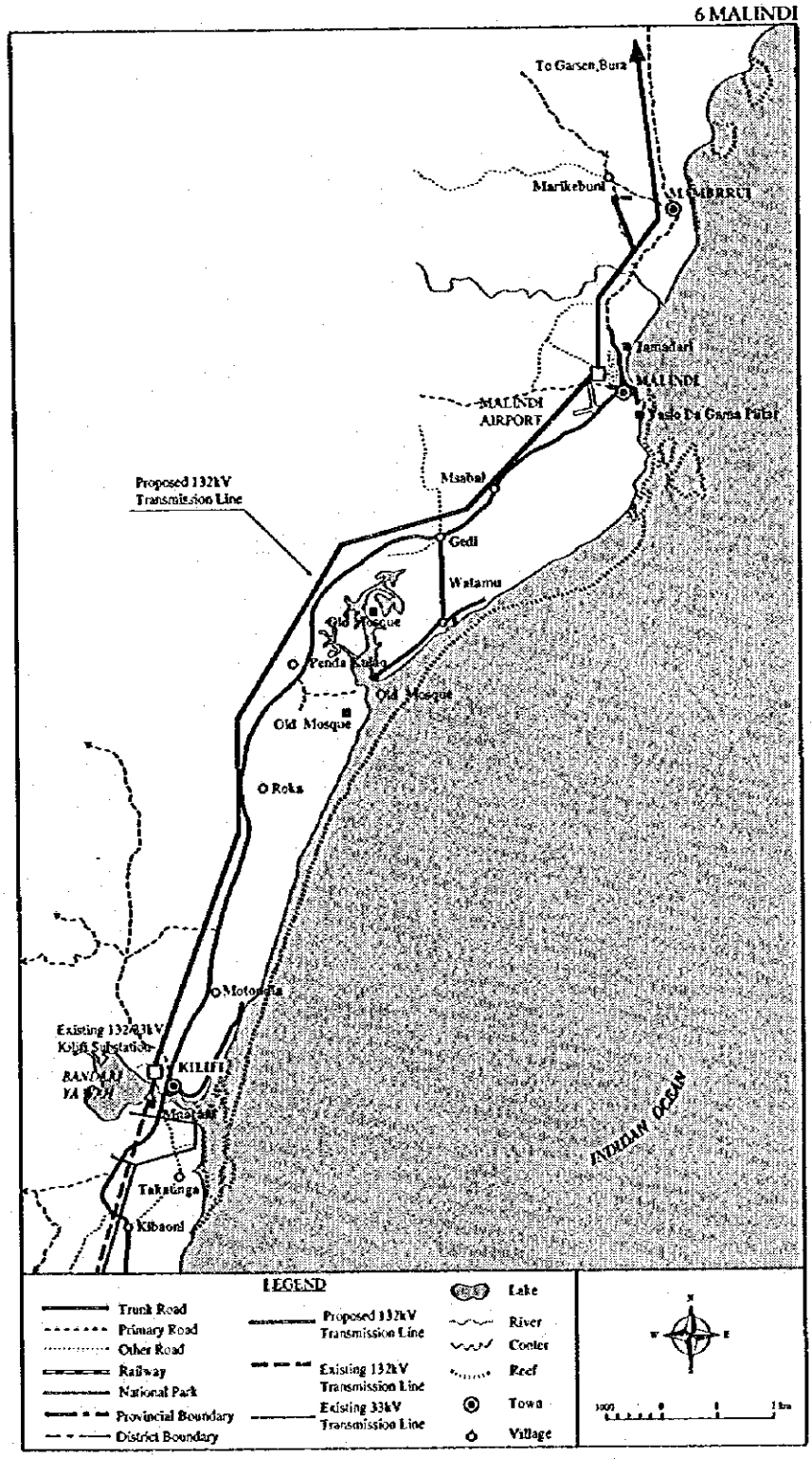
Figure 4. 17 shows the location of a new substation, 132 kV transmission line from Garsen to Lamu (Hindi) and distribution lines to Lamu and Manda islands. The estimated project cost are as follows :

Table 4. 30 Project Cost

Project Name	Specifications	Quantity	Cost
132 kV transmission line	-1 circuit, ACSR 200 sq mm	98 km	K£ 20,986,945
132/33 kV Substation	-132 kV Switch gear	1 set	K£ 2,078,625
	-132/33 kV Transformer (20 MVA)	1 No.	K£ 862,500
	-33 kV Switch gear	2 set	K£ 500,000
33 kV Distribution Line	Submarine cable	1.3 km	K£ 87,625,000
	Overhead distribution line	20 km	K£ 600,000
TOTAL			37,790,570

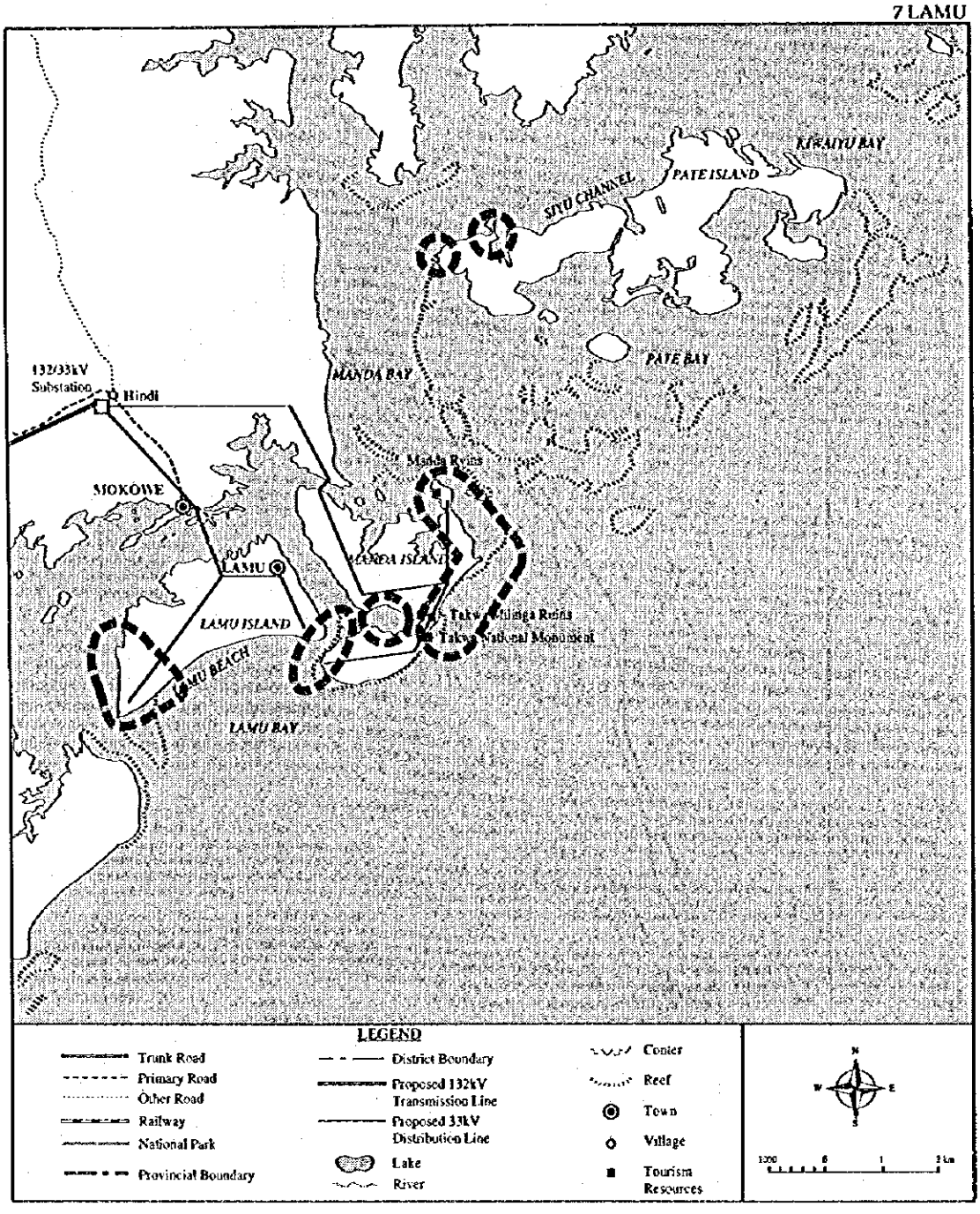
Source: JICA Study Team

Figure 4. 16 Power Supply Plan for the Malindi Coast Tourism Area



Source: JICA Study Team

Figure 4. 17 Power Supply Plan for the Lamu Coast Tourism Area



Source: JICA Study Team

5.6.2. Communication

(1) Demand for Communication by Tourism and Existing Plans

a. Demand Projection

The demand forecast for telephone lines is shown in Table 4. 31.

Table 4. 31 Demand Forecast by Tourism

Year	Existing	2000	2005	2010
No. of Room	9820	14650	22500	29150
Increasing No. of Telephone lines by Tourism	-	242	634	967

Note: Figure of No. of rooms adopted rooms of Hotel / Lodge / Permanent Camp of Room requirement on Table 4.2.
Source: JICA Study Team

The demand for communication lines by tourism in the year 2010 will increase to 967 lines in the Coastal Tourism Area.

b. Review and Assessment of Existing Plans

KPTC has a plan to increase the exchange capacity and service connections for improvement of existing traffic congestion, also in Mombasa. This plan is expected to be executed through a foreign loan. These projects will improve the traffic condition in Nairobi and Mombasa. Consequently it is expected that call completion rates will improve.

(2) Basic Policy for Communication Supply

a. South Mombasa Tourism Area

Tiwi/Diani/Galu

The existing capacity of the telephone trunk line from Mombasa to Diani is 120 channels by radio link. There are automatic exchange stations at Tiwi, Diani and Msambweni. There is a manual exchange station at Shimoni.

The telephone line will be connected to each of the tourism facilities by KPTC.

b. Malindi Coast Tourism Area

Kilifi

There are exchange stations at Kilifi and Malindi by radio link with 120 channels. KPTC has a plan to increase the service line to meet increasing demand using micro wave.

The telephone line will be connected to each tourism facilities by KPTC.

c. Lamu Coast Tourism Area

Manda Island

There is a manual exchange station on Lamu island. This exchanger is connected from Garsen by overhead line with 12 channels. KPTC plans to construct a radio link with 960 channels from Garsen to Lamu island.

The telephone line by radio will be connected to each of the tourism facilities by KPTC.

CHAPTER 5 INITIAL ENVIRONMENTAL EXAMINATION

Chapter 5 Initial Environmental Examination

1. Projects Required to Implement Initial Environmental Examination

In this Master Plan, the three regions, that isthe Central, Western and Coastal Regions, are selected as priority tourism regions. It is in these three regions, that the projects are formulated.

Out of these pogrammes and projects infrastructure projects are required to implement an Initial Environmental Examination (IEE), because of their possible significant environmental impact. Therefore, in this section, the IEEs are presented for the infrastructure projects such as follows:

- Road Project (RD)
- Railway Project (RW)
- Airport Project (AP)
- Port Project (PT)
- Power Supply Project (PS)
- Water Supply Project (WS)
- Sewerage Project (SG), and
- Solid Waste Disposal Project (SD).

Table 5. 1 shows the proposed infrastructure projects together with their project codes by each region. Table 5. 2 shows the proposed infrastructure projects by project type such as:

- RD-I: Road Project located at a rural or mountain area
- RD-II: Road Project located near a lake
- RD-III: Road Project located at a coastal area
- RW: Railway Project
- AP-I: Airport Project located at a rural or mountain area
- AP-II: Airport Project located at a coastal area
- PT: Port Project
- PS-I: Power Supply Project located at a rural or mountain area
- PS-II: Power Supply Project located near a lake
- PS-III: Power Supply Project located at a coastal area
- WS-I: Water Supply Project located in a city area

- WS-II: Water Supply Project located at a rural or mountain area
- WS-III: Water Supply Project located near a lake
- WS-IV Water Supply Project located at a coastal area
- SG-I: Sewerage Project located in a city area
- SG-II: Sewerage Project located at a rural or mountain area
- SG-III: Sewerage Project located near a lake
- SG-IV Sewerage Project located at a coastal area
- SD-I: Solid Waste Disposal Project located in a city area
- SD-II: Solid Waste Disposal Project located near a lake, and
- SD-III: Solid Waste Disposal Project located at a coastal area.

2. Project Description and Site Description

It is essential at the outset to fully understand the Project Description (PD) and Site Description (SD) in order to conduct the IEE. The items for PD and SD are:

Project Description (PD):

- Background
- Objectives
- Location
- Executing Agency
- Beneficaries, and
- Project Component

Site Description (SD):

- Social Environment
- Natural Environment, and
- Pollution

Table 5. 1 The Proposed Infrastructure Projects Listed by Priority Tourism Regions

Tourism Product		Proposed Infrastructure Project	
Central Tourism Region			
CE-IN-1	Creation of Nairobi Urban Resort	CE-IN-1-RD-1	N.P. & N.R. Access Road Improvement
		CE-IN-1-RD-2	Laikipia Road Improvement
		CE-IN-1-RL-1	National Railway Improvement
		CE-IN-1-WS-1	Karen Town Community Water Supply
		CE-IN-1-WS-2	South Limuru Community Water Supply
		CE-IN-1-SG-1	Karen Town Community Sewerage
		CE-IN-1-SG-2	South Limuru Community Sewerage
		CE-IN-1-SD-1	South Limuru Community Solid Waste Disposal
		(WE-IN-4-RD-1	Lake Baringo Road Development)
CE-IN-4	Development of Mt. Kenya Gateway Resport	CE-IN-4-RD-1	Mt. Kenya Access Road Development
		CE-IN-4-PS-1	Naro Moru Distribution Line
		(CE-IN-1-RD-1	N.P. & N.R. Access Road Improvement)
		(CE-IN-1-RL-1	National Railway Improvement)
Western Tourism Region			
WE-IN-1	Development of Lake Victoria Resort	WE-IN-1-AP-1	Kisumu Airport Improvement
		(CE-IN-1-RD-1	N.P. & N.R. Access Road Improvement)
		(CE-IN-1-RL-1	National Railway Improvement)
WE-IN-3	Development of Mt. Elgon Resort	WE-IN-3-RD-1	Mt. Elgon Access Road Development
		WE-IN-3-PS-1	Kitale-Mt. Elgon Distribution Line
		WE-IN-3-WS-1	Mt. Elgon Community Water Supply
		WE-IN-3-SG-1	Mt. Elgon Community Sewerage
		(CE-IN-1-RD-1	N.P. & N.R. Access Road Improvement)
WE-IN-4	Development of Lake Baringo Resort	WE-IN-4-RD-1	Lake Baringo Road Development
		WE-IN-4-PS-1	Lake Baringo Distribution Line
		WE-IN-4-WS-1	Lake Baringo Community Water Supply
		WE-IN-4-SG-1	Lake Baringo Community Sewerage
		WE-IN-4-SD-1	Lake Baringo Community Solid Waste Disposal
		(CE-IN-1-RD-1	N.P. & N.R. Access Road Improvement)
		(CE-IN-1-RD-2	Laikipia Road Improvement Project)
Coastal Tourism Region -1			
CO-IN-1	Development of Diani/Tiwi New Beach Resport	CO-IN-1-RD-1	Moi Int'l Airport Access Road Improvement
		CO-IN-1-RD-2	South Diani Access Road Development
		CO-IN-1-RD-3	Shelly Access Road Development
		(CE-IN-1-RL-1	National Railway Improvement)
		CO-IN-1-PT-1	Mombasa Marina Development
		CO-IN-1-PS-1	Mombasa Transmission Line
		CO-IN-1-WS-1	South Diani Community Water Supply
		CO-IN-1-WS-2	Shelly Community Water Supply
		CO-IN-1-SG-1	South Diani Community Sewerage
		CO-IN-1-SG-2	Shelly Community Sewerage
		CO-IN-1-SD-1	South Diani Community Solid Waste Disposal
		(CE-IN-1-RD-1	N.P. & N.R. Access Road Improvement)
CO-IN-2	Development of Funzi Marine Resort	CO-IN-2-RD-1	Funzi Access Road Development
		CO-IN-2-RD-2	Gazi Access Road Development
		CO-IN-2-WS-1	Funzi Island Community Water Supply
		CO-IN-2-WS-2	Funzi Bay Community Water Supply
		CO-IN-2-WS-3	Gazi Community Water Supply

Source: JICA Study Team

Tourism Product		Proposed Infrastructure Project	
Coastal Tourism Region -2			
(CO-IN-2	Development of Funzi Marine Resort)	CO-IN-2-SG-1	Funzi Island Community Sewerage
		CO-IN-2-SG-2	Funzi Bay Community Sewerage
		CO-IN-2-SG-3	Gazi Community Sewerage
		(CE-IN-1-RD-1	N.P. & N.R. Access Road Improvement)
CO-IN-3	Development of Shimoni Marine Complex	CO-IN-3-RD-1	Shimoni Access Road Development
		CO-IN-3-PT-1	Shimoni Marina Development
		CO-IN-3-WS-1	Shimoni Community Water Supply
		CO-IN-3-SG-1	Shimoni Community Sewerage
		CO-IN-3-SD-1	Shimoni Community Solid Waste Disposal
		(CE-IN-1-RD-1	N.P. & N.R. Access Road Improvement)
CO-IN-7	Development of Kilifi Marine Resort	CO-IN-7-RD-1	Kilifi Access Road Development
		CO-IN-7-PT-1	Kilifi Marina Development
		CO-IN-7-PS-1	Kilifi- Malindi Transmission Line
		CO-IN-7-WS-1	Kilifi Enlargement Water Supply
		CO-IN-7-SG-1	Kilifi Enlargement Sewerage
		(CE-IN-1-RD-1	N.P. & N.R. Access Road Improvement)
CO-IN-8	Development of Watamu New Beach Resport	CO-IN-8-RD-1	Watamu Access Road Development
		CO-IN-8-RD-2	North Watamu Access Road Development
		CO-IN-8-WS-1	Watamu Enlargement Water Supply
		CO-IN-8-WS-2	North Watamu Community Water Supply
		CO-IN-8-SG-1	Watamu Enlargement Sewerage
		CO-IN-8-SG-2	North Watamu Community Sewerage
		CO-IN-8-SD-1	Watamu Enlargement Solid Waste Disposal
		CO-IN-8-SD-2	North Watamu Community Solid Waste Disposal
		(CE-IN-1-RD-1	N.P. & N.R. Access Road Improvement)
CO-IN-9	Improvement of Malindi Resort Complex	CO-IN-9-RD-1	North Malindi Access Road Development
		CO-IN-9-AP-1	Malindi Airport Improvement
		CO-IN-9-PT-1	Malindi Marina Development
		CO-IN-9-WS-1	North Mambrui Community Water Supply
		CO-IN-9-SG-1	North Mambrui Community Sewerage
		CO-IN-9-SD-1	North Mambrui Community Solid Waste Disposal
		(CE-IN-1-RD-1	N.P. & N.R. Access Road Improvement)
CO-IN-10	Development of Manda Marine Resort	CO-IN-10-WS-1	South Manda Community Water Supply
		CO-IN-10-WS-2	East Manda Community Water Supply
		CO-IN-10-SG-1	South Manda Community Sewerage
		CO-IN-10-SG-2	East Manda Community Sewerage
		(CE-IN-1-RD-1	N.P. & N.R. Access Road Improvement)
CO-IN-11	Development of Lamu Beach Resort	CO-IN-11-AP-1	Lamu Airport Improvement
		CO-IN-11-PT-1	Lamu Marina Development
		CO-IN-11-PS-1	Lamu Transmission Line
		CO-IN-11-WS-1	West Lamu Community Water Supply
		CO-IN-11-SG-1	West Lamu Community Sewerage
		(CE-IN-1-RD-1	N.P. & N.R. Access Road Improvement)
CO-IN-12	Development of Pate Island Resort	CO-IN-12-WS-1	Pate Community Water Supply
		CO-IN-12-SG-1	Pate Community Sewerage
		CO-IN-12-SD-1	Pate Community Solid Waste Disposal
		(CE-IN-1-RD-1	N.P. & N.R. Access Road Improvement)

Source: JICA Study Team

Table 5. 2 The Proposed Infrastructure Projects Listed by Project Type

Road Project

RD-I	CE-IN-1-RD-1	N.P. & N.R. Access Road Improvement	CE-IN-4-RD-1	Mt. Kenya Access Road Development
	CE-IN-1-RD-2	Laikipia Road Improvement	WE-IN-3-RD-1	Mt. Elgon Access Road Development
RD-II	CE-IN-1-RD-1	N.P. & N.R. Access Road Improvement	WE-IN-4-RD-1	Lake Baringo Road Development
RD-III	CE-IN-1-RD-1	N.P. & N.R. Access Road Improvement	CO-IN-3-RD-1	Shimoni Access Road Development
	CO-IN-1-RD-1	Moi Int'l Airport Access Road Improvement	CO-IN-7-RD-1	Kilifi Access Road Development
	CO-IN-1-RD-2	South Diani Access Road Development	CO-IN-8-RD-1	Watamu Access Road Development
	CO-IN-1-RD-3	Shelly Access Road Development	CO-IN-8-RD-2	North Watamu Access Road Development
	CO-IN-2-RD-1	Funzi Access Road Development	CO-IN-9-RD-1	North Malindi Access Road Development
	CO-IN-2-RD-2	Gazi Access Road Development		

Railway Project

RW	CE-IN-1-RW-1	National Railway Improvement

Airport Project

AP-I	WE-IN-1-AP-1	Kisumu Airport Improvement		
AP-II	CO-IN-9-AP-1	Malindi Airport Improvement	CO-IN-11-AP-1	Lamu Airport Improvement

Port Project

PT	CO-IN-1-PT-1	Mombasa Marina Development	CO-IN-9-PT-1	Malindi Marina Development
	CO-IN-3-PT-1	Shimoni Marina Development	CO-IN-11-PT-1	Lamu Marina Development
	CO-IN-7-PT-1	Kilifi Marina Development		

Power Supply Project

PS-I	CE-IN-4-PS-1	Naro Moru Distribution Line	WE-IN-3-PS-1	Kitale-Mt. Elgon Distribution Line
PS-II	WE-IN-4-PS-1	Lake Baringo Distribution Line		
PS-III	CO-IN-1-PS-1	Mombasa Transmission Line	CO-IN-11-PS-1	Lamu Transmission Line
	CO-IN-7-PS-1	Kilifi- Malindi Transmission Line		

Water Supply Project

WS-I	CE-IN-1-WS-1	Karen Town Community	CE-IN-1-WS-2	South Limuru Community
WS-II	WE-IN-3-WS-1	Mt. Elgon Community		
WS-III	WE-IN-4-WS-1	Lake Baringo Community		
WS-IV	CO-IN-1-WS-1	South Diani Community	CO-IN-8-WS-1	Watamu Enlargement
	CO-IN-1-WS-1	Shelly Community	CO-IN-8-WS-2	North Watamu Community
	CO-IN-2-WS-1	Funzi Island Community	CO-IN-9-WS-1	North Mambrui Community
	CO-IN-2-WS-2	Funzi Bay Community	CO-IN-10-WS-1	South Manda Community
	CO-IN-2-WS-3	Gazi Community	CO-IN-10-WS-2	East Manda Community
	CO-IN-3-WS-1	Shimoni Community	CO-IN-11-WS-1	West Lamu Community
	CO-IN-7-WS-1	Kilifi Enlargement	CO-IN-12-WS-1	Pate Community

Sewerage Project

SG-I	CE-IN-1-SG-1	Karen Town Community	CE-IN-1-SG-2	South Limuru Community
SG-II	WE-IN-3-SG-1	Mt. Elgon Community		
SG-III	WE-IN-4-SG-1	Lake Baringo Community		
SG-IV	CO-IN-1-SG-1	South Diani Community	CO-IN-8-SG-1	Watamu Enlargement
	CO-IN-1-SG-2	Shelly Community	CO-IN-8-SG-2	North Watamu Community
	CO-IN-2-SG-1	Funzi Island Community	CO-IN-9-SG-1	North Mambrui Community
	CO-IN-2-SG-2	Funzi Bay Community	CO-IN-10-SG-1	South Manda Community
	CO-IN-2-SG-3	Gazi Community	CO-IN-10-SG-2	East Manda Community
	CO-IN-3-SG-1	Shimoni Community	CO-IN-11-SG-1	West Lamu Community
	CO-IN-7-SG-1	Kilifi Enlargement	CO-IN-12-SG-1	Pate Community

Solid Waste Disposal Project

SD-I	CE-IN-1-SD-1	South Limuru Community		
SD-II	WE-IN-4-SD-1	Lake Baringo Community		
SD-III	CO-IN-1-SD-1	South Diani Community	CO-IN-8-SD-2	North Watamu Community
	CO-IN-3-SD-1	Shimoni Community	CO-IN-9-SD-1	North Mambrui Community
	CO-IN-8-SD-1	Watamu Enlargement	CO-IN-12-SD-1	Pate Community

Source: JICA Study Team