- Rehav Road – branch road to Red Light district from Roberts International Airport

Many refugees by civil conflict have been settled in low-lying of floodplain above-mentioned Paynesville outside of Monrovia Capital and new road construction work of culverts and earth material embankment caused the inundation during the rainy season. For these area, the inundation risk areas were assumed based on the information obtained from local inhabitants and site reconnaissance, as shown in Figure 7.2-7. The countermeasure of additional culverts arrangement or maintenance of the culverts increases flow capacity, reducing the inundated water level.

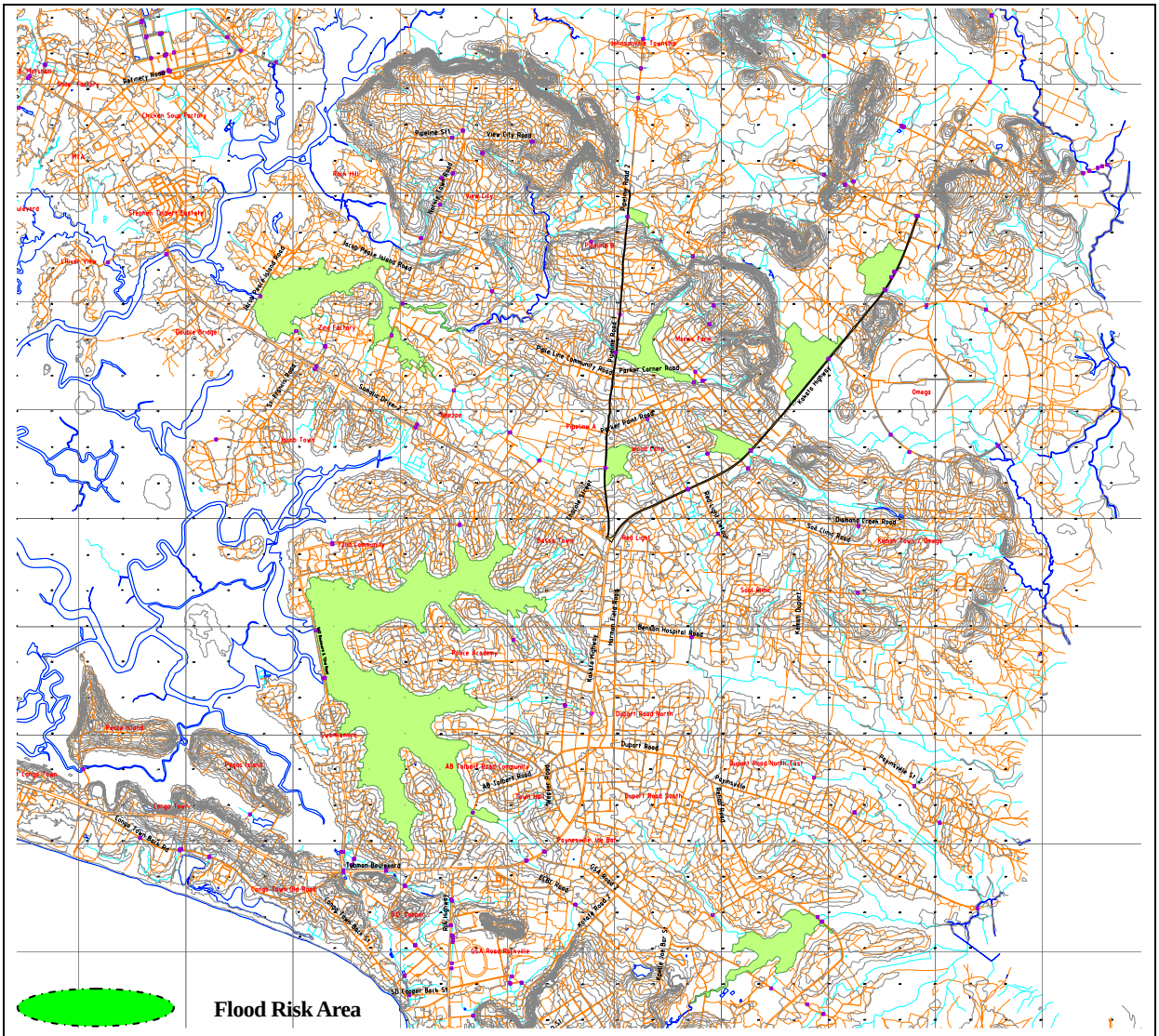

Figure 7.2-7 Flood Risk Area Outside of Old Districts

7.3 Recommendation on Institutional Measures

The Ministry of Public Works has mandate to execute drainage maintenance and operation in Monrovia. The Bureau of Operation having this mandate has the other responsibility to rehabilitate all public highways, bridges and city streets. The Bureau of Operations includes the Highway Maintenance Division, Mobile Equipment Division and Administration Division. These three (3) Divisions carry out separate functions, which correspond to the overall function of the Bureau. The staffs less then 15 persons are dealing with

the surface water drainage of Monrovia. They are equipped only with a limited number of hand tools like shovels and face repeating task of cleaning the drainage works. In addition, there is no layout drawing, structures inventory and maintenance manual to the existing drainage system in the Bureau.

Meanwhile, Monrovia City Corporation (MCC) has mandate of the solid waste management in Monrovia and Liberia Water and Sewerage Corporation (LWSC) has mandate of water supply and sewerage management in Monrovia. Both Corporations understand the detail condition of the City and the staffs have been living in the City. Big constraint of drainage system is solid waste disposal in the drainage thrown by the local residents.

Therefore, the recommendations on the institutional measures reach as follows:

- To set up the operation and maintenance unit for storm water drainage
- To transfer drainage management mandate to Monrovia City Corporation
- To establish semi-public enterprise for operation and maintenance work
- To transfer cleaning work to the community near the drainage
- To prepare the penalty provision for dumping of solid waste into the drainage

7.4 Project Implementation Plan

7.4.1 Cost for Storm Water Drainage Plan

The combined unit prices were developed on the increased addition of consumer price, duly referring to the unit price made of the labor, material and equipment cost, estimated in the Emergency Rehabilitation Program Report. In Liberia, the harmonized consumer price index (HCPI) by Central Bank Liberia is available from 2006 to Apr. 2008. After Apr. 2008, the inflation statistics by Bank of Ghana is used to fill the gaps until April 2009. Consequently, the combined unit price for civil works is 1.256 times of the price in April of 2006. Based on the combined unit prices and the quantities of the structures, the cost of the drainage system improvement is summarized in Table 7.4-1. Its total cost is USD8.7 mln.

Table 7.4-1 Summary Cost of Drainage System Improvement

(Unit: USD)

Drainage Structure	Bushrod Island	Central Monrovia	Sinkor	Total
Improvement Underground Drainage	176,000	1,011,000	278,000	1,465,000
Improvement Ancillary Structures	50,000	287,000	79,000	416,000
Concrete Lining	0	0	2,210,000	2,210,000
New Concrete Channels (2.0 m Top)	321,000	321,000	321,000	963,000
New Concrete Channels (1.5 m Base)	1,388,000	0	762,000	2,150,000
New Concrete Channels (3.0 m Base)	1,133,000	0	319,000	1,452,000
Total Cost	**3,068,000**	**1,619,000**	**3,969,000**	**8,656,000**

The equipment prices of underground pipes cleaning are estimated on the basis of Japanese market in May of 2009. The prices are based on FOB excluding shipping and insurance.

Table 7.4-2 Summary Cost of Equipment for Underground Pipes Cleaning

Equipment Name	Specification	Q'ty		Unit Cost (USD)	Total Cost (USD)
4 tons water jet cleaner	219L/min x 19.6MPa	1	unit	250,000	250,000
4 tons vacuum cleaner	$21m^3$/min x -97KPa	1	unit	260,000	260,000
4 tons dump truck	water tank : $4.5m^3$	2	units	70,000	140,000
4 tons dump truck	sludge hauling	2	units	60,000	120,000
4 tons truck for equipment	with 3 tonnes crane	1	units	80,000	80,000
Submersible pump	50mm dia.	2	sets	4,000	8,000
Diesel generator	20kVA	2	sets	18,000	36,000
Poratable gas detector		2	sets	5,000	10,000
Floodlight		4	sets	3,000	12,000
Blower		2	sets	3,000	6,000
Tools		2	sets	3,000	6,000
Hose, cable, etc.		1	lot	2,000	2,000
Total Cost					**930,000**

In addition, the technical cooperation programme, for establishment of operation and maintenance management system, and for operator training of the drainage pipes cleaning vehicle is based on the personal cost and per diem of eight (8) men-months, etc. (see Table 7.4-3). This cost is added to one of the engineering services.

Table 7.4-3 Cost for Technical Cooperation Programme

Item	Cost (USD)
Personal cost	200,000
Per diem	65,000
Other	13,000
Total	**278,000**

7.4.2 Project Cost

The project cost is generally composed of the following:

- Direct costs
- Compensation
- Administration expenses
- Engineering service cost
- Contingency (Price escalation and physical contingency)
- Government tax (Value Added Tax)

In this case, the compensation cost of land acquisition and removal is unclear and thereby not accounted to the Project cost.

(1) Direct Cost

The direct cost is composed of the improvement drainage system cost and the equipment supply cost for operation and maintenance. The services for technical cooperation programme on operation and

maintenance manual preparation, and operation training of the cleaning vehicles for the underground drainage pipes are allocated to one of the engineering services.

(2) Administration Cost

The administration cost incurred by the Government for the execution of the Works will be assumed to be seven (7) % of the direct cost, engineering services, contingencies (price escalation and physical contingency).

(3) Engineering Services

The cost of engineering services for detailed design and the construction supervision of the drainage structure construction and the equipment supply will be assumed to be ten (10) % of direct cost. The services of technical cooperation programme for operation and maintenance is also added.

(4) Contingency

The physical contingency will cover the cost of subsidiary works, which have not been separately detailed. The rate of the physical contingency is assumed at five (5) % of the direct cost and engineering services.

The price escalation will be also considered by applying the inflation rate of four (4) %. The price escalation will be made to the direct cost and engineering services. The lump sum of price contingency until 2014 will be about ten (10) % to total of the direct cost and engineering services.

(5) Government Tax

In Liberia, the value added tax (VAT) under the Government tax is taken at five (5) % through the commercial transaction. For the project cost estimation, VAT is considered to all the cost.

Consequently, the Project cost is about USD14 mln as summarized in the Table 7.4-4.

Table 7.4-4 Summary of Project Cost

Description		Cost (1,000 USD)
1	Direct Cost	9,587
	(1) Improvement Drainage System	8,657
	(2) Equipment Supply	930
2	Administration Cost	871
3	Engineering Services	1,237
4	Contingency	1623
	(1) Price Escalation	1082
	(2) Physical Contigency	541
5	Total of Cost	13,318
6	Value Added Tax (5%)	665
Grand Total		**13,983**

7.4.3 Implementation Schedule

The project implementation shall be executed through supervising consultant and local contractors for the construction work and the equipment procurement for the underground drainage pipes cleaning. The procurement on the equipment of water jet cleaner, vacuum cleaner, tools and materials shall be tendered as part of the civil works tender. It will be required that the Donor agencies will approve the proposed project in 2010 and project implementation will commence in 2011. The points of concern for the Project implementation are summarized below.

- Preparation of final design and tender document shall be finalized until the end of 2011.
- Technical cooperation for the establishment of operation and maintenance manual will start in the middle of 2011.
- Tendering of civil works and procurement of equipment shall start in the middle of 2011.

The implementation schedule is tentatively indicated in Figure 7.4-1.

Project Description	Physical Year				
	2010	2011	2012	2013	2014
Engineering Service					
Drainage System Improvement					
Central Monrovia					
Sinkor					
Bushrod Island					
Equipment Supply for Drainage Pipes Cleaning					
Technical Cooperation Programme					

Figure 7.4-1 Implementation Schedule

For the project implementation, the fund preparation is very important factor and MPW has to prepare the financial application immediately. World Bank is supporting storm water drainage sector. Therefore, it will be suspected that World Bank will prepare the fund in addition. For the aid on the supply of cleaning-car equipment, JICA has many experiences in the developing countries such as Viet Num, Pakistan, Sri Lanka, etc.