

MINISTRY OF PUBLIC WORKS  
THE REPUBLIC OF LIBERIA

No.

**THE MASTER PLAN STUDY  
ON  
URBAN FACILITIES  
RESTORATION AND IMPROVEMENT  
IN  
MONROVIA IN THE REPUBLIC OF  
LIBERIA  
  
FINAL REPORT**

**November 2009**

**JAPAN INTERNATIONAL COOPERATION AGENCY  
YACHIYO ENGINEERING CO., LTD.  
KATAHIRA & ENGINEERS INTERNATIONAL**

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*(As of September 2009)*

## **PREFACE**

In response to a request from the Government of the Republic of Liberia, the Government of Japan decided to conduct a Master Plan Study on Urban Facilities Restoration and Improvement in Monrovia and entrusted to the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Masatsugu Komiya of Yachiyo Engineering Co, Ltd. between November 2008 and October 2009.

The team held discussions with the officials concerned of the Government of the Republic of Liberia and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Liberia for their close cooperation extended to the study.

November 2009

Toshiyuki KUROYANAGI,  
Director General  
Economic Infrastructure Department  
Japan International Cooperation Agency

November 2009

Mr. Toshiyuki KUROYANAGI,  
Director General  
Economic Infrastructure Department  
Japan International Cooperation Agency  
Tokyo, Japan

## **LETTER OF TRANSMITTAL**

Dear Sir,

We are pleased to submit to you the final report of the Master Plan Study on Urban Facilities Restoration and Improvement in Monrovia in the Republic of Liberia. The report contains a Master Plan for urban facilities restoration and improvement for Greater Monrovia targeting the year of 2019, encompassing future vision of Greater Monrovia with associated land use plan as well as plans for road and transportation sector, water supply sector, sanitation sector, and storm water drainage sector, taking into account the advices and suggestions of your Agency. Also included are comments made by Ministry of Public Works and other relevant organizations.

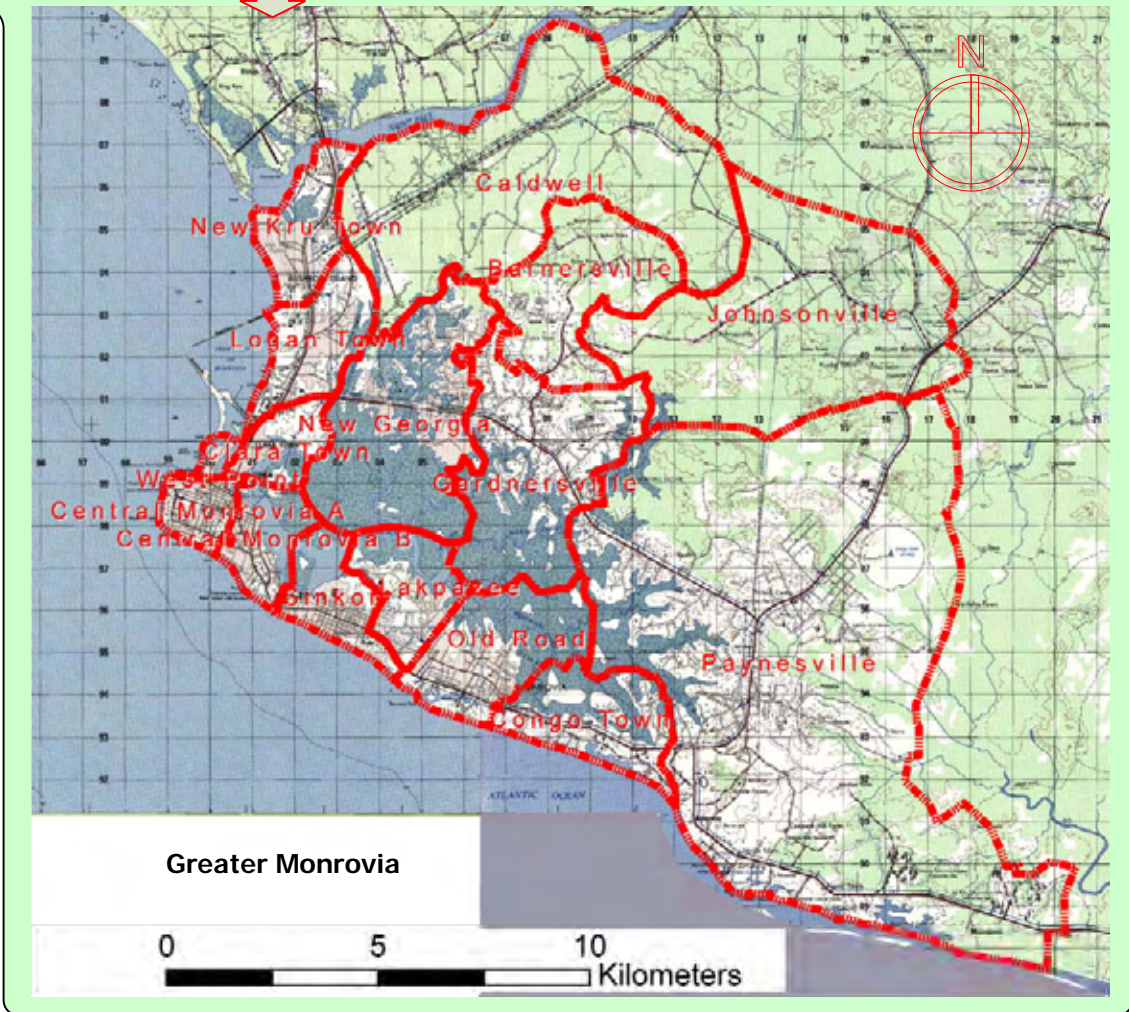
As a result of the 14-year civil conflict in the Republic of Liberia and the incoming population to Greater Monrovia, urban facilities of Greater Monrovia require urgent restoration and improvement through coordinated effort by relevant organizations in various sectors. We proposed profiles of short and medium term projects for road and transportation sector, water supply sector, sanitation sector, and storm water drainage sector, based on future vision, urban structure, land use, and allocation function of Greater Monrovia. Also included in the Master Plan are recommended institutional measures, project implementation plans, and operation and maintenance plans for each sector. It is expected that the institutional strengthening and appropriate operation and maintenance will enhance the effective and efficient restoration and improvement of urban facilities in Greater Monrovia.

In view of the urgent restoration and improvement of urban facilities in Greater Monrovia, we recommended that Government of the Republic of Liberia implements urgently the plans and projects for the concerned sectors proposed in the report.

We wish to take this opportunity to express our sincere gratitude to your Agency and the Ministry of Foreign Affairs. We also wish to express our deep gratitude to the Ministry of Public Works and other relevant organizations for close cooperation and assistance extended to us during our investigation and study.

Very truly yours,

Masatsugu Komiya  
Team Leader  
The Master Plan Study on Urban Facilities Restoration  
and Improvement in Monrovia in the Republic of Liberia



Location Map of Greater Monrovia and Republic of Liberia



## SUMMARY

### Background of the Study

The 14 years of civil strife in Liberia caused major damage to much of the country's infrastructure centered around the capital Monrovia, including trunk roads across the nation, urban roads in Monrovia, power generation and distribution facilities, water supply facilities and so on. Moreover, even the facilities that were not greatly damaged became deteriorated due to lack of maintenance. Accordingly, the country faces an urgent need to restore and reconstruct basic infrastructure facilities. It will be necessary to compile short-term and medium-term restoration and improvement plans and invest comprehensive, efficient and planned resources based on a future vision and strategy.

In this context the Government of Liberia submitted a request for the Master Plan Study on Urban Facilities Restoration and Improvement in Monrovia in the Republic of Liberia to the Government of Japan in November 2007. In response to this, the Government of Japan implemented the preliminary study in June 2008, during which the necessity of the Master Plan for Recovery and Reconstruction of Urban Facilities in Monrovia was confirmed, the S/W was signed for the implementation of the Study.

### Objectives of the Study

- 1) Formulate Master Plan for Restoration and Improvement of urban facilities in Greater Monrovia, and Implementation Plan on construction of public road, water supply, sewerage and sanitation and storm water drainage facilities.
- 2) Transfer technology for formulating Development Plans to the counterpart agencies through conducting the Study.

### Socio-economic Framework

		2008	2019
Population	Current Population (2009)	1,010,575	
	Natural Growth (2008-2019)		230,730
	Social Growth (2008-2019)		228,695
	Future Population (2019)		1,470,000
Sectoral Working Population	Primary	7,280	4,369
	Secondary	31,154	55,904
	Tertiary	209,881	376,619
Unemployment Rate(%)		17	8
Annual Rate per Capital of GDP Growth Rate(%) (2009-2019)			10
Car Ownership (vehicles/1,000 persons)		11	25-50

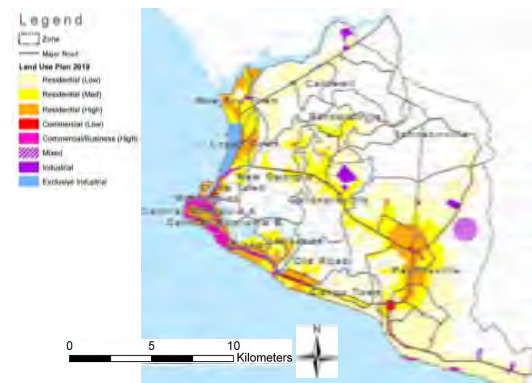
### Future Urban Structure (Multi-core urban corridor pattern)



### Land Use

		2008		2019	
		(ha)	(%)	(ha)	(%)
Residents	On-going	7,790	55%	-	-
	Low density	4,958	35%	5,958	47%
	Medium density	-	-	3,966	32%
	High density	945	7%	1,679	13%
Commercial		471	3%	702	6%
Industry		119	1%	245	2%
Total		14,283	100%	12,550	100%

Note: Land use for 2019 is only for UPM.



### Strategy of Master Plan Formulation

- (1). Restoration & Improvement Plan based on the Required Development
- (2). Formulation of Packaged Projects based on the Restoration & Improvement Needs
- (3). Infrastructural Development Project at Community Level
- (4). Resident Protection in an Urbanization Controlled Area (UCA)
- (5). Management of Time Schedule for Improvement Relevant Projects (Storm Water Drainage & Road, Water Supply & Sewerage)

## Development Goal

Sector	Status	Goal
Urban Development	Expansion of a city area	Efficient infrastructure improvement in a densely populated area (population density in an urbanization zone 227per/ha)
Road / Traffic	Insufficient quality and quantity of road network system (primary : 12%, secondary : 4%, district road : 9%)	Rate (100%) of road development (primary, secondary, district road)
Water Supply	There are lots of dwellers who rely on water venders and water service coverage ratio is low (37%)	Water service ratio (100%) by utilizing river and groundwater for the target year of 2019
Sewage and Sanitation	The access ratio of a sewer and sanitary facilities is as low as 35%with the exception of public toilets (Based on MDG)	Access ratio (68%) to sanitation with the exception of public toilets (Based on MDG of 2019)
Storm Water Drainage	Inundation and overflow of waste water occur at the time of flood. There are the damaged manholes and channels and some of them are missing.	Restoration of storm water drainage in Central Monrovia (open channels, the buried pipes and manholes)

## Master Plan for Restoration and Improvement of Urban Facilities in Greater Monrovia

(Unit: mln USD)

Sector/Projects		Contents	Cost	Year	
				2009-2014	2015-2019
<b>Estimated Cost for Road and Transport</b>					
TR-0	Emergency Infrastructure Project (MPW, LRTF, on-going)	The on-going Project being implemented by the Ministry of Public Works and World Bank utilizing the Liberia Reconstruction Trust Fund by multilateral cooperation	18.60	18.60	0.00
TR-1	Johnson Street Bridge Improvement Project (Undecided)	• Bridge length: 450 m, bridge width: 12.2m (Gabriel Tucker Bridge) • Approach Road: 400 m • Road widening from 2-lane road to 4-lane road • Road length: 13 km • Road width: 23-27.5m	24.00	24.00	0.00
TR-2	Somalia Drive Reconstruction Project (Undecided)	• Improvement of stockton and Double bridges • Improvement of major intersections • Road widening from 2-lane road to 4-lane road	21.10	21.10	0.00
TR-3	Reconstruction of Bridges on Missing Link (Undecided)	• 11 bridges on Missing link, total length: 305m • Bridge width: 5.5-7.0m • Improvement of approach road	10.64	10.64	0.00
TR-4	Road Rehabilitation Project (Undecided)	• Urban primary road: 60km • Urban secondary road: 105km • Tertiary road: 200km	48.28	14.48	33.79
TR-5	Intersection Improvement Project (Undecided)	• 28 intersections • Improvement of geometry design • Installation of traffic signal • ELWA junction is on-going by assistance of World Bank	5.30	1.33	3.98
TR-6	Bus Terminal & Bus Stop Facilities Construction Project (Undecided)	• Five (5) transit terminal new construction • 140 bus stop renovation and installation	6.80	1.70	5.10
TR-7	Traffic Safe Management Project (Undecided)	• Technical transfer program • Pilot project for traffic control and safety	2.00	0.20	1.80
TR-8	Vai Town Bridge Reconstruction (WB, Grant, on-going)	• Bridge length 240m • Reconstruction of collapsed Vai Town Bridge • Improvement of approach road and Vai Town intersection	15.00	15.00	0.00
TR-9	Rehabilitation of Monrovia City Streets Project (WB, Grant, on-going)	• Rehabilitation of 23 streets in Monrovia CBD • On-going by assistance of World Bank	17.60	17.60	0.00
TR-10	Caldwell Bridge Construction Project (WB, Grant, on-going)	• Bridge Length: 110m, Number of Lanes: 4 Lanes • On-going by assistance of World Bank	7.00	7.00	0.00
<b>Estimated Cost for Projects Proposed in this M/P</b>			<b>118.12</b>	<b>73.45</b>	<b>44.67</b>
<b>Total Estimated Cost for Road and Transport</b>			<b>176.32</b>	<b>131.65</b>	<b>44.67</b>
<b>Estimated Cost for Water Supply</b>					
WS-1	Monrovia Water and Sanitation Rehabilitation Program (Ongoing)	• Rehabilitation of the White Plains treatment plant (intake pump, treatment plant, booster pump station, rising&distribution pipelines and service reservoirs ), (Production capacity: 16MGD, Beneficiaries: 750,000)	38.50	38.50	0.00
WS-2	Monrovia Expansion and Rehabilitation of Three County Capitals (Ongoing)	• Development of satellite water supply system in north part of Paynesville zone (Beneficiaries: About 70,000)	19.24	19.24	0.00
WS-3	Project for Emergency Development of Water Supply System at Paynesville in Greater Monrovia (PEDW)	• Development of satellite water supply system in south part of Paynesville zone (Beneficiaries: About 60,000)	16.60	16.60	0.00
WS-4	Expansion Project of White Plains Water Supply System (EPWS) (Undecided)	• Expansion of the White Plains water supply system (treatment plant, rising&distribution pipelines and service reservoirs), (Max. total production capacity: 32MGD, Beneficiaries: 1.1mln)	128.63	34.18	94.45
	Expansion of Treatment Plant Phase I	• Expansion of the White Plains treatment plant (Max. total production capacity: 24MGD)	15.93	10.60	5.33
	Expansion of Treatment Plant Phase II	• Expansion of the White Plains treatment plant (Max. total production capacity: 32MGD)	23.34	0.00	23.34
	Expansion of Rising Main Line	• Expansion of rising pipelines (Capacity: 26MGD)	33.96	13.58	20.38
	Expansion of Distribution Main Line	• Expansion of distribution main pipelines (distribution main to be expanded of 215km out of total network pipelines of about 415km)	40.44	0.00	40.44
	Service Reservoir Installation	• Expansion of 13 service reservoirs (Capacity: 800-8,500m <sup>3</sup> )	14.96	10.00	4.96
WS-5	Project for Expansion of Water Supply System at Paynesville in Greater Monrovia (PEWS) Phase II (Undecided)	• Development of satellite water supply system in Paynesville zone (Beneficiaries: About 100,000)	22.87	13.51	9.36
WS-6	Technical Cooperation Project of Groundwater Management	• Technical transfer of Groundwater monitoring and water quality control management	0.32	0.32	0.00
WS-7	Technical Cooperation Project of Non-Revenue Water (Undecided)	• Technical transfer of non-revenue reduction measures	1.50	1.50	0.00
<b>Estimated Cost for Projects Proposed in this M/P</b>			<b>169.92</b>	<b>66.11</b>	<b>103.81</b>
<b>Total Estimated Cost for Water Supply</b>			<b>227.66</b>	<b>123.85</b>	<b>103.81</b>
<b>Estimated Cost for Sewer</b>					
SN-1	Monrovia Water and Sanitation Rehabilitation Program (WSRP)(Ongoing)	Immediate Rehabilitation of the Sewage Treatment Plant (Restoration on Stabilization Pond, Construction of 11 public Toilets and Procurement of one Vacuum Truck )	15.00	15.00	0.00
SN-2	Urban Infrastructure Construction and Rehabilitation of Monrovia Sewerage Network Pumping Stations (WB, ongoing)	De-sludge and cleaning the blocked sewer pipelines in Central Monrovia to Sinkor area and rehabilitation of pumping stations (4 Nos.) and lifting stations (5 Nos.) in off-site Sewage pipelines for Central Monrovia	4.80	4.80	0.00
SN-3	Community Sanitary System and Public Toilet Installation & Vacuum Truck Procurement Plan for 2014 (Undecided)	Installation and procurement: • 66 community sanitation systems and 225 public toilets • 5 vacuum trucks	18.11	18.11	0.00
SN-4	Project for Reconstruction of Sewerage Treatment & Sludge Treatment Plant (Undecided)	• Reconstruction of the sewage treatment plant of 6MG/day (22,700m <sup>3</sup> /day) • Construction of sludge treatment plant of 230 m <sup>3</sup> /day	74.20	0.00	74.20
SN-5	Community Sanitary System and Public Toilet Installation & Vacuum Truck Procurement Plan for 2019 (Undecided)	Installation and procurement: • 93 community sanitation systems and 86 public toilets • 7 vacuum trucks	23.38	0.00	23.38
<b>Estimated Cost for Projects Proposed in this M/P</b>			<b>115.69</b>	<b>18.11</b>	<b>97.58</b>
<b>Total Estimated Cost for Sewer</b>			<b>135.49</b>	<b>37.91</b>	<b>97.58</b>

The projects highlighted in grey color were proposed by JICA study team.



(Unit: mln USD)

Sector/Projects	Contents	Cost	Year		
			2009-2014	2015-2019	
<b>Estimated Cost for Storm Water Drainage</b>					
SW-1	Improvement of Drainage System in Monrovia Core Area (Undecided)	In Bushrod Island, Central Monrovia, Sinkor Zones 1. Restoration of storm water drainage system (Drainage pipes : about 27km, grating : 970places, manholes : 1,700 places)	12.26	12.26	0.00
	Drainage System Improvement (Central Monrovia)	•Development and restoration of drainage pipes: about 19km, Grating: 669places, Manholes: 1,173places •Restoration of open channel: about 1.5km	1.62	1.62	0.00
	Drainage System Improvement (Sinkor)	•Development and restoration of drainage pipes: about 5km, Grating: 185places, Manholes: 323places •Restoration of open channel: about 9.3km	3.97	3.97	0.00
	Drainage System Improvement (Bushrod Island)	•Development and restoration of drainage pipes: about 3km, Grating: 116places, Manholes: 204places •Restoration of open channel: about 6.7km	3.07	3.07	0.00
SW-2	(Admin, ES, Contingency, etc.)	•Administrative, engineering & supervision, contingency, etc.	3.60	3.60	0.00
	Equipment Supply for Drainage Pipes Cleaning (Undecided)	Procurement of maintenance equipments for storm water drainage •Water jet cleaner, vacuum cleaner (lift type), water tank, sludge hauling dump truck, truck for equipment transport of 4tons	1.33	1.33	0.00
SW-3	Procurement of Equipment	•Administrative, engineering & supervision, contingency, etc.	0.40	0.40	0.00
	(Admin, ES, Contingency, etc.)	•Administrative, engineering & supervision, contingency, etc.	0.28	0.28	0.00
SW-3	Technical Cooperation Programme (Undecided)	Capacity building on operation and maintenance system	0.28	0.28	0.00
<b>Estimated Cost for Projects Proposed in this M/P</b>			<b>13.86</b>	<b>13.86</b>	<b>0.00</b>
<b>Total Estimated Cost for Storm Water Drainage</b>			<b>27.45</b>	<b>27.45</b>	<b>0.00</b>
<b>Estimated Cost for Community Infrastructure Improvement</b>					
CM-1	Community Infrastructure Improvement Project (Undecided)	Community Infrastructure Improvement Project	27.79	11.08	16.71
	Road Rehabilitation	Road Restoration	16.09	4.83	11.26
	Water Supply	Development of Satellite System Water Supply	4.69	2.77	1.92
	Community Sanitary System and Public Toilet Installation & Vacuum Truck Procurement	Improvement of communal sanitation system, public toilet installation and vacuum truck procurement	7.01	3.49	3.52
<b>Estimated Cost for All Projects Proposed in this M/P</b>			<b>445.38</b>	<b>182.62</b>	<b>262.76</b>
<b>Total Est Total Estimated Cost for All Sectors</b>			<b>594.71</b>	<b>331.95</b>	<b>262.76</b>

The projects highlighted in grey color were proposed by JICA study team.

### Pilot Project of Public Tap Construction (Satellite Water Supply System)

#### 1) Scope of Project

The public taps for 1,000 persons of an MTA community was planned and built. (Max. daily water supply : 41m<sup>3</sup>/day)

#### 2) Project Contents

- Well (Depth : 73m) drilling
- Submersible pump installation (90liter/min. x 55m x 2.2kW)
- Generator installation (12.5kVA)
- Elevated tank installation (Capacity : 7.5m<sup>3</sup>)
- Distribution pipe laying (PVC&GS, pipe length : about 900m)
- Kiosk installation (5 places)

#### 3) Construction

JICA Study Team contracted with Bezaleel & Turnkey (Local Construction Contractor). Construction started in March, 2009 on a sub-contract basis by the JICA Study Team and was completed in October, 2009.

### Recommendation

- 1) Authorize the Master Plan formulated in this study for incorporation in national/regional development plan
- 2) Timely implement feasibility studies
- 3) Examine the private funding, new tax regulation, cost sharing by beneficiaries and community activities in order to secure the investment resources
- 4) Involve local labor-based construction for increasing employment opportunity
- 5) Adequately maintain the facilities for sustainability
- 6) Promote local construction industries for improving local contractors
- 7) Adjust the plan in response to the situation change
- 8) Conduct social and environmental assessments smoothly

#### 9) Authorize land use zoning map

#### 10) Designate the detail boundary of Ramsar Site convention

#### 11) Enhance capacity of relevant organization

#### 12) Approve preferential treatment in taxation for the construction equipments & materials to be provided from abroad

#### 13) Examine the tax regulation of preferential treatment for the equipments & materials to be provided from abroad

#### 14) Formulate communal development plan

#### 15) Cooperate with central or local government for implementing communal development plan

#### 16) Promote communal participation for the project led by central or local government

**The Master Plan Study on Urban Facilities Restoration and Improvement in Monrovia  
in the Republic of Liberia  
Final Report  
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## ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
AC	Asphalt Concrete
AfDB	African Development Bank
AIDP	Agriculture and Infrastructure Development Project
BOD	Biochemical Oxygen Demand
BPR	Bureau of Public Roads
BRP	Bureau of Regional Planning
BSC	Bachelor of Science
BST	Bituminous Surface Treatment
CC	Cement Concrete
CBD	Central Business District
CBR	Community-Based Recovery
CDA	County Development Agenda
CL	Cordon Line
COD	Chemical Oxygen Demand
CWIQ	Core Welfare Indicators Questionnaire
DCC	District Development Committee
DFID	UK Department for International Development
EA	Enumeration Area
EC	European Commission
EIA	Environmental Impact Assessment
EIP	Emergency Infrastructure Project
EIPSC	Emergency Infrastructure Project Supplementary Component
EIS	Environmental Impact Statement
EMP	Environment Management Plan
EPA	Environmental Protection Agency
EPWS	Expansion Project of White Plains Water Supply System
ERTC	Expansion and Rehabilitation of Three County Capitals
EU	European Unions
FAO	Food and Agriculture Organization
FDA	Forestry Development Authority
GAA	German Agro Action
GDP	Gross Domestic Product
GIS	Geographic Information System
GPS	Global Positioning System
GM	Greater Monrovia
GNI	Gross National Income
GoL	Government of Liberia
GoJ	Government of Japan
GTZ	Deutsche Gesellschaft für Technical Zusammenarbeit GmbH
HCPI	Harmonized Consumer Price Index
HIS	Household Interview Survey
IDA	International Development Association
IEE	Initial Environment Examine
IT/R	Interim Report
JICA	Japan International Cooperation Agency
LDAA	Liberia Domestic Airports Agency
LDHS	Liberia Demographic and Health Survey
LHS	Liberian Hydrological Services
LCIP	Liberia Community Infrastructure Program
LIRP	Liberia Infrastructure Rehabilitation Project
LISGIS	Liberia Institute for Statistics and GeoInformation Services
LNP	Liberia National Police

LPRC	Liberia Petroleum Refining Company
LRTF	Liberia Reconstruction Trust Fund
LWSC	Liberia Water and Sewer Corporation
MCC	Monrovia City Corporation
MFA	Ministry of Foreign Affairs
MIA	Ministry of Internal Affairs
MoF	Ministry of Finance
MLME	Ministry of Lands, Mines and Energy
MoT	Ministry of Transport
M/P	Master Plan
MPEA	Ministry of Planning and Economic Affairs
MPW	Ministry of Public Works
MSC	Master of Science
MTA	Monrovia Transit Authority
NECOLIB	National Environmental Commission of Liberia
NHA	National Housing Authority
NGO	Non Governmental Organization
NPA	National Port Authority
NTA	National Transit Authority
NTPS	National Transportation Policy and Strategy
O & M	Operation and Maintenance
OD	Origin-destination
OJT	On the Job Training
PAPs	Project Affected Persons
PFMU	Project Financial Management Unit
PEDWW	Project for Emergency Development of Water Supply System at Paynesville in Greater Monrovia
PEMU	Project Financial Management Unit
PPP	Public-Private Partnership
PRS	Poverty Reduction Strategy
PS	Pump Station
RIA	Roberts International Airport
RIAA	Roberts International Airport Agency
RMTC	Road Maintenance Training Center
ROW	Right of Way
PCU	Passenger Car Unit
PSU	Primary Sampling Unit
PT	Person Trip
SC	Steering Committee
SCL	Screen Line
SEZ	Special Economic Zone
SIU	Special Implementation Unit
SOE	State-Owned Enterprise
SPM	Suspended Particulate Matter
S/W	Scope of Work
TC	Traffic Count
TFLIB = LRTF	Trust Fund for Liberia
TP	Total Point
UN	United Nations
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Found
UNHCR	United Nations High Commissioner for Refugees
UNMIL	United Nations Mission in Liberia
UPA	Urbanization Promotion Area
URSP	Urban Rehabilitation and Sanitation Project
USAID	U.S. Agency for International Development



UTM	Universal Transverse Mercator Projection
VAT	Value Added Tax
VCR	Volume to Capacity Ratio
VES	Vertical Electric Sounding
WB	World Bank
WG	Working Group
WHO	World Health Organization
WMO	World Meteorological Organization
WSRP	Water and Sanitation Rehabilitation Program
WTP	Water Treatment Plant

### UNIT

°C	Degree Celsius
bln	billion
ft	Feet
Gal	Gallon
Hrs	Hour
ha	Hectare
kg/cm <sup>2</sup>	Kilogram per square meter
km	Kilometer
km/h	Kilometer per Hour
L/min	Liter per minute
L/sec	Liter per second
LRD	Liberian dollar
m	Meter
mb	Millibar
MG	Million Gallons
MGD	Million Gallons per Day
mg/L	Milligram per liter
mln	million
min	Minute
mm	Millimeter
m <sup>2</sup>	Square meter
m <sup>3</sup>	Cubic meter
m <sup>3</sup> /d	Cubic meter per day
m <sup>3</sup> /sec	Cubic meter per second
mS/m	Milli-Siemens/meter
PCU	Passenger Car Unit
per/ha	Persons hectare
No(s).	Number(s)
NTU	Nephelometric Turbidity Units
Sq.m.	Square meter
Ohm-m	Ohm-meter
%	Percent
USD	U.S. (United States) Dollar

## CHAPTER 1 INTRODUCTION

### 1.1 Background of the Study

The Republic of Liberia (hereinafter referred to as Liberia) achieved its independence in 1847 and is the second oldest country in Africa behind Ethiopia. The civil war that suddenly broke out in December 1989 continued for approximately 14 years until the signing of a comprehensive peace agreement in August 2003. During this time, it is estimated that conflict claimed the lives of some 270,000 people and displaced 790,000 refugees. Moreover, the conflict caused destruction of the country's main social and economic infrastructure and collapse of the national economy, and forced many Liberians into homelessness and poverty.

Under the refugee repatriation assistance program that started in October 2004, UNHCR assisted in the return of 157,755 people to Liberia. Most returnees, numbering 60,298 or 38% of the total number, came from Guyana, followed by 46,366 (29%) from Sierra Leone, 29,314 (19%) from Ivory Coast, and 19,306 (12%) from Ghana. As of October 2004, 233,264 Liberian refugees were registered in foreign countries. The repatriation assistance program officially ended on June 30, 2007 however, there were still 75,797 non-repatriated refugees in foreign countries as of December 1 that year (see Table 1.1-1).

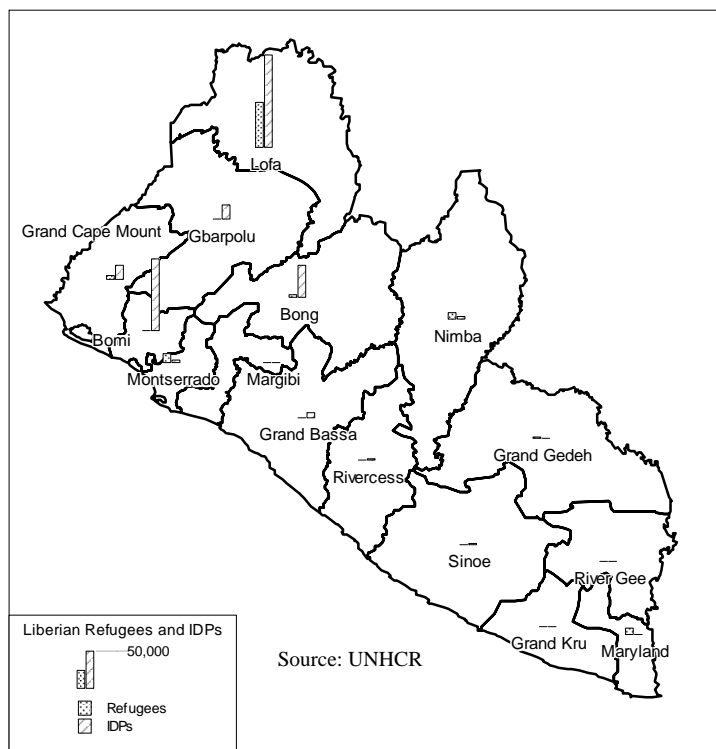
**Table 1.1-1 Liberian Refugees Repatriation Statistics (01 October 2004 to 31 December 2007)**

Asylum Country	Original Registered Pop. (01-Oct-04)	Assisted Returns	Spontaneous Returns	Total Returns		Residual Registered Pop.
Guinea	73,115	51,263	9,035	60,298	(38.2%)	<b>12,817</b>
Ivory Coast	53,922	21,543	7,771	29,314	(18.6%)	<b>24,608</b>
Sierra Leone	55,890	29,955	16,411	46,366	(29.4%)	<b>9,524</b>
Ghana	41,450	7,031	12,275	19,306	(12.2%)	<b>22,144</b>
Nigeria	6,879	2,136	5	2,141	(1.4%)	<b>4,738</b>
Others	2,008	328	2	330	(0.2%)	<b>1,678</b>
<b>TOTAL</b>	<b>233,264</b>	<b>112,256</b>	<b>45,499</b>	<b>157,755</b>	<b>(100.0%)</b>	<b>75,509</b>

Source: UNHCR

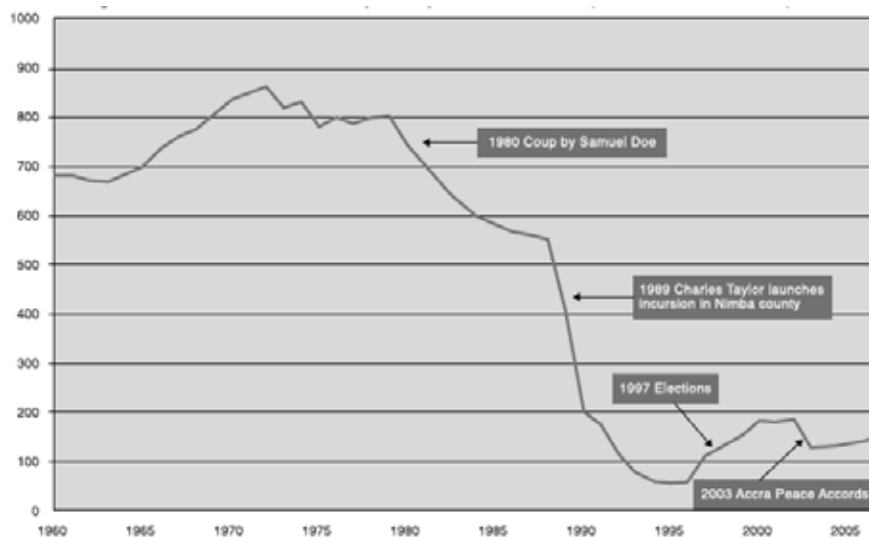
Meanwhile, 326,990 internally displaced people who had been living in 35 refugee camps throughout the country returned to their places of birth or to their desired locations between November 2004 and December 2006.

Many of these returnees and refugees have moved to the areas around the metropolitan area including the counties of Lofa, Bomi and Bong, etc. (see Figure 1.1-1).



**Figure 1.1-1 Distribution of Returnees by County**

According to the report by the World Bank, the GDP of Liberia fell by 90% between 1987 and 1995. Average income at the time of the general election following the peace accord in 2005 was one-quarter of that in 1987 and one-sixth of that in 1979 (see Figure 1.1-2). However, the economy of Liberia has been showing signs of steady recovery in recent years, with the GDP increasing at a rate of 2.6% in 2004, 5.3% in 2005, 7.8% in 2006 and 9.4% in 2007<sup>1</sup>. The issue confronting the country now concerns how to best distribute these benefits amongst the people fairly.



Source: World Bank, World Development Indicators

**Figure 1.1-2 Evolution of GDP per capita, 1960-2007 (constant 2004 USD)**

The 14 years of civil strife in Liberia caused major damage to much of the country’s infrastructure centered around the capital Monrovia, including trunk roads across the nation, urban roads in Monrovia, power generation and distribution facilities, water supply facilities and so on. Moreover, even the facilities that were not greatly damaged became deteriorated due to lack of maintenance.

<sup>1</sup> Source: Government of Liberia and IMF staff estimates

Accordingly, the country faces an urgent need to restore and reconstruct basic infrastructure facilities. Major donors such as the World Bank, EU and United States, etc. have been conducting post-conflict emergency recovery support programs in the fields of electric power, water supply and roads, etc., however, due to the sheer extent of the damage caused by the conflict and the rapid growth in population following the end of hostilities, urban functions are being hindered by chronic traffic congestion, low operating rates of water supply and sewerage facilities and reduced drainage functions, etc. From now on, in order to realize the full-scale recovery and reconstruction of urban functions, it will be necessary to compile short-term and medium-term recovery plans and invest comprehensive, efficient and planned resources based on the future vision and strategy.

The Government of Liberia submitted a request for the Master Plan Study on Urban Facilities Restoration and Improvement in Monrovia in the Republic of Liberia to the Government of Japan in November 2007. In response to this, the Government of Japan implemented the preliminary study in June 2008, during which the necessity of the Master Plan for Recovery and Reconstruction of Urban Facilities in Monrovia was confirmed, the S/W was signed which was decided to implement the Study.

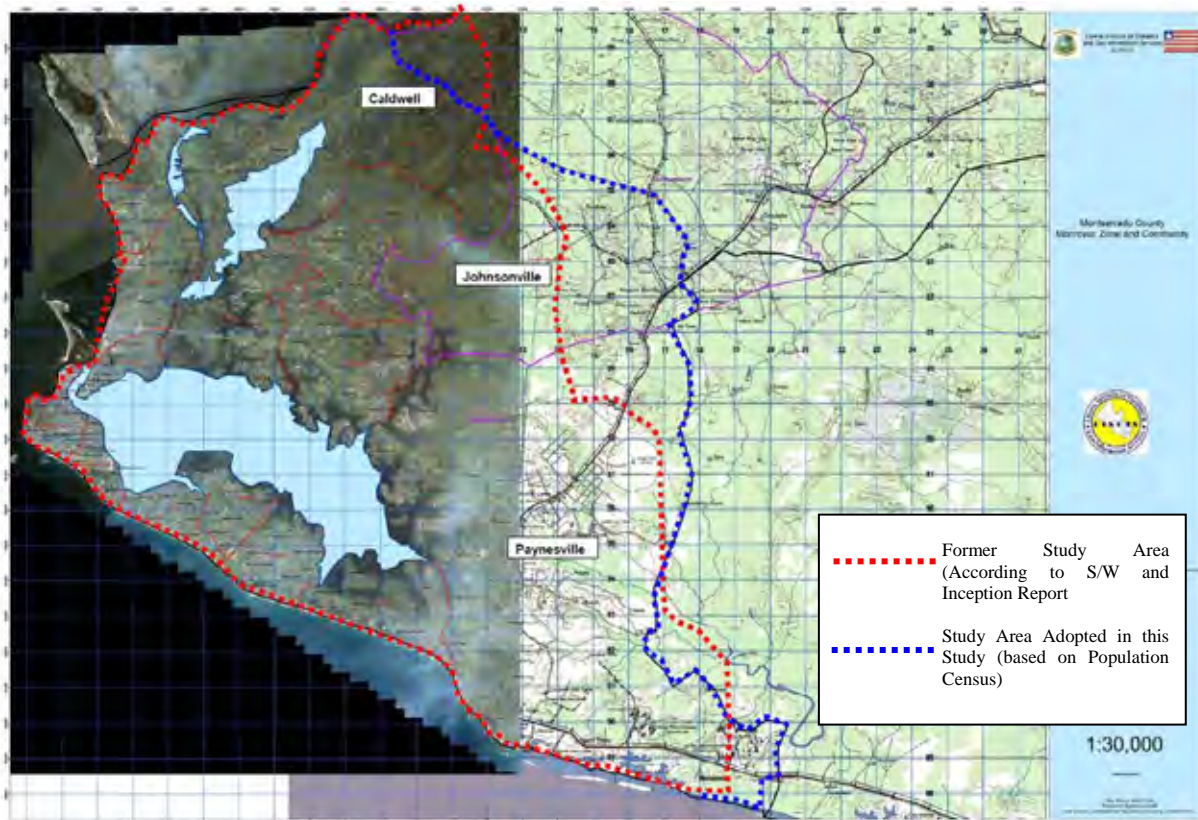
## **1.2 Objectives of the Study**

- |  |
|--|
| <ol style="list-style-type: none"><li>1) To compile a master plan for recovery and reconstruction of urban facilities in Greater Monrovia, and to compile a project implementation plan targeting roads, public water supply, sewerage and storm water drainage facilities</li><li>2) Through implementation of the Study, to implement the transfer of technology for compilation of development plans among the counterpart agencies</li></ol> |
|--|

## **1.3 Study Area**

The Study target area is Greater Monrovia comprising the city of Monrovia as well as Paynesville and Johnsonville. However, in subsequent surveys, it was found that Paynesville has already been incorporated into Monrovia and that the administrative scope of Paynesville and Johnsonville is different from the scope that was indicated in the S/W and Inception Report. Considering that it is appropriate to implement the M/P Study in accordance with the administrative boundaries, the M/P Study Team proposed and gained approval for revision of the Study scope in the Working Group. Figure 1.3-1 shows the target scope of the Study following the revision.

As a result of aligning the Study scope with the administrative boundaries, parts of Caldwell and Paynesville are smaller than the scope indicated in the Inception Report. Conversely, parts of Johnsonville and Paynesville are larger and the overall area is approximately 10% larger (20 km<sup>2</sup>). Moreover, JICA Headquarters has agreed to adopt the said M/P Study's scope in the map drawing work separately being conducted by the JICA Study Team for Mapping.



**Figure 1.3-1 Revision of the Study Area**

#### **1.4 Scope of Study and Study Flowchart**

The scope of the study is as follows.

##### **Phase I**

- [1-1] Collection, Organization and Review of Relevant Documents and Information
- [1-2] Review on Approach, Contents and Methodology of Study Implementation and Preparation of Inception Report
- [1-3] Establishment of Study Organization and Discussion on Inception Report
- [1-4] Collection and Review of Information
- [1-5] Comprehension of Issue
  - Current Problems
  - Constraint and Issues
- [1-6] Formulation of Future Vision and Approach to Urban Restoration and Improvement (Target Year 2019)
  - Ideal Vision of the City
  - Level of Urban Facilities Services = Vision
  - Approach to Urban Restoration and Improvement
- [1-7] Setting of Socio- Economic Frame
  - Population
  - Industry
  - Society
  - Land Use
  - Others
- [1-8] Formulation of Land Use Plan
  - Objectives of Land Use Plan
  - Status of Management of Land Use Plan
  - Analysis on Urban Structure and Allocation of Functions
  - Survey on Current Land Use

- Land Use Demand
- Preparation of Land Use Map (Target Year 2019)
- [1-9] Implementation of Survey on Actual Circumstances
  - Traffic Volume Survey, Road Inventory Survey
  - Public Awareness Survey
  - Groundwater Survey
  - Water Quality Survey
- [1-10] Analysis on Actual Traffic Conditions
  - Traffic Generation Characteristics
  - Traffic Distribution
  - Transport Modal Split
  - Current Condition of Road and Traffic
- [1-11] Implementation of an Exploratory Well as a Producing Well (Construction Supervision)
- [1-12] Preparation of and Discussion on Interim Report
- [1-13] Briefing, Discussion and Holding Seminar on Interim Report

## **Phase II**

- [2-1] Formulation of Restoration and Improvement Plan for Road Sector
  - Demand Forecast for Road Sector
  - Formulation of Road Plan
  - Formulation of Project Implementation Plan (Road Sector)
- [2-2] Formulation of Restoration and Improvement Plan for Water Supply Sector
  - Demand Forecast for Water Supply Sector
  - Formulation of Water Supply Plan
  - Formulation of Project Implementation Plan (Water Supply Sector)
- [2-3] Formulation of Restoration Plan for Sanitation Sector
  - Demand Forecast for Sanitation Sector
  - Formulation of Sanitation Plan
  - Formulation of Project Implementation Plan (Sanitation Sector)
- [2-4] Formulation of Restoration Plan for Storm Water Drainage Sector
  - Formulation of Storm Water Drainage Plan
  - Formulation of Project Implementation Plan (Storm Water Sector)
- [2-5] Economic and Financial Analysis
- [2-6] Formulation of Comprehensive Master Plan Urban Facility on Restoration and Improvement
- [2-7] Implement of Survey on Social and Environmental Impact Assessment (IEE Level)
- [2-8] Formulation of Operation and Maintenance Management Plan
- [2-9] Conclusions and Recommendations
- [2-10] Preparation, Discussion, and Holding Seminar on Draft Final Report
- [2-11] Preparation and Submission of Final Report

## **Phase III**

- [3-1] Groundwater Development Survey for the Project for Emergency Development of Water Supply System at Paynesville
- [3-2] Monitoring of Operation and Maintenance of Common Water Tap
- [3-3] Environmental Survey for Road Project

The flowchart of the Study is shown in Figure 1.4-1.



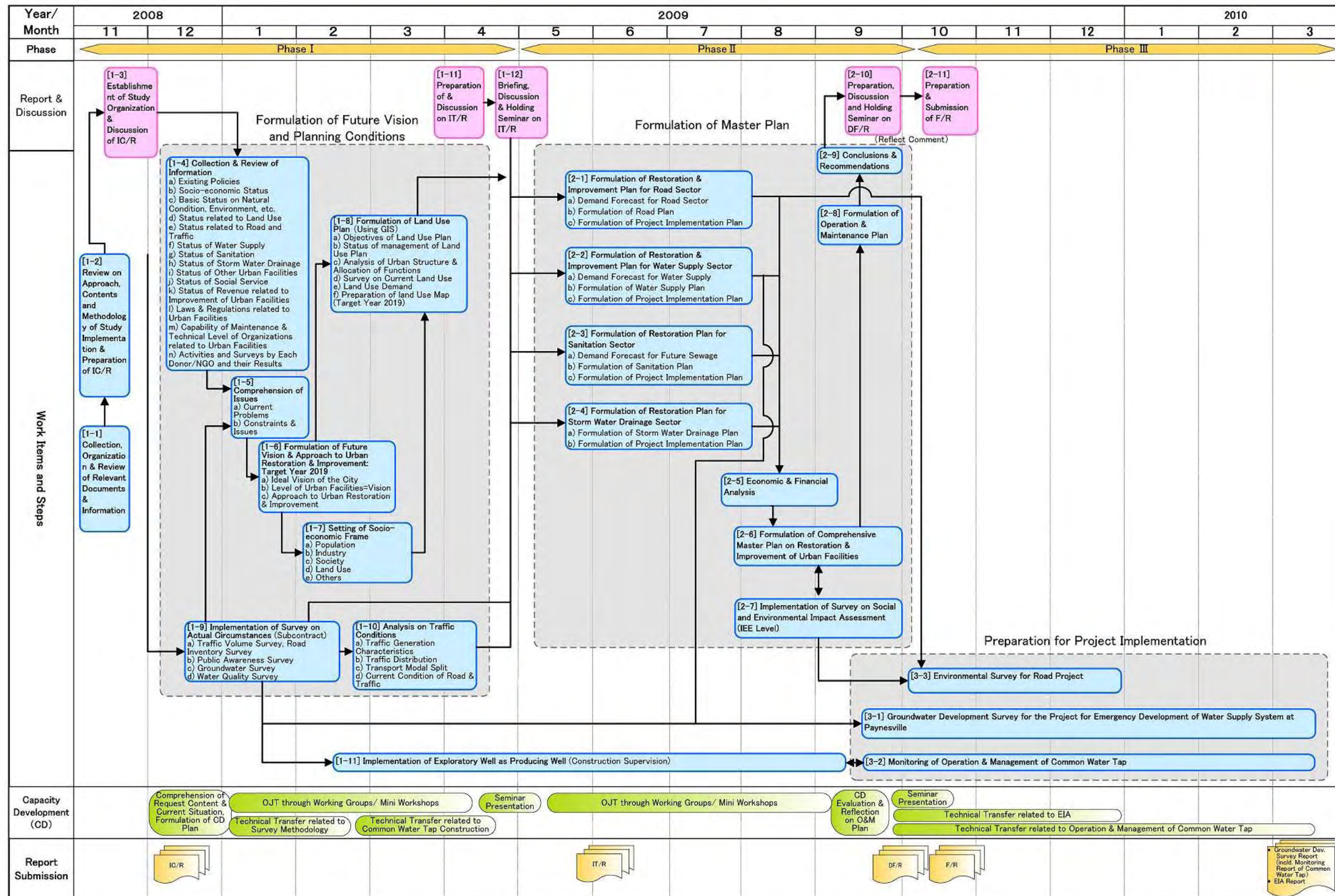


Figure 1.4-1 Study Flow Chart

## 1.5 Study Organization

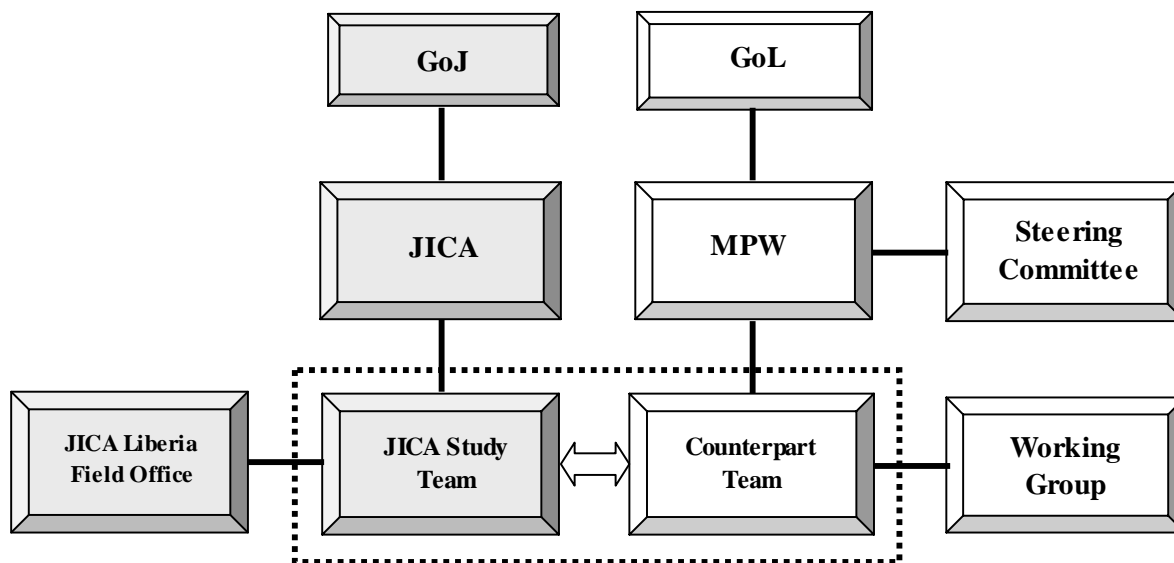


Figure 1.5-1 Study Organization

### [Steering Committee]

Chair:	Ministry of Public Works (MPW)
Vice Chair:	Ministry of Planning and Economic Affairs (MPEA)
Members:	Ministry of Foreign Affairs (MFA)
	Ministry of Transport (MoT)
	Ministry of Land, Mines and Energy (MLME)
	Monrovia City Corporation (MCC)
	Liberia Water and Sewer Corporation (LWSC)

### [Working Group]

Ministry of Public Works (MPW)
Ministry of Planning and Economic Affairs (MPEA)
Ministry of Foreign Affairs (MFA)
Ministry of Transport (MoT)
Ministry of Land, Mines and Energy (MLME)
Monrovia City Corporation (MCC)
Liberia Water and Sewer Corporation (LWSC)

### [JICA Study Team]

Mr. Masatsugu KOMIYA	Team Leader	YACHIYO ENGINEERING CO.LTD.
Mr. Akio NAKAMURA	Deputy Team Leader	KATAHIRA & ENGINEERS INTERNATIONAL
Mr. Toshiaki HORII	Social Economic Analysis	YACHIYO ENGINEERING CO.LTD.
Mr. Takashi KADOTA	Land Use Plan	KATAHIRA & ENGINEERS INTERNATIONAL
Mr. Masazumi ONO	Road Plan/Road Maintenance Plan	KATAHIRA & ENGINEERS INTERNATIONAL
Mr. Keiichi MURAKAMI	Road Facility Design	KATAHIRA & ENGINEERS INTERNATIONAL
Mr. Shuichi YASHIRO	Traffic Demand Forecast	KATAHIRA & ENGINEERS INTERNATIONAL
Mr. Masahiro TAKEUCHI	Water Supply Implementation Plan/Water Supply Maintenance Plan	YACHIYO ENGINEERING CO.LTD.
Mr. Taketoshi FUJIYAMA	Water Supply Piping Facility Design	YACHIYO ENGINEERING CO.LTD.
Mr. Akinori MIYOSHI	Operation & Maintenance Planning for Water Supply Facilities	YACHIYO ENGINEERING CO.LTD.
Mr. Tsuyoshi ONOZATO	Water Treatment Facility Design	YACHIYO ENGINEERING CO.LTD.
Mr. Nobuyuki IJIMA	Hydraulic Geology	YACHIYO ENGINEERING CO.LTD.
Mr. Hisashi OURA	Groundwater Development Plan/Construction Management I	YACHIYO ENGINEERING CO.LTD.

Mr. Yoshiaki ISHIZUKA	Groundwater Development Plan/Construction Management	YACHIYO ENGINEERING CO.LTD.
Mr. Tsutomu KAMEYAMA	Sewage Plan/Storm Water Drainage Facility Plan I	YACHIYO ENGINEERING CO.LTD.
Mr. Masatoshi SENO	Sewage Plan/Storm Water Drainage Facility Plan II	YACHIYO ENGINEERING CO.LTD.
Mr. Takao FUKUMA	Environment Social Consideration	KATAHIRA & ENGINEERS INTERNATIONAL
Mr. Gaku ADACHI	Coordinator I	YACHIYO ENGINEERING CO.LTD.
Mr. Atsushi KATO	Coordinator II/GIS I	YACHIYO ENGINEERING CO.LTD.
Mr. Ko TAKEUCHI	Coordinator III/GIS II	YACHIYO ENGINEERING CO.LTD.

## **1.6 Study Schedule**

The Study commenced in November 2008 and is to be completed in November 2009. Additional study will be completed in February 2010.

## **1.7 Main Meetings and Mini Workshops**

### **1.7.1 Explanation and Discussion of IC/R**

The Inception Report was separately explained to and discussed with the related agencies during the courtesy visits made immediately after entering Liberia. Additionally, explanation and discussions were held with respect to all related agencies when the first Steering Committee meeting was held on December 11, and consensus was reached on the M/P Study methods and schedule, etc. at this time.

Initially, the Ministry of Land, Mines and Energy (MLME) was originally not included on the Steering Committee when the S/W was signed on June 11, 2007 during the preliminary study. However, its membership was approved by all the other agencies including the Ministry of Public Works (MPW) in the latest discussions. As a result, composition of the Steering Committee is as shown below. Also, it was confirmed that the Working Group will be composed of working level representatives from the same agencies as the Steering Committee.

Chair:	Ministry of Public Works (MPW)
Vice Chair:	Ministry of Planning and Economic Affairs (MPEA)
Members:	Ministry of Foreign Affairs (MFA)
	Ministry of Transport (MoT)
	Ministry of Land, Mines and Energy (MLME)
	Liberia Water and Sewer Corporation (LWSC)
	Monrovia City Corporation (MCC)

### **1.7.2 Steering Committee Meeting**

The first Steering Committee meeting was held on December 11, 2008 in order to confirm the contents of Inception Report prepared by the Study Team, in presence of Ministry of Public Works and related organizations.

The second Steering Committee meeting was held on March 26 with attendance of the Minister of Public Works and related organizations. The Study Team gave reports on progress of the overall Study and the rough progress and findings of surveys in each sector.

The third Steering Committee meeting was held on April 28, 2009 with the presence of the Minister of Public Works. The JICA Study Team explained the contents of the IT/R and received comments from the Liberian side.

The fourth Steering Committee meeting was held on September 28, 2009 with attendance by the Ministry of Public Works and other related organizations. In the meeting, the contents of Draft Final Report were confirmed.

### 1.7.3 Working Group

The Working Group was established based on the S/W discussions of July last year. So far, eight working group meetings have been convened, and the main topics and contents of discussion in the meetings are as indicated below.

**Table 1.7-1 Working Group Meeting (1<sup>st</sup> – 9<sup>th</sup>)**

No.	Date/Time	Main Topics	Main Discussion
1 <sup>st</sup>	December 17, 2008 (Wed.)	<ul style="list-style-type: none"> <li>➤ Introduction of Attendants</li> <li>➤ Group Discussions</li> </ul>	The members were divided into two groups; Road sector group and Water sector group. Both groups discussed the questionnaires which were submitted by the study team.
2 <sup>nd</sup>	December 30, 2008 (Wed.)	<ul style="list-style-type: none"> <li>➤ Sub-contracts</li> <li>➤ Capacity Development Program (Draft)</li> <li>➤ Progress in Data/Information Collection</li> </ul>	The Liberian side requested to be further involved in the implementation of sub-contracts.
3 <sup>rd</sup>	January 21, 2009 (Wed.)	<ul style="list-style-type: none"> <li>➤ Progress Reporting (on Sub-contracts)</li> <li>➤ Notification of Mini Workshop</li> </ul>	JICA study team reported progress of survey activities, and Liberian side understood and agreed upon the progress, purposes, contents and time schedule of survey works.
4 <sup>th</sup>	February 13, 2009 (Fri.)	<ul style="list-style-type: none"> <li>➤ Progress Reporting</li> <li>➤ Request for Quick Provision of Census Results</li> <li>➤ Confirmation on the Alteration of Study Area</li> </ul>	JICA study team expressed a concern that there was no data regarding 2008 Population and Household Census would be available by the middle of February. JICA study team explained that the study area of this Study and the mapping work should be expanded, and Liberian side agreed upon this change.
5 <sup>th</sup>	March 10, 2009 (Tue.)	<ul style="list-style-type: none"> <li>➤ Progress Reporting</li> <li>➤ 2<sup>nd</sup> Steering Committee Meeting Schedule</li> <li>➤ Table of Contents of IT/R (Draft)</li> </ul>	All the members of the working group agreed on the schedule and contents of the next (2 <sup>nd</sup> ) Steering Committee. The table of contents of the interim report was explained.
6 <sup>th</sup>	April 16, 2009	<ul style="list-style-type: none"> <li>➤ Work Activity Reporting</li> <li>➤ Tentative Schedule of Next Working Group and Mini-Workshop</li> </ul>	JICA study team explained the results of exploratory drilling and public awareness survey. All the members of the working group agreed on the schedule and contents of the next (7 <sup>th</sup> ) Working Group and 4 <sup>th</sup> Mini-Workshop.
7 <sup>th</sup>	June 4, 2009	<ul style="list-style-type: none"> <li>➤ Work Activity Reporting</li> <li>➤ Schedule of Next Mini-Workshop and Working Group</li> </ul>	Progress of road planning, groundwater development plan and drainage planning was explained. Schedule of next (5 <sup>th</sup> ) Mini-Workshop and 8 <sup>th</sup> Working Group was informed.
8 <sup>th</sup>	July 14 and 15, 2009 (Working Group on July 15, 2009 was conducted as Field Workshop on Land Use lead by Mr. Komiya and Mr. Nakamura)	<ul style="list-style-type: none"> <li>➤ Introduction of Future Planning</li> <li>➤ Boundary of the Ramsar Convention</li> <li>➤ Concept of Urban Area</li> <li>➤ Preparation Works for Project Implementation</li> <li>➤ Request Letter for Grand Aid Project</li> <li>➤ Time Schedule of Implementation of Grant Aid</li> <li>➤ Tentative Schedule of Next Working Group</li> </ul>	JICA study team explained the future planning, including land use and urban sector, road sector, and water sector. JICA study team expressed its concern about the boundary of the Ramsar Convention for future land use and proposed to change the boundary. Liberian side understood verification if the boundary can be changed. Liberian side agreed to shoulder the expected preparation work of project implementation. JICA study team explained the procedures of request letters for grant aid project. Liberian side expressed strong intention of request grant aid project to Japanese Government.
9 <sup>th</sup>	August 31, 2009	<ul style="list-style-type: none"> <li>➤ Introduction of Future Projects</li> <li>➤ Explanation of supplemental study</li> <li>➤ Schedule of 4<sup>th</sup> Steering Committee Meeting and 2<sup>nd</sup> Seminar on Draft Final Report</li> </ul>	JICA Study Team explained the future project for road and water sector and the Liberian side understood the draft report of the projects. JICA Study Team also informed Liberian side about the supplemental study for EIA and exploratory well drilling and Liberian side understood the supplemental study.



## **1.7.4 Mini Workshop**

Staging of the Mini Workshop was proposed in the 2<sup>nd</sup> Working Group meeting as a means of realizing the transfer of technology, which is one of the objectives of the Study, and was approved by all the members. The implementation plan for this is as described below.

### **1.7.4.1 Background and Objective**

The technical transfer to the related organizations of Liberia regarding the formulation of a development plan is the essential activity through the execution of the Master Plan Study. The JICA Team's members conducted the mini workshops as one of on-the-job training in the capacity building to Liberian counterparts. Otherwise, the seminars explaining the study result were held for the Interim Report and the Draft Final Report

### **1.7.4.2 Activity and Timing**

The Team's member conducted mini workshops during their working in Liberia. The theme or topic for technical transfer highlighted key issues on technical aspect in each sector. The mini workshops were held in the Office of Study Team by lectures less than three (3) hours.

- Trainees required from Counterpart Agencies

MPW and the related agencies to the Study (Working Group) shall nominate the trainees. At present, the following agencies' members of Working Group will participate.

Ministry of Public Works (MPW)

Ministry of Land, Mines and Energy (MLME)

Ministry of Planning and Economic Affairs (MPEA)

Ministry of Transport (MoT)

Monrovia City Corporation (MCC)

Liberia Water and Sewer Corporation (LWSC)

Liberia Institute of Statistics & Geo-Information Services (LISGIS)

- Activities and Timing

Fixture and the theme or topics for the mini workshop were informed in advance to Working Group from Team Leader or the representative of the Team. Seven Mini Workshops have been executed until the preparation of this Draft Final Report. The activities for the work shop are summarized in Table 1.7-2.

**Table 1.7-2 Activities for Mini Workshop**

Theme	Topic (Lecturer)	Schedule
<b>A. Planning Condition Group</b>		
<b>1. Socio-economic Frame</b>	a) Population Distribution Planning Premises (Mr. Horii)	Mar. 30, 2009
<b>2. Land Use</b>	a) Zoning System in the Urban Master Plan (Mr. Kadota)	Mar. 3, 2009
<b>3. Environmental Evaluation</b>	a) Introduction of IEE Concept & EIA Procedure (Mr. Fukuma)	Jan. 29, 2009
<b>B. Road Sector Group</b>		
<b>1. Needs Assessment</b>	a) Traffic Surveys for Urban Transport Planning (Mr. Yashiro)	Mar. 30, 2009
	b) Transport Demand Forecast (Results of Traffic Demand Survey) (Mr. Yashiro)	Mar. 3, 2009
	c) Future Transportation Demand Forecasting (Mr. Ono)	May. 13, 2009
<b>2. Restoration/Improvement/Construction</b>	a) Road Maintenance System in Japan (Mr. Murakami)	Aug. 10, 2009
<b>C. Water Sector Group</b>		
<b>1. Resource Development</b>	a) Utilization of Well Inventory Survey (Mr. Iijima)	Jan. 29, 2009
	b) Groundwater Development (Electric Sounding and Aquifer) (Mr. Oura)	May. 13, 2009
<b>2. Restoration/Improvement/Construction</b>	a) Water Quality Management (Mr. Onozato)	Jul. 10, 2009
	b) Urban Drainage in Japan (Mr. Kameyama)	Jun. 29 2009

## CHAPTER 2 PRESENT CONDITION OF THE STUDY AREA

### 2.1 Natural Condition

#### 2.1.1 Meteorology

As meteorological data, temperature, relative humidity, pressure, wind direction and wind speed data of Roberts field (Monrovia International Airport) during 2000 to 2006 can be obtained from LHS. As rainfall data, old existing data of various stations during 1938 to 1989 and recent data of agriculture company near Firestone during 2000 to 2006 from LHS. Because of long-term missing observation during civil war and not recovery of observation system up to present, meteorology of the study area is mentioned using limited data. The location of meteorological observation stations is shown in Figure-2.1-1.

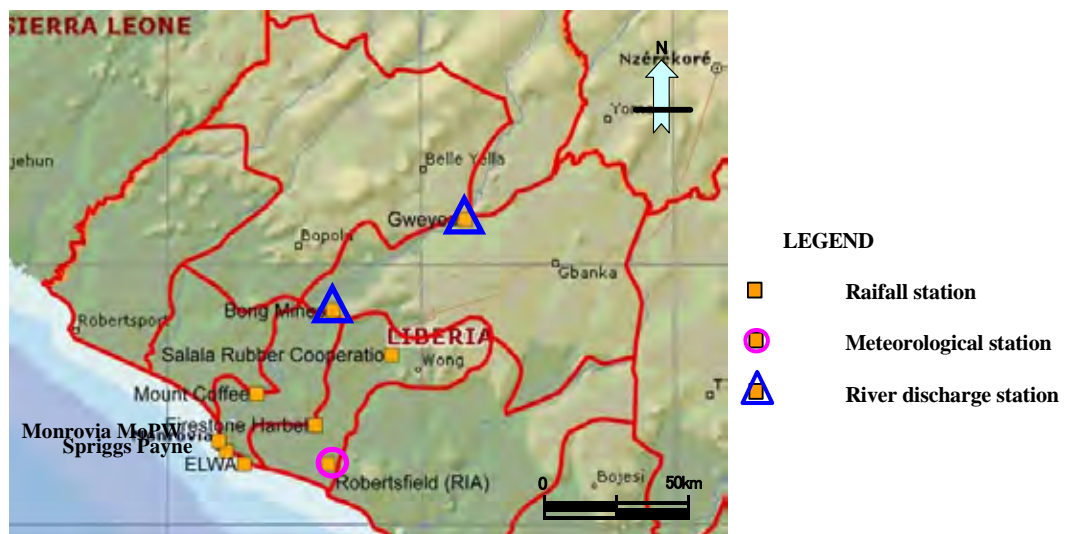
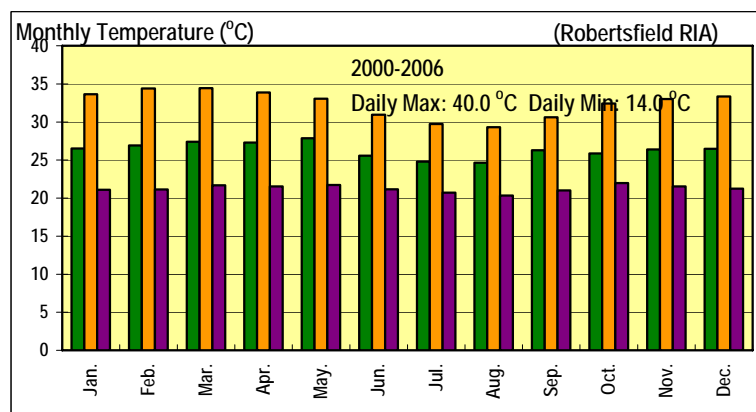


Figure 2.1-1 Meteorological Observation Station Surrounding Monrovia

##### 2.1.1.1 Temperature (Robertsfield, 2000-2006)

Monthly mean temperature shows maximum of 27.9°C in May, minimum of 24.3°C in September, and average of 26.3°C. Monthly maximum temperature shows maximum of 34.4°C in March and April, minimum of 29.3°C in August, and average of 32.4°C. Monthly minimum temperature shows maximum of 21.7°C in March and May, minimum of 20.3°C in August, and average of 21.3°C. Maximum daily temperature is of 40.0°C, and Minimum daily temperature is 14.0°C.

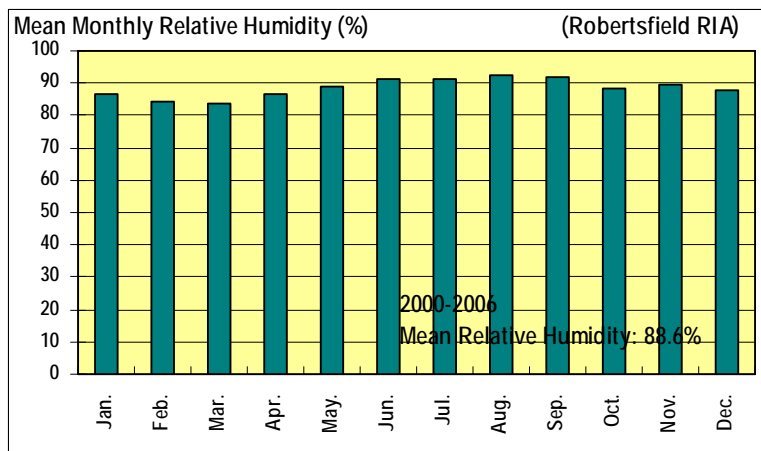


Source: LHS Data

Figure 2.1-2 Monthly Temperature of Robertsfield in 2000-2006

### 2.1.1.2 Relative Humidity

Monthly mean relative humidity shows maximum of 92.4% in August, minimum of 84.4% in February and average of 88.6%.

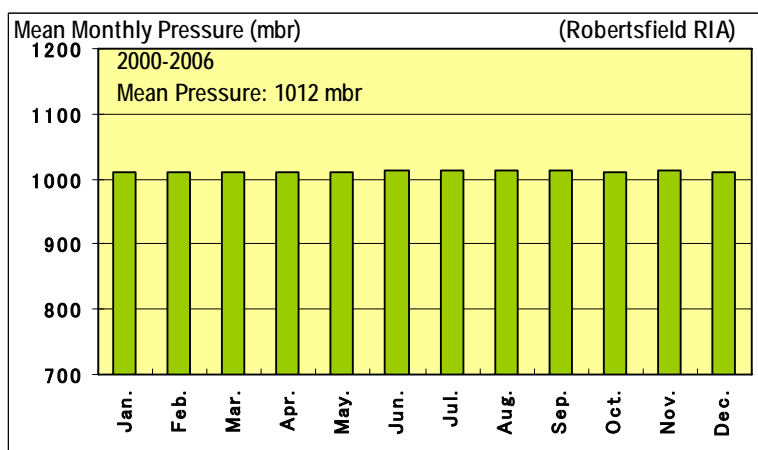


Source: LHS Data

**Figure 2.1-3 Monthly Mean Relative Humidity of Robertsfield in 2000-2006**

### 2.1.1.3 Pressure (Robertsfield, 2000-2006)

Monthly mean pressure shows maximum of 1014mbar in June and August, minimum of 1010mbar in January to April and average of 1012mbar.

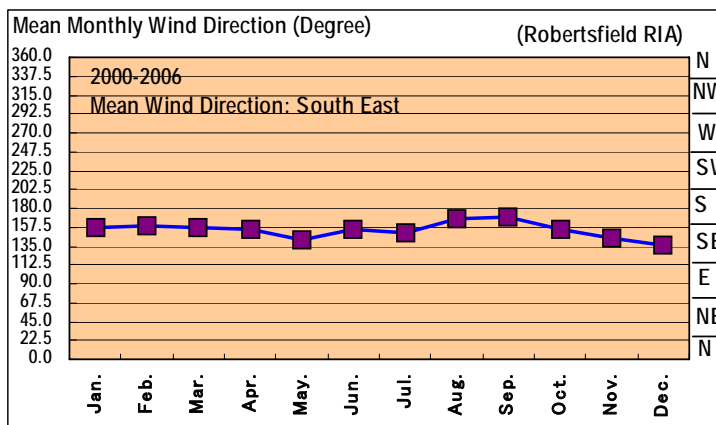


Source: LHS Data

**Figure 2.1-4 Monthly Mean Pressure of Robertsfield in 2000-2006**

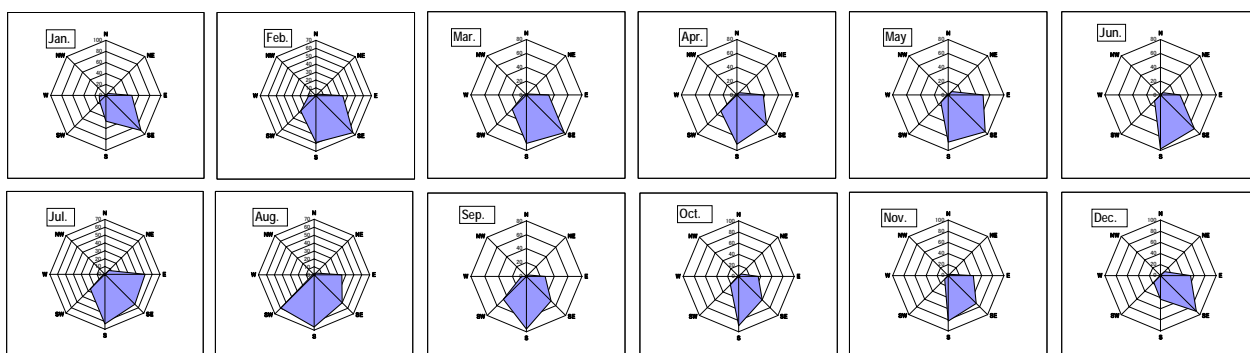
### 2.1.1.4 Wind Direction (Robertsfield, 2000-2006)

Monthly mean wind direction shows southeast as the most frequent direction and south as the second frequent direction. According to frequency chart, wind direction slightly changes such as southeast in January, southeast to south in February to July, south to southwest in August, south to southeast in September to November and southeast in December.



Source: LHS Data

Figure 2.1-5 Monthly Mean Wind Direction of Robertsfield in 2000-2006

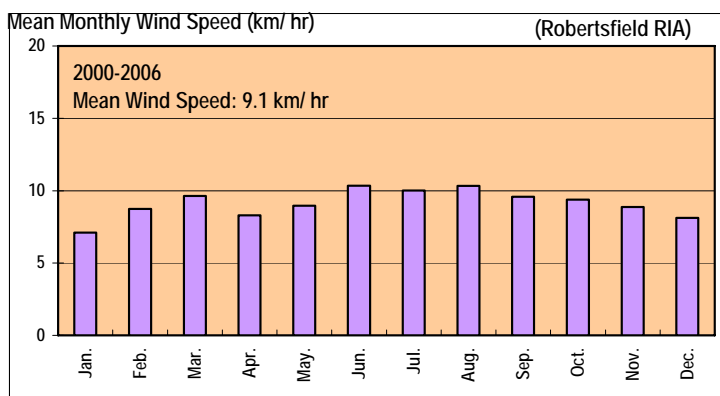


Source: LHS Data

Figure 2.1-6 Monthly Frequency of Wind Direction of Robertsfield in 2000-2006

### 2.1.1.5 Wind Speed (Robertsfield, 2000-2006)

Monthly mean wind speed shows maximum of 10.3km/hr in August, minimum of 7.1km/hr in January and average of 9.3km/hr.



Source: LHS Data

Figure 2.1-7 Monthly Mean Wind Speed of Robertsfield in 2000-2006

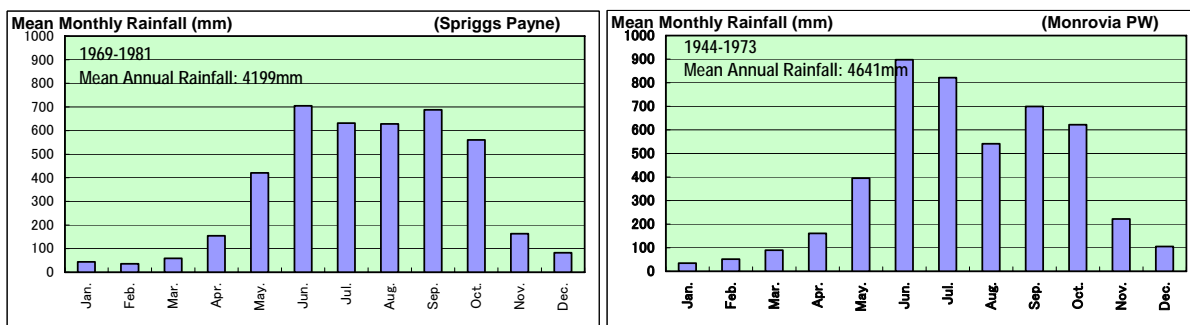
### 2.1.1.6 Rainfall

The Rainfall data of Spriggs Payne (1969-1981) and Monrovia MPW (1944-1973) are applied as rainfall data of Monrovia area. Rainy season is from May to October, and dry season is from November to April.

Monthly mean rainfall shows maximum of 705mm in June at Spriggs Payne and 898mm in June at



MPW, minimum of 34mm in February at Spriggs Payne and 35mm in January at MPW. Mean Annual rainfall is 4199mm at Spriggs Payne and 4641mm at MPW.

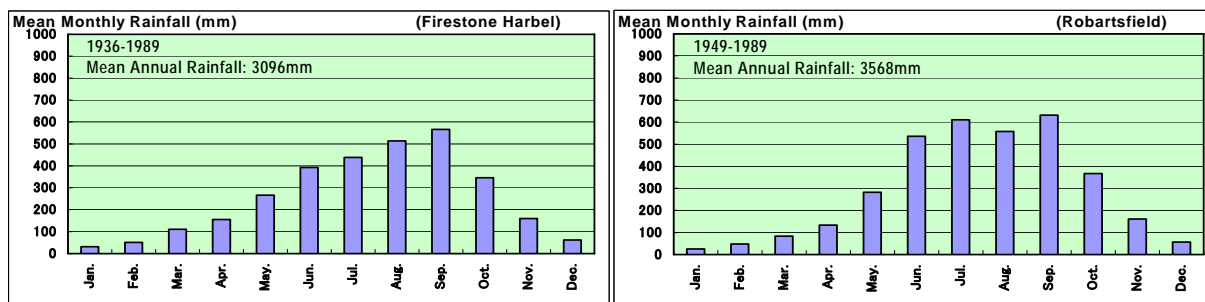


Source: LHS Data

**Figure 2.1-8 Monthly Mean Rainfall of Spriggs Payne in 1969-1981 and MPW in 1944-1973**

The Rainfall data of Firestone Harbel (1969-1981) and Robertsfield (1944-1973) are applied as rainfall data of Eastern and Northern part area. Rainy season is from May to October, and dry season is from November to April.

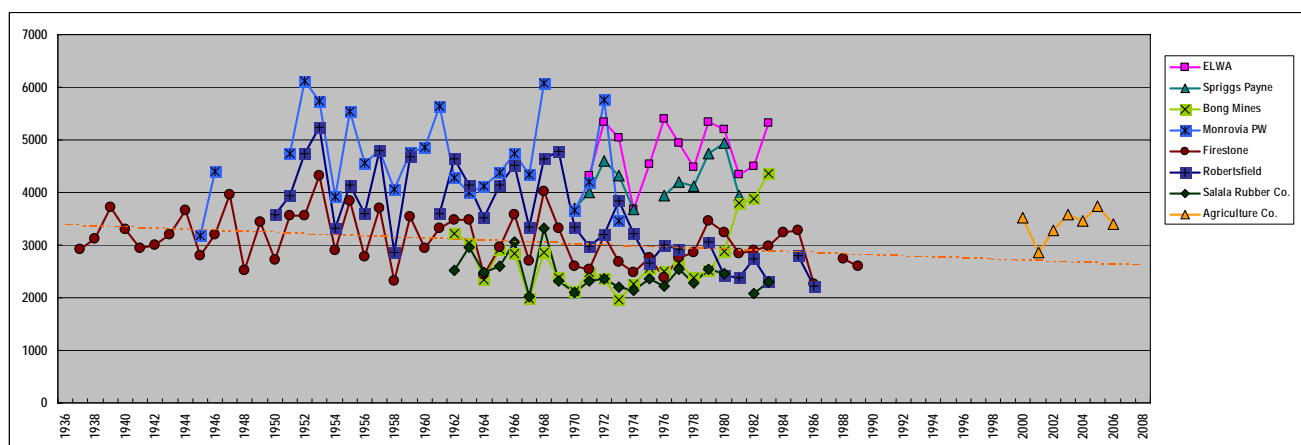
Monthly mean rainfall shows maximum of 566mm in September at Firestone and 631mm in September at Robertsfield, minimum of 32mm in January at Firestone and 24mm in January at Robertsfield. Mean Annual rainfall is 3906mm at Firestone and 3568mm at Robertsfield.



Source: LHS Data

**Figure 2.1-9 Monthly Mean Rainfall of Firestone in 1935-1989 and Robertsfield in 1949-1989**

The variation of annual rainfall of each rainfall observation station is shown in Figure 2.1-10. The variation of every year is rather large and the annual rainfall of Firestone during 54 years shows a trend of gradual decline.



Source: LHS Data

**Figure 2.1-10 Variation of Annual Rainfall of Each Rainfall Station**

## **2.1.2 Topography and Geology**

### **2.1.2.1 Topography**

The study area has a large lagoon from southern to central area. Surrounding the Mesurado lagoon, flat land is spread and distributed over the west side and northwest side, and low hills with gentle undulation are distributed in Monrovia southern side along cost of narrow peninsula and watershed boundaries among Mesurado river basin, Warner creek basin and Du river basin.

The watershed division of the study area is shown in Figure 2.1-11, and is as follows:

- 1) Mesurado lagoon watershed
  - Mesurado river sub-watershed (Ws1-1)
  - Warner creek sub-watershed (Ws1-2)
  - Barnersville creek sub-watershed (Ws1-3)
- 2) Du river watershed (Ws2)
- 3) St. Paul river watershed (Ws3)
- 4) Monrovia cost watershed (Ws4)
- 5) Bushrod island watershed
  - Bushrod island east sub-watershed (Ws5-1)
  - Bushrod island west sub-watershed (Ws5-2)

The main ridges divided watersheds are are as follows and shown in Figure 2.1-11:

- a) Monrovia south coast ridge (R-1); Elevation is from 10m to maximum 74m at Mamba point light house.
- b) East side ridge of Mesurado river sub-watershed (R-2); Elevation is from 10 to 20m.
- c) South east side ridge of Warner creek sub-watershed (R-3); Elevation is from 20 to maximum 46m.
- d) North-east ridge of the study area (R-4); Elevation is from 40 to maximum 88m.



**Figure 2.1-11 Feature of Topographic Condition of the Study Area**

### 2.1.2.2 Geology

The geology of the study area mainly consists of Precambrian Melanocratic gneiss, Devonian Paynesville sandstone, Jurassic Diabase dike, Tertiary Edna sandstone and Quaternary Beach and Fluvial deposits.

The geological composition of the study area and surrounding area is shown in Table 2.1-1. The geological map of the study area and surrounding area is shown in Figure 2.1-12.

The Precambrian Melanocratic gneiss is widely distributed as a base rock in northern part of the study area such as New Kru Town, North part of Logan town, Caldwell, Barnesville, North part of New Georgia, North part of Gardnersville and Johnsonville.

The Devonian Paynesville sandstone is distributed at central area of New Georgia and at every part of Paynesville. The formation is intruded by Jurassic Diabase at every area and covered by Tertiary and Quaternary deposit at low flat area.

The Jurassic Diabase is distributed as a dike or intrusive rock with rather large rock body in Central Monrovia A and B, Congo Town and Paynesville. The rock bodies often form low-height hill.

The Tertiary Edina sandstone is distributed at the front of Paynesville sandstone in central and southern east area of New Georgia, and in central and partly southern area of Paynesville.

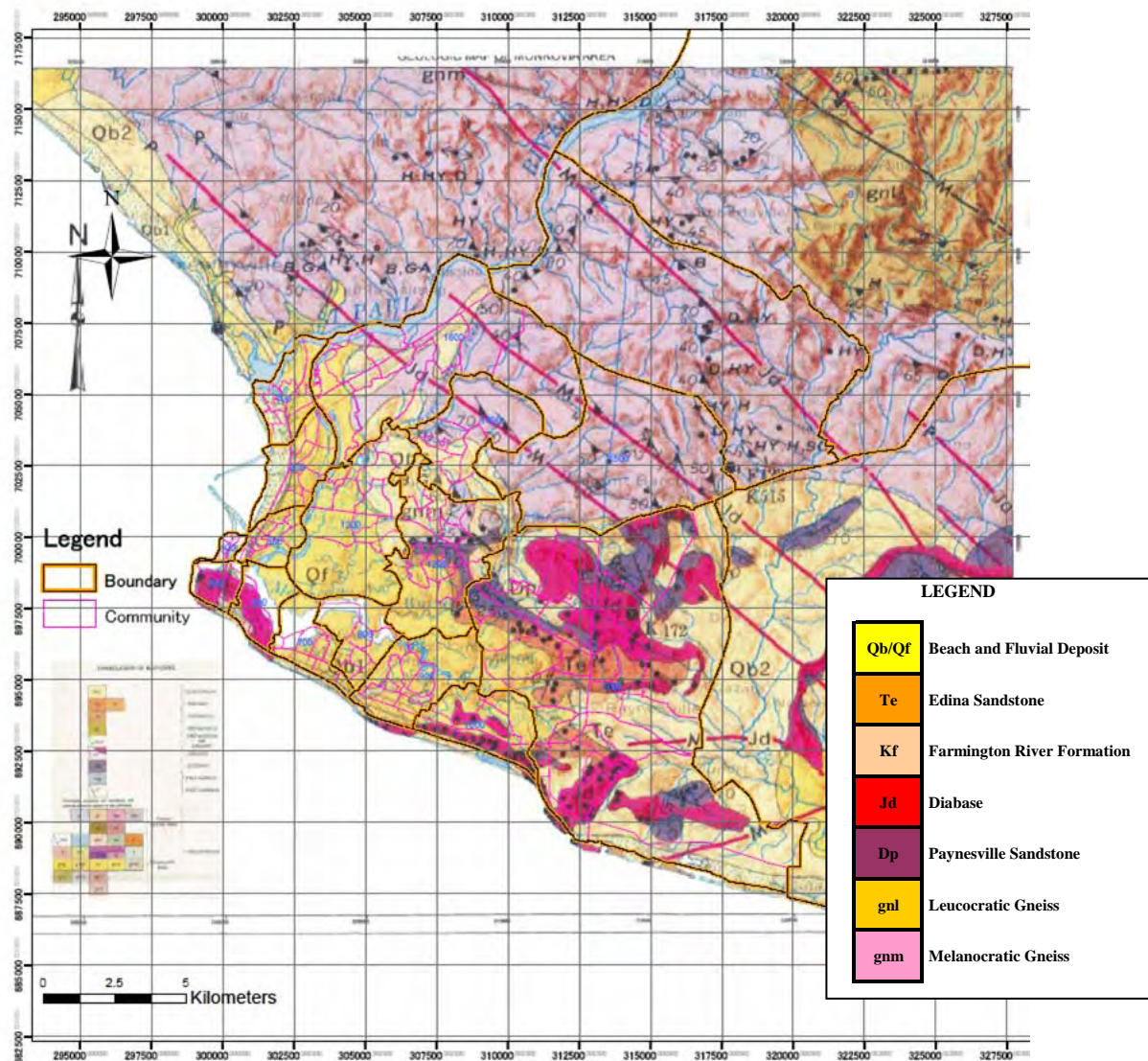
The Quaternary deposit is distributed at low flat land of all the study area and covers underlying other formations.



**Table 2.1-1 Geological Composition of Study Area and Surrounding Area**

Era	Period	Symbol	Formation	Description	Remarks
Cenozoic	Quaternary	Qb/Qf	Beach and Fluvial Deposit	Modern beach deposits (seashore sand), Older beach deposits (pure white quartz sand, buff to yellowish-brown sand and silt)	
	Tertiary	Te	Edina Sandstone	Brownish yellow, light-brown, white, medium to coarse grained gritty to conglomeratic quartz sandstone	Generally less than a few meters thick
Mesozoic	Cretaceous	Kf	Farmington River Formation	Brown to dark green massive sandstone, poorly to moderately well sorted, Conglomerate unit at base	No indication in the geological map
	Jurassic	Jd	Diabase	Dark-gray, fine to coarse grained rock, mainly diabasic but locally gabbroic in texture, chiefly dikes with north-west trending, partly forming sill-like bodies	
Paleozoic	Devonian	Dp	Paynesville Sandstone	Light colored, fine to medium grained, well rounded and well sorted, cross bedded quartz sandstone, subordinate cross bedded reddish brown siltstone and shale	
Precambrian		gnl	Leucocratic Gneiss	Light colored, medium to coarse grained, foliated, commonly banded, rock composition ranging from granite to granodiorite, locally quartz diorite	Distribution out of the study area
		gnm	Melanocratic Gneiss	Dark colored, medium grained, moderately foliated, rock composition ranging from diorite to gabbro, including amphibolite and granitic gneiss	

Source: 1/62,500 GEOLOGICAL MAP OF MONROVIA AREA (LISGIS Material)



Source: Geological Map of Monrovia Area (LISGIS materials)

**Figure 2.1-12 Geological Map of the Study Area and Surrounding Area**

## 2.2 Socio-economic Condition

### 2.2.1 Population

#### 2.2.1.1 Population in Liberia

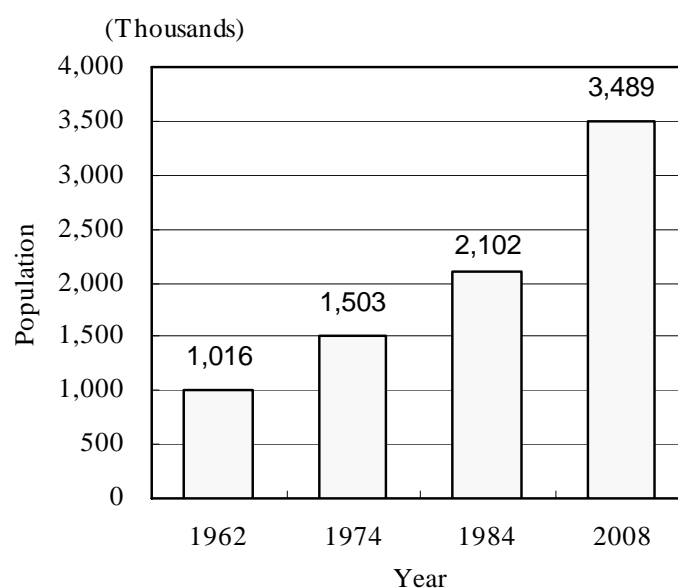
The first population Census in Liberia was implemented in 1962, and further Censuses were implemented in 1974 and 1984. However, the original drafts and data of the third Census in 1984 were lost during the civil war and the detailed findings were never disclosed. Accordingly, the population Census that was implemented in March 2008, the first time in 24 years, extremely represents important data for the Study.

According to the preliminary findings that were disclosed in June 2008, the population of Liberia in 2008 is 3,489,072, representing an increase of 1.66 times from the figure of 2,101,628 in 1984. This works out as an annual rate of population growth of 2.1% over this period, which is a lot smaller than the growth rate of 3.3% in 1974 and 3.4% in 1984 (see Table 2.2-1), however, it is thought that the figure would have been similar to this if the civil war had not occurred.

**Table 2.2-1 Population Trend, 1962-2008**

Index	1962	1974	1984	2008
Population	1,016,443	1,503,368	2,101,628	3,489,072
Population change		486,925	598,260	1,387,444
Average annual increase		40,577	59,826	57,810
Percentage increase		47.9	39.8	66.0
Annual rate of growth		3.3	3.4	2.1

Source: 2008 National Population and Housing Census Preliminary Results



**Figure 2.2-1 Population Change, (1962-2008)**

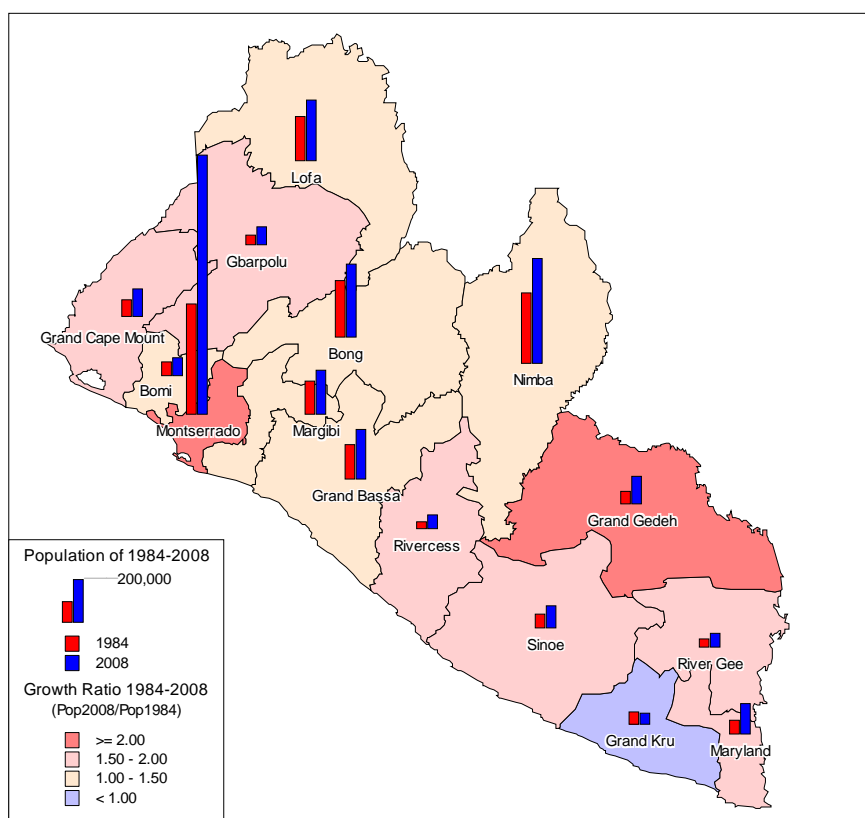
Figure 2.2-2 and Table 2.2-2 show population movements by county. It can be seen that the population is concentrated in Montserrado County which contains Monrovia. According to the 2008 Census, the population of Montserrado accounts for approximately one-third of the national population. Since this ratio was just under one-quarter in 1984, it can be seen that population concentration into Montserrado is advancing. The same conclusion may also be drawn from the county-separate population growth rates: whereas the national rate of growth is 2.1%, the rate is 3.6% in Montserrado. Over the past 24 years, the population of Montserrado has increased 2.3 times by more than 650,000. In contrast to the population concentration into Montserrado, growth rates have been low in the surrounding counties of Bomi, Bong, Margibi, etc.

**Table 2.2-2 Population and Density by County (1984 and 2008)**

County	Population		Distribution Ratio (%)		Annual Growth Rate (%)	Area (Sq.m.)	Density	
	1984*	2008	1984*	2008	1984-2008		1984*	2008
Bomi	66,420	82,036	3.2	2.4	0.9	750	89	109
Bong	255,813	328,919	12.2	9.4	1.1	3,387	76	97
Gbarpolu	48,399	83,758	2.3	2.4	2.3	3,741	13	22
Grand Bassa	159,648	224,839	7.6	6.4	1.4	3,064	52	73
Grand Cape Mount	79,322	129,055	3.8	3.7	2.0	1,993	40	65
Grand Gedeh	63,028	126,146	3.0	3.6	2.9	4,048	16	31
Grand Kru	62,791	57,106	3.0	1.6	-0.4	1,504	42	38
Lofa	199,242	270,114	9.5	7.7	1.3	3,854	52	70
Margibi	151,792	199,689	7.2	5.7	1.1	1,010	150	198
Maryland	69,267	136,404	3.3	3.9	2.9	887	78	154
Montserrado	491,078	1,144,806	23.4	32.8	3.6	737	666	1553
Nimba	313,050	468,088	14.9	13.4	1.7	4,460	70	105
Rivercess	37,849	65,862	1.8	1.9	2.3	2,160	18	30
Rivergee	39,782	67,318	1.9	1.9	2.2	1,974	20	34
Sinoe	64,147	104,932	3.1	3.0	2.1	3,914	16	27
<b>TOTAL</b>	<b>2,101,628</b>	<b>3,489,072</b>	<b>100.0</b>	<b>100.0</b>	<b>2.1</b>	<b>37,483</b>	<b>56</b>	<b>93</b>

Source: National Population and Housing Census

\* The population used were those that were derived for the respective counties after accounting for boundary change between 1984 and 2008



**Figure 2.2-2 Population Change, 1984-2008**

### 2.2.1.2 Population in Greater Monrovia

The population of Greater Monrovia in 2008 was 1,010,575. Over the 24 years from 1984, the population of Paynesville increased approximately 7.6 times by more than 300,000. Population increased 4.8 times in New Georgia and 3.4 times in Clara Town, indicating that population growth is occurring in outlying parts of the existing urban areas and the suburbs are expanding outwards from the center (see Table 2.2-3).

**Table 2.2-3 Population Change in Greater Monrovia, 1084-2008**

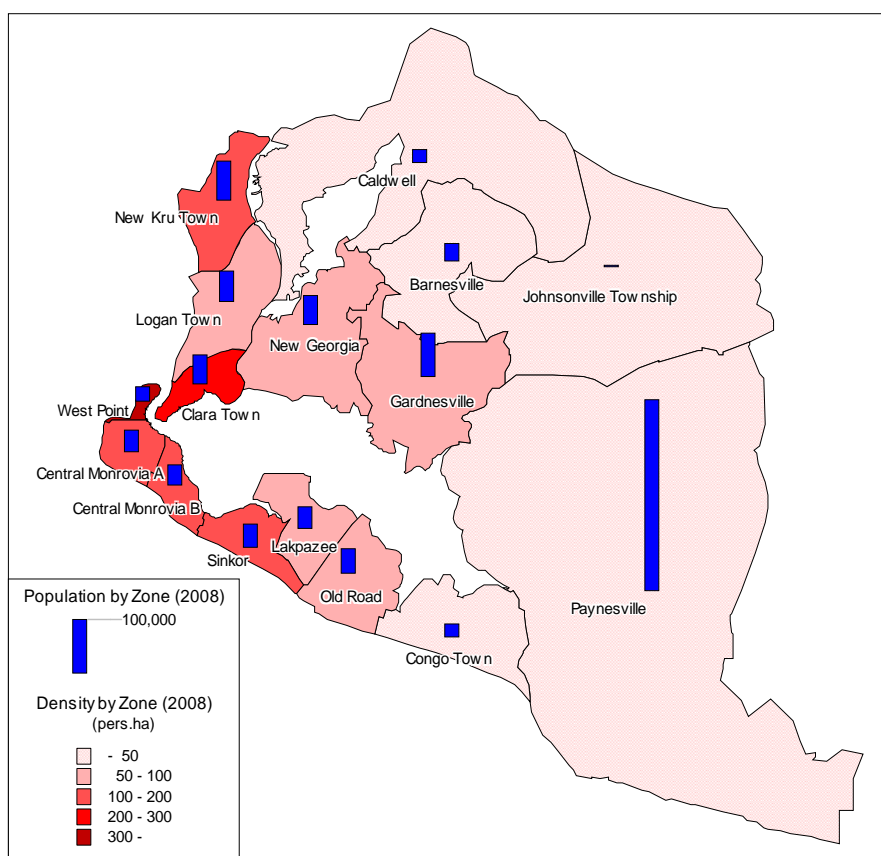
Zone Code	Zone Name	Population		2008 /1984	Area (ha)	Density (persons/ha)
		2008	1984			
1	New Kru Town	73,379	46,561	1.576	515	142.4
2	Logan Town	58,168	40,754	1.427	627	92.8
3	Clara Town	55,462	16,181	3.428	244	227.8
4	West Point	29,516	22,499	1.312	53	558.0
5	Central Monrovia A	42,139	39,562	1.065	246	171.4
6	Central Monrovia B	40,688	54,770	0.743	213	191.5
7	Sinkor	43,780			321	136.6
8	Lakpazee	42,045			441	95.4
9	Old Road	48,274			554	87.2
10	Congo Town	25,217			784	32.2
	Sub Total	159,316	95,426	1.670	2,099	75.9
11	Paynesville	350,998	46,477	7.552	9,130	38.4
12	Gardnesville	80,397	40,707	1.975	1,221	65.8
13	New Georgia	54,188	11,232	4.824	1,052	51.5
14	Barnesville	35,224	6,884	5.117	1,212	29.1
	<b>SUB-TOTAL</b>	<b>979,475</b>	<b>421,053</b>	<b>2.326</b>	<b>16,612</b>	<b>59.0</b>
15	Johnsonville	4,514			3,203	1.4
16	Caldwell	26,586			3,008	8.8
	<b>GREATER MONROVIA</b>	<b>1,010,575</b>			<b>22,823</b>	<b>44.3</b>

Source: National Population and Housing Census

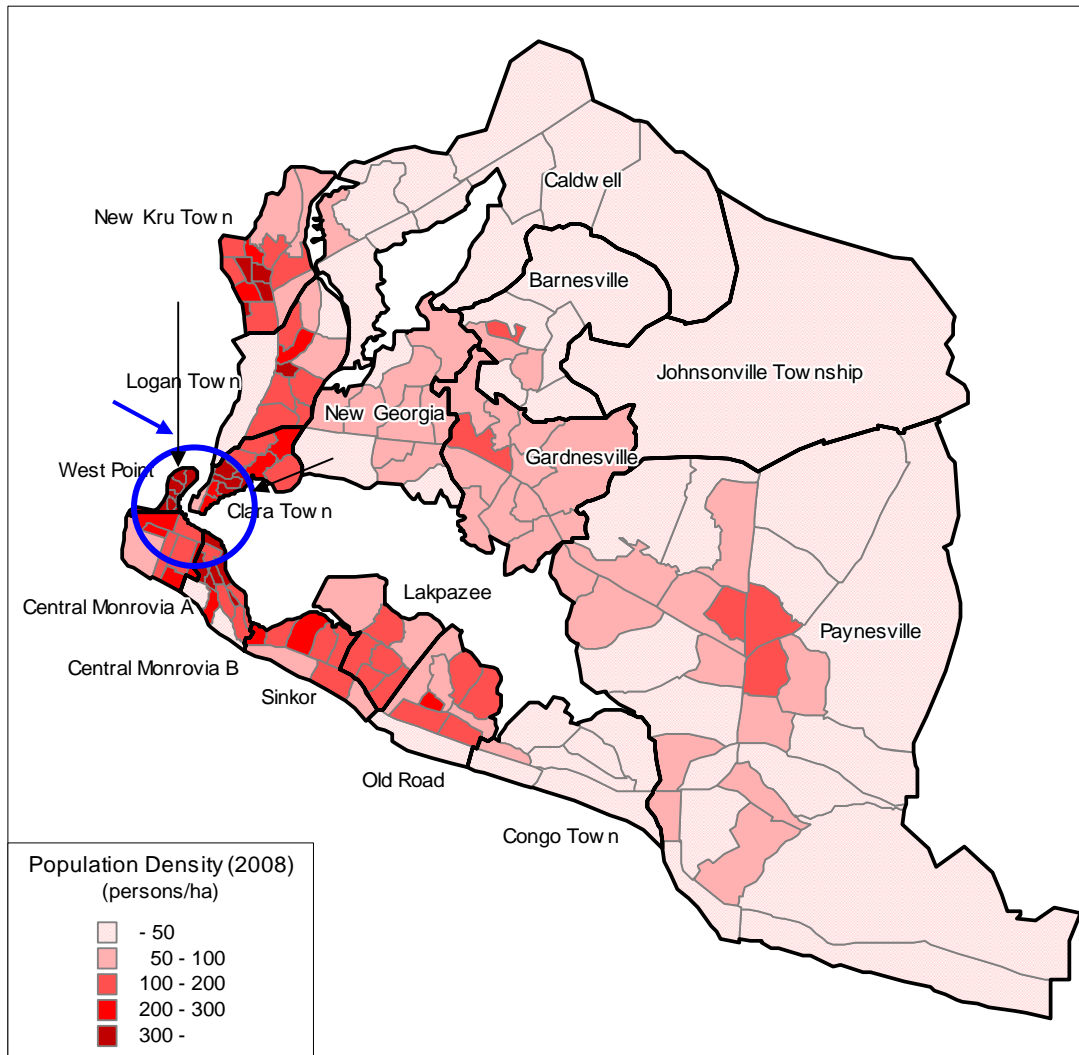
Looking at the population by district, Paynesville, which covers the widest area, also has the most population at around 350,000, and this is followed in order by Gardnersville and New Kru Town. Paynesville accounts for 35% of the population of Greater Monrovia overall. In terms of population density, the slum districts of West Point and Clara Town show the highest figures (see Figure 2.2-3).

Figure 2.2-4 shows population density according to community. Here too, West Point and Clara Town show the highest population density, especially in West Point district, the communities of Power Plan and West Point show population density in excess of 1,000 people per hectare.

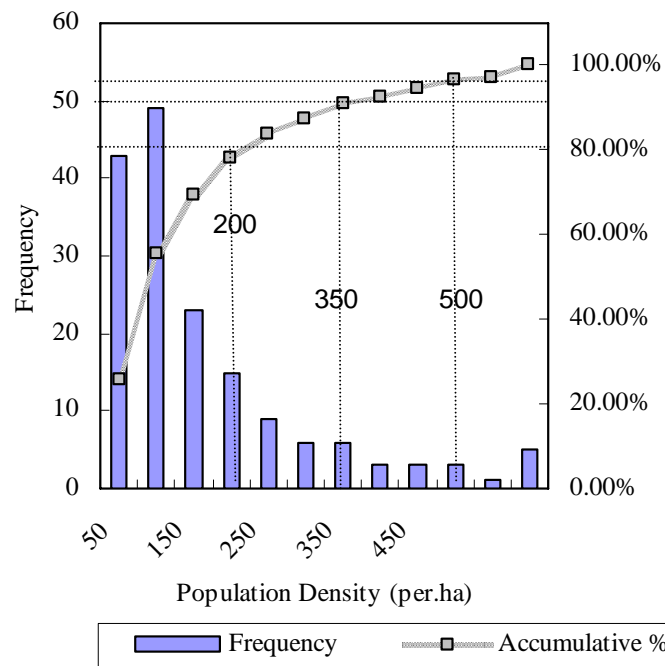
Around 50% of communities have population density of 100 people/ha or less, while communities with more than 300 people/ha account for around 10% of the total.



**Figure 2.2-3 Population by District in Greater Monrovia**



**Figure 2.2-4 Pop. Density by Community in Greater Monrovia**

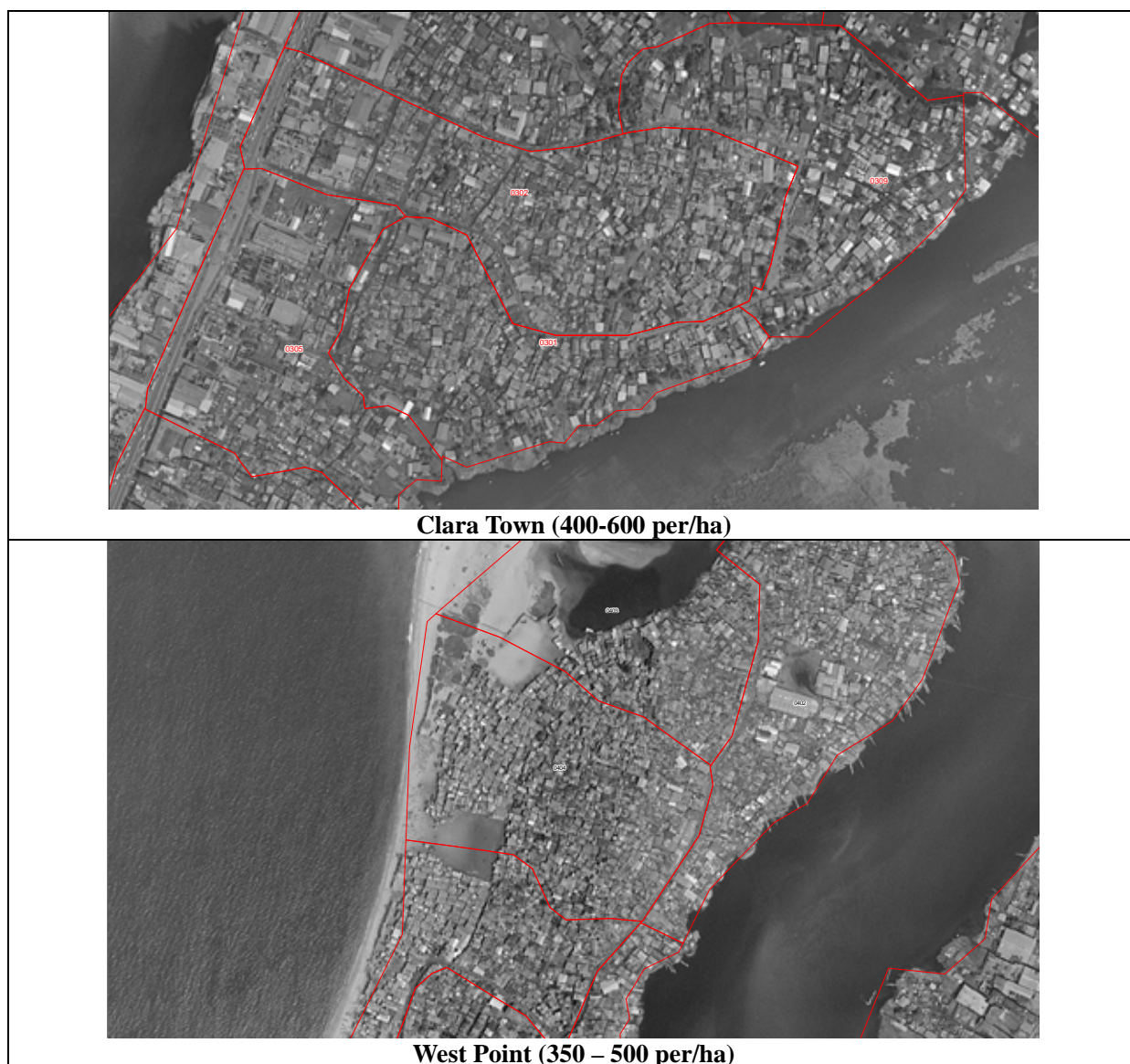


**Figure 2.2-5 Histogram of Pop. Density by Community in Greater Monrovia**

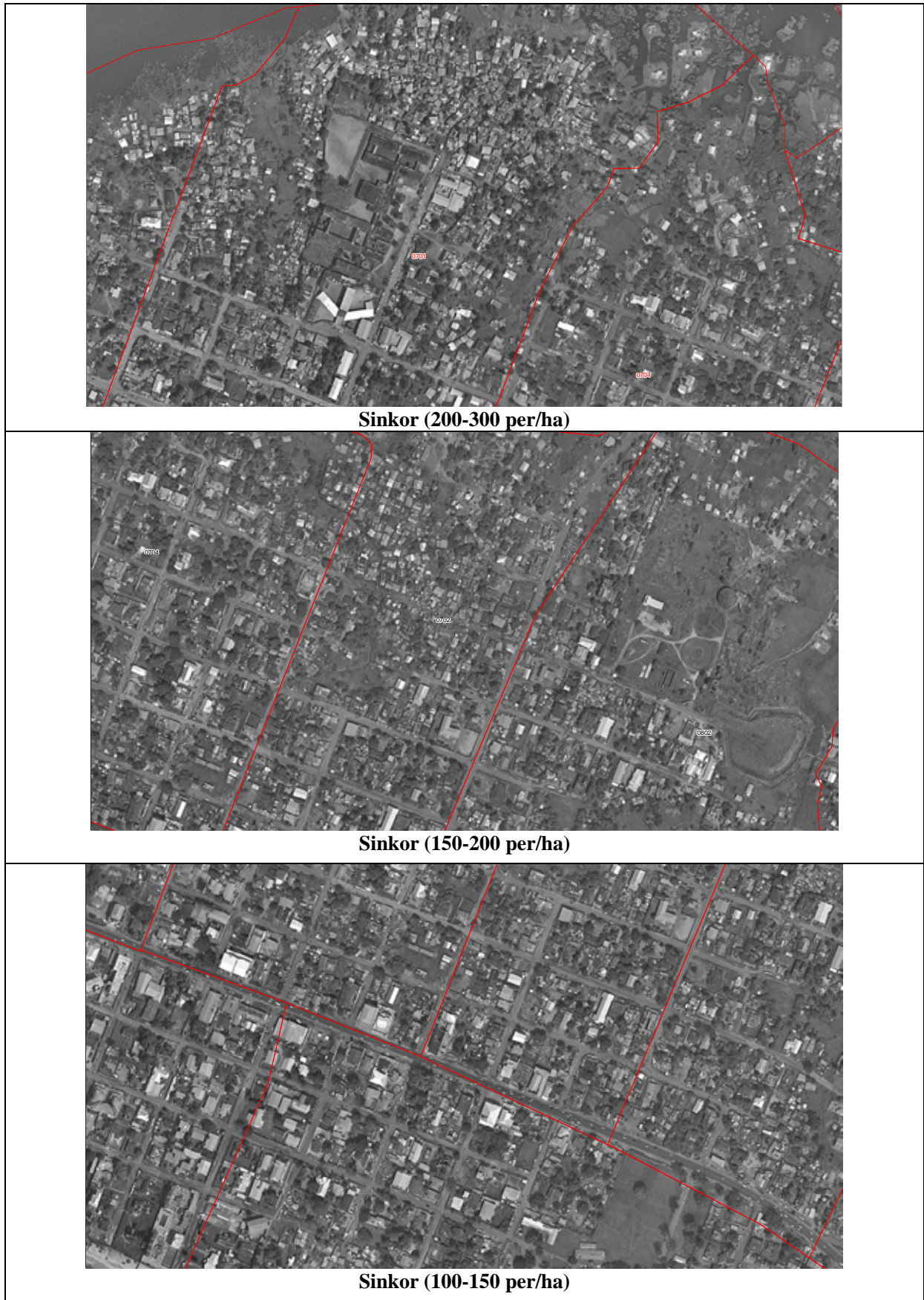


Figures 2.2-6~2.2-9 show the housing situation according to population density. The following points can be drawn from these figures.

- Population density in excess of 200 per/ha, in the existing urban districts comprising almost exclusively low-level detached houses, represents overcrowding that offers no room for construction of district roads. Such districts can barely accommodate any more population than they already do.
- Urban districts with population density of 150~200 per/ha are rather overcrowded; however, levels are acceptable for general housing districts.
- The urban districts with population density of 150~200 per/ha form favorable residential areas with ample open spaces. In some districts, the current population density was attained before the process of indiscriminate urbanization was completed and, although some open spaces exist, there is concern over deterioration of the living environment due to the indiscriminate land use and poorly developed road networks.
- Urban districts with population density of less than 100 per/ha still have open spaces, however, indiscriminate urbanization will advance here if they are left unattended. It is necessary to choose either restricting urbanization or conducting planned urbanization.



**Figure 2.2-6 Housing Situations by Population Density (1/4)**



**Figure 2.2-7 Housing Situations by Population Density (2/4)**





**Paynesville (100-150 per/ha)**

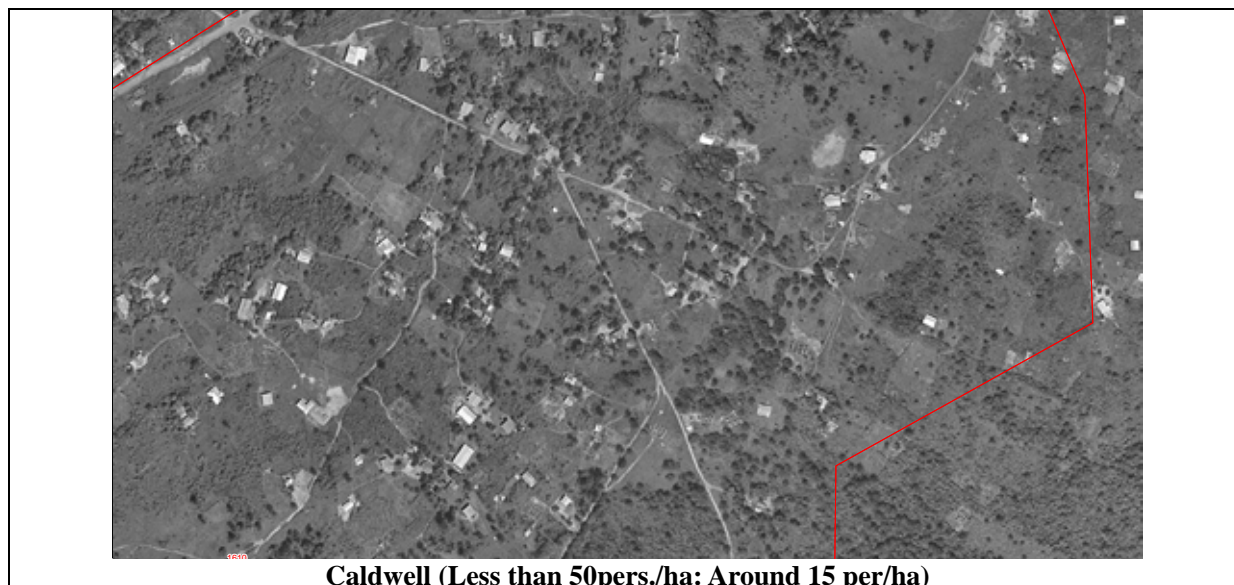


**Paynesville (50-100 per/ha)**



**Barnesville (Around 50 per/ha)**

**Figure 2.2-8 Housing Situations by Population Density (3/4)**



**Caldwell (Less than 50pers./ha: Around 15 per/ha)**  
**Figure 2.2-9 Housing Situations by Population Density (4/4)**

## 2.2.2 Economy

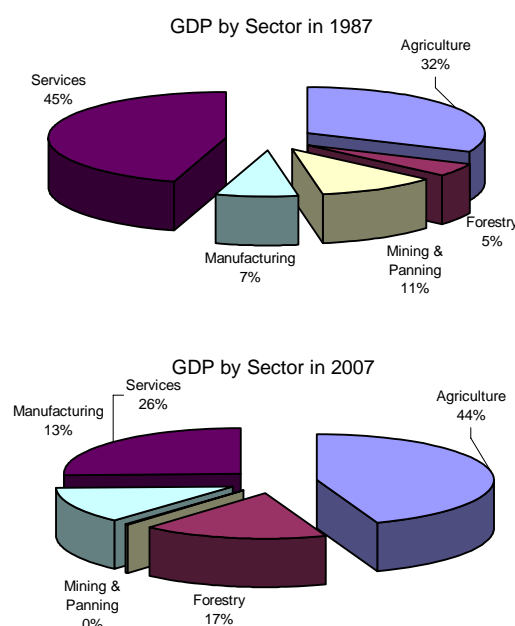
### 2.2.2.1 Outline

The civil war had a major impact on the economy of Liberia; indeed the national economy was ravaged by the conflict. The GDP in 2007 was estimated to be USD473.9, however, this was only 40% of the GDP before fighting broke out in 1987. Economic stagnation has extended to all industrial sectors. Decline has been especially severe in the mining industry with mines being closed and mine railways lying idle. The service sector shrunk by 22.8% between 1987 and 2007. In particular, the financial and government service sectors have declined to less than 10% of their previous levels. Also, the agriculture and forestry sector has dropped to 57.1% of its previous size, while engineering has declined to 69.9%. The only sector that has displayed growth has been charcoal and wood (see Table 2.2-4 and Figure 2.2-10).

**Table 2.2-4 GDP by Sector in Liberia, 1987-2007**  
**at 1992 Constant Prices (Unit:mln. USD)**

	(A)	(B)	(B/A)
	1987	2007	Decline(%)
<b>Real GDP</b>	<b>1,167.0</b>	<b>473.9</b>	<b>40.6</b>
<b>Agriculture</b>	<b>368.7</b>	<b>210.4</b>	<b>57.1</b>
Rubber	59.9	38.6	64.4
Coffee	0.9	1.4	155.6
Cocoa	5.9	0.1	1.7
Rice	117.1	40.4	34.5
Cassava	57.4	45.9	80.0
Others	127.6	84.0	65.8
<b>Forestry</b>	<b>56.6</b>	<b>81.1</b>	<b>143.3</b>
Logs & timber	34.4	0.0	0.0
Charcoal & wood	22.2	81.1	365.3
<b>Mining &amp; Panning</b>	<b>124.9</b>	<b>0.8</b>	<b>0.6</b>
Iron Ore	116.2	0.0	0.0
Others	8.7	0.8	9.2
<b>Manufacturing</b>	<b>86.9</b>	<b>60.7</b>	<b>69.9</b>
Cement	23.0	14.7	63.9
Beverages & beer	52.5	42.3	80.6
Others	11.4	3.8	33.3
<b>Services</b>	<b>529.9</b>	<b>120.9</b>	<b>22.8</b>
Electricity & water	18.2	3.3	18.1
Construction	39.0	12.4	31.8
Trade, hotels, etc	71.5	31.9	44.6
Transport & communication	89.5	33.8	37.8
Financial institutions	141.8	11.8	8.3
Government services	129.0	11.4	8.8
Other services	40.9	16.3	39.9

Source: Government of Liberia and IMF staff estimates



**Figure 2.2-10 GDP Distribution by Sector, 1987-2007**

The Liberian economy has displayed steady growth in recent years with GDP increasing by 5.3% in 2005, 7.8% in 2006 and 9.4% in 2007. Growth in production has been especially conspicuous for products like rice, cassava, construction and commerce, etc., and such agricultural and service sectors may be said to hold the key to economic recovery (see Table 2.2-5).

**Table 2.2-5 Liberia Sectoral Origin of GDP at 1992 Constant Prices**

(Unit: mln. USD)

	2005	2006	2007
<b>Agriculture</b>	<b>184.8</b>	<b>192.3</b>	<b>210.4</b>
Rubber	41.5	35.3	38.6
Cocoa	1.2	1.3	1.4
Coffee	0.1	0.1	0.1
Rice	32.0	36.9	40.4
Cassava	36.5	42.0	45.9
Others	72.5	76.8	84.0
<b>Forestry, hunting gathering &amp; fishing</b>	<b>71.3</b>	<b>74.1</b>	<b>81.1</b>
Logs & Timber	0.0	0.0	0.0
Charcoal & wood	71.3	74.1	81.1
<b>Mining &amp; Panning</b>	<b>0.7</b>	<b>0.7</b>	<b>0.8</b>
Iron Ore	0.0	0.0	0.0
Others	0.7	0.7	0.8
<b>Manufacturing</b>	<b>51.7</b>	<b>55.5</b>	<b>60.7</b>
Cement	14.9	13.4	14.7
Beverages	33.7	38.7	42.3
Others	3.2	3.5	3.8
<b>Tertiary</b>	<b>93.3</b>	<b>110.5</b>	<b>120.9</b>
Electricity & water	2.8	3.0	3.3
Construction	8.0	11.3	12.4
Trade, hotels, etc	20.1	29.2	31.9
Transport & communication	28.6	30.9	33.8
Financial institutions	10.3	10.8	11.8
Government services	9.9	10.4	11.4
Other services	13.6	14.9	16.3
<b>Total</b>	<b>401.8</b>	<b>433.2</b>	<b>473.9</b>
<b>GDP Growth Rate (%)</b>	<b>5.3</b>	<b>7.8</b>	<b>9.4</b>

Source: Central Bank of Liberia, Annual Report 2007

### 2.2.2.2 Workforce and Unemployment by Industry

According to LDHS<sup>1</sup> 2007, the employment rate of persons in the 15~49 age group is 59.2% for women and 77.5% for men. Comparing urban areas with rural areas, the employment rate is lower in the cities. Accordingly, the employment rate is lowest in Monrovia, which accounts for the biggest urban area. However, it is thought that these figures do not include the burgeoning informal sector that exists in the cities. Since some data sources estimate that the informal sector in urban areas accounts for more than three times the workforce in the formal sector<sup>2</sup>, it may be erroneous to conclude that Monrovia has the highest unemployment in the country.

<sup>1</sup> Liberia Demographic and Health Survey

<sup>2</sup> Central Bank of Liberia, Annual Report 2007, P.32

**Table 2.2-6 Employment Status**

(Women) (Unit: %)

Background characteristic	Employed in the 12 months preceding the survey		Not employed in the 12 months preceding the survey	Missing/ don't know	Total
	Currently employed	Not currently employed			
<b>Residence</b>					
Urban	<b>44.4</b>	5.4	50.1	0.1	100.0
Rural	<b>70.0</b>	7.1	22.5	0.4	100.0
<b>Region</b>					
Monrovia	<b>44.5</b>	5.0	50.4	0.0	100.0
North Western	44.1	22.2	33.6	0.0	100.0
South Central	60.6	2.4	36.5	0.5	100.0
South Eastern A	62.8	6.2	30.1	0.9	100.0
South Eastern B	60.3	8.3	31.0	0.4	100.0
North Central	75.1	5.7	18.9	0.4	100.0
<b>Total</b>	<b>59.2</b>	6.4	34.2	0.3	100.0

(Men) (Unit: %)

Background characteristic	Employed in the 12 months preceding the survey		Not employed in the 12 months preceding the survey	Missing/ don't know	Total
	Currently employed	Not currently employed			
<b>Residence</b>					
Urban	<b>66.3</b>	4.1	29.5	0.1	100.0
Rural	<b>85.1</b>	3.2	11.6	0.1	100.0
<b>Region</b>					
Monrovia	<b>66.7</b>	2.9	30.4	0.1	100.0
North Western	82.4	6.4	11.2	0.0	100.0
South Central	77.1	3.6	19.2	0.1	100.0
South Eastern A	84.8	7.6	7.6	0.1	100.0
South Eastern B	89.7	2.7	7.4	0.2	100.0
North Central	82.8	3.1	14.0	0.1	100.0
<b>Total</b>	<b>77.5</b>	3.6	18.8	0.1	100.0

Source: LDHS 2007

Looking at employment by industry, agriculture accounts for the highest national average for both men and women, and this is followed by the sales and services sector. Combined, these two sectors account for more than 70% of the overall working population (more than 90% of working women). However, the employment rates are very different by industry in Monrovia and its environs, where sales and services account for the highest share and agriculture only at a small rate.

**Table 2.2-7 Employment by Industry**

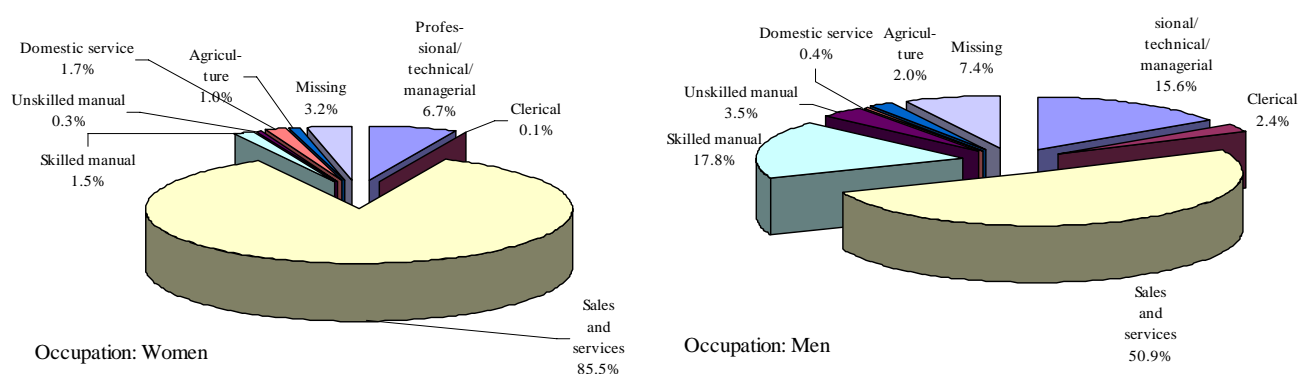
(Women) (Unit: %)

Background characteristic	Profes- sional/ technical/ managerial	Clerical	Sales and services	Skilled manual	Unskilled manual	Domestic service	Agricul- ture	Missing	Total
<b>Residence</b>									
Urban	5.7	0.2	81.2	1.8	0.2	1.5	5.1	4.2	100.0
Rural	1.3	0.0	16.7	0.8	0.5	0.1	79.1	1.6	100.0
<b>Region</b>									
Monrovia	6.7	0.1	85.6	1.5	0.3	1.7	1.0	3.2	100.0
North Western	0.8	0.0	35.3	3.7	0.0	0.0	58.1	2.2	100.0
South Central	1.7	0.1	37.7	0.7	1.9	0.4	54.8	2.8	100.0
South Eastern A	1.5	0.0	29.3	0.7	0.0	0.8	64.1	3.8	100.0
South Eastern B	2.7	0.1	9.8	0.1	0.1	0.0	85.9	1.4	100.0
North Central	1.2	0.1	14.6	0.7	0.1	0.1	81.2	1.9	100.0
<b>Total</b>	2.7	0.1	37.4	1.1	0.4	0.5	55.3	2.5	100.0

(Men) (Unit: %)

Background characteristic	Profes- sional/ technical/ managerial	Clerical	Sales and services	Skilled manual	Unskilled manual	Domestic service	Agricul- ture	Missing	Total
<b>Residence</b>									
Urban	14.4	2.8	45.2	19.0	3.7	0.5	7.6	6.8	100.0
Rural	4.6	0.6	7.2	6.9	1.9	0.0	76.9	1.9	100.0
<b>Region</b>									
Monrovia	15.6	2.4	50.9	17.8	3.5	0.4	2.0	7.4	100.0
North Western	2.1	1.3	7.1	16.9	2.3	0.2	62.2	7.8	100.0
South Central	5.5	1.6	14.1	11.3	3.2	0.2	61.5	2.6	100.0
South Eastern A	6.9	0.8	11.0	10.3	5.1	0.1	62.9	2.9	100.0
South Eastern B	7.3	1.4	9.1	6.6	2.1	0.3	71.4	1.9	100.0
North Central	5.1	0.6	7.9	6.2	1.3	0.0	77.9	0.9	100.0
<b>Total</b>	8.0	1.4	20.5	11.1	2.5	0.2	52.6	3.6	100.0

Source: LDHS 2007



Source: LDHS 2007

**Figure 2.2-11 Employment by Industry in Monrovia**

### 2.2.2.3 Exports and Imports

The total value of exports and imports in 2007 was projected as USD682.8 million (mln), representing a 9.3% increase compared to that of 2006. The value of exports and imports is increasing every year, however, the value of imports greatly exceeds exports and this trade deficit is growing every year. In 2007, the trade deficit stood at USD314.6 mln. (see Table 2.2-8).



**Table 2.2-8 Exports and Imports**

(Unit: mln USD)

Year	Exports	Imports	Trade Balance	Total Merchandise Trade
2005	131.1	306.5	-175.4	437.6
2006*	157.9	466.7	-308.9	624.6
2007**	184.1	498.7	-314.6	682.8

Source: Ministry of Commerce & Industry, Ministry of Finance and Ministry of Lands, Mines and Energy

The value of exports in 2007 was USD184.1mln, increasing by 16.7% over the figure of USD157.8mln in 2006. This was largely underpinned by an increase in exports of rubber. Looking at exports by commodity, rubber is by far the most important item accounting for USD 170.9mln or 93% in 2007 (see Table 2.2-9).

**Table 2.2-9 Composition of Exports**

(Unit: mln USD)

Commodity	2005	2006*	2007**
Rubber	126.7	150.1	170.9
Logs	n.a.	n.a.	n.a.
Cocoa Beans & Coffee	0.3	0.3	1.3
Iron ore	-	1.0	0.5
Gold		0.1	4.5
Diamond		0.0	2.3
Other Commodities	4.3	6.4	4.6
<b>Total</b>	<b>131.1</b>	<b>157.9</b>	<b>184.1</b>

\* Revised

\*\* Provisional

Source: Ministry of Commerce & Industry and Ministry of Lands, Mines & Energy

Turning to imports, petroleum products and foods each account for approximately one-quarter of the total value of imports. Concerning foods, imports from the United States account for the majority of all food imports. In recent years, there have been dramatic increases in imports of manufactured products, machinery and transport equipment, etc. Specifically, imports of manufactured products increased by 31% from 2006, while imports of machine and transport equipment increased by 57% (see Table 2.2-10).

**Table 2.2-10 Composition of Imports**

(Unit: mln USD)

Commodity	2005	2006*	2007**
Foods & Live Animals	68.2	117.0	121.8
O/w: Rice	17.2	62.4	65.3
Beverages & Tobacco	8.4	13.7	14.8
Crude Materials	8.0	11.9	7.9
Minerals, Fuel & Lubricants	28.9	10.6	9.4
Animals & Vegetable Oil	2.6	7.5	7.9
Chemical & Related Products	9.2	23.6	19.6
Manufactured Products	27.3	48.7	63.8
Machinery & Transport Equipment	32.6	57.3	90.2
Petroleum Products	91.0	122.0	125.1
Miscellaneous Articles	30.3	54.4	38.2
<b>Total</b>	<b>306.5</b>	<b>466.7</b>	<b>498.7</b>

\* Revised

\*\* Provisional

Source: Ministry of Commerce & Industry and Ministry of Finance



### 2.2.3 Social Conditions (Poverty and Civilian Lifestyle)

Liberia's GNI per capita was USD150 in 2007, far lower than in neighboring countries and making Liberia one of the most impoverished countries in Africa (see Table 2.2-11).

According to the CWIQ survey conducted in 2007<sup>3</sup>, 63.8% of people in Liberia are impoverished, while 47.9% live in extreme poverty<sup>4</sup>. The poverty rate is higher in rural areas (67.7%) than in urban areas (55.1%). Moreover, approximately three-quarters (73.4%) of the population in poverty live in rural areas (see Table 2.2-12).

**Table 2.2-11 Gross National Income per Capita 2007**  
(Unit: USD)

Country	GNI per Capita
Liberia**	150
Sierra Leone*	260
Cote d'Ivoire*	910
Sudan*	960
Guinea*	400
Ghana*	590
Nigeria*	930

Sources: World Development Indicators database, WB, revised 18 October 2008

**Table 2.2-12 Liberia 2007 Poverty Profile**

			Urban	Rural	Total
Poverty	Poverty Ratio (%)	Urban	55.1	-	<b>55.1</b>
		Rural	-	67.7	<b>67.7</b>
		<b>Total</b>	<b>55.1</b>	<b>67.7</b>	<b>63.8</b>
	Number of Poor	Urban	459,570	-	<b>459,570</b>
		Rural	-	1,266,236	<b>1,266,236</b>
		<b>Total</b>	<b>459,570</b>	<b>1,266,236</b>	<b>1,725,806</b>
	Contribution to Poverty (%)	Urban	100.0	-	<b>100.0</b>
		Rural	-	100.0	<b>100.0</b>
		<b>Total</b>	26.6	73.4	<b>100.0</b>
Extreme Poverty	Poverty Ratio (%)	Urban	29.0	-	<b>29.0</b>
		Rural	-	56.3	<b>56.3</b>
		<b>Total</b>	<b>29.0</b>	<b>56.3</b>	<b>47.9</b>
	Number of Poor	Urban	242,055	-	<b>242,055</b>
		Rural	-	1,053,240	<b>1,053,240</b>
		<b>Total</b>	<b>242,055</b>	<b>1,053,240</b>	<b>1,295,295</b>
	Contribution to Poverty (%)	Urban	100.0	-	<b>100.0</b>
		Rural	-	100.0	<b>100.0</b>
		<b>Total</b>	<b>18.7</b>	<b>81.3</b>	<b>100.0</b>

Source: CWIQ2007

In terms of region, the poverty rate is high in South Eastern A (76.7%) and North Western (76.3%), followed by Northern Central (68.1%) and South Eastern B (67.2%). Out of the population living in poverty, approximately 660,000 or 38.3% of the total live in the Northern Central region. The poverty rate is lowest in Greater Monrovia at 48.5%.

<sup>3</sup> 2007 Core Welfare Indicator Questionnaire Survey in Liberia

<sup>4</sup> According to this survey, the poverty line is USD504 in urban areas and USD357 in rural areas, while the extreme poverty line is USD241 in urban areas and USD242 in rural areas.

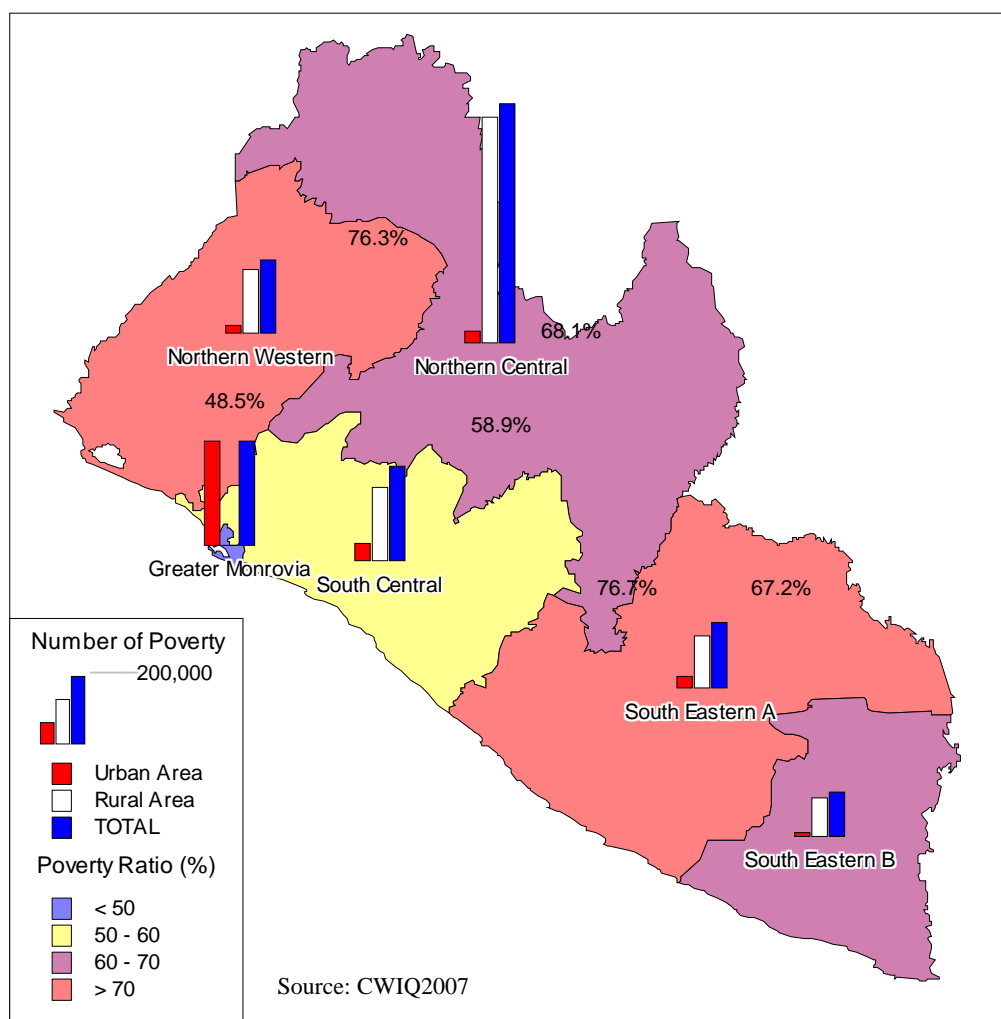


Figure 2.2-12 Poverty Level in Liberia

Table 2.2-13 shows the results of a survey of household durable goods ownership. Urban areas show higher rates of ownership than rural areas under all headings. In Monrovia, ownership rates are high for radios and mobile phones, with more than half of all households are possessing these goods. The rate of households owning a car is 5.2%.

Table 2.2-13 Household Durable Goods

(Unit: %)

Possession	Household			Population		
	Urban	Rural	Total	Urban	Rural	Total
Radio	72.7	39.3	51.5	74.3	42.6	54.5
Television	17.4	1.0	7.0	18.9	1.3	7.9
Mobile telephone	63.0	9.0	28.7	65.9	10.5	31.2
Refrigerator (ice box)	4.1	0.6	1.8	7.3	0.9	2.1
Generator	22.9	1.5	9.3	23.8	1.7	10.0
Sewing machine	4.1	0.7	2.0	5.0	0.9	2.4
Computer	2.0	0.1	0.8	2.5	0.1	1.0
Bicycle	7.0	2.4	4.1	8.2	2.6	4.7
Motorcycle / scooter	3.0	1.0	1.7	2.8	1.0	1.7
Car / truck	5.2	0.3	2.1	5.6	0.3	2.3
Ownership of farm animals*1	21.1	41.8	34.3	25.4	46.2	38.4

Source: LDHS 2007

\*1 Cows, pigs goats, sheep, or chickens