

#### 4.3.4 Drainage

##### (1) Basic Policy

Planning for an appropriate drainage system including flood control is mentioned in the National Vision and the direction of the draft 7<sup>th</sup> National Socio-Economic Development Plan in better sanitation and infrastructure for people as mentioned in the sewerage/ wastewater system. The clear drainage channel and marsh will be part of the beautification of the city and greenery and recreation area network.

The policy for proper drainage system in Vientiane Capital shall consider the following:

- Sustainability in implementation
- Priority in frequent and severe flood area
- Robust financial plan in investment, operation and maintenance
- Phasing in implementation
- Utilize data base from the current study and update if possible
- Public awareness, participation and involvement

From these policies, strategy in drainage system development can be summarized in the table below:

**Table 4.3.23: Strategy in Drainage system and Action Plan**

Development Strategy	Detail Action Plan
1. Diversion of runoff	<ul style="list-style-type: none"> <li>• Runoff needs to be diverted partly to relieve the pressure on existing drain</li> <li>• Diversion of runoff is also partially possible by interconnecting canals.</li> </ul>
2. Improving existing channel	<ul style="list-style-type: none"> <li>• Improving the carrying capacity of existing drains by widening &amp; increasing slope. Many secondary drains need improvement.</li> <li>• In areas where there are no man made secondary drains of sufficient capacity, new drains are to be provided.</li> <li>• Improving broken cover of drainages/ ditches used as pedestrians.</li> </ul>
3. Regulatory Pumping Systems	<ul style="list-style-type: none"> <li>• Provision of pumping facility may have to be considered in problematic areas where natural flow alone cannot create rapid discharge. Pumps are more effective at drain outlet discharging to prevent back water.</li> </ul>
4. Providing Silt Pits	<ul style="list-style-type: none"> <li>• If deposition of silt and solid waste can be controlled, stagnation will be brought down considerably. Provisions of silt pits at all discharge end of tertiary, secondary drains to be considered.</li> </ul>
5. Controlling Land Development	<ul style="list-style-type: none"> <li>• At present regulations of land use and land development is not done properly, so formation levels of each zone/sub zones to be fixed and land development to be regulated to ensure positive area drainage (i.e. no obstruction to current drainage system or no change in run-off pattern)</li> </ul>
6. Separat System of Storm Water and Sewage	<ul style="list-style-type: none"> <li>• Drainage carrying sewerage / wastewater and effluent combined together can cause severe health and environmental problems. Septic tanks may directly discharge the effluents by overflow to open drainage due to high water table, low permeability of soil.</li> <li>• Segregating sewage or wastewater and effluents from open drains by sewerage system should be considered.</li> </ul>
7. Upgrading Solid Waste Management	<ul style="list-style-type: none"> <li>• Large quantity of solid waste contaminates and clogs the drains. Hence a system in proper collection of solid waste has to be developed, together with the implementation of a public awareness program.</li> </ul>
8. Eviction and Rehabilitation of Encroachment	<ul style="list-style-type: none"> <li>• The natural river or marsh has encroachment in a number of places along its stretch. Removal of encroachments and providing resettlement / rehabilitation as required should be done to maintain the river or marsh area.</li> </ul>

Source: JST

(2) Rainwater and Drainage in Catchment Area

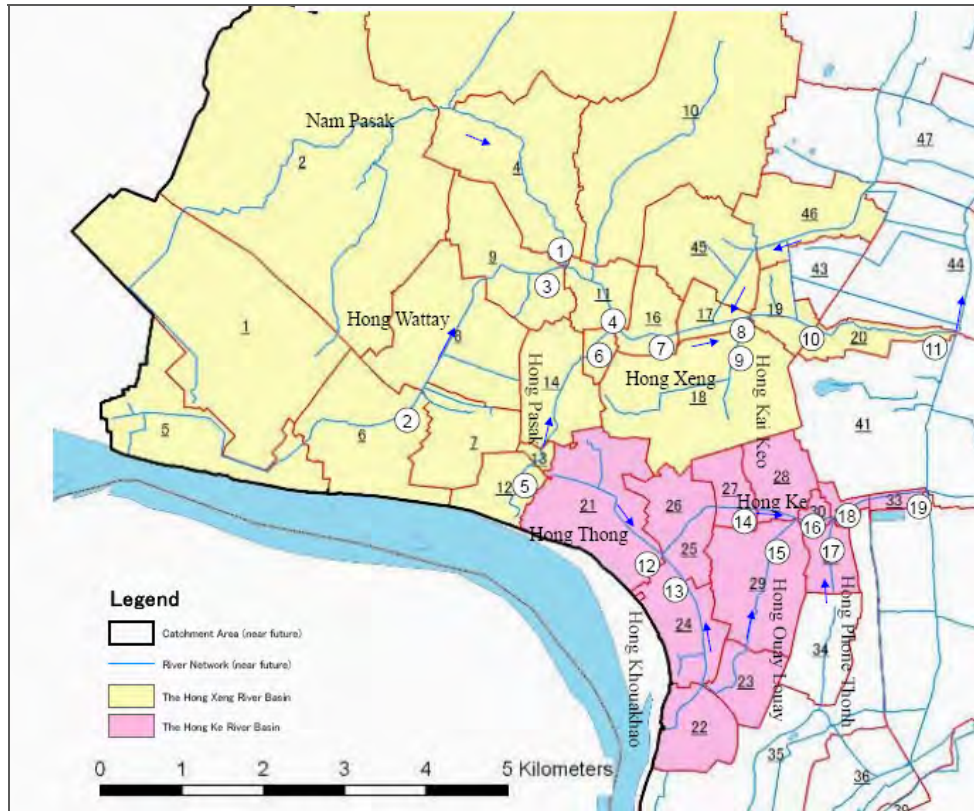
The rainwater and drainage in urban Vientiane consists of 2 main catchment areas: Hong Xeng and Hong Ke Basins which discharge to That Luang Marsh then Mak Hiao River before discharging to the Mekong River, as shown in Figure 4.3.19. The result of analysis from the Interim Report of the Study on Improvement of Water Environment in Vientiane City shows that most of the existing channels can accommodate a 2-year probability rainfall with natural retention ponds volume added as flood detention. Problems encountered in the drainage system that causes insufficient drain or some flooding is the following:

- Undersized drainage laterals
- Unevenly laid longitudinal slope of the channel or conduit
- Irregularly shaped channels
- Inconsistent drain size, i.e., the line should progressively increase in size as it goes down slope
- Clogged manholes
- Sediment deposits of varying depth along drainage laterals
- Overflowing of roadside drain
- Floodwater spilling to neighboring drainage blocks

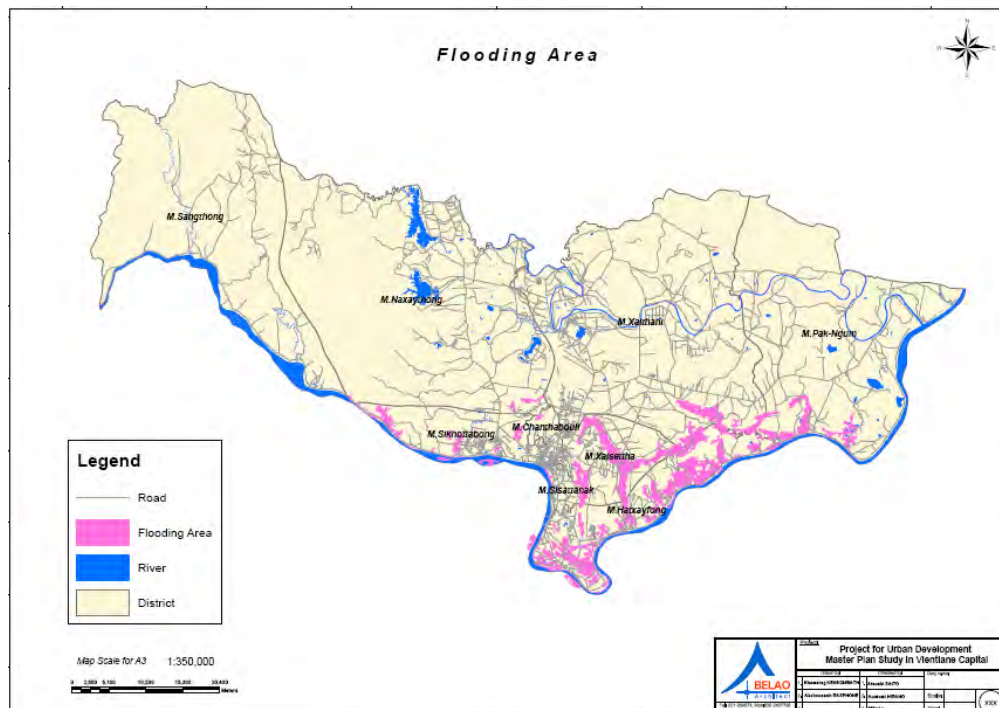
The above actions described in Table 4.3.23, will greatly improve the drainage system efficiency and some of them have already been implemented with donor assistances, which reduces flood problem in Vientiane recently. However for new construction of drainage system in the future, a 10-year probability rainfall should be used in the design criteria to minimize flood problem in the urban area.

(3) Flood Management Plan

A flood management plan shall be prepared by using GIS map showing facilities and flood condition and data base that has been collected and update from several drainage study projects. Special attention should be paid to the frequent flood area as shown in Figure 4.3.20 below, which is from two main reasons as 1) overflow from the Mekong River and 2) lack of sufficient drainage system in the City for internal flooding. High water level of the Mekong River also makes gravity discharging of storm water from the City difficult, so it would cause both kinds of flood.



Source: ITR – The Study on Improvement of Water Environment in Vientiane City  
**Figure 4.3.19: Analysis of Drainage Flow and Catchment Area in Urban Area**



Source: JST  
**Figure 4.3.20: Frequent Flooding Area in Vientiane Capital**

(4) Facility Plan

The rainwater drainage is highly dependent on the land use due to variation in coefficient of runoff that changes from more urbanize i.e. change of surface from soil or green field to concrete or smooth surface material resulting in more drainage flow from development area to drainage channel or river. Therefore; green area or park should be considered as part of the land use plan for new urban area to reduce the problem in drainage system.

1) Components of Future Drainage Facilities

The following components shall be prepared in the complete drainage facilities:

- Open or with covered drainage channel with side wall protection
- Drainage pipe and manhole
- Retarding pond or marsh
- Trunk main drainage line
- Water gate
- Drainage pump station
- Flood protection bank
- Data base on drainage system with GIS data

For the future land use plan in the urbanized area, the proposed drainage system is recommended in the Table 4.3.24.

**Table 4.3.24: Proposed Drainage Facility to Future Land Use**

Land Use Area	Land Use Policy	Proposed Drainage System
1.Historic conservation zone	Conserved for tourism purpose	Improved existing channel by removal of sediment, garbage and rehabilitation of side wall and cover of drainage used as pedestrians. Pond or marsh area should be kept as retarding basin.
2.Inner urban zone	Higher efficiency commercial use	Same as historic conservation zone, drainage pump might be necessary in low area with flood prone.
3.Outer urban zone	Expansion of residential area and new town center	Provide proper drainage system inside the area by using additional drainage channel, pipe and retarding basin.
4.Sub-center zone	New urban function development with higher land density	Provide drainage system inside the developed area by proper design of drainage channel, pipe and retarding basin (if necessary).
5.Urban clusters zone and outside of the urban planning area	Village center, agriculture area	Provide proper drainage system inside the area by using additional drainage channel and natural pond or marsh.

Source: JST

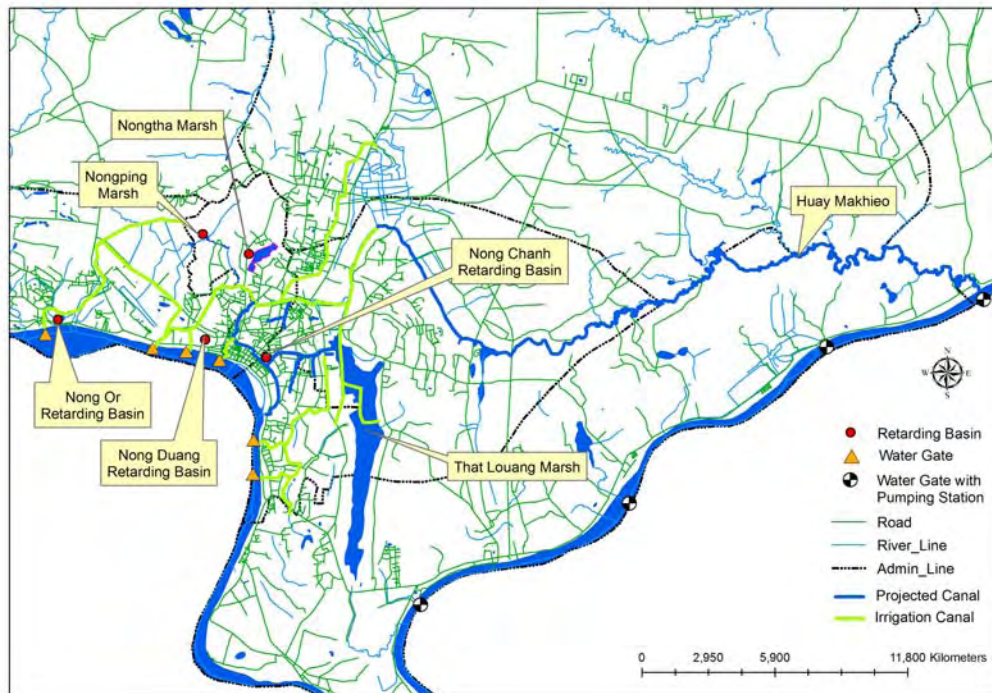
The future drainage system for urban area in Vientiane Capital is shown in Figure 4.3.21, in which a retarding pond or marsh with a water gate and drainage pump station should be provided for more efficient discharge of rain water out of the natural river or pond inside the city.

2) Improvement of Open Ditch to Under Drainage

If the land acquisition is difficult to maintain enough space of road, pedestrian and drainage for the present road with drainage, open ditch to under drainage is applicable at some urban area where the existing road is narrow. The measurement could be applicable for future road

with drainage where the land acquisition will be difficult. But, the measures are applicable for small open ditches but not for middle or large open ditches (for example more than 1m wide ditches) as generally it is recommended that ditches or drainages shall be constructed without cover for easy maintenance, easy access to water body, and keeping water quality good that needs water contact with air.

It is necessary to improve the broken cover of the drainage along road in urban area for people walk on it safely. It is necessary to introduce wastewater treatment system to drain good water along drainage and a appropriate land acquisition is required.



Source: JST

**Figure 4.3.21: Future Drainage System for Urban Area in Vientiane Capital**

#### (5) Operation and Maintenance

VUDAA is the main body responsible for operation and maintenance of drainage channels in urban area of Vientiane Capital. Regular maintenance in sediment and garbage removal from drainage channel is very important to keep the drainage system efficient in Vientiane Capital, as the dominant soil is sand and silt that can be easily washed out by rain water and deposit in the channels. Proper cleaning machinery and equipment for maintenance work is needed together with O&M budget. A maintenance plan requires sediment and grass removal from channel before rainy season.

#### (6) Human Resource, Institution and Legal Development

Development of human resource with capacity building by training and workshop is needed to keep the drainage operation and maintenance work efficient. More staffs are needed in VUDAA with specific assignment in regular drainage system O&M. Private participation or involvement can be arranged in some work such as sediment and garbage removal. A regular budget should be requested and provided for the drainage O&M work also.

Public awareness and participation in keeping channels, marshes and rivers clean should be promoted together with the awareness in wastewater management for sustainable implementation. Moreover; regulation in keeping the marsh or pond area as retarding basin or wetland should be issued, or at least changing in water surface area shall be studied for its possible impact to the drainage system nearby, and an approval process shall be required prior to further construction.

### 4.3.5 Solid Waste

#### (1) Basic Policy

Considering the insufficient manners and capacity for the solid waste treatment, sanitation of the citizen's living environment can be deteriorated and it might be accelerated if no effective improvement was devised in the process of growing population and economy. One result of the social survey says that over 95% of respondents without the waste collection service answered they openly burn the wastes.

Sanitary living environment should be improved and maintained for the residents. Toward this objective, solid waste should be properly collected, transported and disposed of to the landfill site to prevent scattering and leaking in the environment, which is the basic policy for the solid waste disposal in the Vientiane Capital.

Following the basic policy, three targets are proposed by three process of solid waste treatment namely i) Disseminate sanitary waste treatment, ii) Expand the collection service area, and iii) Establish the sanitary landfill site.

Table 4.3.25 summarizes the basic policies.

**Table 4.3.25: Basic Policy and Targets**

Objective	Basic policies	Targets	
		For generation and discharge	Disseminate sanitary waste management
Improve and maintain sanitary living environment for the residents	No scattering and No Leaking (from proper collection and proper disposal in landfills toward sanitary landfills)	For collection and transportation	Expand the collection service area
		For final disposal	Establish the sanitary landfill site

Source: JST

#### (2) Estimation of Future Waste Amount

##### 1) Population Framework and Distribution

JST estimated the population of Vientiane Capital at 1,439,000 persons in 2030 and distributed it for the Multi-core structure in Chapter 3. In Table 4.3.26, intermediate year's populations were estimated with the growth rates used in Chapter 3.

**Table 4.3.26: Population Distribution of Multi-core Urban Structure**

Area	Year	2005*	2010	2015	2020	2025	2030	Growth Rate
	VC population		691	801	927	1,075	1,246	1,439
Multi-core Urban Structure		636	703	781	870	975	1,089	
Urban Center		204	209	214	219	224	230	0.5%
Suburban Area including Sub-centers		126	155	191	234	288	350	4.2%
Other Area including Urban Clusters		306	339	376	417	463	509	2.1%

Note: \* Census 2005

Source: JST



## 2) Domestic Waste Amount

### a) Assumption of Waste Generation Ratio

Use the waste disposal ratios as a substitute for the waste generation ratios:

Domestic solid waste ratios were assumed on the statistics of solid waste disposal at KM32 landfill site and collection services mentioned in Chapter 2 and Appendix 1. The waste disposal data show how many tons of waste the 6 collectors annually disposed at KM32. The other data show how many subscribers (households, markets, embassies, offices, factories, schools, hospitals, and hotels) the collectors have in which district. From these data, the collector's disposal ratios by household were calculated, which include other private and public institutions' disposals.

Then the average numbers of persons in a household at 5.5 was adopted from Census 2005, and the average waste disposal ratio was calculated at 1.31 kg/person/day as shown in Table 4.3.27. JST finally calculated three ratios according to the types of subscribers as business/commercial/residence, commercial/residence and residence. JST regarded these ratios as the waste generation ratios although these were not actually measured generation ratios. The waste generation ratios were applied for the areas: Inner urban zone, Outer urban zone and Outskirts zone including Sub-centers and the other area including urban clusters as follows.

- 1.53 kg/person/day: Business/commercial/residence is applied for the inner urban zone
- 1.20 kg/person/day: Commercial/residence is applied for the outer urban zone and the outskirts zone
- 0.90 kg/person/day: Residence applied for the other area

**Table 4.3.27: Waste Generation Ratio**

No.	Name of Collector	Chanthabouly	Sikhottabong	Sisattanak	Xaythany	Hadxai fong	Xaysetha	Total hhs	disposal (t/y)	(k/hh/d)	(k/p/d)	Major subscriber
1	Vientiane Solid Waste Collection Service	4,302	3,327	566	1,536	289	0	10,020	30,351	8.30	1.51	Business/commercial/residence
2	Vientiane Solid Waste Disposal Service Company	0	0	0	0	0	5,835	5,835	10,573	4.96	0.90	Residence
3	Transportation Service & Cleaning Company	0	0	3,404	0	0	0	3,404	8,028	6.46	1.17	Commercial/residence
4	Lao Kabase Company Limited	0	0	801	0	0	0	801	2,397	8.20	1.49	Business/commercial/residence
5	Chanthabouly Cleaning Company Limited	2,490	0	0	0	0	0	2,490	8,140	8.96	1.63	Business/commercial/residence
6	Center Service Xaysetha Solid Waste Company	0	955	0	0	0	0	955	2,496	7.16	1.30	Commercial/residence
	<b>Total</b>	<b>6,792</b>	<b>4,282</b>	<b>4,771</b>	<b>1,536</b>	<b>289</b>	<b>5,835</b>	<b>23,505</b>	<b>61,857</b>	<b>7.21</b>	<b>1.31</b>	

Note: hh (household), t/y (ton/year), k/hh/d (kg/household/d), k/p/d (kg/person/day)

Source: JST



*b) Growth Rate of Waste Generation Ratios*

To calculate future increase in the generation ratios, a similar waste generation ratio was calculated based on the results surveyed by a JICA Study, “The Solid Waste Management System Improvement Project in Vientiane 1992”, as presented in Table 4.3.28. This ratio was calculated except recycled waste amount because the above ratios also excluded the recycled waste amount. An annual growth was calculated at 2.7% for 18 years (1991 – 2009) increased from 0.82 kg/person/day in 1991 to 1.31 kg/person/day in 2009.

- The waste generation ratios increase annually at 2.7% up to 2030

**Table 4.3.28: Waste Generation 1991**

	Item	(ton/day)	(%)
1	Generation amount	141.0	100.0%
2	Recycled amount	23.8	16.9%
3	Own disposal amount	99.8	70.8%
4	Collected amount	17.4	12.3%
5	Recycled in landfills	0.3	
6	Final disposal	17.1	
7	Generation without recycled amount	117.2	ton/day
8	Subjected population (urban area)	142,723	person
9	Waste Generation Ratio except recycled amount	0.82	kg/person/day

Source: JICA Study of “The Solid Waste Management System Improvement Project in Vientiane 1992”, JST calculation

*c) Waste Generation Amount*

Table 4.3.29 shows the results of estimations of waste generation amounts. The amounts were calculated by areas with their populations and the waste generation ratios. A recycled rate was applied by the same rate at 16.9% in 1991. Collection rates were assumed to gradually increase up to 2020 and then be accelerated up to 2030.

**Table 4.3.29: Estimation of Annual Domestic Solid Waste Generation**

Item	Year				
	2010	2015	2020	2025	2030
1 Total Generation (ton/year)	365,672	461,055	583,240	742,760	944,415
2 Recycled amount (ton/year)	61,723	77,823	98,448	125,374	159,412
3 Not collected amount (ton/year)	227,961	249,100	242,396	154,347	0
4 Collected amount (ton/year)	75,987	134,131	242,396	463,040	785,003
5 Collection rate excluding recycled amount	25%	35%	50%	75%	100%

Source: JST

3) Industrial wastes

Wastes of not large-scale manufacturing factories are included in the waste generation ratios. Solid wastes of large-scale factories will be generated in VIP. JICA VIP Study estimated the solid waste generation from tenants at 309 tons/day in the industrial area of 130ha (gross), which is the F/S targeted area. VIP has the industrial area of 560ha (gross) for the next phase targeting 2025, thus a daily waste generation amount was calculated at 1,330 ton/day.

JST assumed that VIP’s solid wastes could be generated from 2015<sup>1</sup> when some factories start their operation and the annual volume could averagely increase up to 309 tons/day in 2020. Then the annual waste volume also averagely increases up to 1,330 ton/day in 2030 although the VIP Study targeted 2025. JST assumed the lots would not be fully filled yet in 2025. Waste generation of VLP was estimated with a unit waste generation at 0.1 tons/ha/day for garment & sewn product, which is the smallest unit of waste generation used in JICA VIP Study. No recycling ratio was considered for the estimation.

**Table 4.3.30: Estimation of Annual Solid Waste Generation from Industrial Zones**

Item \ Year	2015	2020	2025	2030
1 VIP (ton/year)	18,798	112,785	290,723	485,450
2 VLP (ton/year)	222	1,332	1,332	1,332
3 Total (ton/year)	19,020	114,117	292,055	486,782

Source: JST

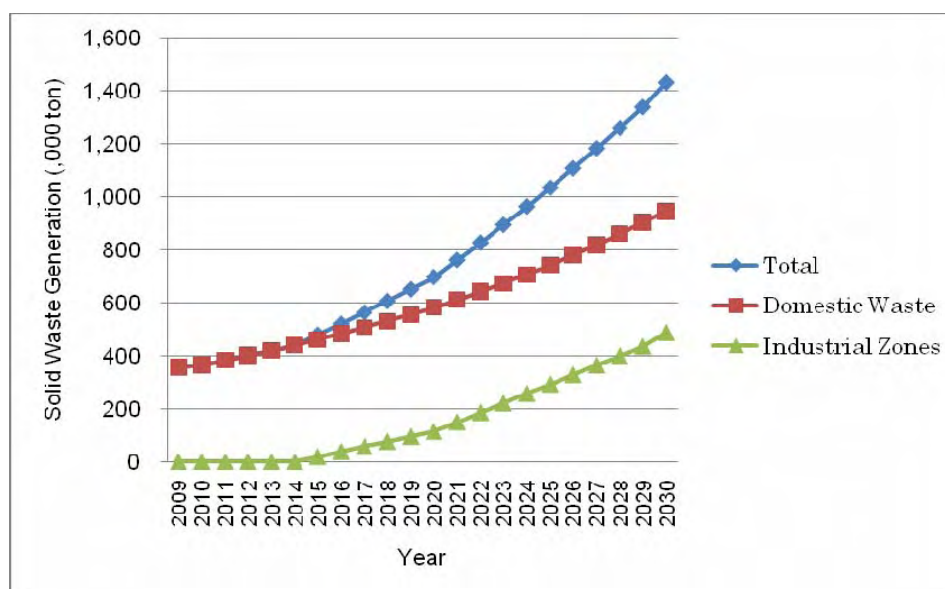
4) Amount of Wastes

The waste generations were estimated as follows and it would drastically increase after the tenants of VIP start their operation. Detail estimations are shown in Table 4.3.32.

**Table 4.3.31: Estimation of Solid Waste Generation**

Item \ Year	2015	2020	2025	2030
1 Domestic Waste	461,055	583,240	742,760	944,415
2 Industrial Zones	19,020	114,117	292,055	486,782
3 Total (ton/year)	480,075	697,357	1,034,815	1,431,197

Source: JST



Source: JST

**Figure 4.3.22: Estimation of Annual Volume of Solid Waste Generation**

<sup>1</sup> The target year is set in 2015 but JST assumes the lots are not fully filled yet.



5) Landfill requirement

The following assumptions<sup>2</sup> were used for the estimations of the landfill requirement. The existing landfill pits can be used up to 2013. Additional 10 landfill pits can be used with the cell method up to 2022 in the existing site. A service life of new site is expected from 2022 to 2027 as the expansion phase-1. The expansion phase-2 is from 2027 to 2030, the service life is expected for 3 – 4 years. Increasing amount of waste disposal shorten the service lives in the future, even after the capacities of pits are increased.

For estimation of the total disposal volume (m<sup>3</sup>/year):

- Dumped volume density: 0.5 ton/ m<sup>3</sup>
- Covering soil ratio: 10% of dumped volume
- Stable volume weight after half a year: 0.8 ton (the dumped volume reduce due to water evaporation and decomposition with time)
- Stable volume density: 0.8 ton/ m<sup>3</sup>

For estimation of necessary landfill pits and accumulation of landfill pits:

- Present using pit size: 116,454 m<sup>3</sup>/ pit (200mx200mx3m: no filling up)
- Proposed use pit size: 226,140 m<sup>3</sup>/ pit (200mx200mx6m: 3m filling up)
- Proposed use pit size: 317,142 m<sup>3</sup>/ pit (200mx200mx9m: 6m filling up)

For landfill method:

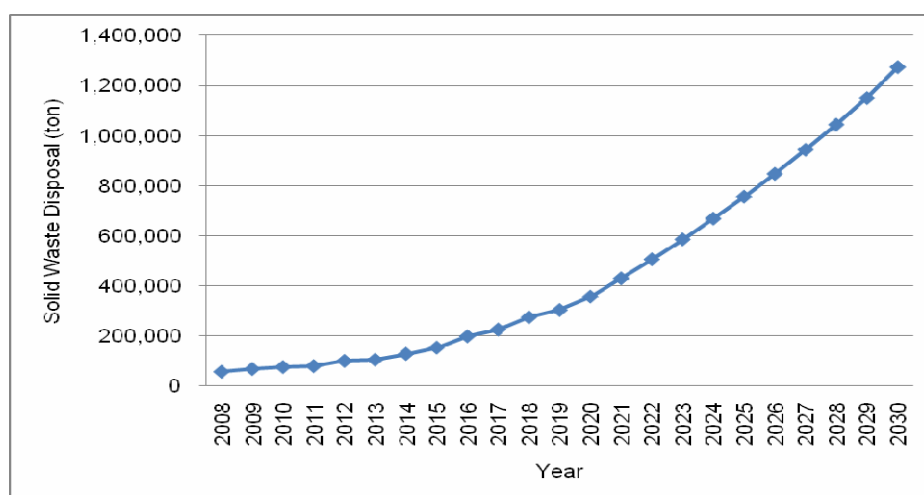
- Use the existing size of landfill pit: total 14 with the existing size (200m x 200m) can be constructed in the existing site (4 pits are working and additionally 10 pits)
- Up to 2011: the method is not drastically changed; the existing landfill pits (4 pits) are used in flat filling with soil covering
- 2012 - 2017: the cell method (6 meters filling up) is applied for gradual improvement.
- 2018 - 2030: the cell method (9 meters filling up) is applied.

**Table 4.3.33: Estimation of Annual Solid Waste Disposal**

Year	2008	2009	2010	2015	2020	2025	2030
Total disposal (ton/year)	57,033	68,089	75,987	153,151	356,514	755,095	1,271,786

Source: JST

<sup>2</sup> JICA study, “The Study on Solid Waste Management in the Municipality of Phnom Penh” as reference



Source: JST

**Figure 4.3.23: Estimation of Annual Volume of Solid Waste Disposal**

### (3) Basic Strategy

Based on the basic policies and demand of solid waste management, scenarios for solid waste management are outlined below and the basic strategy is summarized in Table 4.3.34.

- Legislation: definition of wastes and responsibilities or relevant organizations to be stipulated in legislation for enforcement
- Organization: revitalization of solid waste management for expansion and reinforcement
- Generation and Discharge: awareness-raising for the importance of collection and reduction of generation and discharge
- Collection and transportation: from the build-up area to new urban area
- Intermediate treatment: from encouragement of the existing recycling system to control of inappropriate recycling activities
- Final disposal: from service life extension of the existing landfills to establishment of sanitary landfills

Main actors for the management strategy are WREA and MOH for legislation in collaborating with VUDAA. International donors are also indispensable collaborators technically and financially. For organization, VSWCS (Vientiane Solid Waste Collection Service) and SWMDS (Solid Waste Management and Disposal Section) with VUDAA are main actors involving Vientiane Capital, WREA, MOH, international donors and NGOs.

The short-term strategy targets the existing built-up area: Historic conservation zone & Inner urban zone) and Outer urban zone. The medium to long-term strategy expands target area to new urban area: Sub-centers and Urban clusters & Outside of the urban planning area.

**Table 4.3.34: Summary of Basic Strategy**

Short-term Strategy	Subjected Area	Medium to Long-term Strategy	Subjected Area	Main Actors	Collaborators
<b>1. Management Strategy</b>					
<b>1-1 Legislation</b>					
- Provide guidelines to define types of waste with responsible parties - Provide wastes management ordinances of Vientiane Capital - Provide industrial and hazardous wastes management guidelines	VC	- Legislate industrial and hazardous wastes management laws - Regulate inappropriate waste management activities	VC	WREA MOH VC	VUDAA Donors
<b>1-2 Organization</b>					
- Strengthen the organization of VSWCS to expand the service areas - Strengthen the organization of SWMDS to improve the operation of KM32	HC/IU OU	- Further reinforce VSWCS and SWMDS to manage increasing wastes	HC/IU SC/OU/OS UL/OA	VUDAA VSWCS SWMDS	VC Government Donors
<b>1-3 Finance</b>					
- Awareness-raising for Vientiane Capital and the government to obtain further public supports	HC/IU OU	- Continuous awareness-raising for Vientiane Capital and the government	HC/IU SC/OU/OS UL/OA	VUDAA VSWCS SWMDS	VC Government Donors
<b>2. Technical Strategy</b>					
<b>2-1 Generation and Discharge</b>					
- Community awareness raising for sanitary waste discharge	HC/IU OU	- Continue community awareness raising and environmental education	HC/IU SC/OU/OS UL/OA	VUDAA	WREA MOH Donors NGOs
<b>2-2 Collection and transportation services</b>					
- Design plans of service area expansion including VIP & VLP, KM7 maintenance shop/transfer point - Provide community collection points with their involvement - Promote privatization	HC/IU OU	- Design plans of service area expansion for new urban areas - Expand KM7 maintenance shop/transfer point	HC/IU SC/OU/OS UL/OA	VSWCS VUDAA	VC Donors
<b>2.3 Intermediate treatment</b>					
- Promote individual and corporate recycling	HC/IU OU	- Further promote individual and corporate recycling - Regulate inappropriate recycling activities	HC/IU SC/OU/OS UL/OA	VSWCS VUDAA	VC Donors
<b>2.4 Final disposal</b>					
- Design the facility/operation plan and conduct an EIA - Establish Level 2 landfills - Expand landfills in the existing site - Capacity development for the sanitary operation and management	VC	- Establish Level 3 & 4 landfills (Construct new landfill sites) - Safety closure of the existing site - Conduct environmental monitoring	VC	SWMDS VUDAA	VC Donors

Note: VC (Vientiane Capital), HC/IU (Historic conservation zone & Inner urban zone), SC/OU/OS (Sub-centers & Outer urban zone & Outskirts zone), UL/OA (Urban clusters & Outside of the urban planning area), VSWCS (Vientiane Solid Waste Collection Service), SWMDS (Solid Waste Management and Disposal Section)

Source: JST

1) Short-term Strategy

a) *Management Strategy*

(a) *Legislation*

Provide guidelines to define the different types of waste with responsible parties:

WREA together with MOH shall define the types of waste, classifications, standards and clarify responsible parties and their activities for the sanitary solid waste management, and then officially acknowledge those guidelines as regulations, laws or Vientiane Capital's ordinances. In particular, hazardous wastes must be defined as early as possible.

Provide wastes management ordinances of Vientiane Capital:

VC and VUDAA shall provide the wastes management ordinances of VC based on and in complement to the legislations above. They also establish a monitoring framework to control inappropriate waste management activities.

Provide industrial and hazardous wastes management guidelines:

WREA and MOH shall provide industrial waste and hazardous waste discharging guidelines before VIP and VLP are established. It must be stated in the guidelines that tenants of VIP and VLP treat their hazardous wastes by their own responsibility. Recycling must also be promoted before discharging.

(b) *Organization*

Strengthen the organization of VSWCS to expand the service areas:

VUDAA shall strengthen VSWCS to expand waste collection activities (coverage area). VSWCS must deal with large part of waste collection as well as the privatization. The privatization which VUDAA promotes is a key factor for the expansion of solid waste management. The private collectors operate the service on profitability basis and it gives weakness sometimes in stable and regular operation. The waste collection is an essential public service which can maintain sanitary urban environment, thus the service suspension would give urban activities serious adverse impacts. Once private collectors stop the waste collection services due to their own reason like a financial trouble or bankruptcy, nobody can cover their services at present. VUDAA must avoid high dependency on the privatization for the waste collection.

In addition, the private collectors tend to use large vehicles and cover the area with good accessibility only, because of the profitability (less operation costs), consequently the coverage is limited to the areas along major roads. VSWCS covers less accessible areas as a public service.

Strengthen the organization of SWMDS to improve the operation of KM32:

The method of final disposal will be related with the waste collection service for the sanitary environment. VUDAA will need to strengthen SWMDS's organization to improve KM32 for sanitary landfills, and to provide for increasing amount of final disposal due to the expansion of waste collection service and expanding urban areas.



(c) Finance

Awareness-raising for VC and the government to obtain further public supports:

In order to strengthen the organizations of VSWCS and SWMDS and improve their operational conditions for the indispensable public service, more involvement of the public sector will be required. Although both of them manage the waste collection and final disposal services on their own account, the earning from the collection and disposal fees limits the quantity and quality of the services. As a result, their services are not provided for all the local residents as the indispensable public services and they request financial supports to expand the collection services and establish the sanitary landfills.

Meanwhile, few people within the government seem to have concern about how the wastes are treated once they are discharged and transported to the final disposal sites. Most uncollected wastes are burned in the urban area and the collected wastes are openly dumped in the KM32 landfill site. As KM32 is located away from the urban areas, the residents also pay little attention to the condition of landfills. Solid wastes must be appropriately collected and disposed of in the KM32 landfills to maintain sanitation and environment of VC.

Raising the collection and disposal fees is an idea for additional financial resource but it has limitation. A result of the social survey conducted for this Study shows that the local residents can pay almost equal to the existing collection charge (between LAK 20,000 and 30,000 per month). Even higher income household will not be willing to pay more than that.

Financial sources from the account of VC or supports by donors overseas are relied on. VUDAA conducts awareness-raising for VC and the government to obtain further public support, such as public seminars workshops and/or observation trips involving international donors or NGOs.

*b) Technical Strategy*

(a) Generation and Discharge

Community awareness-raising for sanitary waste discharge:

VUDAA shall conduct an awareness campaign of domestic solid waste management to enlighten local residents in terms of the importance of solid waste collection and of environmental education. In the campaign, VUDAA promotes the idea that collection service can maintain sanitary living environment. They disseminate the solid waste management manuals (discharging rules) to promote sanitary discharge.

A result of the social survey says that the respondents answered to what the main problems are, “No rules for discharging waste”, followed by “Littering streets, side ditches, building lots or public places” and “Bad manners of citizens at waste collection points”. They also give higher priority on waste management measures through self-reliant efforts (voluntary actions) by citizens and communities, environmental education, regulations and public awareness for waste discharge. These results show that they are generally prepared to accept the awareness-raising activities.

(b) Collection and transportation services

Design plans of service area expansion:

VUDAA shall design an expansion plan of waste collection service with the target of the existing built-up area. The plan should include an operation/maintenance plan which can cover those costs on their revenues without decline in quality of performance. An extension plan of KM7 maintenance shop/transfer point is also included in the plan. VUDAA proposes the plan to VC, and VC financially supports VUDAA or seeks governmental supports, and/or international donor assistance if necessary.

VSWCS procures necessary equipment and recruit personnel with training for the expansion. They also start construction to expand the KM7 maintenance workshop and the transfer point of solid waste transportation.

Provide community collection points with their involvement:

In some of the urban areas in VC, collection service is not provided due to poor accessibility, such as narrow, bad surface, not paved roads in the viewpoint of the waste collectors. Especially the waste collectors use dump tracks for the collection service, thus it is not easy to drive in narrow streets. It is sure that they tend to put priority in the areas with good access, where they can easily collect the waste and earn fees with less transportation cost. Meanwhile, 61% of the respondents of the social survey who are not receiving waste collection service answered they want to use the collection service. They are potential subscribers for the collection services.

However, road improvement takes long time to complete. Thus VUDAA shall consider providing public collection points at locations with better accessibility in each community. VUDAA involves communities to make the system, where is the best place, how resident carry solid wastes there, and rules of discharge and maintenance at the collection points.

Promote privatization:

Private collectors are operating as part of the waste collection service as well as VSWCS although there are a few rules of subcontract. To increase subscribers and expand the service area, private collectors will be partners for the solid waste management in VC. VUDAA provides criteria, formal license, contract and operational guidelines to appropriately involve private sector in the waste collection services. VUDAA also provides monitoring system for the private subcontractors.

*(c) Intermediate treatment*

Promote individual and corporate recycling:

VUDAA shall promote individual and corporate recycling to reduce amount of solid waste discharge, transportation and disposal. VUDAA will also conduct an actual condition survey of recycling manufactures to maintain the existing recycling system and promote more participation.

*(d) Final Disposal*

Design the facility/operation plan and conduct an EIA:

The existing KM32 landfill site was constructed without a proper master plan or EIA in a short period. This provides a cause for the present open dumping in the landfills which will adversely affect sustainable operation/management and surrounding environment. VUDAA and SWMDS design the facility/operation plan and conduct an EIA to improve the existing facilities and operation, and provide for increasing requirement of waste disposal. The plan

should include an operation/maintenance plan which can cover the costs from their revenues without a decline in performance.

**Establish Level 2 landfills:**


Compacting, daily soil covering and gas venting are indispensable for a step to establish sanitary landfills. Cell method which has these activities is applied to KM32 as the method is suitable for flatland. Compacting the dumped waste with heavy machinery can reduce volume of waste (thus increasing the density of the waste) to make more landfill capacity. It leads to more efficient use of the space and consequently will extend their service life. After the compaction, the surface should be covered with soils.

Soil covering is the most fundamental measure for sanitary landfills. The soil covering in the cells can prevent litter, offensive odor, vermination (especially flies), spontaneous combustion and smoke. Reducing landfill area and the soil covering also can reduce seepage of rainwater and reduce leachate. With the soil covering, gas collection pipes have to be installed to vent gas into the open air because organic parts produce gas with risks of firing and even explosion.

Other necessary activities are follows.

- Rehabilitate the drain system (drain and regulating pond): provide drain gutters to collect and drain rainwater around the landfills, thus to maintain approach roads and onsite roads and prevent inflow to the landfill pits.
- Provide heavy machinery: the existing machines have worked since 1998, thus are old and hardly workable due to frequent troubles.
- Improve maintenance workshop
- Dividers are made inside the cells (enclosing bunds) to reduce amount of leachate
- VUDAA regularly monitors and evaluates the KM32 operation and management to sustain the improved conditions.

**Table 4.3.35: KM32 Landfills Improvement**

The existing condition		Short term
Level-1 - Control facility - Measurement (weighbridge) - Landfill equipment (but are hardly working) - Approach and site roads		Level-2 Level-1 plus: - Enclosing Bunds - Buffer Zone - Daily soil covering and gas venting

Source: JST

**Expand landfills in the existing site:**

VUDAA and SWMDS construct new landfill pits in the existing site. The improvement for level 2 landfills can extend the service lives of the existing landfill pits in the short-term. However, SWMDS should also provide for early depletion of capacity due to late actions and retardation of the improvements.

**Capacity development for the sanitary operation and management:**

For introducing the cell method, KM32 management needs sufficient skills to construct the facilities, operate and maintain them. On-the-job training should be provided to achieve step-by-step improvements from open dumping toward level 2 sanitary landfills.

2) Medium to Long-term Strategy

a) *Legislation*

Legislated industrial and hazardous wastes management laws:

WREA and MOH shall provide the industrial waste and hazardous waste management laws before VIP and VLP start operations.

Regulate inappropriate waste management activities:

In addition to the laws, WREA and MOH must provide a monitoring framework on waste management activities. They also need to strengthen the monitoring frameworks and tighten control of inappropriate waste management activities with penalties as well as VC does.

b) *Organization*

Further reinforce VSWCS and SWMDS to manage increasing wastes:

VSWCS shall expand the service area with the target of new urban areas: the Sub-centers & Outer urban zone, Outskirts zone, Urban clusters & Outside of the urban planning area, VIP and VLP. SWMDS furthers the improvement for the sanitary landfills. They strengthen both organizations with the facilities, equipment, human resources (quantity and quality) and finance with governmental supports.

c) *Generation and Discharge*

Continue community awareness-raising and environmental education:

VUDAA continuously shall conduct the awareness campaign targeting new urban areas: the Sub-centers & Outer urban zone, Outskirts zone, Urban clusters & Outside of the urban planning area.

Promote own reduction by establishments:

Once factories start operations in VIP, they will generate large amount of solid wastes as another JICA Study<sup>3</sup> of VIP estimates. KM32 landfills are expected to dispose the solid wastes discharged from VIP. Efforts to reduce the discharging wastes are strongly requested of the tenants themselves to minimize environmental impacts as well as the cost both for the tenants and the solid waste management.

d) *Collection and transportation services*

Design plans of service area expansion for new urban areas:

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<sup>3</sup> Preparatory Survey on Industrial Zone Development in the Lao People's Democratic Republic

VSWCS designs the expansion plan of waste collection service with the target of new urban areas: the sub-centers, newly urbanizing areas, VIP and VLP. Especially for VIP and VLP where large amount of solid waste discharge is expected in near future, VSWCS studies a solid waste management plan.

Expand KM7 maintenance shop/transfer point:

Responding to the increase of waste collection services, VSWCS shall expand KM7 maintenance shop and transfer point of collected wastes. However, as urbanization in the surrounding area of KM7 is expected, buffer zone with fence or greenery distancing from residence should be provided to reduce offensive odor and litter. Relocation of the facility will also be considered in the case of rapid urbanization more than expected.

*e) Intermediate treatment*

Further promote individual and corporate recycling:

VUDAA further promotes individual and corporate recycling with 3R (reduce, reuse, recycle) to reduce amount of solid waste discharge and disposal. Especially, the corporate recycling should be accelerated as the number of tenants in VIP increases.

Regulate inappropriate recycling activities:

VUDAA provides guidelines to regulate environmentally inappropriate recycling activities after the actual condition survey of recycling manufactures, and promote the entries of proper recycling manufactures for recycling business.

*f) Final Disposal*

Establish Level 3 or 4 landfills (Construct new landfill sites):

Once factories start operations in the VIP and VLP, the amount of waste disposal will increase drastically. VUDAA shall construct new landfill pits, relocate the office and equipment beside the existing site adding the following facilities so that VWMDs operates sanitary landfills (level 3 or 4). Difference between level 4 and 3 is whether installing a facility to purify leachate or not. The level 4 which purifies leachate can reduce risk to pollute the surrounding land when leachate flows out especially in the rainy season but more skills and costs for maintenance and construction will be necessary. Thus, the level 3 is set as the temporal target.

- Leachate circulation treatment: leachate is collected by leachate collection pipes laid on the bottom of the landfills for regulation (evaporation) pond
- Mobile fence around the working space of the heavy machineries to prevent litter scattering from landfill operation
- Greenery in the buffer zone to prevent effects to the outside of KM32 and harmonization with the surrounding landscape

**Table 4.3.36: KM32 Landfills Improvement**

Short-term	Medium to Long-term	
Level-2 Level-1 plus: - Enclosing Bunds - Buffer Zone - Daily soil covering and gas venting	Level-3 Level-2 plus: - Leachate circulation treatment - Mobile fence for litter prevention	Level-4 Level-3 plus: - Leachate purification - Seepage control works

Source: JST

**Safety closure of the existing site:**

In the end, soil will be covered to stabilize the surface and the slopes of the landfills. After the landfills are closed, continuous monitoring will be required for subsidence, temperature and gases from the landfill, leachate components, and the quality of the groundwater, because the landfills are not stable due to consolidation settlement, decomposition of wastes, generation of landfill gases and leachate in the waste layers. These management activities can contribute to the reduction of environmental impacts and facilitating easier use of land after the closure such as for a public park.

**Conduct environmental monitoring:**

SWMDS shall conduct regular monitoring for littering, vehicle operations, gases from the landfill, the properties of the leachate and other items to regularly evaluate the operation and maintenance arrangements of KM32 landfills.

#### 4.3.6 Parks, Open spaces and Greenery

##### (1) Basic Concept and Policy

###### 1) Basic Concept

Aiming at Vientiane Capital to be surrounded by rich green and water in the future as one of the development visions, three basic concepts are settled on in terms of public parks, open spaces and greenery (hereinafter “Green-space”) as follows.

###### *Concept 1: The city to be conceptually “enclosed” by Greenery and Water*

Maintaining and improving high green spaces coverage ratio in urban areas indicates some directions as follows.

- Maintenance and improvement of green spaces in urban areas in accordance with the requirement and features of the land
- Well-managed urban development in harmony with environmental conservation.



###### *Concept 2: The city to be well-maintained by Greenery and Water*

Providing the four (4) important functions for the citizens living in urban areas in cooperated with all green spaces comprehensively indicates some directions as follows.

- Construction of green space systematically by means of a network and/or a distribution system to be established in advance.
- Conservation of existing nature especially marshes which have important functions such as mitigating disasters, and conservation of nature in urban areas.



###### *Concept 3: The buildings to be buried in Greenery and Water*

Improving urban scenery with rich green indicates some directions as follows.

- Harmonious urban scenery between roadside trees and buildings along major urban arteries.
- Providing urban scenery with rich green.



For achieving three (3) basic concepts, the following items, 2) basic policies and 3) a linkage and distribution policy should be formulated and carried out in close relation with urban development planning in terms of harmonized and sustainable urban development for the future.



2) Basic Policy

*Concept 1: The city to be conceptually “enclosed” by Greenery and Water*

Based on basic concept 1, basic policies are proposed with the viewpoints of maintaining and improving a high ratio of green space coverage in urban areas.

*Policy 1-1: To maintain and improve greenery in urban areas*

It is necessary to maintain and improve green space with suitable green spaces coverage ratio for each land use zones including urbanizing areas in the future.

*Policy 1-2: To promote new development projects in harmony with nature conservation*

It is necessary to conserve and create green space with rich volume on the site for new large-scale development project to be constructed, especially in NE zone and other equivalent areas.

*Concept 2: The city to be well-maintained by Greenery and Water*

Based on concept 2, basic policies are proposed with the viewpoints of providing and supplying 4 important functions for the citizens living in urban areas especially by making public parks.

*Policy 2-1: To make new public parks and open spaces*

It is necessary to make and maintain public parks and open spaces in both new urbanizing areas and urbanized areas to contribute establishing an effective network and distribution system of green space for sustainable urban development.

*Policy 2-2: To renovate and improve public parks to be more attractive and usefu*

It is necessary to renovate and improve public parks to be be more attractive and useful spaces for the citizens not only for the tourists.

*Concept 3: The buildings to be buried in greenery and water*

Based on concept 3, basic policies are proposed with the viewpoints of improving urban scenery with rich green.

*Policy 3-1: To improve greenery major urban arteries with rich green*

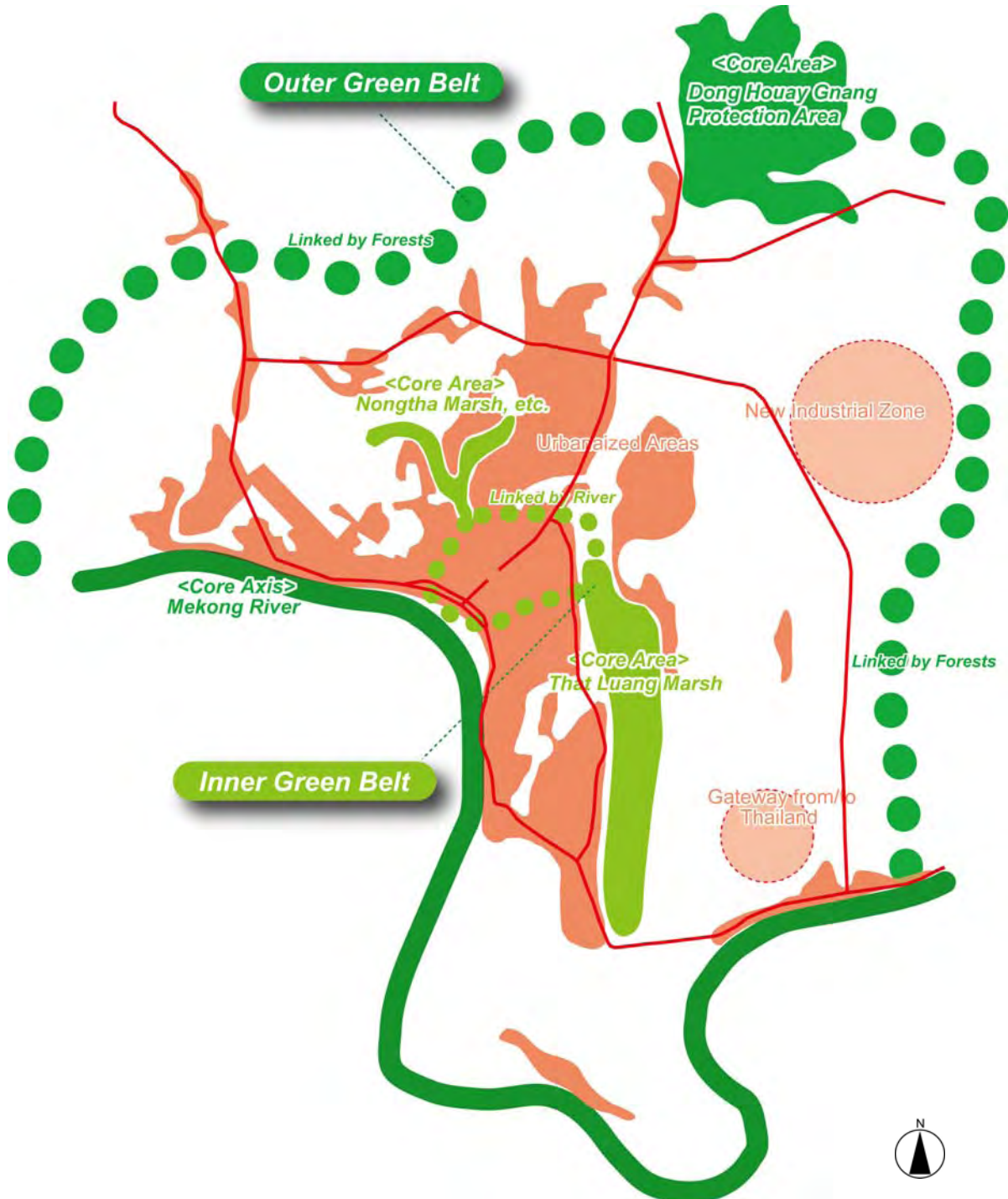
It is necessary to improve urban scenery with rich green along major urban arteries by means of planting roadside trees along the major urban roads with flowers and grasses.

*Policy 3-2: To improve private spaces with rich green*

It is necessary to improve urban scenery in private spaces with rich green and with protecting existing large trees.

3) A Linkage and Distribution Policy of Greenery and Water

First, a basic idea for spatial linkage and distribution of greenery and water was roughly drawn up on the city scale by forming “Inner Green Belt” and “Outer Green Belt” which enclose the inner and outer urban areas, respectively.



Source: JST

Figure 4.3.24: Basic Idea for Linkage and Distribution of Greenery and Water

(2) Basic Strategy

To grasping the current conditions and examine the strategies, three (3) surveys were carried out by JICA Study Team; 1) A survey of green spaces coverage ratio by satellite samplings, 2) A survey of public parks utilization and 3) A survey of green scenery coverage. In consideration of the surveys and based on concepts and policy as mentioned above, JICA Study Team proposes six (6) categorized strategies in this section as shown in Table 4.3.37.

**Table 4.3.37: Summarized Table of Concepts, Policies and Strategies**

Basic Concept	Basic Policy	Strategy	Reference (Conducting Study)
Concept 1: The city to be conceptually “enclosed” by Greenery and Water	Policy 1-1: To maintain and improve greenery in urban areas	Strategy (1): To Maintain and Improve Green Spaces Coverage in Urban Areas - <i>Three (3) steps of administrative direction should be conducted</i> - <i>More than 20ha scale development, green spaces must be remained and maintained in the site.</i>	A survey of green spaces coverage ratio by satellite samplings
	Policy 1-2: To promote new development projects in harmony with nature conservation	Strategy (2): To Conserve Natural Environment in NE Zone - <i>Basic principle in NE zone is to stop destructing current natural environment any more.</i> - <i>Project of more than 20 ha in NE zone must conserve natural environment at the ratio of more than 50% of the site.</i>	-
Concept 2: The city to be well-maintained by Greenery and Water <functional aspect>	Policy 2-1: To create new public parks and open spaces	Strategy (3): To Make New Public Parks and Open Spaces - <i>In new urbanizing areas, two (2) types of public park, so-called “District Park” and “Pocket Park”, should be made</i> - <i>The area of these parks will increase by 375ha in total for 2030.</i>	-
	Policy 2-2: To renovate and improve public parks to be more attractive and useful	Strategy (4): To Renovate and Improve Public Parks to be more Attracted and Useful - <i>Public parks should be made for the citizens use, not only for the tourists</i>	A survey of public parks utilization
Concept 3: The buildings to be buried in Greenery and Water <urban scenery aspect>	Policy 3-1: To improve greenery major urban arteries with rich green	Strategy (5): To Improve Major Urban Arteries with Rich Greenery - <i>Improving green Sceneries by means of planting of roadside trees along the major urban axes and flowers and grasses should be carried out.</i>	A survey of green scenery coverage
	Policy 3-2: To improve private spaces with rich green	Strategy (6): To Improve Private Spaces with Rich Greenery - <i>Mainly two (2) sub-strategies should be taken, one of which is promoting information and popularization and the other is constructing a system for greenery.</i>	-

Source: JST

To achieve these proposed strategies, implementation methods will be examined more in the Draft Final Report in this study.

1) Strategy1: To Maintain and Improve Green Spaces Coverage in Urban Areas

To maintain and improve green spaces in the urban areas, three (3) steps of administrative direction; namely “Required”, “Strongly recommended” and “Preferred”, should be introduced according to the location and/or scale of a development activity.

In the case urban development projects of more than 20ha, green spaces must be maintained on the site with a proposed green spaces coverage ratio through the administrative “Required”.

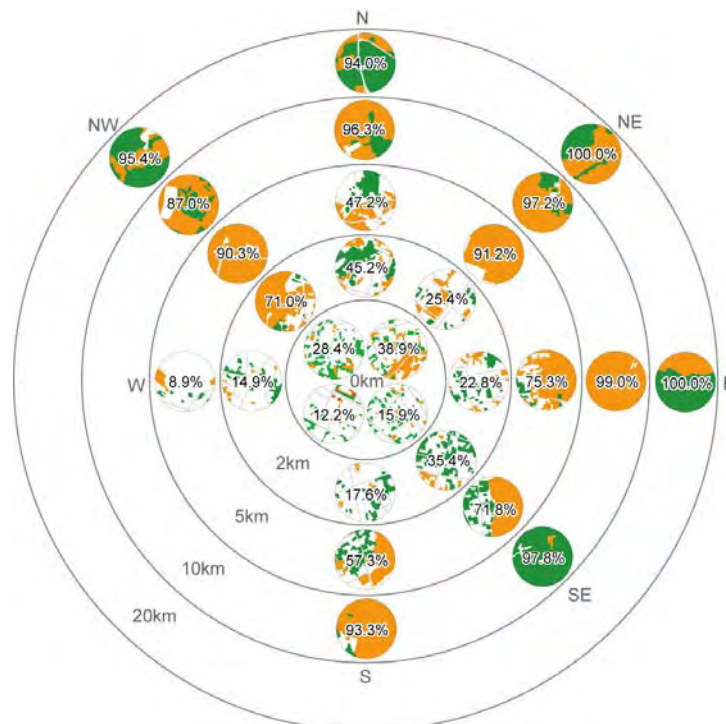
a) *Grasping and Monitoring of Green Spaces Coverage Conditions*

JICA Study Team carried out “A survey of green spaces coverage ratio by satellite samplings” to grasp the current and suitable green spaces coverage ratio in each land use zones as shown in Table 4.3.38 (Refer to the Appendix-5 for the detailed results). In order to grasp green space conditions, this survey was done in a more detail scale than land use mapping.

**Table 4.3.38: Outline of a “Survey of Green Spaces Coverage Ratio by Satellite Samplings”**

Survey Name	Survey of Green Spaces Coverage Ratio by Satellite Samplings
No. of Samples	28 samples in total
Sampling Method	Based on the distance and direction from the city center - Distance (0km, 2km, 5km, 10km and 20km) - Direction (West, NW, North, NE, East, SE, South)
Using Base Image	Quick Bird Satellite Image
Two Categories of Green Spaces	Green Color ■: Covered mainly by trees Orange Color ■: Covered mainly by grasses and agricultural lands

Source: JST

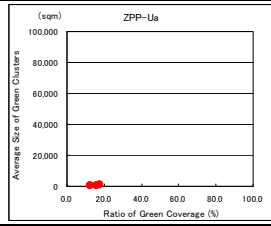
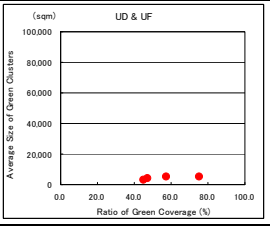
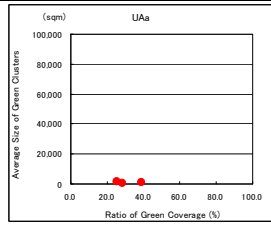
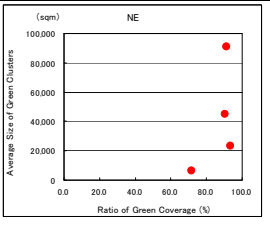
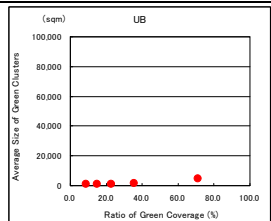
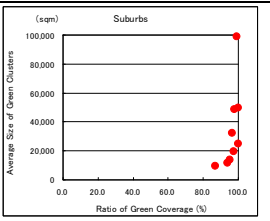


Source: JST

**Figure 4.3.25: Current Green Spaces Coverage Ratio in Satellite Sampling Areas**

According to the result of the survey as shown in Table 4.3.39, an average green spaces coverage ratio in ZPP-Ua is only 15.2%, while, in contrast, UA or UB are still more than 30%. As the table indicates, NE zone and suburbs (out of urban planning areas) retain much more green spaces.

**Table 4.3.39: Current Green Spaces Coverage Ratio in Land Use Zones**

Land Use Zone	Average Ratio	Green Ratios and Average Green Sizes	Land Use Zone	Average Ratio	Green Ratios and Average Green Sizes
<b>ZPP-Ua (A)</b>	<b>15.2 %</b>		<b>UD (C)</b>	<b>56.3 %</b>	
<b>UA (A)</b>	<b>30.9 %</b>		<b>NE (E)</b>	<b>86.7 %</b>	
<b>UB (B)</b>	<b>30.6 %</b>		<b>Suburbs (Other)</b>	<b>96.3 %</b>	

Source: JST

This survey would be more informative if monitored in every 5 years whether green spaces coverage is improving or not in relation with the policies, regulations and projects to be conducted. Conducting the monitoring of this survey is one of the proposals by JICA Study Team.

*b) Strategies to Maintain and Improve Green Spaces Coverage*

Corresponding to the land use zoning, suitable green spaces coverage ratio (green spaces/ total development area) should be adopted when buildings are constructed or re-constructed. JICA Study Team proposed that administrative directions for development activities be formulated in three steps according to the locations and/or the sizes of development activities as follows;

- 1<sup>st</sup> Step “Required”: Green spaces must be remained and maintained with more than proposed ratio as a prerequisite for development.
- 2<sup>nd</sup> Step “Strongly Recommended”: An administrative direction should be taken with strongly recommended with more than proposed ratio.
- 3<sup>rd</sup> Step “Preferred”: An administrative guidance will be considered to be preferable if provided for more than the proposed ratio, but the guidance are not for individual.

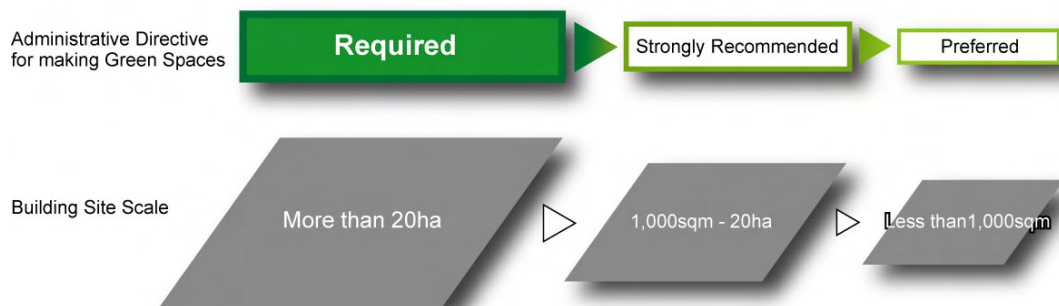
**Table 4.3.40: Steps of Administrative Direction and Green Spaces Coverage Ratio**

Size of Development Site	A Zone, B Zone C Zone, D Zone E Zone (Only I)	E Zone (Except I, NE, NA)	E Zone (NE, NA)
20ha -	<b>Required</b> <Ratio: 12-30%>	<b>Required</b> <Ratio: 30%>	(Refer to Next Section)
1,000sqm - 20ha	Strongly Recommended <Ratio: 12-30%>	Strongly Recommended <Ratio: 30%>	
- 1,000sqm	Preferred <Ratio: 12-30%>	Preferred <Ratio: 30%>	

A – E zone: See the section 2.2

Source: JST

- In the case of development activity which has the size of more than 1,000sqm, an administrative guidance will be strongly recommended by those who are in charge of building permit targeting to the party who wishes to conduct the development activity to provide for the proposed green spaces coverage ratios (12% - 30%) corresponding to the building coverage ratio.
- Especially in the case of urban development projects of more than 20 ha (200,000sqm), the development activity must follow the requirement for maintaining the proposed green spaces coverage ratio in the development site.
- In the case of development of less than 1,000sqm, administrative guidance will be intended for general information and direction, not for individual.



Source: JST

**Figure 4.3.26: Steps of Administrative Direction according to the Scale of Building Sites**

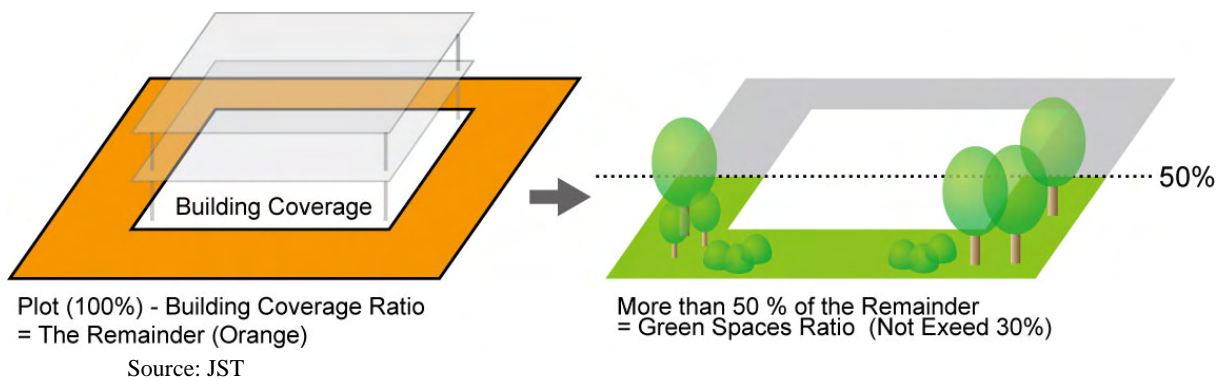
According to the result of the survey, suitable and practical green spaces coverage ratios in each land use zone should be set in the urban areas (A, B, C and D zone) as follows.

By definition,

$$\text{Green Spaces Coverage Ratio} = (\text{Site 100\%} - \text{Building Coverage Ratio}) / 2$$

Note: not exceed 30%





**Figure 4.3.27: Proposed Green Spaces Coverage Ratio in Development site**

Based on the result of the survey and the proposed definition, green spaces coverage ratio in each land use zone will be followed as shown in Table 4.3.41.

**Table 4.3.41: Estimated Green Spaces Coverage Ratio in Land Use Zones**

Land Use Zones		Building coverage ratio (Previous)	Building coverage ratio (Revision)	Green spaces coverage ratio (estimated)
A	ZPP-Ua	75%	-	12%
	ZPP-Ub	50%	-	25%
	UA (a,b)	75%	60%	20%
B	UB (a,b)	60%	-	20%
	UC (a,b)	50%	-	25%
C	UD (a,b,c)	40%-50%	-	25%
	UF	40%	-	30%
D	UE (a,b)	50%	-	25%
E*	I	30%	-	35% → 30% (not exceed 30%)

\* In the case of development projects in "I", the proposed ratio, 30%, should be examined and discussed more.

Source: JST

c) *Enhancing Measures for Formulating the Strategies*

With regard to the building permit procedure, those who are in charge of building permit should conduct the administrative directions with some examples as follows;

- To inform of the greenery direction to the public with brochures
- To have oral explanation in advance by those who seeking a building permit
- To check the plan at the time of construction application
- To check the development site at the time of completion of construction

In addition to the above, it is necessary to construct more public parks and open spaces in urban areas to avoid excessive concentration of buildings. This matter will be discussed later.



2) Strategy2: To Conserve Natural Environment in NE Zone

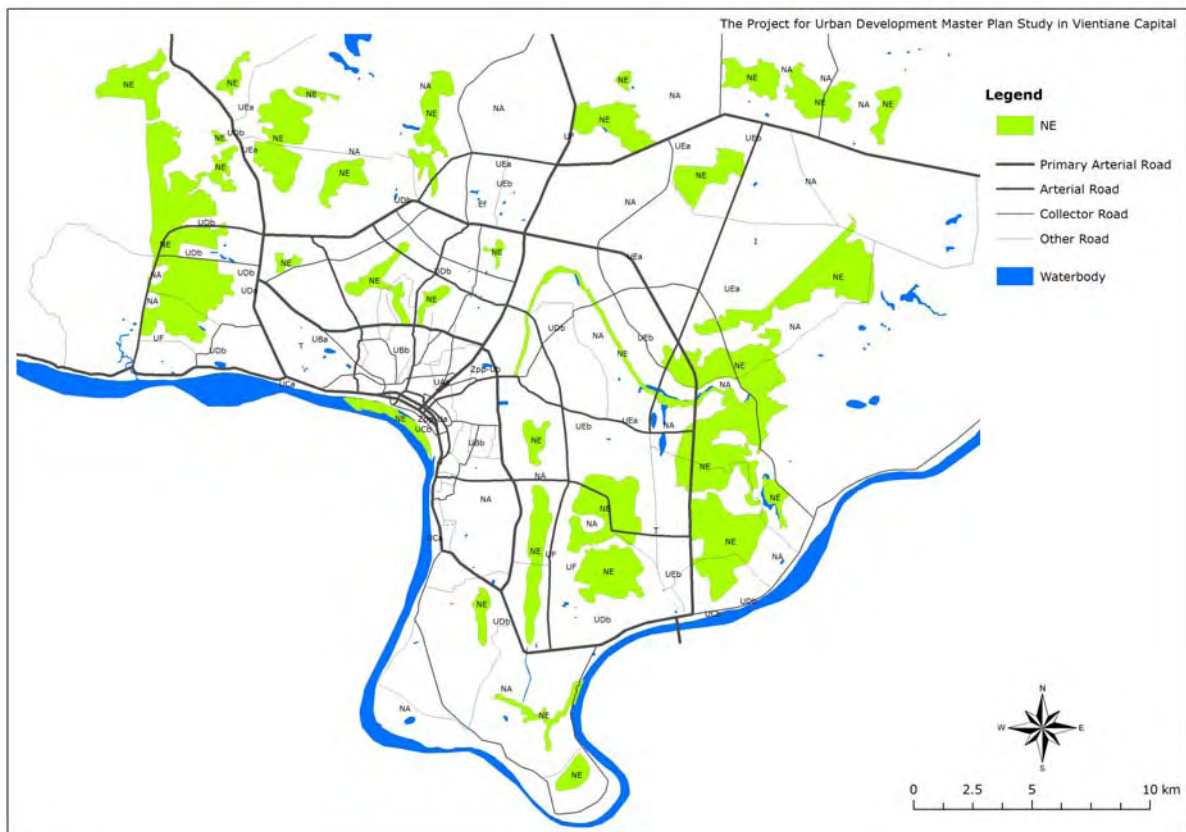
NE Zone is important for forming Greenbelt of the Capital city. Therefore, basic principle in NE zone is to stop any destruction of current natural environment, or “No Net Loss of Greenery Policy”.

If a development activity is unavoidable in NE zone, the development construction should be harmonized with the natural environment as much as possible.

Project of more than 20 ha must conserve natural environment in more than 50% of the site.

a) Revision of NE (Natural Environment Conservation) Zone

As discussed in Section 4.1, previous master plan for Vientiane Capital was revised with a larger city planning area as shown in Figure 4.3.28. In regard to NE zone, which aims to conserve natural environment and to prohibit all development activities, new areas of NE zone were additionally proposed mainly on the outskirts of the urban areas.



Source: JST

**Figure 4.3.28: NE Zone in New Land Use Plan 2030**

b) *No Net Loss of Greenery Policy in NE Zone*

In NE zone, basically all development activities must be prohibited to promote sustainable development in Vientiane Capital. Therefore “No Net Loss of Greenery Policy” should be adopted mainly in NE zone.

***No Net Loss of Greenery Policy***

*No Net Loss Policy was an overall policy and goal for natural environmental protection especially for wetland protection advocated in United States of America.*

*The goal is to stop declining of the overall area of natural environment (wetland). The no net loss policy refers to strive to balance unavoidable natural environment losses with replacement of them on a project-by-project basis so that further reductions to habitat may be prevented.*

In the case that a new development activity starts to occur in NE zone, it must be prohibited in principle at first. When the development was accepted in NE zone through the proper and visible procedure, the party seeking to construct buildings should conserve natural environment as much as possible by following directions as follows. It is recommended that this policy should be adopted not only in NE zone but also in NA zone.

c) *Strategies to Conserve Natural Environment in NE Zone*

If development activity is not avoidable in NE zone, the development construction should be harmonized with natural environment as much as possible. Hence administrative obligation regarding the green spaces coverage ratio should be carried out according to the locations and/or the sizes of the development activity as shown in Table 4.3.42.

**Table 4.3.42: Administrative Obligation and Green Spaces Coverage Ratio**

Size of Development Site	Administrative Obligation	
	Conserving Natural Environment	Making Parks and Greenery
20ha -	<b>Required</b> for Conserving Natural Environment in a Whole Development Site <Ratio: more than 50%>	<b>Required</b> for Making Parks and Greenery in the Built-up Site <Ratio: more than 30%>
- 20ha	-	<b>Required</b> for Making Parks and Greenery in a Whole Development Site <Ratio: more than 50%>

Source: JST

(a) *Development of More than 20ha*

In the case of a development which has a size of more than 20ha, such as large-scale industrial parks and housing development, an administrative obligation should be taken into consideration through the building permit or equivalent procedure. The obligation consists of two (2) steps as shown in Figure 4.3.29. First, more than 50% in a whole development site must be conserved as natural environment for the future. Second, more than 30% in the rest of the whole site (built-up site) must be reserved for green spaces as public parks with rich nature.

A development activities in NA zone, protected areas or outside of city planning areas, the procedure should be conducted in the same way as one in NE zone.

(b) Development of Less than 20 ha

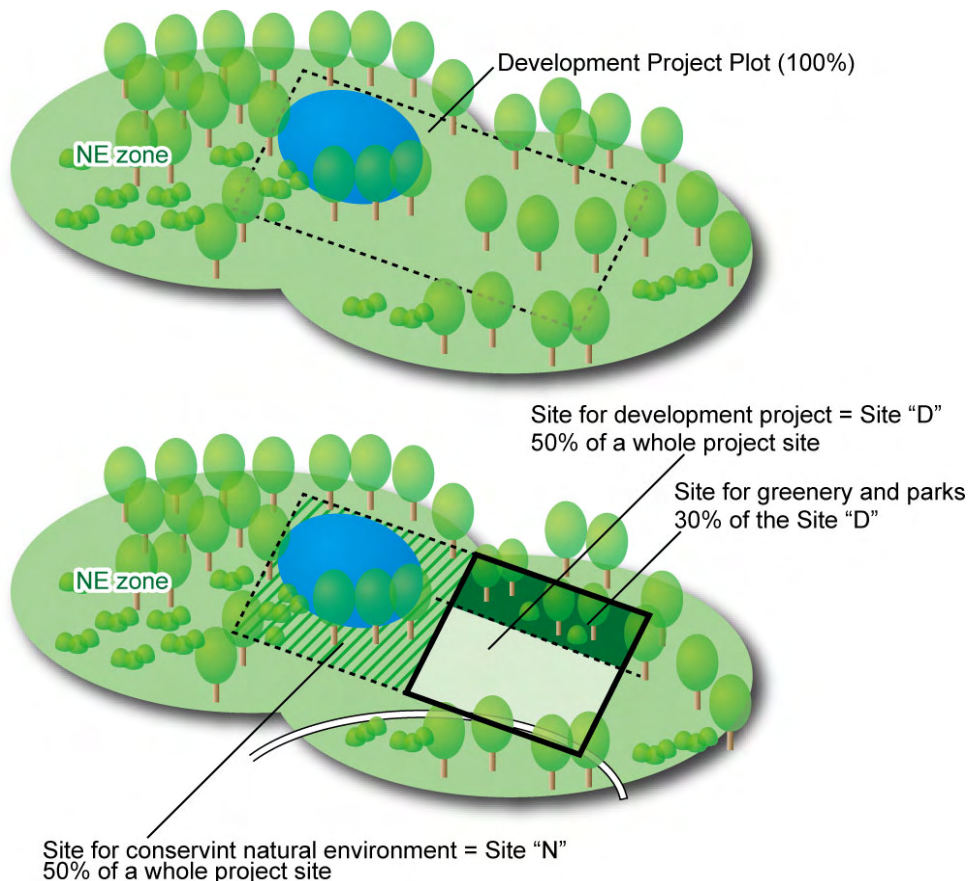
In the case of development of less than 20ha, more than 50% of a whole development site must be reserved as green spaces and public parks.

(c) Green Spaces

In Regard to the green spaces to be reserved in the site, it is recommended that more than 50% spaces of the whole green spaces should consist of forests with trees which have a function of improving landscape and mitigating environmental pollution that may originate from inside of the site.

(d) EIA Procedure

At “Screening” procedure in Environmental Impact Assessment (EIA), a development activity in NE zone should follow the EIA (not IEE) process. Additionally, Environmental Management Plan (EMP) must also be required for the development activities in the EIA process.



Source: JST

**Figure 4.3.29: Administrative Obligation in more than 20ha Development Site in NE Zone**

3) Strategy3: To Make New Public Parks and Open Spaces

In new urbanizing areas, two (2) types of public park, namely “District Park” and “Pocket Park”, should be made according mainly to these sizes and functions, and the area of these parks will increase by 375ha in total for 2030.

In urbanized areas, it is necessary to make new public parks by means of a proposed scenario of four (4) phases.

*a) A Basic Idea for Making Public Park*

There are at present only 9 public parks with a total area of 20.6ha in Vientiane Capital. This figure corresponds only to 0.3m<sup>2</sup> per person. To improve living conditions in new urbanizing area as well as to increase the low level of park area per resident figure, it is necessary to make more of new public parks. The new public park might not only mean public facility that consumes much budget to make but also open space for public use. As the making of new public parks may not be much of urgency compared with other infrastructure construction such as road, water supply, sewerage and electricity, but from the long-term viewpoint, this will be essential to achieve sustainable urban development and improve living conditions.

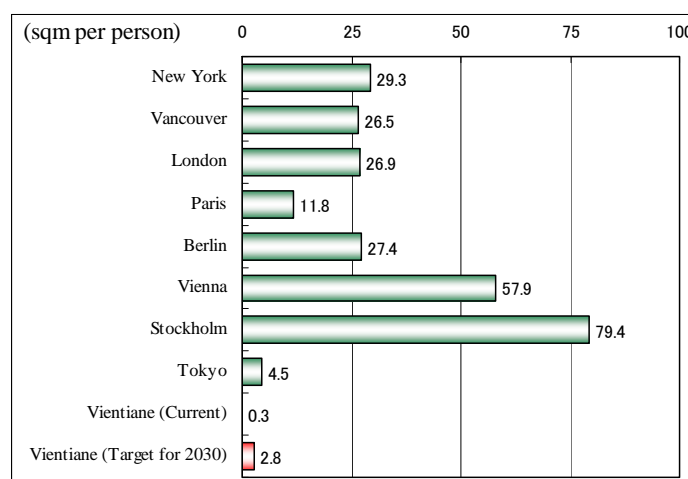
A basic idea to increase public parks is that new urbanization activities must accompany new public parks as one of urban facilities such as road, water supply, sewerage and so on.

From a long-term aspect, the total area of public parks in 2030 will be set at 10 times as much as in the current (2010) level as shown in Table 4.3.43 and Figure 4.3.30. This is a quantitative target for making public parks.

**Table 4.3.43: Total Area and per Person of Public Parks**

Stage	Year	Total Area of Public Parks	Population	Area per person
Current	2010	20.6 ha	795,000	0.3 m <sup>2</sup>
Target (Goal)	2030	400.0 ha	1,439,000	2.8 m <sup>2</sup>

Source: JST



Source: JST

**Figure 4.3.30: Quantitative Target of Public Park Area per Person for 2030**



b) Strategies for Making Public Parks in New Urban Areas

Public parks to be made mainly in new urbanizing areas will be categorized basically into two (2) types, one of which is “District Park” and the other is “Pocket Park” according to their sizes and functions.

**Table 4.3.44: Standard size and Function of District Park and Pocket Park**

Type of Park	Standard Size (example in existing parks)	Main Function for Use			
		Relaxing Chatting	Sports Exercise	Walking Jogging	Events
District Park	1-2ha (Size of Regent Park)	Required	Required	Required	Required
Pocket Park	0.2-0.25 ha (Half size of Nampu Park)	Required	-	-	-

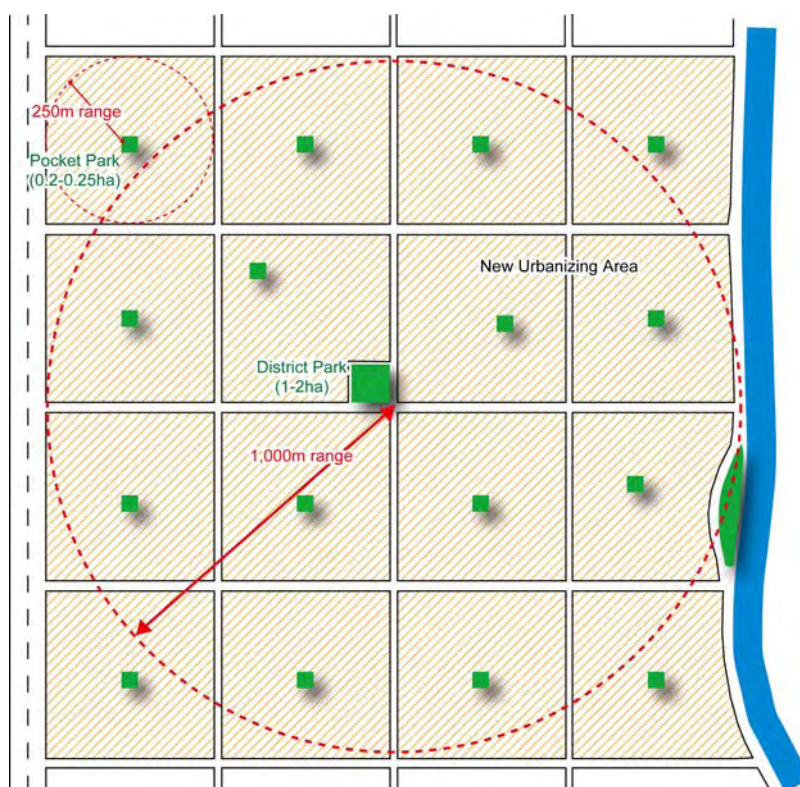
Source: JST

For making these two (2) types of public parks, accessibility for user will be considered. It is so-called as “Service distance for use”. Table 4.3.45 and Figure 4.3.31 show basic idea of the attracting distance to use.

**Table 4.3.45: Service Distance to Use of District Park and Pocket Park**

Type of Park	Service Distance for Use			Standard Size
	Round Distance	Block Size to be Made	Estimation Time to Access the Park	
District Park	1,000m range	Square of 2km length	Within 20 min on foot	1-2ha
Pocket Park	250m range	Square of 500m length	Within 5 min on foot	0.2-0.25 ha

Source: JST



Source: JST

**Figure 4.3.31: Service Distance for Use of District Park and Pocket Park**

To make public parks efficiently, it is necessary to reduce the necessary expenses and labor for construction and management of new public parks. On the other hand, new public parks will play a role for enhancing community relationship instead of temples because there will be few temples in new urbanizing areas. Hence, public parks should be managed by not only local government but also local communities as much as possible for reducing expenses to manage.

JICA Study Team proposed the methods of construction and management of public parks as shown in Table 4.3.46.

**Table 4.3.46: Methods of Construction and Management of District Park and Pocket Parks**

Type of Park	Creation (Construction) Phase	Management Phase
District Park	<ul style="list-style-type: none"> <li>- Vientiane Capital (DPWT) which constructed many existing parks will be the main responsible organization to construct new District parks in cooperation with, or in supervision of the developers who intend to do development activity in new urbanizing areas.</li> <li>- District parks should be constructed by using surplus spaces in cooperation with other infrastructure construction such as roads, public facilities, etc.</li> <li>- District parks should be constructed making good use of existing and remaining marsh, pond, forest, trees and the other natural materials as much as possible.</li> <li>- Surrounding road (sidewalk) of the park should be constructed in consideration to be used for running, jogging and walking.</li> </ul>	<ul style="list-style-type: none"> <li>- VUDAA or OPWT (district level) will manage and operate District parks.</li> </ul>
Pocket Park	<ul style="list-style-type: none"> <li>- Organizations which intend to construct new urban development or infrastructures should also construct new pocket park by using surplus spaces without large expenses and labor.</li> <li>- Pocket parks should utilize existing large trees to provide good shade space for relaxation.</li> </ul>	<ul style="list-style-type: none"> <li>- OPWT (district level) will manage and operate pocket park with necessary (minimum) expenses.</li> <li>- Local communities (District level) will manage in daily basis</li> </ul>

Source: JST

In the context above, the area of public parks will increase by 375ha newly and its total area will be approximately 400ha together with the existing parks. The population projection of 2030 will be 1,439,000 in Vientiane Capital, so that a parameter of public park area per person in 2030 will be 2.8m<sup>2</sup> per person which is 10 times as much as one in current.

**Table 4.3.47: The Area Estimation of Public Parks for 2030**

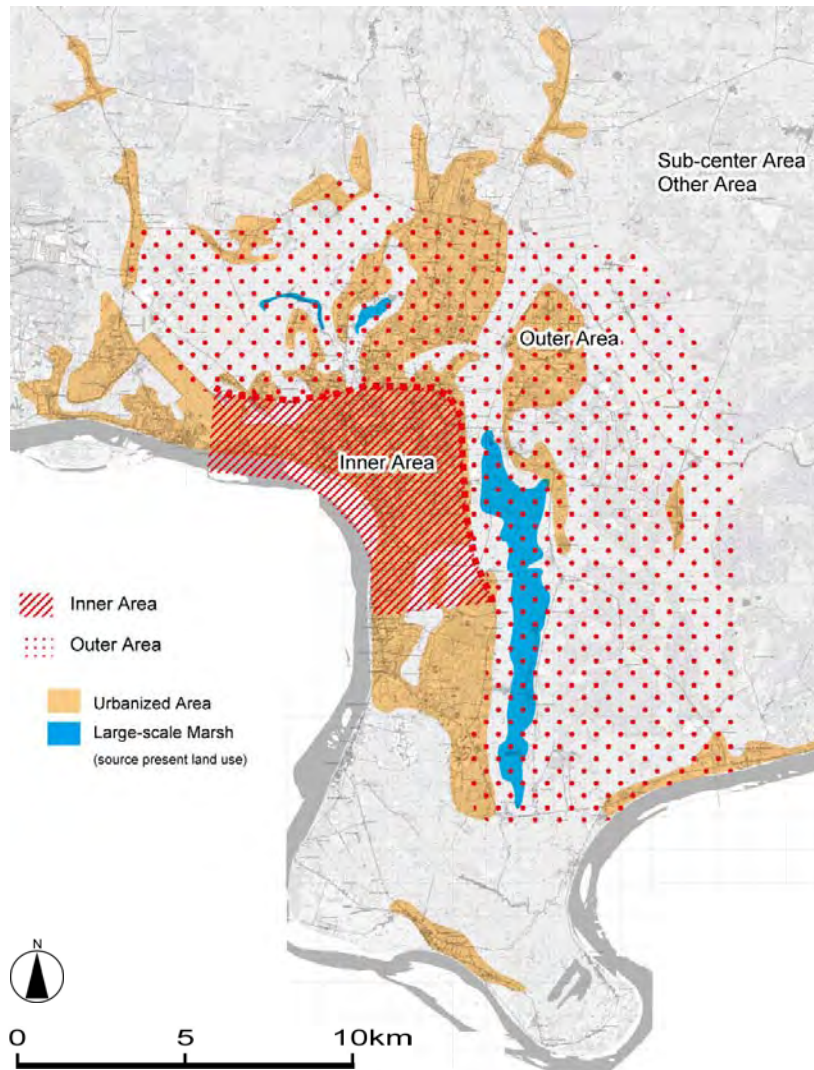
Type of Park	Block Size which one park is constructed (A)	New Urbanizing Area (B)	Number of new public parks to be constructed (C=A/B)	Standard Size of one park (D)	Total area of new public parks (E=C*D)
District Parks	4km <sup>2</sup>	249km <sup>2</sup>	62	1 to 2ha	125ha
Pocket Parks	0.25km <sup>2</sup>	249km <sup>2</sup>	1,000	0.25 ha	250ha
Total Area					375ha

Source: JST

c) *Strategies to Make Public Parks in Urbanized Areas (Inner Urban Zone)*

(a) General

In the urbanized areas, or so-called Inner Urban Zone, there are only 8 existing public parks at present (one parks is outside of inner area). This number seems to be much too small for the capital city, and the distribution of these parks lacks in balance. Therefore it is necessary to make new public parks in urbanized areas, as well as in new urbanizing areas, though finding space for public parks would be more difficult in urbanized areas.



Source: JST

**Figure 4.3.32: Urbanized Areas (Inner Area and Outer Area)**

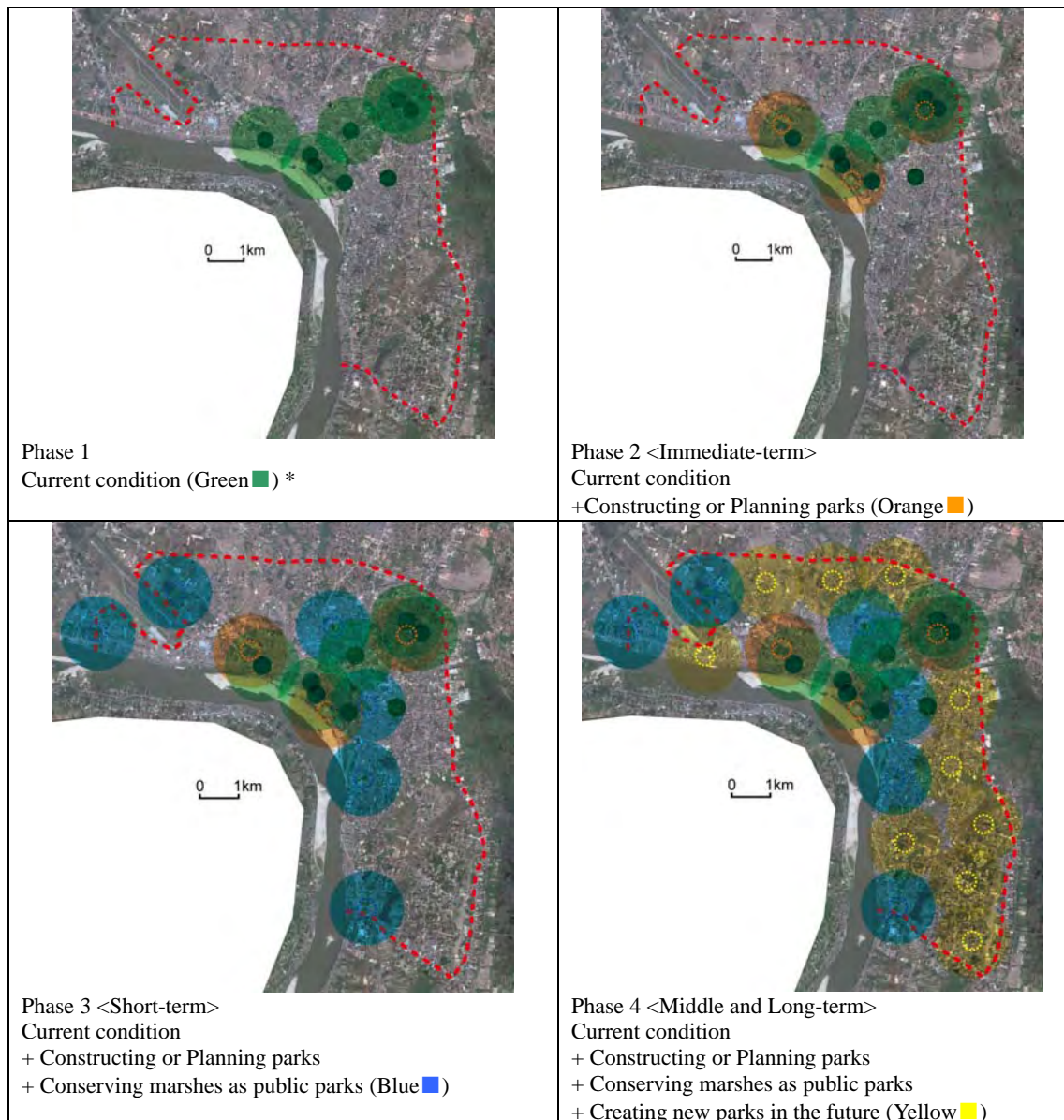
In urbanized areas, large size public parks are needed, and more so than small ones, because there are a number of temples in urbanized area that play a role for improving community relationship, and generally there are much green spaces in these temples. Therefore District Park is considered a more important target in the urban area lacking in existing public parks.



(b) Inner Urban Zone

Figure 4.3.33 and Table 4.3.48 presents a proposed scenario of making District Parks in inner area by main four (4) phases from long-term aspect. First phase is the current condition. In the second phase 3 parks under constructing or planning currently are added. After, in the third phase 6 marshes in the areas lacking in existing parks are added as new parks. Finally, in the fourth phase new parks are added by means of the methods shown in detail in Table 4.3.48.

The parks in inner area will be made by not only Lao governments or Vientiane Capital but also donors due to its highly construction expense and highly appeal effect to the citizens.



\*Existing small parks (less than 1ha) do not have service distance for use, so some parks have no surrounding big circle (right green color) in the figure.

Source: JST

**Figure 4.3.33: Proposed Scenario of Making District Parks in Inner Urban Zone**

**Table 4.3.48: Proposed Scenario of Making District Parks in Inner Area**

Phase	Achieving Time	No. Park	Contents
1	Current	8	- Existing 8 parks(one is outside of inner area) 1) Regent Park, 2) Riverside Park, 3) Patu Xay Park 4) That Luang Park, 5) Xaysetha Park, 6) 555 Park ( <i>small-scale</i> ) 7) 23 Singha Park ( <i>small-scale</i> ), 8) Namphu Park ( <i>small-scale</i> )
2	Immediate-term Within 2-3 years	11	- Adding under constructing or planning 3 parks; 1) Nongsaphanglen Park (near That Luang Temple) 2) Chao Anouvong Park (along the Mekong River) 3) Nong Douang Park (existing marsh)
3	Short-term Within 5 years	16	- Adding 5 marshes where are located at the areas lacking parks; 1) Nong Chan Marsh 2) Thongsangnang Marsh 3) Sokpaluang Marsh 4) Chenaimo Marsh 5) Nong Owe Marsh
4	Middle and Long-term Within 20 years	26	- Adding 10 new parks at least in the areas lacking in parks by means of some methodologies listed below; 1) As part of large-scale public facilities reconstructing or relocating 2) As part of large-scale private development with large open spaces for public use 3) In the course of a land readjustment or urban re-development project

Source: JST

*(c) Outer Urban Zone*

In the outer urban zone, NE zone are designated for remaining natural environment such as That Luang Marsh, Nongtha Marsh, Nongping Marsh. These large-scale marshes are very important as open spaces to provide important functions for mitigating disasters (for example, flood control) and conserving environmental conditions. As mentioned above, if a development project will occur in NE zone, the development construction should be harmonized with natural environment as much as possible.

In addition, it is highly recommended that the rivers flowing through the urban areas such as the Mak Hiao River are improved as natural environment with trail which the citizen can enjoy walking, jogging and running in good natural atmosphere. The Mekong River is an important landmark for Vientiane Capital and the river bank should be improved as natural environment in consideration of landscape of the capital city.



Source: JST

**Figure 4.3.34: Improving Natural River and Riverside with Trail**

4) Strategy4: To Renovate and Improve Public Parks to be more Attracted and Useful

Public parks should not only be for the tourists or for memorial use, but basically for the citizen's use, and thus should satisfy the basic functions (recreation, landscape, mitigation of disaster and nature conservation) to be expected of public parks.

Providing shade spaces by large trees and trails for jogging, running and walking users are also important.

a) *Grasping and Monitoring of Public Park Utilization*

(a) Conducting a Survey

In Vientiane Capital, there are only 9 existing public parks but it is quite likely that those parks are used in much different ways by users. JICA Study Team carried out "A survey of public parks utilization" to examine and grasp the current condition of park utilization. Table 4.3.49 shows an outline of this survey (Refer to the Appendix-5 for the detailed results).

**Table 4.3.49: Outline of a "Survey of Public Parks Utilization"**

Survey Name	Survey of Public Parks Utilization
Target parks	Four (4) parks which are used mainly by the citizens not by tourists - Regent Park - 555 Park - Riverside Park - Xaysetha Park
Contents of the Survey	(1) Counting total numbers of users in 4 time zones (2) Interviewing with some users in same time zones of (1)
Date of the Survey	Two (2) days in weekday and weekend - 11 <sup>th</sup> /June/2010 (Weekday) - 12 <sup>th</sup> /June/2010 (Weekend)

Source: JST



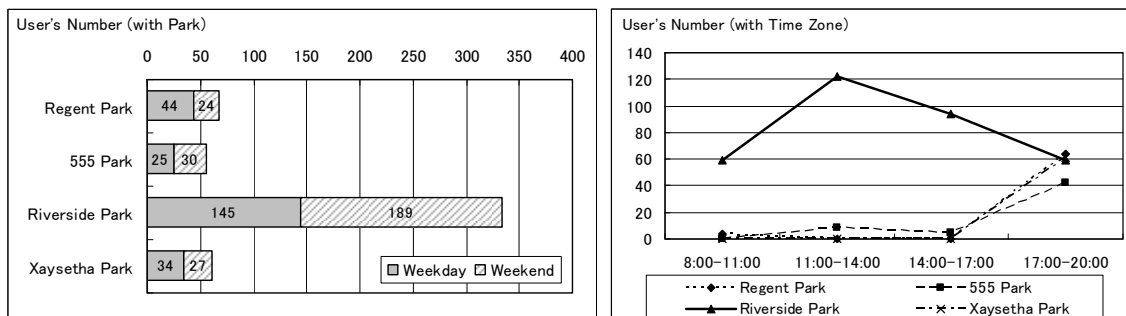
Source: JST

**Figure 4.3.35: Four (4) Public Parks the survey conducted**

(b) Outline of the Result of the Survey

Some important points in terms of renovating public parks clarified by the result of the survey are as follows;

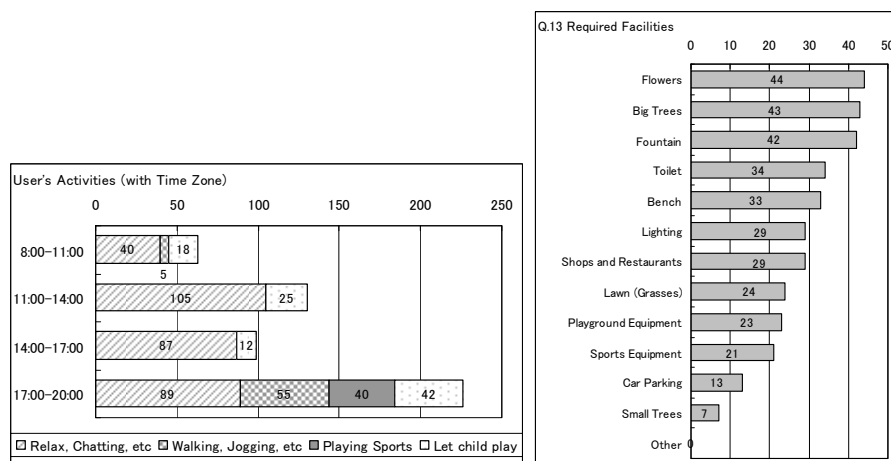
- Figure 4.3.36 shows the number of users by time zones in each park. The result clearly shows that the total number in Riverside Park was much more than the others. In addition, the result indicated that Riverside Park was the only park used intensively during the day time (8:00-17:00), while all other parks were seldom used in the day time. Riverside Park has much more shade spaces by large trees on the site than the others. Therefore, it seems that comfortable shady spaces provided by large tree tend to be attracted users in the day time. Hence shady spaces are considered to be necessary to increase the number of users and to satisfy the citizen's needs in parks.



Source: JST

Figure 4.3.36: The Number of Users in Transition at the time

- Figure 4.3.37 shows the purposes of use. The result clearly shows that main purpose in the day time (8:00-17:00) are relaxing, chatting and making child play, and purpose in the evening (8:00-17:00) shifts to walking, jogging and playing sports.
- Figure 4.3.37 shows required facilities for the parks. Many users need flowers, large trees and fountains.



Source: JST

Figure 4.3.37: The Purpose, and Required Facilities of Park Users

This survey would be more informative if monitored every 5 years to check whether the public parks is used by more users or not in relation with the policies, regulations and projects to be conducted. JICA Study Team proposes to continue the monitoring with this survey by the Lao side in future.

*b) Strategies to Renovate and Maintain to be more Attracted and Useful Public Parks*

Based on the result of the survey, the following strategies are proposed for consideration when new public parks are constructed or existing parks are renovated.

(a) Basic Idea for renovating

- Satisfying the functions to be expected of public parks listed below as much as possible at the time that public park is planed and constructed.

- (a) Providing spaces for recreation
- (b) Improving landscape
- (c) Mitigating disasters (flood control etc.)
- (d) Conserving nature

- Considering public parks not for the tourists or for memorial use, but basically for the citizen's use,.
- Making maximal use of existing and remaining natural elements such as marsh, pond, forest, trees and the other in the site of public parks.
- Considering the role of each public park according to its size and service distance. A smaller and nearer park should be for relaxing, and a larger and more distant one should be for multi-purpose.

(b) Shady Spaces and Big Trees

- Providing shady spaces by large trees in the public parks, as it seems a very important factor for use by users according to the result of the survey.
- Making maximal use of existing large trees as much as possible at the time of construction of the public parks.
- Planting and raising large trees in public parks such as *Samanea saman* (Figure 4.3.38), *Ficus annulata* (Figure 4.3.38) and *Ficus religiosaes* from the long-term aspect.
- Covering the surface of pubic parks with grasses especially under a large tree to make cooler spaces even in the day time.

(c) Water Spaces

- Making maximal use of existing marsh, pond and river as much as possible at the time of construction of the public parks (Figure 4.3.38).
- Constructing fountains or a pond in the public park to improve the scenery and make cooler based on the requirement of the users (Figure 4.3.38).





**Figure 4.3.38: Ideas for Renovating the Public Parks**

(d) For Jogging and Walking Demands

- Keeping up with the emerging demand for jogging, running and walking users in or around public parks especially in (large) District Parks.
- Considering not only inside the park space but also surrounding road (side walk) of parks to meet users' demands for running, jogging and walking.

(e) Making Parks with Specific Concept

- Making parks with specific concepts send messages and create new trends for citizens and to satisfy citizens' specific and important demands such as follows;
  - 1) Ecological Park
  - 2) Playground Park
  - 3) Botanical Park
  - 4) Forest Park

5) Strategy5: To Improve Major Urban Arteries with Rich Greenery

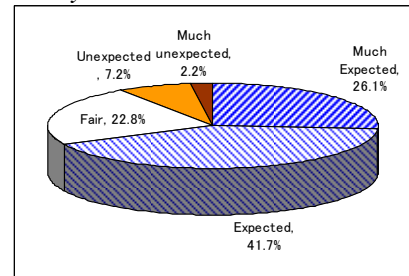
Improving green scenery by means of planting roadside trees along the major urban arteries with flowers and grasses should be carried out.

Providing roadside trees may normally use linear planting method at regular intervals but sometimes partial or irregular planting by using even small spaces could be considered.

a) *Basic Ideas for Improving Urban Arteries with Greenery*

In general, green scenery along major roads has an important role of making impression on the citizens and tourists. Therefore to improve greenery along the roads especially major urban arteries is necessary, as greenery in urban has a effect of attracting people as depicted in a survey in Japan shown in Figure 4.3.39.

Source: Social experiment Survey (MLITT Japan: 2005)



**Figure 4.3.39: Expectation of Green effect for Attracting People**

It is high time to re-consider scenery along which road is better suited for the future as shown in Figure 4.3.40, as Vientiane Capital has been losing much of traditional scenery with urbanization.



Kouvieng Road in 1991  
(Source: Vientiane Times, issue 119)



Source: JST

**Figure 4.3.40: Alternative Scenario of Road Scenery**



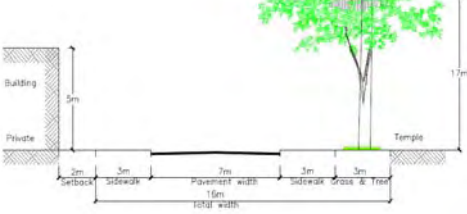
b) *Grasping and Monitoring of Green Scenery Coverage*

(a) Conducting a Survey

JICA Study Team carried out “A survey of green scenery coverage” to calculate and grasp ratios of green coverage in pictures taken at 21 points along the main urban roads as shown in Table 4.3.50. In addition, an analysis was done by using green scenery coverage ratios in

relation with types of roadside trees and sections of roads (Refer to the Appendix-5 for the detailed results).

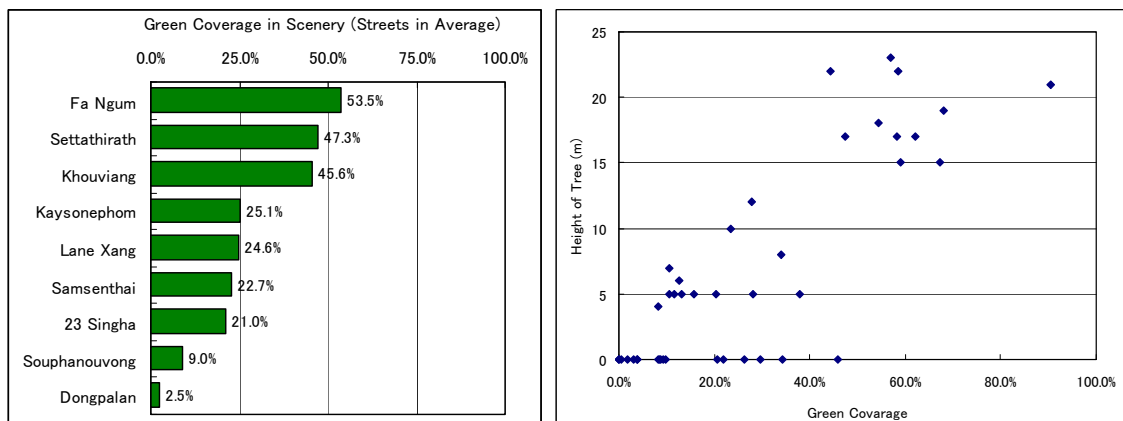
**Table 4.3.50: Outline of a “Survey of Green Scenery Coverage”**

Survey Name	Survey of Green Scenery Coverage
Target Street and Points	Nine (9) roads and 21 points - Lane Xane - Settha Thirath - Souphanouvong - 23 Shinha - Samsenthai - Kaysonephom - Khouviang - Dongpalan
Sample of Analysis	(One points along Settha Thirath Road)
	
Original Picture	Identifying Green Coverage
	
Section of the Road	

Source: JST

*(b) The Outline of the Result of the Survey*

The results of the survey are shown in Figure 4.3.41. High averages of green scenery ratio are seen at Fa Ngum (53.5%), Settha Thirath (47.3%) and Khouviang (45.6%) roads, and there is a positive correlation between ratio of green scenery coverage and the height of roadside trees, as shown in Figure 4.3.41. Basically, the height of trees can be defined as the species of trees due to its potential to growth when fully grown. In other words, ratio of green scenery coverage is in close relation with the type of roadside trees.



Source: JST

**Figure 4.3.41: The Result of the Survey of Green Scenery Coverage**

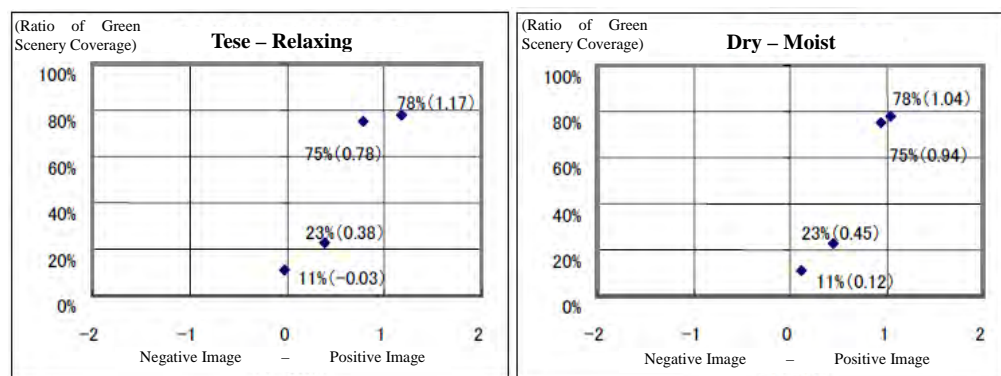
This survey would be more informative if monitored in every 5 years to check whether road with greenery has been improving or not in relation with the policies, regulations and projects to be conducted. JICA Study Team proposes to continue the monitoring with this survey by the Lao side in future.



c) *Strategies to Improve Major Urban Arteries with Rich Greenery*

(a) Basic Idea for Greenery

- Improving green scenery along the major roads by means of planting roadside trees with flowers and grasses along major urban arteries (main trunk roads).
- Planting and raising large trees as roadside trees such as *Samanea saman* and *Swietenia macrophylla* and increasing the ratio of green scenery coverage in the long-term aspect for improving good impressions such as “relaxing” and “moist” as shown in Figure 4.3.42.
- Providing roadside trees not only in linear planting at regular intervals but also with partial or irregular planting by using even small spaces.
- Selecting the tree species to be planted based on those characteristics such as height, shape and flower (Refer to the Appendix-5).



Source: Social experiment Survey (MLITT Japan: 2005)

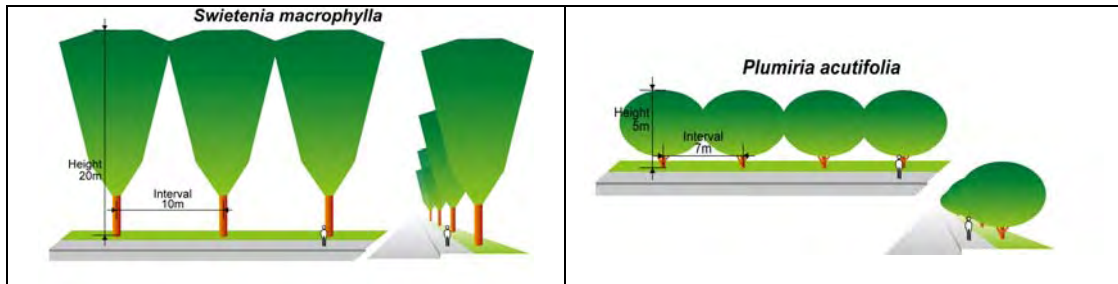
**Figure 4.3.42: The Proportion between Ratio of Green Scenery Coverage and Impressions**

(b) Linear Planting (Basic Method)

It is necessary to consider how to plant roadside trees in consideration both of avoiding hindrance to drivers and making good spaces for pedestrians. Basic ideas of linear planting are as follows;

- Selecting the tree species which can grow up 15m high or more.
- Selecting the tree species which have single and vertical trunk.
- Selecting the tree species which make its tree crown at a higher level so as to provide clear sight ahead for drivers and prevent pedestrians from darkness at night.
- Considering to making efficient use of roadside spaces with tall, middle or small trees, flowers and grasses. Better planting would be to plant small trees and flowers on the roadside and tall one on the building side to avoid hindrance to drivers.
- Considering to providing clear sight for a memorial, cultural and historic objects such as Patu Xay and That Luang, in the case that the vista of object through the road is important for creating scenery.

- Considering the interval of planting based on the characteristics of the tree species, such as size and shape of the crown and height, as shown in Figure 4.3.43 for some examples of typical roadside trees.



Source: JST

**Figure 4.3.43: Some Examples of Planting Typical Roadside Trees**

(c) Partial Planting

It is necessary to consider and adopt partial or irregular planting in the case that planting spaces are limited.

- Considering partial planting to make a pocket park or make the roadside spaces more attractive and comfortable for use where many pedestrians may gather and enjoy.
- Selecting the tree species which can grow up high and make a good single shape such as *Samanea saman*, *Ficus annulata* and *Ficus religiosaes*.
- Using part of car parking lane for partial planting.

(d) Strategies according to the Rank of the Roads

It is recommended to consider how to plant roadside trees according to the rank (types) of the roads as shown in Table 4.3.51.

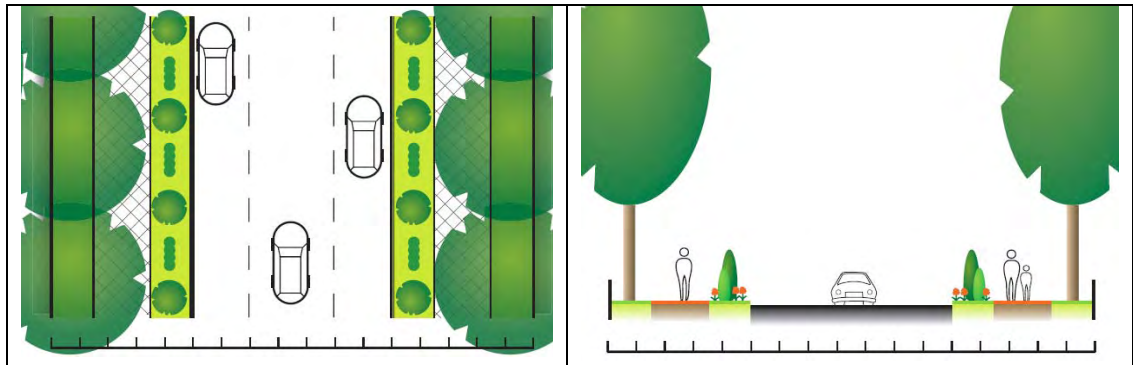
**Table 4.3.51: Strategies according to the Rank of the Roads**

Type of Road	Requirement	Planting Policies
Symbol Trunk Road	- Dignity - Scenery - Easy to walk	- High and large crown trees <High level in the height> ex: <i>Swietenia macro</i> , <i>Samanea saman</i> - Symbolic trees <Middle level> ex: <i>Plumiria acutifolia</i> - Colorful flowers <Low level>
Symbol Trunk Road with Vista	- Vista - Dignity - Scenery - Easy to walk	- Middle crown and regular height trees <High level> ex: <i>Swietenia macro</i> , <i>Tectona grandis</i> - Symbolic trees <Middle level> ex: <i>Plumiria acutifolia</i> - Colorful flowers <Low level>
Shopping and Tourism Road	- Easy to walk - Attractive - Scenery	- Point panting with large crown to make shade <High level> ex: <i>Samanea saman</i> - Flower and symbolic trees <Middle level> ex: <i>Plumiria acutifolia</i> , <i>Delonix regia</i> - Colorful flowers in planting container <Low level>
District Trunk Road (Others)	- Locality - Scenery	- Flower and symbolic trees <Middle level> ex: <i>Plumiria acutifolia</i> , <i>Delonix regia</i> , <i>Lagerstroemia ma etc.</i>

Source: JST

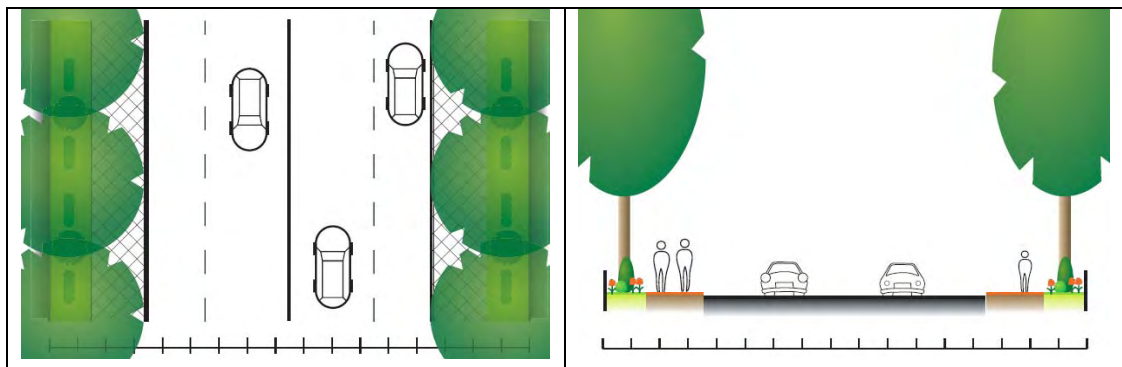
(e) Strategies according to the sections of the roads

According to the sections of the road, it is necessary to consider how to plant trees and flowers efficiently. Planting in combination of large trees, middle trees, small trees (Shrub) and flowers in some typical sections of the roads are proposed as shown in Figure 4.3.44, 4.3.45 and 4.3.46. In each case, it is necessary to consider providing shade spaces for pedestrians, avoiding hindrance to drivers, protecting pedestrians from accidents, safe guarding pedestrians from darkness at night and improving good landscape.



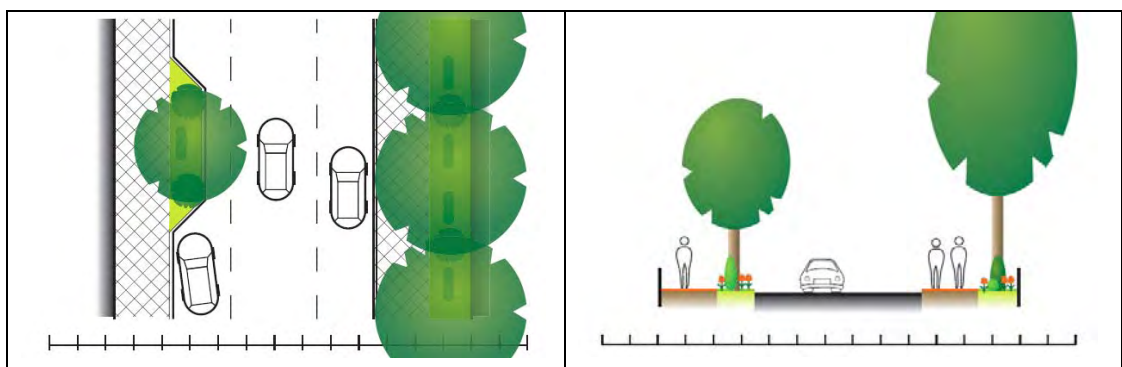
Source: JST

Figure 4.3.44: Plan and Section along the Road which have two lanes of sidewalks in both sides



Source: JST

Figure 4.3.45: Plan and Section along the Road which have one lane of sidewalk in both sides

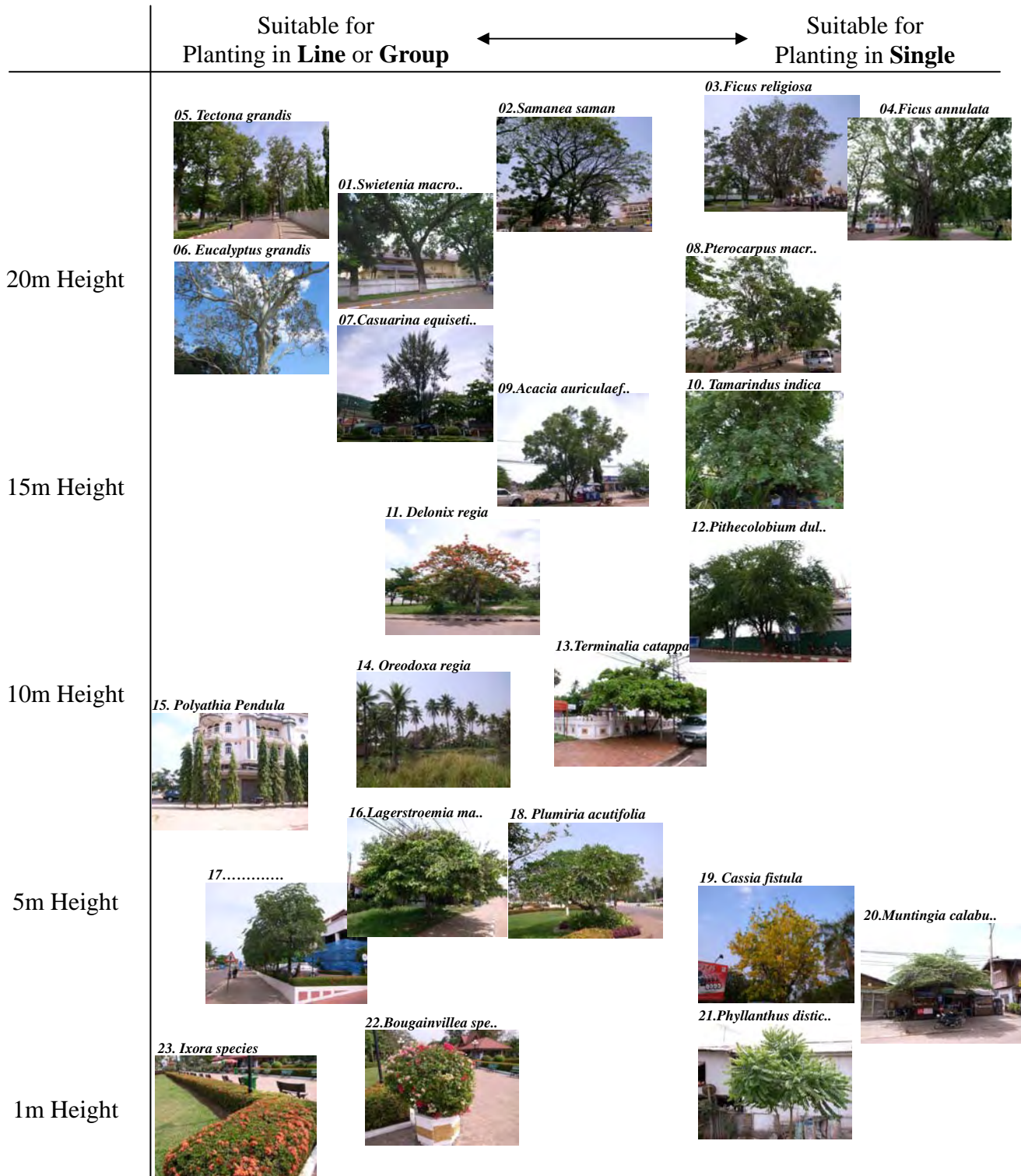


Source: JST

Figure 4.3.46: Plan and Section along the Road which have one lane of sidewalk in one side

d) *Selecting Tree Species to be Planted*

When selecting trees for planting, to understand and consider the characteristics of the tree species is quite important. Figure 4.3.47 shows the average heights and suitable situations for plantings (Refer to the Appendix-5).



Source: JST

Figure 4.3.47: Tree Species to be Planted and those Characteristics



6) Strategy6: To Improve Private Spaces with Rich Greenery

Mainly two (2) categorized strategies should be adopted, one of which is promoting and disseminating information related to greenery and the other is constructing a system for recommendation, guidance and supporting for greenery.

a) *Strategies to Improve Private Spaces with Rich Greenery*

To improve private spaces with rich greenery, mainly two (2) main categorized strategies should be adopted, one of which is promoting and disseminating information related to greenery and the other is constructing a system for recommendation, guidance and supporting for greenery.

(a) Information and dissemination

- Making and distributing “Greenery guideline for private properties” (refer to a framework in next section)
- Holding public seminars and making a qualification system to register the persons who can support greenery activities in practice
- Selecting 100 symbolic trees, or so-called “Vientiane 100 Trees”

(b) System for recommendation, guidance and supporting

- Making a consulting channel supported by professional advisers for greenery
- Supporting for improving greenery of regional level both in expenses and in practice
- Subsidizing and supporting hedges, containers and planters for individual houses both in expenses and in practice
- Constructing a system of recommendation and guidance for greenery in large-scale development in cooperation with those who are seeking building permit

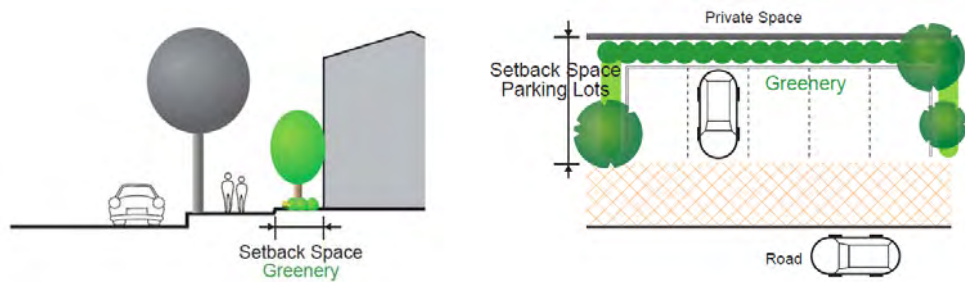
b) *Framework of the Greenery Guideline*

JICA Study Team proposes a framework of the greenery guideline for private property as follows. This framework is expected to be elaborated in detail and be informed to the citizens by relevant Lao authority.

(a) Greenery on the Boundary with Road Spaces

(a-1) Setback Spaces

- Improving greenery as much as possible in the setback spaces in cooperation and harmony with existing greenery in private spaces. (Left in Figure 4.3.48)
- In the case of making a car parking lot in the setback spaces, improving greenery by providing planting spaces in the car parking lot and by covering the surface with grasses and blocks. (Right in Figure 4.3.48)

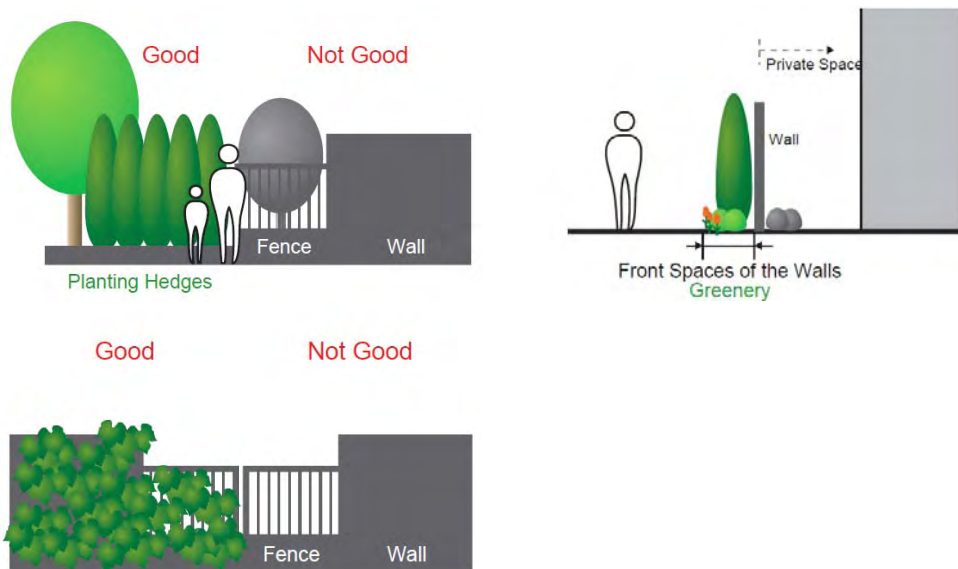


Source: JST

**Figure 4.3.48: Greenery Images of Setback Spaces**

(a-2) Hedges

- Planting hedges on the boundary with road spaces, instead of putting walls or fences. (Upper Left in Figure 4.3.49)
- In the case of putting walls or fences, planting hedges in the front of walls or fences in the setback spaces. (Upper Right in Figure 4.3.49)
- In the case of the walls causing a sense of oppression for road spaces, improving greenery on the wall, or so-called “green curtain”. (Lower Left in Figure 4.3.49)



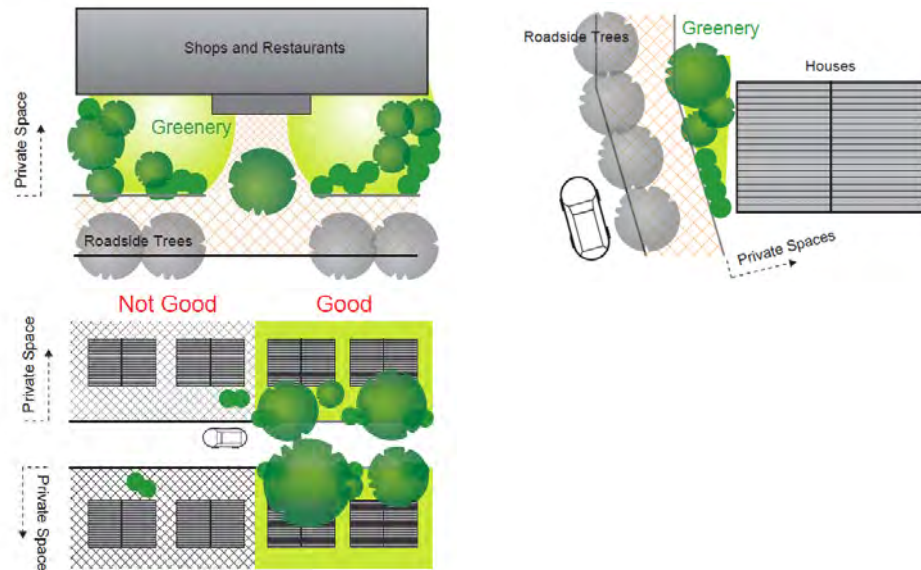
Source: JST

**Figure 4.3.49: Greenery Images of Hedges**

(b) Greenery in Private Spaces

(b-1) Front Spaces of Roads

- Improving greenery in the front space or courtyard of shops or restaurants to provide good atmosphere for guests. (Upper Left in Figure 4.3.50)
- Improving greenery in the front space or corner space of houses. (Upper Right in Figure 4.3.50)
- Improving greenery in cooperation with the neighborhood to make more effective greenery by adopting a common greenery design code. (Lower Left in Figure 4.3.50)

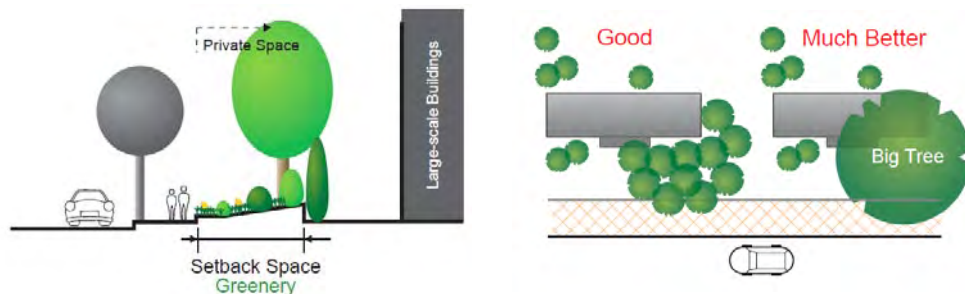


Source: JST

**Figure 4.3.50: Greenery Images of Front Spaces of the Roads**

(b-2) Large-scale Spaces

- Making open spaces in front of buildings and improving greenery to mitigate a sense of oppression caused by large-scale and high buildings. (Left in Figure 4.3.51)
- Planting symbolic trees which can grow up high and large trees in the future to provide shade and relaxing spaces. (Right in Figure 4.3.51)



Source: JST

**Figure 4.3.51: Greenery Images of Large-Scale Spaces**

(b-3) Temples and Historical Places

- Maintaining and improving greenery in harmony with temples and historical buildings to provide cultural and relaxing atmosphere and be attracted peoples. (Figure 4.3.52)

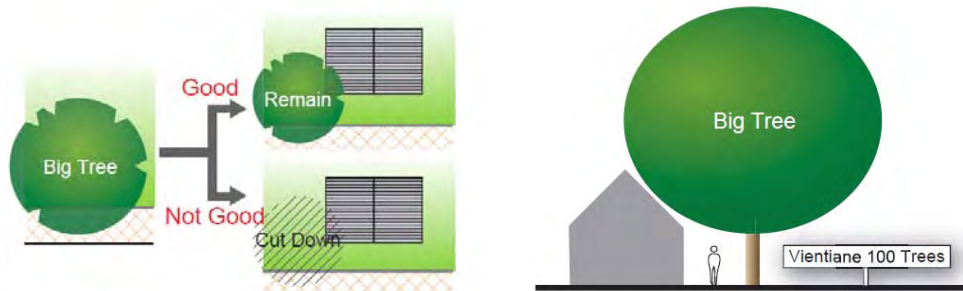


Source: JST

**Figure 4.3.52: Greenery Images of Temples and Historical Places**

(b-4) Symbolic Trees

- Preserving and maintaining existing large trees as much as possible to build up on the good landscapes even when new buildings constructing. (Left in Figure 4.3.53)
- Selecting 100 symbolic trees, or so-called “Vientiane 100 Trees”, to promote conservation of large and conspicuous trees in urban areas. (Right in Figure 4.3.53)



Source: JST

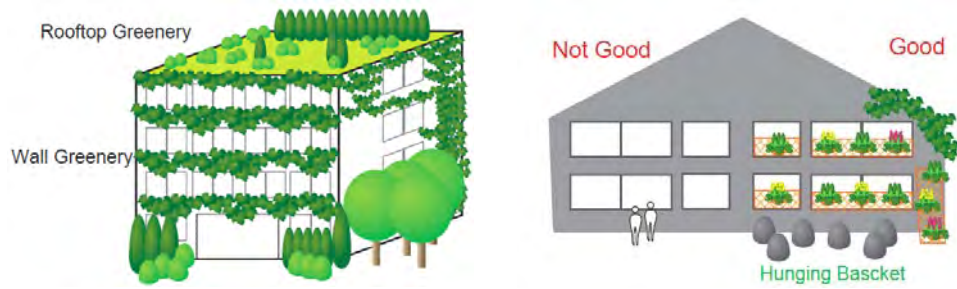
**Figure 4.3.53: Greenery Images of Symbolic Trees**

(c) Greenery attached to Buildings

(c-1) Wall and Rooftop Spaces (Ecological Buildings)

- Improving greenery by use of walls, rooftop and veranda spaces of large-scale buildings to be “ecological building”. (Left in Figure 4.3.54)
- Hanging plant baskets on windows, fences and walls with beautiful and colorful grasses and flowers to make attractive spaces. (Right in Figure 4.3.54)





Source: JST

**Figure 4.3.54: Greenery Images of Wall and Rooftop Spaces**

(c-2) Containers and Planters

- In the case of limited spaces for greenery, putting movable containers or planters and planting small green with colorful flowers as much as possible.