3.9 Power Supply Plan

3.9.1 Framework of Power Supply Development Plan

(1) Present Condition of the Area Surrounding VIP

As for the area surrounding VIP, 22 kV distribution lines from 115/22kV Khoksaad Substation are being maintained. However, in case of an increase in the number of tenants in the industrial park, the existing 22 kV distribution lines will not be enough.

As shown in Table 3.9.1, the transformer capacity of the 115/22 kV Khoksaad substation (two 22 MVA units) nearest to VIP will be insufficient in the future. The power demand forecast does not include the demand of VIP, and so far, the 115/22 kV Khoksaad Substation has no plans for expansion.

Table 3.9.1: Power Demand Forecast for the 115/22 kV Khoksaad Substation

Unit:MW

	Actual	Forecast						
	2008	2009	2010	2011	2012	2013	2014	2015
Peak Demand	20.00	20.20	21.00	23.22	27.40	30.00	34.80	35.80

Source: EDL

(2) Issues on the Development of VIP

According to the regulation on electric power technical standards for constructing electric facilities, if the voltage reaches 100 kV or more for the substation and transmission lines, and the length of new lines reaches 5 km or more for 22 kV distribution line, the project owner shall apply for approval from the Ministry of Energy and Mines (MEM) during the detailed design stage.

Table 3.9.2: Application and Approval by MEM

Applicable Facilities	Name of Documents
Transmission Line (100 kV or more)	Application Form for Election or Dismissal of Registered Chief Engineer
	Application Form for Permission of Transmission Line Facilities
	Drawings
	Detailed design documents
Substation (100 kV or more)	Application Form for Election or Dismissal of Registered Chief Engineer
	Application Form for Permission of Substation Facilities
	Detailed design documents
	Tender documents including drawings
22 kV Distribution Line (5 km or more)	Application Form for Election or Dismissal of Registered Chief Engineer (before detailed design)
	Application Form for Permission of Distribution Line Facilities
	Drawings
	Owner's inspection record for detail design

Source: Electric power technical standards

3.9.2 Power Supply Plan

When the power supply from the Electricite du Lao (EDL) is requested by a private company (i.e. factory), power supply facilities (i.e. transmission lines, substation and distribution lines) shall be constructed by VIP. and shall be connected with 22 kV distribution line to the tenants.

(1) Design Concept and Standard

Design concepts of power supply system in the VIP are as follows:

- The power supply facilities shall be constructed at initial stage to provide sufficient power supply to tenants
- The power supply system shall be highly reliable and flexible at the time of extension.
- Construction cost shall be reduced as much as possible.
- Since landscape in VIP shall be considered, underground cables shall be partially adopted.

Applicable design standards for power supply system are as follows:

- International Electro-technical Commission (IEC)
- Lao Electric Power Technical Standard (Ministry of Industry and Handicrafts, Department of Electricity)
- Guideline on Operating and Managing Lao Electric Power Technical Standards and Safety Rules for Operation and Maintenance (MEM)
- Distribution Design Manual (EDL)

(2) Power Demand Forecast of VIP

Power demand in VIP was forecasted based on its sales plan and the existing capacity of industrial parks in the surrounding countries. Demand forecast of VIP is shown in Table 3.9.3.

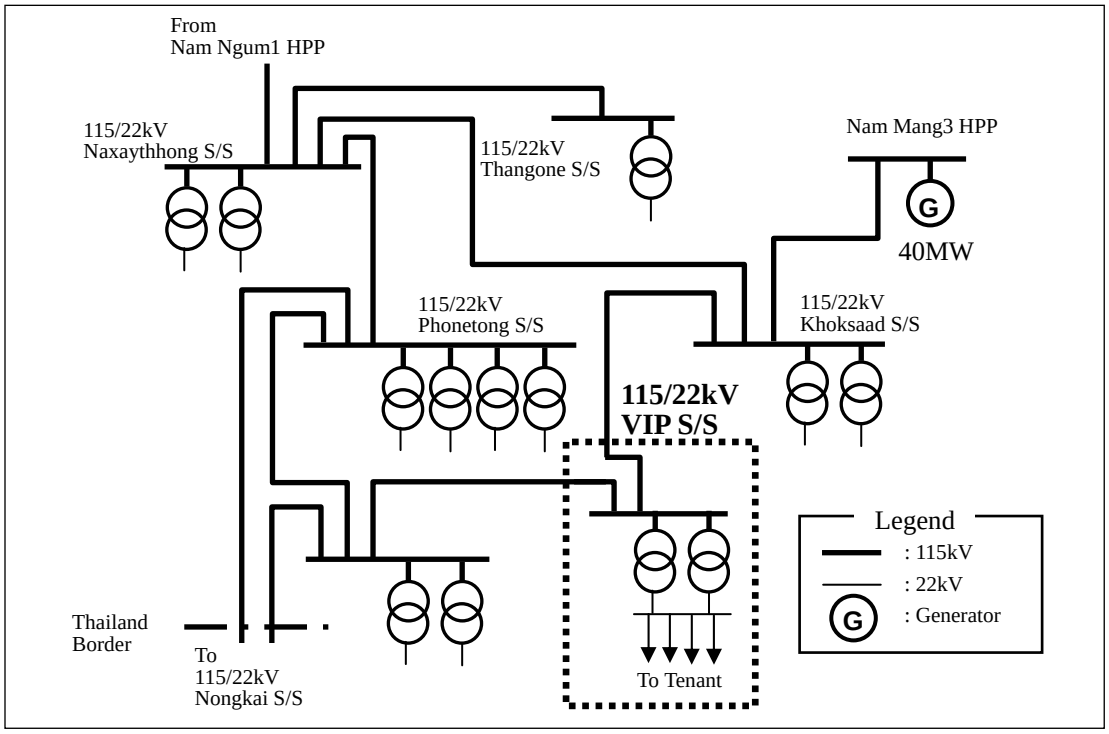
Table 3.9.3: Power Demand Forecast of VIP

Year	Peak Demand (MW)	Power Consumption by year (MWh)
2015	9.49	7,510
2016	18.17	60,747
2017	23.96	96,388
2018	29.75	123,085

Source: JICA Survey Team

(3) Proposed Power Supply System

The existing transformer capacity of the 115/22 kV Khoksaad Substation will be insufficient in the future. Considering reliability and flexibility at the time of extension, VIP shall be developed with a 115/22kV substation during its initial stage. Power supply from this new 115/22kV substation shall be transmitted through 22 kV distribution lines.



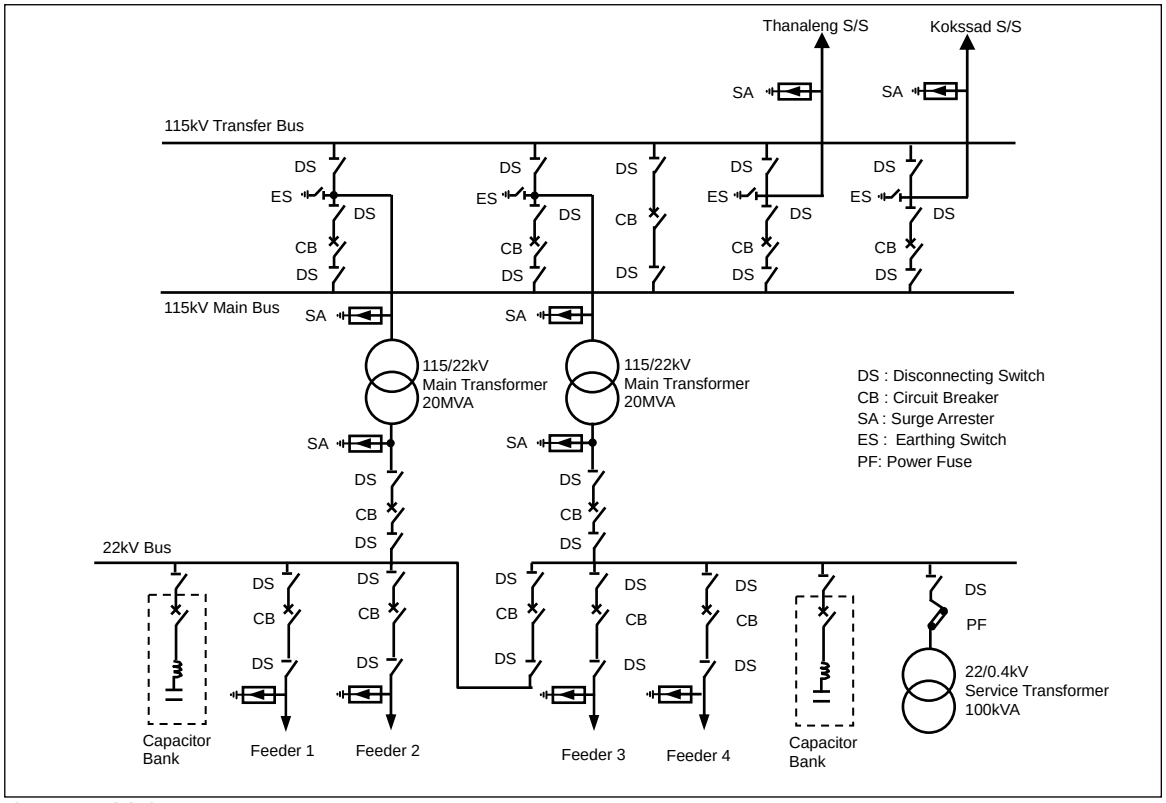
Source: JICA Survey Team based on information from EDL

Figure 3.9.1: Power Grid System Surrounding VIP

1) 115/22 kV VIP Substation Plan

Since peak demand will be 29.75 MW, the main transformer shall be installed with 40 MVA (two 20 MVA units) at its initial stage. Its single line diagram is as shown in Figure 3.9.2.

Additional space for transformer will be secured in the substation area at the time of expansion.



Source: JICA Survey Team

Figure 3.9.2: Single Line Diagram of 115 kV VIP Substation

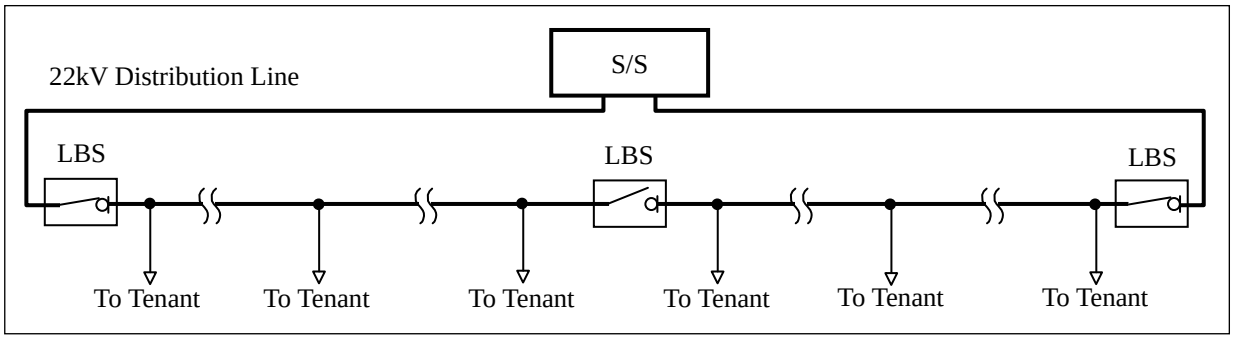
2) 22kV Distribution Line Plan

a) Method of Laying 22kV distribution line

There are two methods of supplying power to tenants, namely the overhead distribution system and the underground distribution system.

① Overhead Distribution System

This method is less reliable compared with underground distribution line. However, since it is possible to supply power directly from all over the 22 kV overhead lines, the workability and expandability of the overhead distribution system is better as the VIP will no longer need a 22 kV switchgear.

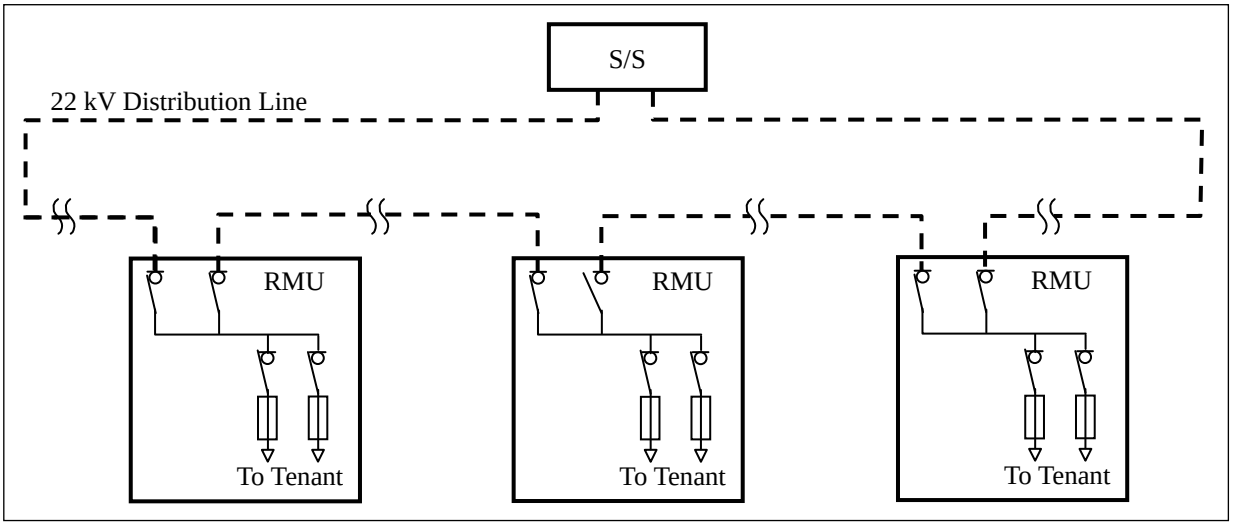


Source: JICA Survey Team

Figure 3.9.3: 22kV Overhead Distribution System

② *Underground Distribution System*

Reliability and landscape of this method is better compared with overhead distribution line. However, in order to supply power to tenants with the 22 kV line, it is necessary to install a ring main unit (RMU), consisting of a 22 kV switchgear panel. The price per unit is approximately USD60,000. The RMU will be installed at boundary lines during the initial stage and if a tenant purchases many lots, several RMUs may be useless. In addition, installation cost for underground lines is five times higher than that of overhead lines.



Source: JICA Survey Team

Figure 3.9.4: 22kV Underground Distribution System

Conclusion of method of 22kV distribution system

The comparison between the two distribution systems is as shown Table 3.9.5. Considering reliability, expandability, and lower construction cost, overhead distribution lines shall be adopted.

It is noted that landscape for the main entrance is very important. Hence, in consideration of landscape, underground distribution lines will be used in the main entrance area and road crossings.

Table 3.9.4: Comparison of Overhead and Underground

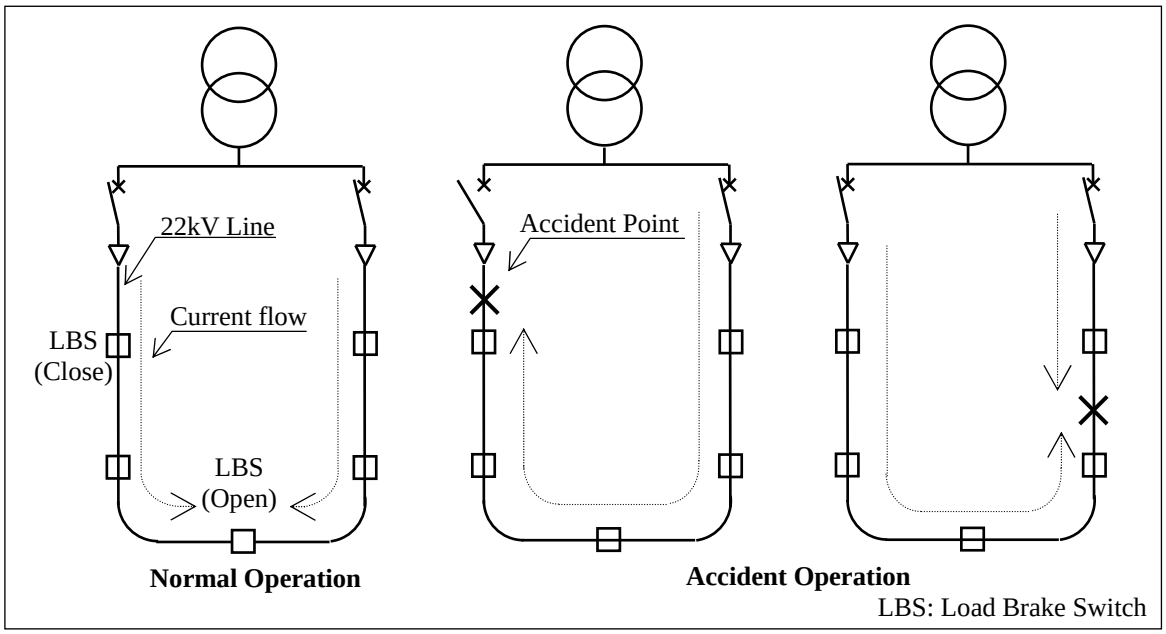
Merit and Demerit	Overhead Line	Underground Line
Landscape	Inferior	Superior
Reliability of natural disaster	Inferior	Superior
Workability of cabling	Superior	Inferior
Expandability of tenant	Superior	Inferior
Approximate Installation cost	Superior (459,000 USD)	Inferior (2,235,000 USD)

Source: JICA Survey Team

b) Configuration of 22 kV Distribution System

In order to improve reliability, the configuration of distribution lines shall be in loop system. A load break switch (LBS) will be installed on the distribution line and current flow will be sectionalized.

Allowable capacity of one loop distribution is up to around 20 MW. Since peak demand will be 29.75 MW, two loops of distribution lines will be installed in VIP.



Source: JICA Survey Team

Figure 3.9.5: Method of Operation for Loop System

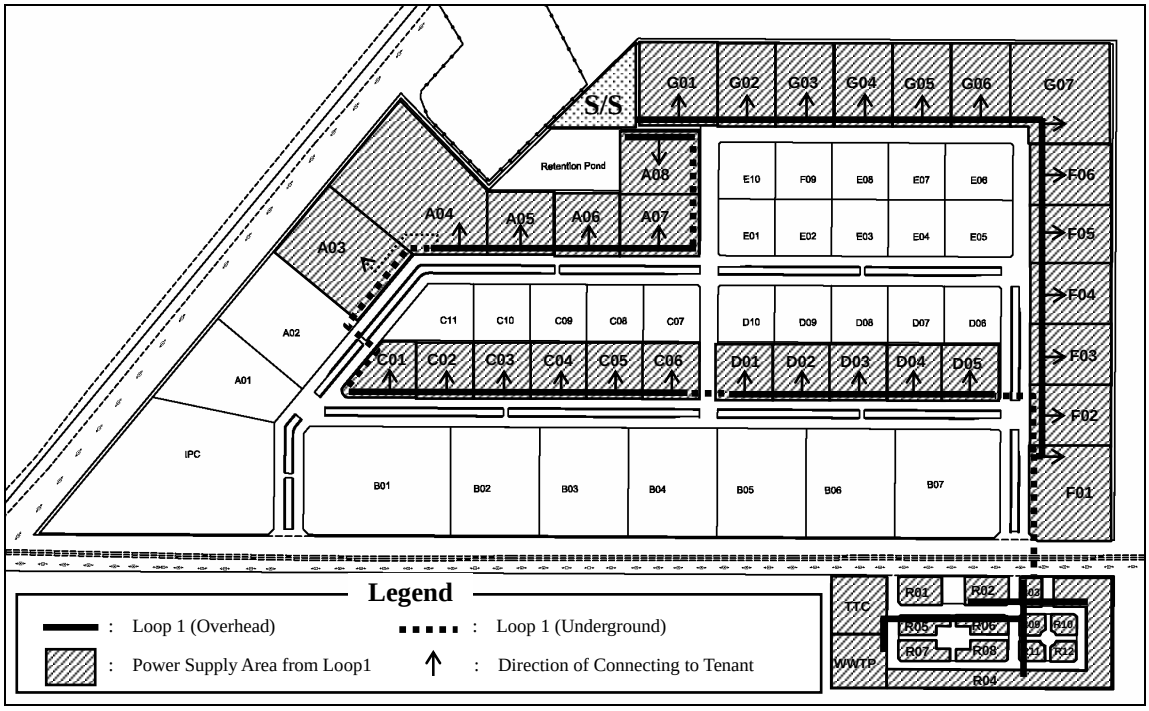
a. Loop 1 Plan

Loop 1 will cover 30 lots occupied by tenants, residents, TTC and WWTP. Power supply area, power demand forecast and route for Loop 1 are shown in Table 3.9.5.

Table 3.9.5: Power Supply to Tenant from Loop 1

Lot No.	Lot Size(ha)	Lot No.	Lot Size(ha)
A3	3.00	F1	2.50
A4	4.58	F2	1.50
A5	1.33	F3	1.50
A6	1.33	F4	1.50
A7	1.60	F5	1.50
A8	1.52	F6	1.50
C1	1.02	G1	2.00
C2	1.00	G2	1.50
C3	1.00	G3	1.50
C4	1.00	G4	1.50
C5	1.00	G5	1.50
C6	1.00	G6	1.50
D1	1.00	G7	3.01
D2	1.00	Residential	-
D3	1.00	TTC	-
D4	1.00	WWTP	-
D5	1.00		
Total size of Industrial Zone (ha)			46.89
Peak Demand Forecast for Loop 1 (MW)			14.57

Source: JICA Survey Team



Source: JICA Survey Team

Figure 3.9.6: 22 kV Distribution Line for Loop 1

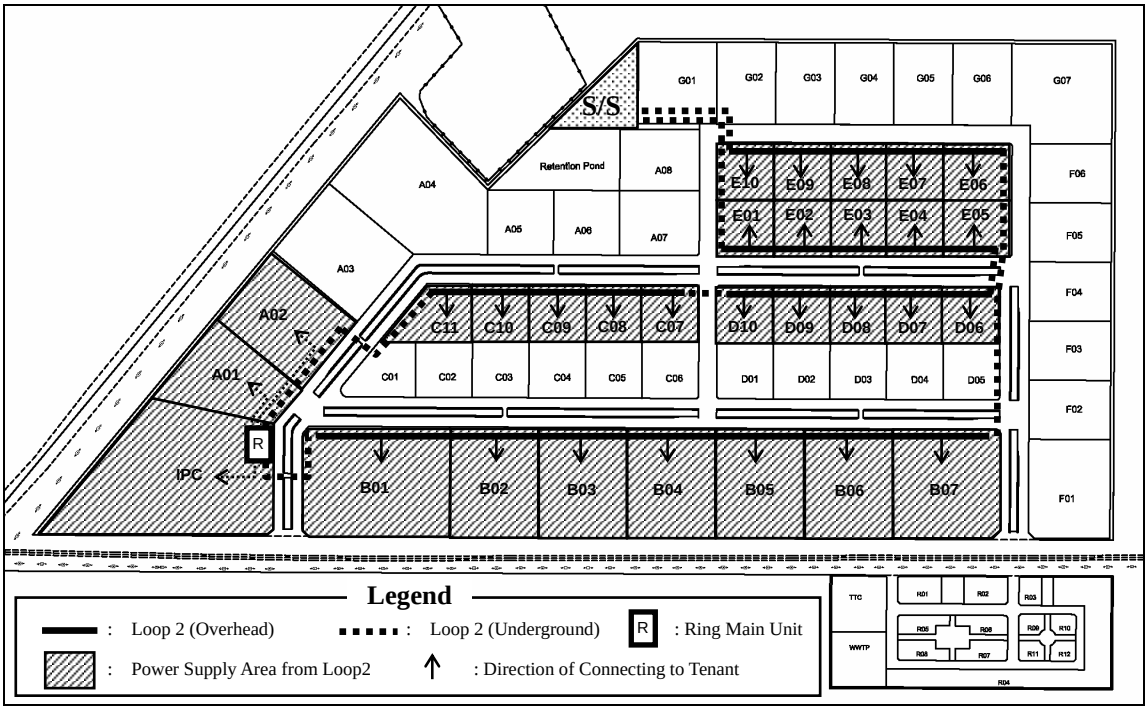
b. Loop 2 Plan

Loop 2 will cover 29 lots, occupied by tenants and IPC. Power supply area, power demand forecast and route for Loop 2 are shown in Table 3.9.6.

Table 3.9.6: Power Supply to Tenant from Loop 2

Lot No.	Lot Size(ha)	Lot No.	Lot Size(ha)
IPC	-	D6	1.00
A1	2.50	D7	1.00
A2	3.00	D8	1.00
B1	4.95	D9	1.00
B2	3.00	D10	1.00
B3	3.00	E1	1.00
B4	3.00	E2	1.00
B5	3.00	E3	1.00
B6	3.00	E4	1.00
B7	3.54	E5	1.20
C7	1.00	E6	1.20
C8	1.00	E7	1.00
C9	1.00	E8	1.00
C10	1.00	E9	1.00
C11	1.22	E10	1.00
Total size of Industrial Zone (ha)			49.61
Peak Demand Forecast for Loop 2 (MW)			15.18

Source: JICA Survey Team

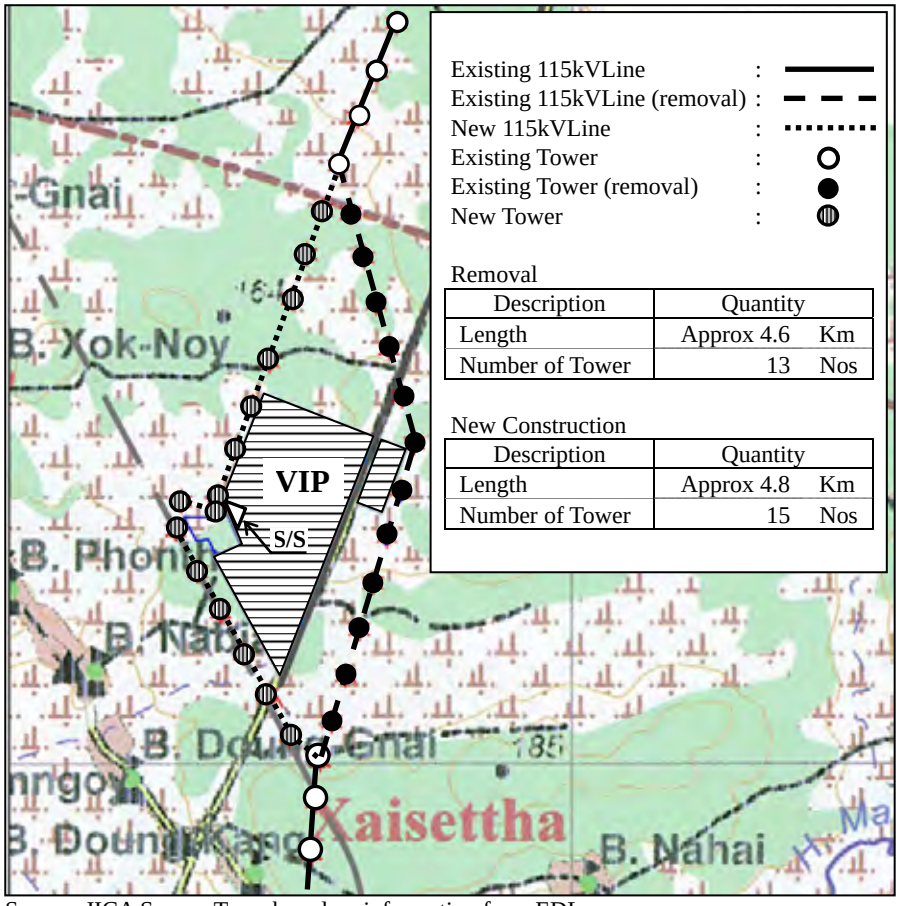


Source: JICA Survey Team

Figure 3.9.7: 22 kV Distribution Line for Loop 2

3) Relocation of 115 kV Transmission Line surrounding Industrial Park

The existing 115 kV transmission line will be realigned because it passes through the proposed industrial park, and will be connected to the VIP substation. Plan for relocation of the 115kV transmission line surrounding the industrial park is shown in Figure 3.9.8.



Source: JICA Survey Team based on information from EDL

Figure 3.9.8: Relocation of 115kV Transmission Line Surrounding VIP

4) Examination on Introduction of Solar Energy

In view of minimizing environmental impacts, it would be beneficial to use photovoltaic generation as power supply. However, its required installation is too expensive considering power tariff in the Lao PDR is low and lifetime of equipment is not long. Therefore, it is impossible to compensate the installation cost from power tariff if interest rate is not considered. A study on introducing photovoltaic generation system is shown in Table 3.9.8. In addition, since the present power in the Lao PDR is generated through hydropower, reduction of CO_2 emission is not expected.

Consequently, since cost is not suitable, photovoltaic generation system shall not be adopted.

Table 3.9.7: Study of Introduction of Photovoltaic Generation System

Generation Capacity (kW) A	Necessary Area (m2) B	Installation Cost (USD) C	Estimated Annual Power output (kWh) d	Convert to Annual Power Tariff (USD) e	Payback period (Year) f (=c/e)
10	180	104,000	14,400	901	115
30	540	259,000	43,200	2,704	96
50	900	417,000	72,000	4,506	93
100	1,800	794,000	144,000	9,013	88

Source: JICA Survey Team

Table 3.9.8: Lifetime of Photovoltaic Generation System

Item	Lifetime (Year)	Proportion of Construction Cost (%)
Solar Panel	20	50
Power Conditioner	10	10

Source: JICA Survey Team based on information from manufacturer

In case that a photovoltaic generation plant will be installed in VIP instead of a 115/22 kV substation, it will require installation of an 86 MW photovoltaic plant including a battery system based on the estimated power consumption. Comparison between photovoltaic generation plant and 115/22kV substation is shown in Table 3.9.10.

Solar radiation in the Lao PDR is high compared with Japan. Since power photovoltaic power generation is during daytime only, and decreases when cloudy or when the sun is either in the east or west, the required capacity of photovoltaic generation must be large.

Table 3.9.9: Comparison between Photovoltaic Generation Plant and Substation

Photovoltaic generation Plant				115/22kV Substation	
Generation Capacity (MW)	Necessary Area (Ha)	Estimated Annual Power output (MWh)	Installation Cost (USD)	Necessary Area (Ha)	Construction Cost (USD)
86	150	123,840	675 million	1.7	9 million

Source: JICA Survey Team

(4) Operation and Maintenance Plan

1) 115/22 kV Substation and 22 kV Distribution System

From the point of view of operation and maintenance (O&M), the 115/22 kV substation and 22 kV distribution system in the VIP shall be handed over to EDL because it would be difficult to employ an electrical engineer with experience in 115 kV and 22 kV voltages. If accident occurs in the VIP substation during operation, which could spread to the electric power system of EDL as the worst case, power failure will occur affecting the other areas.

After the turnover, the 115/22 kV substation and 22 kV distribution system will be maintained by EDL which shall be responsible for power supply.

2) Electrical Utilities Facilities and Overall adjustment

Electrical utilities (i.e. street lighting, IPC building of electrical facilities) are necessary for O&M in VIP. The following institutional aspects are taken into account to reinforce the project implementation organization and establish the O&M mechanism for the electrical utilities.

- O&M of street lighting, IPC building and other electrical facilities.
- Introduction to tenant on EDL
- Adjustment of overall power supply and contact to EDL

3) Power Tariff

Tenants shall be contracted and pay tariffs directly to EDL. VIP will not be involved with power tariff collection.

(5) Conclusion and Recommendations

1) Conclusion

Required facilities for the proposed power supply system plan are summarized in Table 3.9.11. Single line diagram of 115/22 kV substation is as shown previously in Figure 3.9.2. Two 20 MVA transformers are required to be installed based on peak demand. The total length of the 22 kV distribution line consisting of overhead and underground lines is around 10.7 km. About 4.6 km of the existing 115 kV transmission line shall be realigned and with a new length of 4.8 km connected to the 115/22 kV VIP substation.

Table 3.9.10: Summary of Power Supply Facilities

No.	Item	Quantity	
1	**115/22kV Substation**		
a)	115/22 kV Main Power Transformers 20 MVA	2	lot
b)	22/0.4 kV Auxiliary Power Transformers 200 kVA	1	lot
c)	Outdoor Switchgear 115 kV Transformer Bays (includes DS, CB, ES, LA)	2	lot
d)	Outdoor Switchgear 115 kV Transmission Line Bays (includes DS, CB, ES)	1	lot
e)	Outdoor Switchgear 115 kV Bus-tie Bay (includes DS, CB)	1	lot
f)	Outdoor Switchgear 22 kV Transformer Bays (includes DS, CB, LA)	2	lot
g)	Outdoor Switchgear 22 kV Bus Sectionalizer Bay (includes DS, CB)	1	lot
h)	Outdoor Switchgear 22 kV Distribution Line Bays (includes DS, CB, LA)	4	lot
i)	Outdoor Switchgear 22 kV Static Capacitor Bays (includes DS, CB)	2	lot
j)	Control & Protection Equipment	1	lot
k)	Batteries, Chargers & Switchboards	1	lot
l)	Communication Equipment	1	lot
2	**22kV Distribution Line**		
a)	22kV Over head Line	7.7	km
b)	22kV Underground Line	3.0	km
c)	Ring Main Unit (22kV switchgear for power supply to tenant)	1	lot
3	**Relocation of 115kV Transmission Line**		
a)	Removal of 115kV Transmission Line	4.6	km
b)	Removal of Tower	13	unit
c)	New Construction of 115kV Transmission Line	4.8	Km
d)	New Construction of Tower	15	unit

Source: JICA Survey Team

2) Recommendations

The implementation of the following recommendations will be the major basis for the development of an effective and reliable power supply system:

- To enhance the reliability and flexibility of power supply, VIP shall be installed with a 115/22 kV substation at the time of development. All power demand in VIP will be served by this substation.
- As for the 22 kV distribution system for power supply to tenants, overhead lines and two loop systems shall be adopted in order to enhance reliability and expandability, and reduce costs.
- VIP shall be applied for certification from the MEM during its detailed design stage. Regular meetings with EDL regarding power supply will be required.

- A 115/22 kV substation and 22 kV distribution system shall be handed over to EDL. The power supply system will be maintained by EDL.
- An organization for O&M of electrical utilities will be established.

3.10 Telecommunication Plan

3.10.1 Framework of Telecommunication Development Plan

(1) Basic Concept of Telecommunication Development Plan

Telecommunication system will be established in cooperation with telecommunication companies. Telecommunication companies shall handle the switch station development and wiring works for each tenant. Therefore, the development of telecommunication system in VIP will be carried out by telecommunication companies.

Situation of large number of Telecommunication Line in the Vientiane Capital

Overhead transmission lines are typically adopted in the Lao PDR, instead of the underground type. Telecommunication lines will increase in the future, thus, the continuous use of overhead lines could deteriorate the landscape in VIP. Therefore, underground telecommunication lines should be installed for VIP.

Consequently, only the conduit piping system is maintained by VIP side. The wiring in the conduit pipe shall be carried out by the telecommunication companies.

Table 3.10.1: Demarcation Works for Telecommunication System

Work Item	Pertinent
Switch Station	Telecommunication Companies
Telecommunication Line (Trunk line)	Telecommunication Companies
Telecommunication Line (Brunch line)	Telecommunication Companies
Conduit Pipe and Manhole	VIP

Source: JICA Survey Team

(2) Present status of Telecommunication Network

The surrounding area of VIP has already been installed with optical fiber lines under ETL. Considering the situation of the telecommunication trunk line and since Vientiane Capital uses STM-16 (2,488.32 Mbps capacity) as its main trunk line, VIP can be connected with STM-1 (155 Mbps) optical fiber cable trunk line.

The transmission capacity depends on the capacity of the trunk line. When the capacity is insufficient, either switch station must be added or transmission equipment be upgraded based on the telecommunication demand.

3.10.2 Telecommunication Plan

(1) Telecommunication Demand Forecast

Telecommunication demand in VIP was forecasted based on its sales plan and the existing capacity of industrial parks in surrounding countries. The demand forecast for VIP is shown in Table 3.10.2.

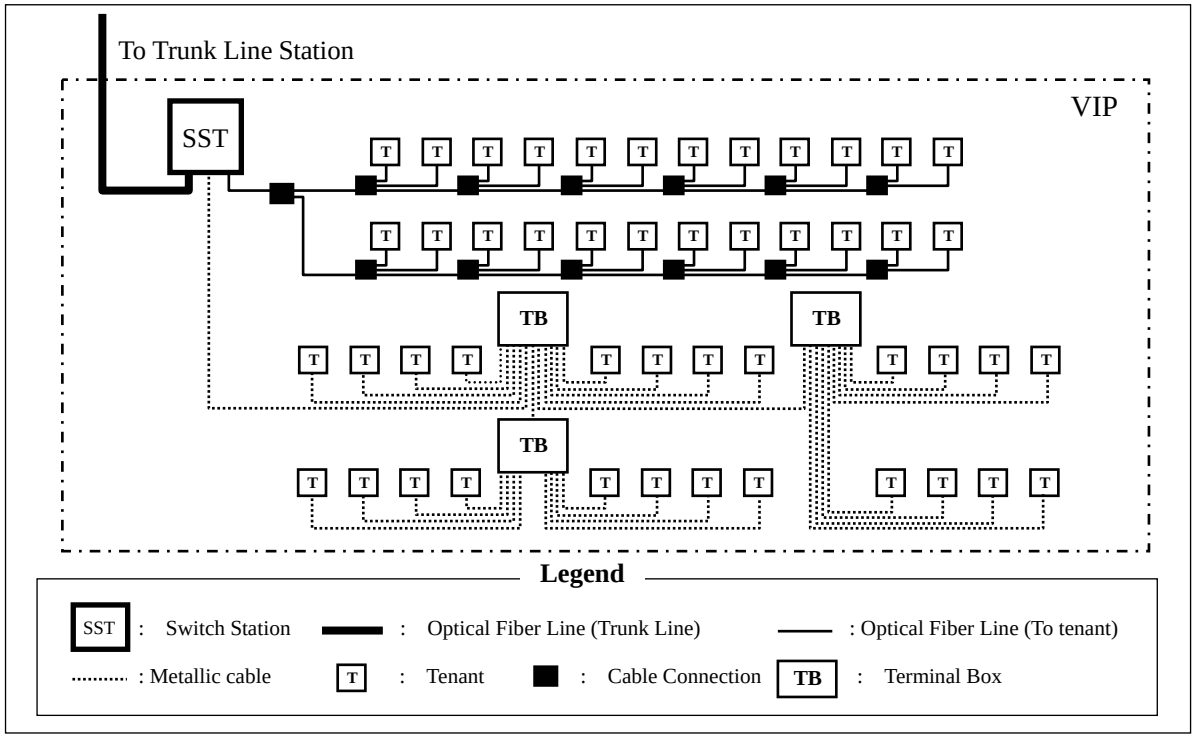
Table 3.10.2: Telecommunication Demand Forecast for the VIP

Year	Peak Traffic Demand (Mbps)
2015	22.93
2016	45.86
2017	61.14
2018	76.43

Source: JICA Survey Team

(2) Method of Connection to Tenants

Since telecommunication demand is estimated to be 76.43 Mbps, one switch station of STM-1 (capacity is 155Mbps) will be installed in the VIP and will be connected to the trunk line by the telecommunication companies. Each tenant will be connected to the STM-1 station. Tenants will select their preferred transmission channel such as optical fiber cable, metallic cable, or wireless LAN.



Source: JICA Survey Team

Figure 3.10.1: Method of Cable Connection between Switch Station and Tenants

(3) Proposed telecommunication infrastructure

The conduit pipe system, which will consist of conduit pipes and manhole, shall be developed within VIP.

1) Conduit Pipe (PVC Pipe 100Φ)

As shown in Table 3.10.3, four conduits are required to be installed along the pipe alignment. Since it is difficult at present to forecast the number of required telecommunication cables, such data will be based on the existing industrial park in Vietnam. No standard telecommunication conduit pipe system is set in the Lao PDR.

Table 3.10.3: Installed Conduit Pipe Number

No.	Purpose of use	Number of Pipe
1	Optical fiber cable	1
2	Metallic cable	2
3	Spare	1
	Total	4

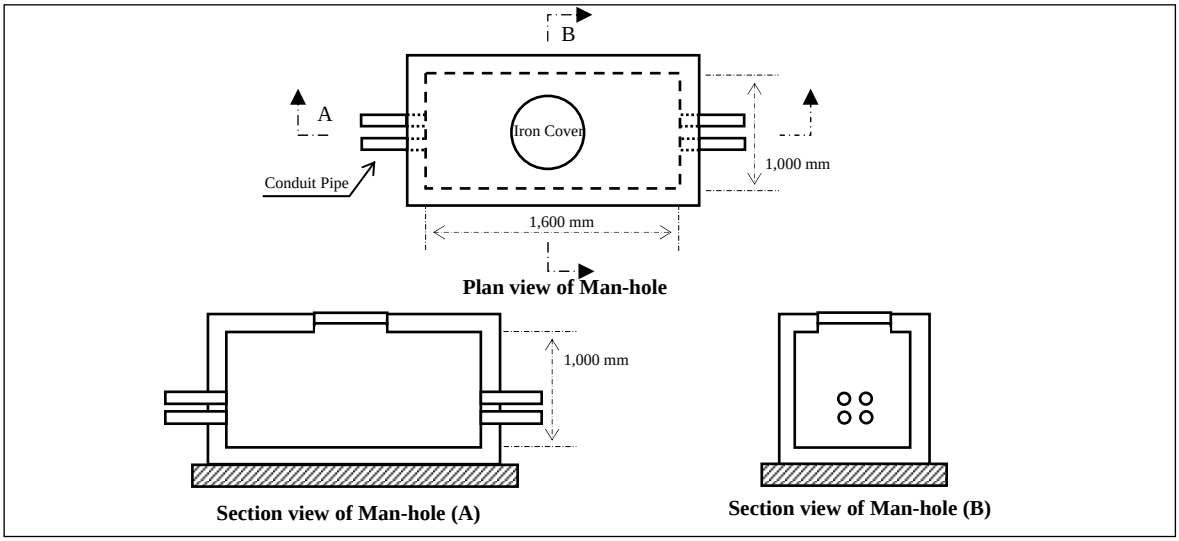
Source: JICA Survey Team

2) Manhole

In order to maintain workability and connection to tenants, manholes will be installed along the conduit pipe. Manholes are to be placed at an interval of less than 300 m along the boundary lines of tenants and road crossings.

Size of manhole shall be selected in consideration of the following points:

Space for bending radius of cables is secured. Working space, which is usually over 1,600 mm (L) x 1,000 mm (W) x 1,000 mm (H), is ensured for cable laying and connection. Outline for manholes is as shown in Figure 3.10.2



Source: JICA Survey Team

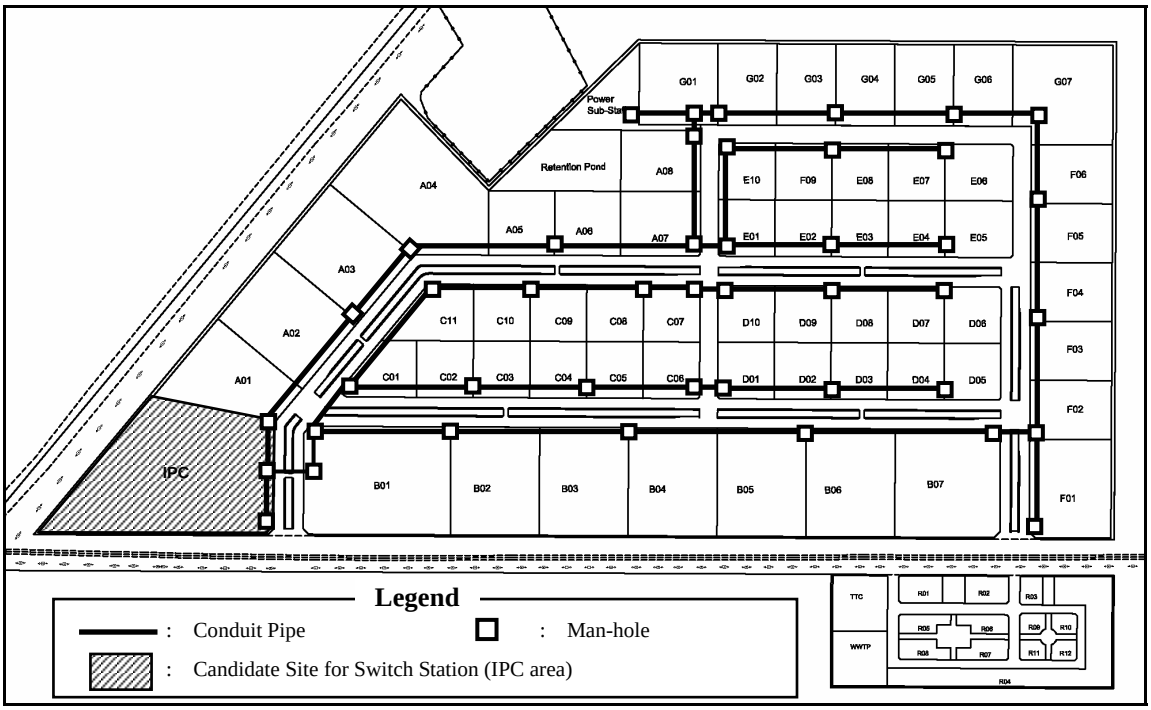
Figure 3.10.2: Outline of Manhole

3) Dimension of Switch Station

Since the area of switch station must be 200 m^2 (20 m x 10 m) based on ETL requirement, it is necessary to secure the above space in IPC area. It is necessary for this matter to be further discussed between telecommunication companies (i.e. ETL, Lao Telecom) during the detailed design stage.

4) Summary of Conduit Pipe System

The plan of the conduit pipe system is shown in Figure 3.10.3. Tenants will be connected to telecommunication lines via the manholes installed along the boundary lines. It is assumed that the switch station shall be constructed in IPC area and wiring works shall be implemented between the switch station and each tenant.



Source: JICA Survey Team

Figure 3.10.3: Route of Conduit Pipe System

(4) O&M Plan

1) Telecommunication Line and Equipment

Telecommunication companies shall conduct O&M on telecommunication lines and equipment in the VIP.

2) Conduit Pipe System and Overall Adjustment

The following institutional aspects are taken into account to reinforce the project implementation organization and to establish O&M mechanism for telecommunication facilities to be managed by VIP. Figure 3.6.5 shows the proposed structure for O&M. Main activities for O&M are as follows:

- Manage and maintain the conduit pipe system.
- Introduce tenants to telecommunication companies
- Adjust overall telecommunication system which should be contracted to telecommunication companies.

3) Telecommunication Charge

Tenant shall make a contract with the telecommunication companies and pay the telecommunication charge directly to them. VIP will not be involved in the collection of telecommunication charges.

(5) Conclusion and Recommendations

1) Conclusion

Required facilities for the telecommunication plan are summarized in Table 3.10.4. The total length of conduit pipe is around 7.7 km with 44 manholes.

Table 3.10.4: Summary of Telecommunication Facilities by VIP

No.	Item	Quantity
1	Conduit pipe PVC Pipe φ100	7.7 km
2	Man-hole (1,600mm x x1,000mm x 1,000mm)	44 units

Source: JICA Survey Team

2) Recommendations

The implementation of the following recommendations will be the major basis for the development of an effective telecommunication system:

- Underground telecommunication lines will be adopted in VIP to preserve its landscape .
- The switch station development and wiring works to each tenant will be carried out by telecommunication companies. VIP shall only maintain the conduit pipe system.
- VIP shall prepare a space for installing the switch station in the IPC area. Regular meetings with telecommunication companies regarding the switch station and trunk line will be required during the detailed design stage.
- An organization for O&M of the conduit pipe system will be established.

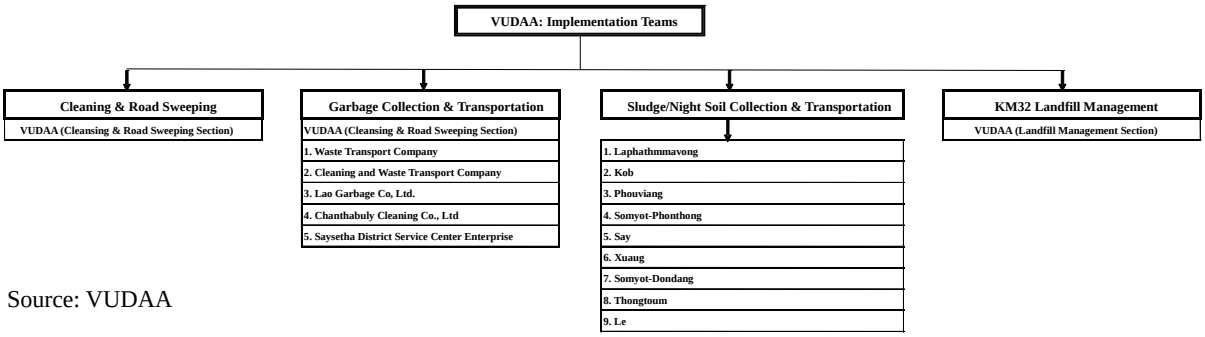
3.11 Solid Waste Management Plan

3.11.1 Framework of Solid Waste Management Plan

(1) Present Solid Waste Management of VUDAA

The implementation team of the Vientiane Urban Development and Administration Authority (VUDAA) is responsible for collecting and transporting garbage, cleaning and sweeping of roads and drainage facilities, and managing the Km 32 Landfill. The present structure of solid waste management is presented in Figure 3.11.1. VUDAA and entrusted five solid waste management enterprises collect garbage in the city and transport to KM 32 Landfill which has 37% service ratio of customers to total households. Waste generation rate, including domestic, commercial, and industrial waste, is estimated to be 1.34 kg/c/d on the average based on the data of actual performance of VUDAA and the five enterprises.

As for sludge and night soil, nine private enterprises handle the collection and transportation instead of VUDAA, as shown in Figure 3.11.1. Hazardous waste is not collected by VUDAA and the private enterprises since there are no disposal/treatment centers for toxic wastes in the Lao PDR. However, VUDAA does not hold the list of wastes defined as toxic/hazardous as provided by the Government of the Lao PDR.



Source: VUDAA

Figure 3.11.1: Present Structure of Solid Waste Management

(2) Basic Concept for Planning

The following concept is applied for solid waste management in VIP:

Target year	: 2015
Planning area	: 140 ha of Vientiane Industrial Park consisting of the industrial area with 130 ha and residential area with 10 ha
Generation quantity projection area	: 101.5 ha consisting of the industrial area with 96.5 ha and residential area with 5.0 ha
Design population	: 6,000
Collection system	: Separate system at tenant side
Toxic/hazardous waste	: Individual treatment or storage at tenant side
Solid waste collection & transportation	: VUDAA
Final disposal site	: Km 32 Landfill

(3) Solid Waste Generation Projection

Domestic wastes generated in VIP, are supposed to be organic products, paper, textile, plastic, rubber, leather, wood, hair, feathers, metal, and glass, which are mostly ordinary wastes. Although some domestic wastes may be hazardous, such as used batteries and household chemicals, the quantity of toxicity will likely be quite small. As for industrial wastes, quantity and components of wastes depend on the type of industries and the actions undertaken by each tenant. The industrial waste generation rates and quantity are estimated as follows:

1) Solid Waste Generation Rate

Industrial solid waste generation rate is calculated based on the result of the investment demand survey conducted by JST and the unit waste generation per tenant recommended by the Design Standard for Core Industrial Estate of Japan as shown in Table 3.11.1. The industrial solid waste generation rate will be 3.13 ton/ha/d.

Table 3.11.1: Industrial Waste Generation Rate in VIP

Type of Industry	Number of investors*[1]	Unit Area*[2] (ha)	Total Area (ha)	Unit Waste Generation*[2] (ton/ha/d)		Waste Generation (ton/d)		
				Combustible	Incombustible	Combustible	Incombustible	Total
Food Manufacturing	6	0.6	3.6	0.40	1.24	1.440	4.464	5.904
Garment & Sewn Product	8	0.4	3.2	0.08	0.02	0.256	0.064	0.320
Chemical	3	3.1	9.3	0.29	3.38	2.697	31.434	34.131
Rubber Manufacturing	1	2.2	2.2	0.12	0.05	0.264	0.110	0.374
Iron & Steel	2	3.5	7	0.03	5.95	0.210	41.650	41.860
Nonferrous Metal	2	4.8	9.6	0.04	6.08	0.384	58.368	58.752
General Machinery Apparatus	4	1.9	7.6	0.05	0.53	0.380	4.028	4.408
Electric Machinery Apparatus	10	1.3	13	0.04	2.81	0.520	36.530	37.050
Transport Machinery Apparatus	4	2.1	8.4	0.06	0.65	0.504	5.460	5.964
Precision Machinery Apparatus	2	0.9	1.8	0.05	9.26	0.090	16.668	16.758
Total	42*[3]		65.7			6.745	198.776	205.521
Average Solid Waste Generation Rate to be adopted for VIP (ton/ha/d)						0.10	3.03	3.13

Source: JICA Survey Team
(Note) *[1]: Data of Investment Demand Survey conducted by JST
*[2]: Design Standard for Core Industrial Estate, Japan Development Corporation
*[3]: The number of investor does not accord to Investment Demand Survey as the investor belong to "General" cannot be utilized for estimation of solid waste generation ratio.

Domestic waste generation rate of VIP will be 1.30 kg/c/d considering past rate of 1.34 kg/c/d on the average in Vientiane Capital and as stated in the Solid Waste Handbook: A Practical Guide (William D. Robinson, 1986).

2) Solid Waste Generation Quantity Projection

Based on the unit water consumption, the water demand projection for VIP was estimated as shown in Table 3.11.2.

Table 3.11.2: Slid Waste Generation Quantity in VIP

	Lot Area (ha)	Population	Generation Rate		Waste Generation (ton/d)
Industrial Area	96.5		3.13	ton/ha/d	302.0
Residential Area	5.0	6,000	1.30	kg/c/d	7.8
Total	101.5	6,000			309.8

Source: JICA Survey Team

The amount of waste generated in VIP is estimated to be 309.8 ton/d, which is composed of industrial wastes with 302.0 kg/d and domestic wastes with 7.8 ton/d, based on the assumption that collection ratio is 100% for all kinds of waste.

3.11.2 Proposed Solid Waste Management Plan

(1) VUDAA and Entrusted Solid Waste Management Enterprises

To ensure adequate solid waste management in VIP, tenants should make contracts with VUDAA, which is responsible for solid waste collection, transportation, treatment, and disposal services in Vientiane Capital. An appropriate solid waste management system could be applied by VUDAA, considering the characteristics of each kind of waste. The following solid waste management

enterprises are registered and entrusted to collect garbage/sludge and transported to Km 32 Landfill as shown in Figure 3.11.1.

Garbage	1) Waste Transport Company, 2) Cleaning and Waste Transport Company, 3) Lao Garbage Co, Ltd., 4) Chanthabuly Cleaning Co., Ltd, 5) Saysetha District Service Center Enterprise
Sludge/Night Soil	1) Laphathmmavong, 2) Kob, 3) Phouviang, 4) Somyot-Phonthong, 5) Say, 6) Xuaug, 7) Somyot-Dondang, 8) Thongtoum, 9) Le

(2) Solid Waste Management Service Fee

VUDAA and the entrusted solid waste management enterprises shall collect fees directly from residents and tenants. Therefore, staff from VUDAA or the entrusted enterprises may periodically visit their customers in VIP to collect fees for their service. Service fees for solid waste management are officially determined as follows:

Services	Fee
1. Garbage Collection & Transportation	
- Domestic Waste	: LAK6,000/basket (25 kg)
- Industrial Waste	: LAK600,000/trip by 5 m^3 truck or LAK300,000/container (2 m^3)
2. Cleaning & Sweeping	
- Road	: LAK65,000/trip by 6 m^3 truck
- Drainage Facilities	: LAK25,000/m^3 for large facilities, LAK20,000/m^3 for small facilities
3. Sludge/Night Soil Collection & Transportation	: LAK250,000/time by 3-4 ton truck
4. Disposal at Km 32 Landfill	: LAK15,000/ton for solid waste, LAK10,000/truck for sludge

Source: VUDAA

(3) Proposed Solid Waste Management Plan

Under the current solid waste management methods, the following authorities are responsible for the respective wastes:

(a) Ordinary solid waste and sewage/sludge: VUDAA and MPWT

(b) Toxic/hazardous waste: Water Resource and Environment Administration (WREA)

It is clear that VUDAA is the executive agency for the collection and disposal of ordinary wastes. Hence, wastes generated in VIP are collected and disposed under agreement with VUDAA. It is also understood that there are no agencies for collection, treatment, and disposal of hazardous wastes in the Lao PDR since WREA is the government agency for formulating environmental policies, and supervising and monitoring environmental impacts. Therefore, hazardous waste producers are required to provide proper treatment and storage facilities in their own premises in accordance with the Environmental Protection Law of 1999 until suitable toxic waste treatment plants and disposal sites are made available by the Government of the Lao PDR.

1) Ordinary Solid Waste

Ordinary solid waste from domestic, public, and industrial sectors of the VIP will be left out for collection in suitable container with a capacity of 2 m^3, typically garbage bin with a capacity of 25 kg. Such ordinary waste shall be collected, transported, treated and disposed at Km 32 Landfill by VUDAA and the entrusted solid waste management enterprises. Recycling is not yet adopted by VUDAA, but should be considered to reduce the amount of waste disposed to Km 32 Landfill and minimize its impact to the surrounding environment. Plastic and inorganic wastes, such as bottles and cans, are collected and reused in practical by private collectors. Non-recyclable waste should be disposed in Km 32 Landfill, which has appropriate

facilities for minimizing pollution. Organic waste will also be disposed in Km 32 Landfill since there are no composting plants in the Lao PDR.

2) Hazardous and Other Wastes

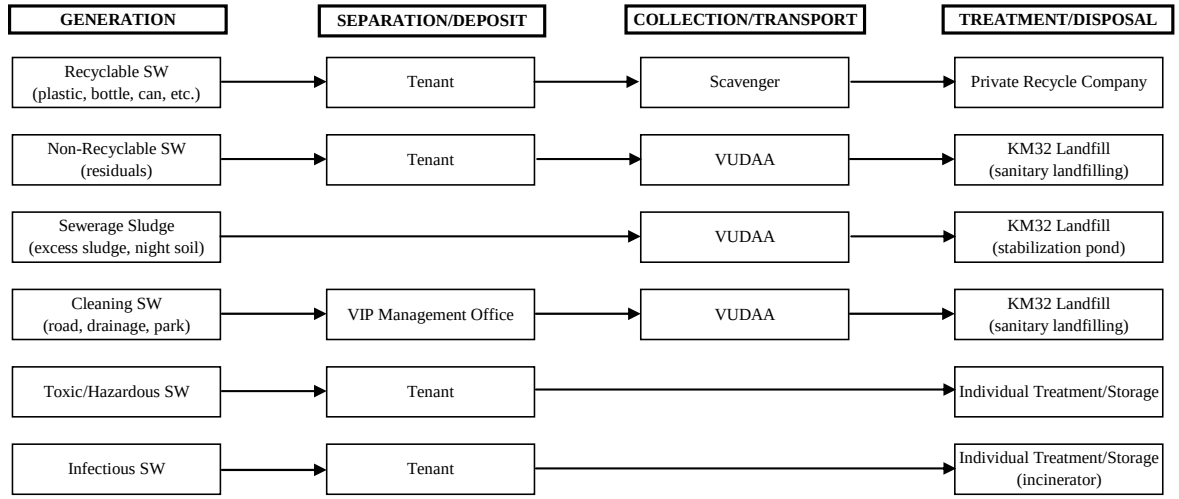
VIP has policy that tenants should not discharge their hazardous wastes as the Lao PDR does not have agencies that are able to treat and dispose these wastes. Accordingly, tenants generating hazardous waste will be obliged to segregate at the source or treat their wastes under their responsibility.

Medical and infectious wastes generated in Vientiane Capital are brought to the incinerator located at and operated by Sethathirath Hospital. Therefore, tenants could transport their infectious wastes to this facility for incineration. It is planned to construct incinerators for three hospitals in 2010 with assistance of SIDA.

Sludge will be generated by wastewater treatment plants and combined type septic tanks in the VIP. The generated amount of sludge is estimated to be 5.0 m^3/day. Sewage sludge will also be collected, transported, and disposed at Km 32 Landfill by VUDAA.

3) Proposed Solid Waste Management System for VIP

The proposed solid waste management system for VIP is summarized in Figure 3.11.2.



Source: JICA Survey Team

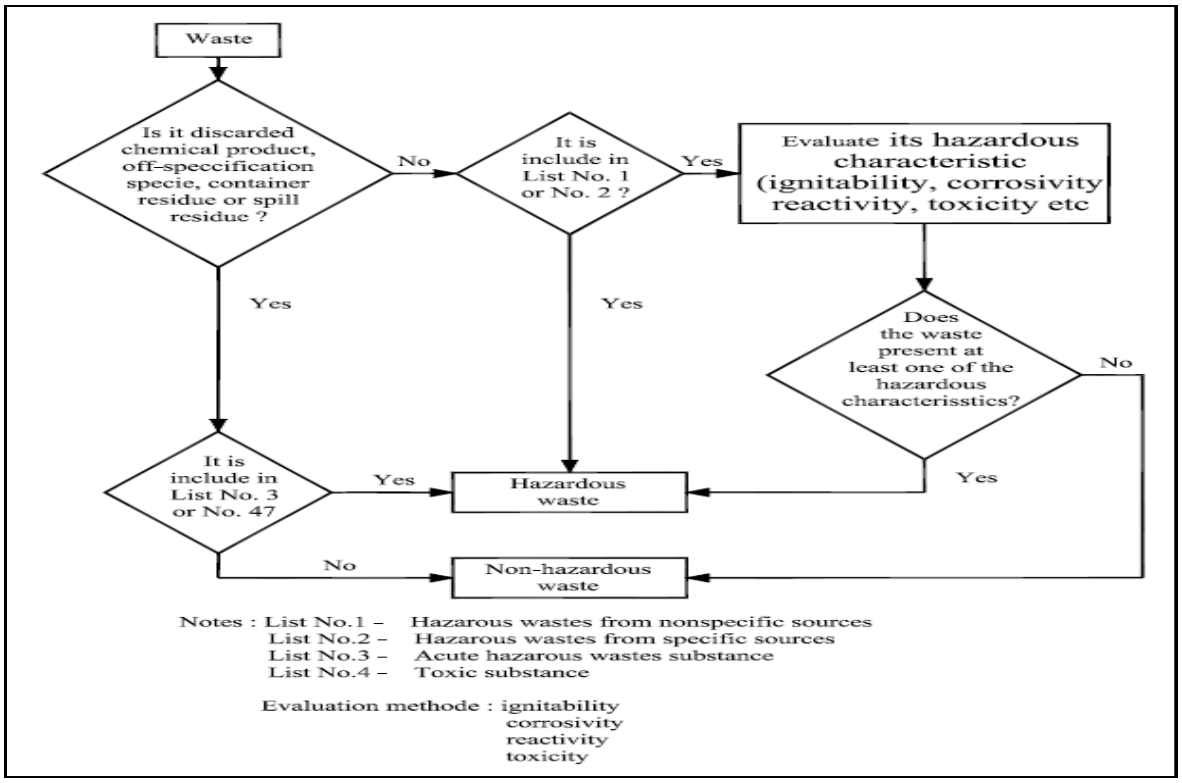
Figure 3.11.2: Proposed Solid Waste Management System for VIP

4) Definition of Hazardous Waste

Although there is no generally accepted definition of the term "hazardous" in relation with industrial solid wastes in the Lao PDR, this term indicates the probability that an industrial waste will cause adverse effects to humans and the environment because of conditions under which they are handled. Therefore, the term "hazardous" has a very wide spectrum of characteristics, namely toxic, carcinogenic, mutagenic, teratogenic, ignitable, corrosive, reactive, radioactive, infectious, and odorous. Each characteristic also has a very broad intensity scale.

Realistic focusing of efforts accompanied by practical definition of hazardous wastes is the key for successful hazardous solid waste management of every industrial estate. There are two methods for defining hazardous wastes: the first is by analysis of hazardous characteristics, and the second is by preparation of lists. The first method can be considered as a direct definition of hazardous wastes, while the second one is as an indirect definition.

In industrialized countries, the method by analysis is used in defining hazardous wastes as shown in Figure 3.11.3. This method should be introduced gradually into the definition system of hazardous wastes to prioritize the capacity of laboratories available in WREA and other agencies responsible for hazardous waste management because the Lao PDR lacks the expertise and sophisticated laboratories for such analysis.



Source: Resource Conservation and Recovery Act 1976, U.S.A.

Figure 3.11.3: Definition of Hazardous Wastes by Analysis

The practical definition of hazardous wastes in the Lao PDR will be through preparation of lists. The lists usually include hazardous wastes from nonspecific sources (e.g. wastes containing PCB and PCT) and from specific sources (e.g. sludge generated from re-refining used oil products). Hazardous wastes in the lists are called scheduled wastes. A definition system of hazardous wastes through the preparation of lists is recommended to be adopted in the Lao PDR. WREA is recommended to provide and regulate lists of scheduled wastes as soon as possible for proper hazardous waste management. Table 3.11.3 presents a sample of scheduled wastes for reference in order for WREA to provide the lists.

Table 3.11.3: Scheduled Wastes (Sample)

No.	Name of Hazardous Waste
1	Hazardous mud, drilling mud and waste, slag, asbestos
2	Waste lubricant and mixture of lubricant water
3	Waste acid solution and base solution
4	Carcass, animal waste, animal and plant wastes
5	Organic plant protection chemicals, wood protection substance, and other bio seed wastes
6	Chemical substance and laboratory mixture waste. Hazardous chemical substance
7	Fly ash emitted from furnace
8	Activated carbon after use
9	Non-halogen solvent
10	Waste paint, color powder, printing ink
11	Colloidal, plastic chemical
12	Color and dye containing hazardous substance
13	Waste neon, fluorescent, electric bowl
14	Electric, electronic component, electronic circuit, capacitor
15	Chrome, nickel, tm, bronze, zinc, mercury, metal residue
16	Waste package, container, rug, contaminated with waste substance
17	Outdated animal food with unidentified hazardous elements
18	Waste electrolytic battery, transformer
19	Saw dust, chip, left timber, plank, fiber containing hazardous elements
20	Substances containing hazardous elements
21	Equipment, waste emission component containing hazardous elements
22	Leather dust, tanning waste
23	Oil and hazardous contaminated metal waste
24	Waste cleaning liquid contaminated with chemical substances
25	Waste package for plant protection
26	Waste containing PCB and PCT
27	Radioactive waste, medical waste

Source: JICA Survey Team

5) Recommendations

In conclusion, the following issues on solid waste management are recommended not only for VIP but also for the Lao PDR:

i) Vientiane Industrial Park Authority-Management Office (VIPA-MO) shall make a general agreement with VUDAA for solid waste management in VIP.

ii) Tenants in VIP shall segregate their hazardous waste at the source and treat it under their responsibility.

iii) In accordance with the agreement between VIPA-MO and VUDAA, all tenants in VIP shall make contracts with VUDAA entrusting them to perform for solid waste collection, treatment, and disposal, in compliance with the relevant legislation.

iv) Tenants in VIP shall periodically report the status of solid waste management in their sites (quantity and quality of generated waste, method of storage at source, etc.) to VIPA-MO and WREA.

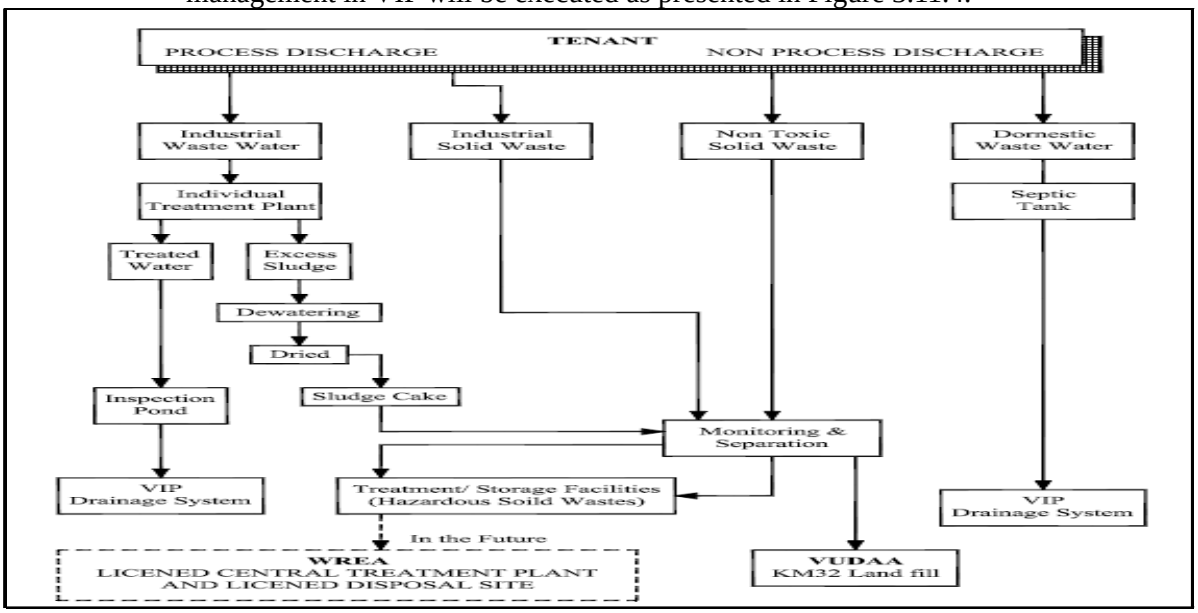
v) Tenants that will generate different kinds of hazardous waste for which VUDAA is incapable to collect, transport, treat, and dispose will not be allowed in principle to be established within VIP.

vi) In case that tenants generate hazardous waste, the tenants shall segregate their toxic/hazardous waste at the source and/or treat it under their responsibility

vii) Tenants who generate hazardous wastes shall submit copies of their records and report on hazardous waste management to WREA and VIPA-MO, as stipulated in the supplementary agreement between VIPA-MO and tenants.

viii) WREA shall provide the list of hazardous waste as soon as possible for proper solid waste management.

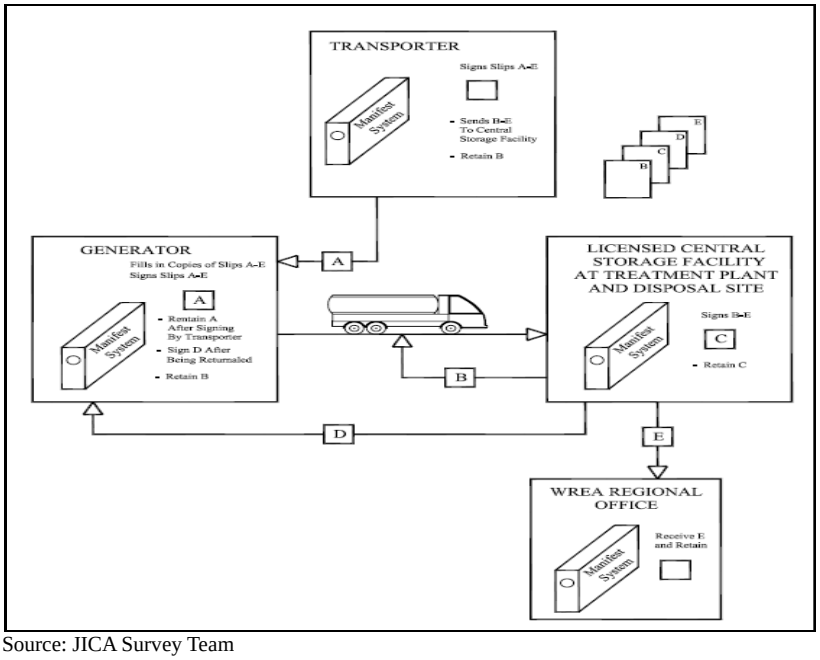
ix) In the near future, the central hazardous waste treatment plant and disposal site licensed by WREA shall be established. Consequently, the industrial waste management in VIP will be executed as presented in Figure 3.11.4.



Source: JICA Survey Team

Figure 3.11.4: Flow Chart of VIP Industrial Waste Management

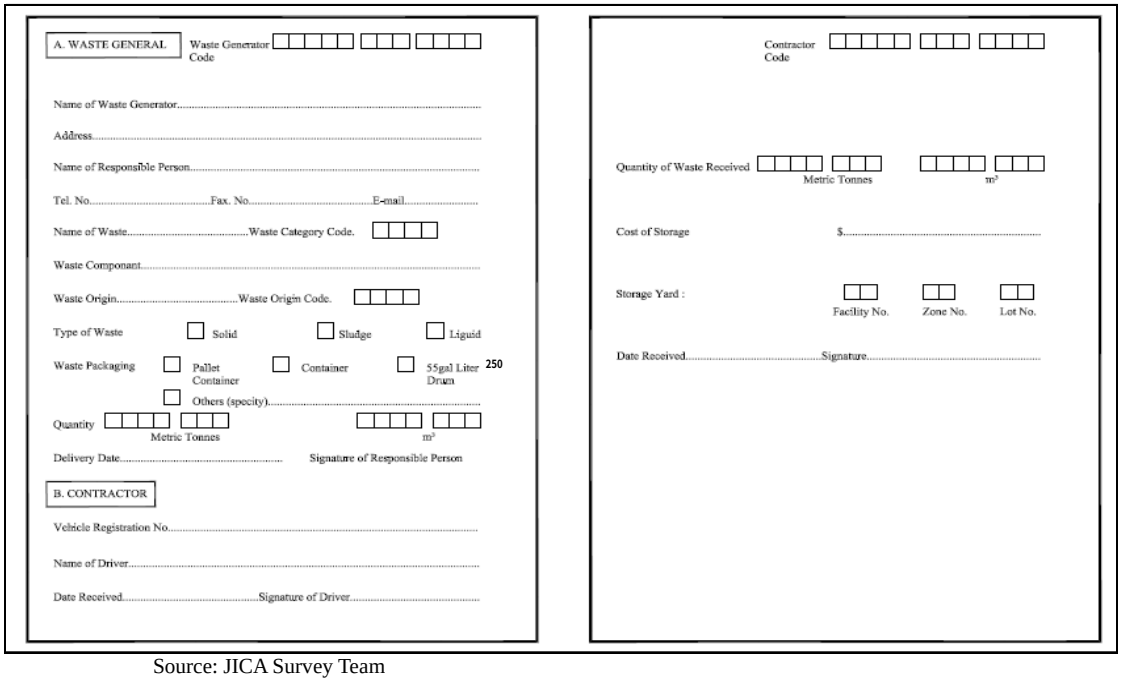
x) The management of hazardous waste shall be controlled and monitored by a manifest system that can track and record scheduled wastes from generation to disposal, as shown in Figure 3.11.5.



Source: JICA Survey Team

Figure 3.11.5: Flow Chart of Manifest System

The proposed manifest system will be conducted essentially by means of a multiple carbon-copy shipping document consisting of five sheets, namely Slip A, B, C, D, and E. The destination of wastes and the procedure for handling of slips are indicated in Figure 3.11.5. The format of the manifest is recommended as shown in Figure 3.11.6.



Source: JICA Survey Team

Figure 3.11.6: Manifest Form (Sample)

3.12 Building Plan

3.12.1 Industrial Park Center (IPC)

IPC will be constructed at the most convenient location for tenants and for managing of VIP. IPC shall be located in front, beside the main gate where visitors will pass.

The lot is less valued by investors due to its inconvenient land shape. To effectively utilize this land, it is proposed to construct public infrastructure, such as retention pond.

Following the successes of existing industrial parks in the surrounding countries, such as Thailand and Vietnam, the IPC shall have space for the following activities:

(1) Management and O&M works for VIPA

(2) Marketing and information for VIPA

(3) Establishment works and/or business supports to the tenants

(4) Banking and insurances services

(5) Health care services

(6) Meal/food and shopping services

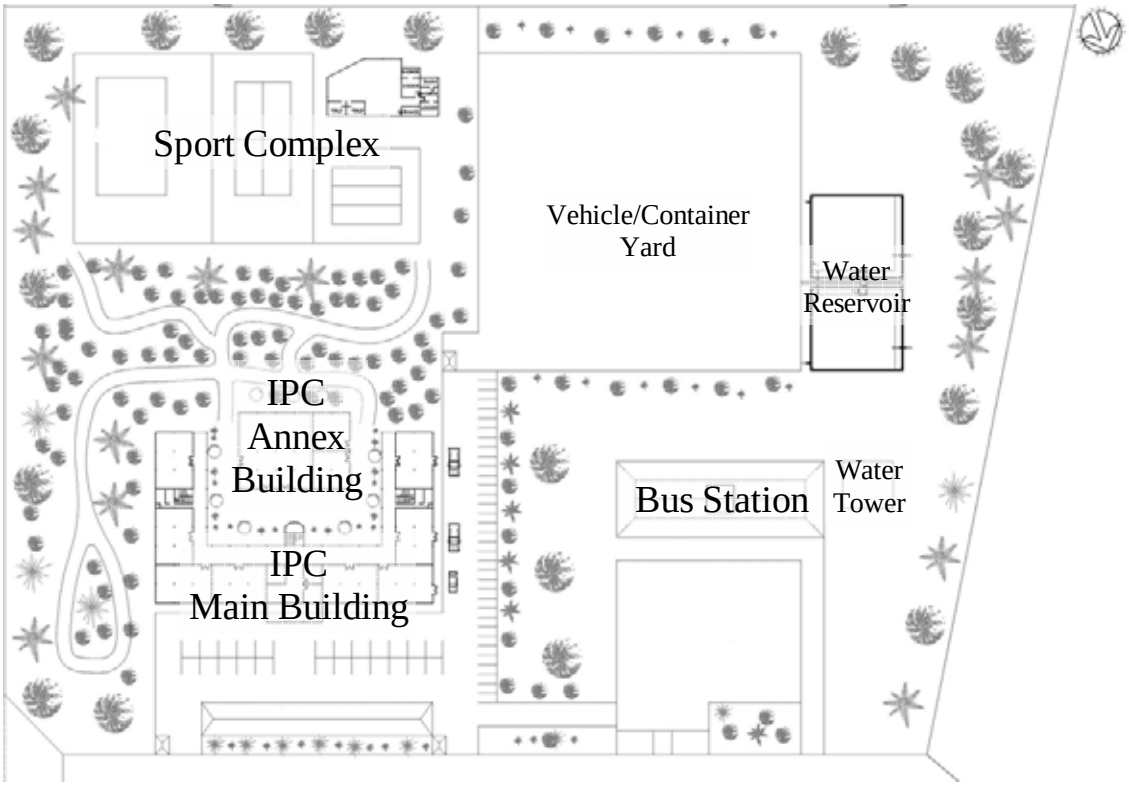
(7) Station for public transportation, such as bus and taxi

(8) Amenities and entertainment

Considering that the features of above items (1) to (5) require individuality, such activities will be carried out in the main building. Public services meanwhile will be located in the annex building. A garden separates said building from the main building.

For better landscape, the height of the building will be limited up to two floors only, or below the height of the trees along the sidewalk in Vientiane Capital.

Layout plan of IPC is shown in Figure 3.12.1.



Source: JICA Survey Team

Figure 3.12.1: Layout Plan of IPC

(1) IPC Main Building

The main building of IPC is recommended to have temporary rental offices for tenants during its establishment in the construction period, which can be occupied by small enterprises that will support the activities of tenants at the time of operation. Moreover, commercial services, such as banking and posting services, is also required to attract investors.

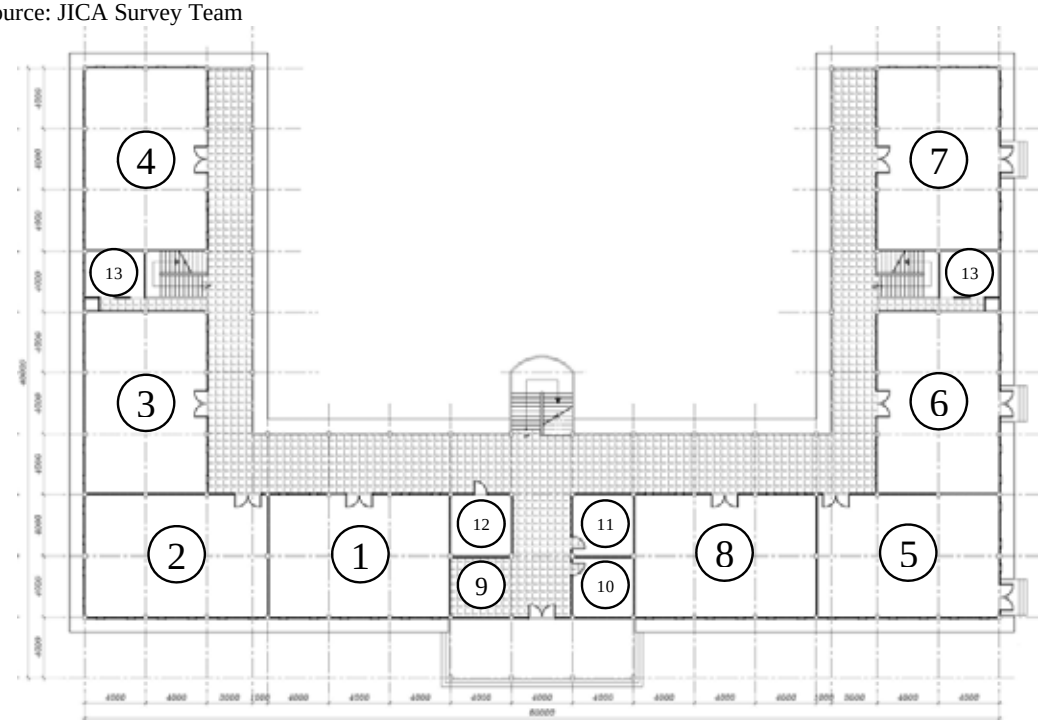
The floor plan and design outline of the IPC main building are shown in Table 3.12.1 and Figures 3.12.2 to 3.12.5.

Table 3.12.1: Floor Plan for IPC Main Building

Space/Function	Unit	Unit Area (m^2)	Area (m^2)
1st Floor			**1,276**
1. VIPA management office	1	96	96
2. New product display & marketing/ consultation room	1	96	96
3. Meeting/conference room	1	96	96
4. Technical & environmental dept. office	1	96	96
5. Clinic	1	96	96
6. Customs office	1	96	96
7. Courier service office	1	96	96
8. Rental office	1	96	96
9. Lobby	1	16	16
10. Post office	1	16	16
11. Bank	1	16	16
12. Reception/security post	1	16	16
13. Lavatory	4	6	24
14. Common space	L.S.	1	420

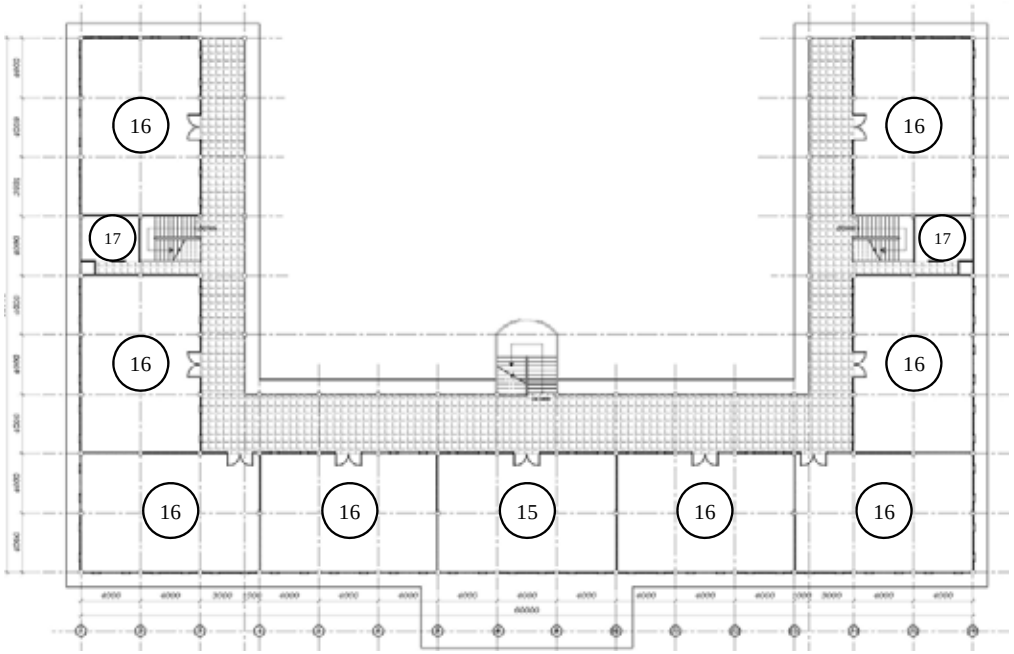
Space/Function	Unit	Unit Area (m^2)	Area (m^2)
2nd Floor			**1,276**
15. Meeting/conference room	8	96	768
16. Rental office	1	96	96
17. Lavatory	6	6	24
18. Common space	L.S.	1	388
TOTAL			**2,552**

Source: JICA Survey Team



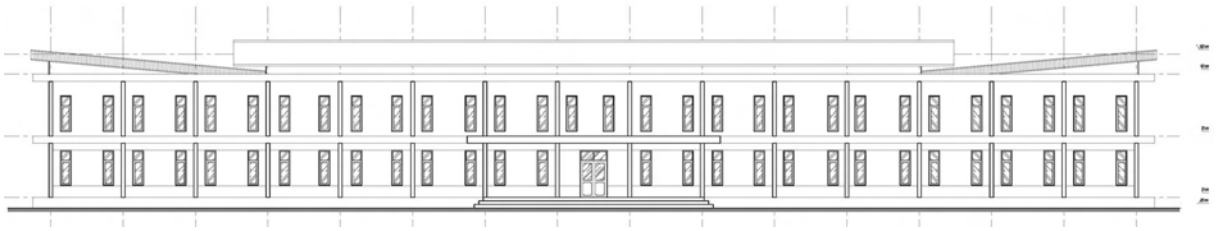
Source: JICA Survey Team

Figure 3.12.2: Floor Plan of IPC Main Building (1st Floor)



Source: JICA Survey Team

Figure 3.12.3: Floor Plan of IPC Main Building (2nd Floor)



Source: JICA Survey Team

Figure 3.12.4: Front Elevation of IPC Main Building

Source: JICA Survey Team

Figure 3.12.5: Perspective of IPC Main Building

(2) IPC Annex Building

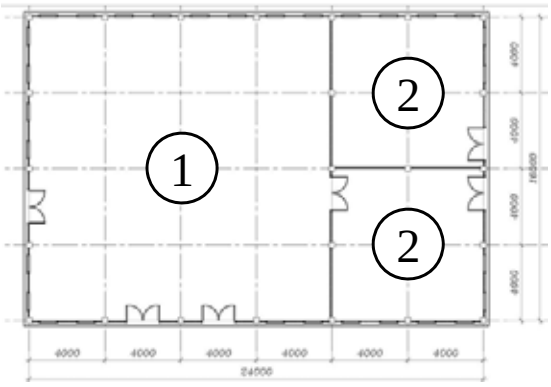
Food court is recommended to provide food varieties for foreign investors and local employees. The food court will be limited only to a single floor with a high ceiling to create an open and friendly atmosphere.

Floor plan and design outline of the IPC annex building are shown in Table 3.12.2 and Figures 3.12.6 to 3.12.8.

Table 3.12.2: Floor Plan for IPC Annex Building

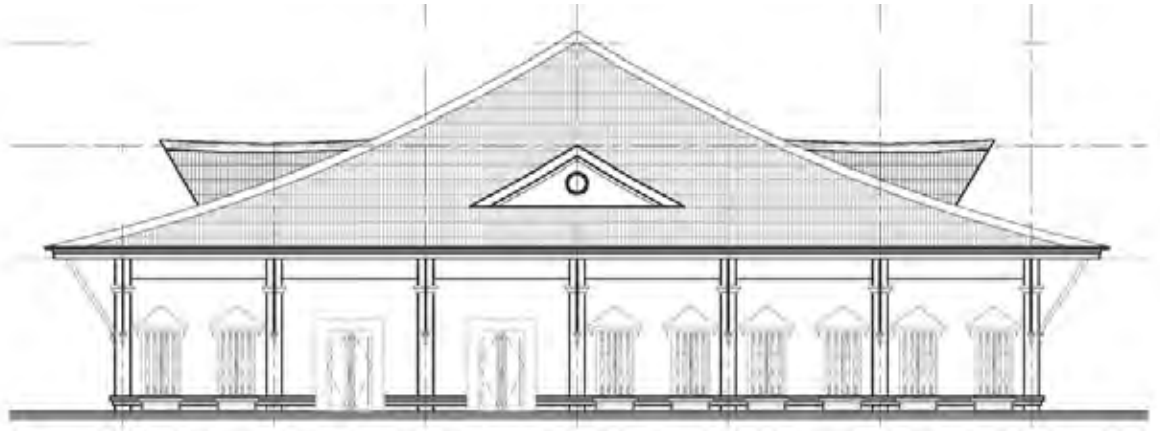
space/function	Unit	Unit Area (m^2)	Area (m^2)
1. Food Court	1	256	256
2. Shops	2	64	128
TOTAL			**384**

Source: JICA Survey Team



Source: JICA Survey Team

Figure 3.12.6: Floor Plan of IPC Annex Building



Source: JICA Survey Team

Figure 3.12.7: Front Elevation of IPC Annex Building

Source: JICA Survey Team

Figure 3.12.8: Perspective of IPC Annex Building

(3) Bus Station

To secure traffic conjunction and safety inside the VIP, public transportation from outside should be restricted at the entrance. Therefore, a bus station will be constructed within the IPC lot.

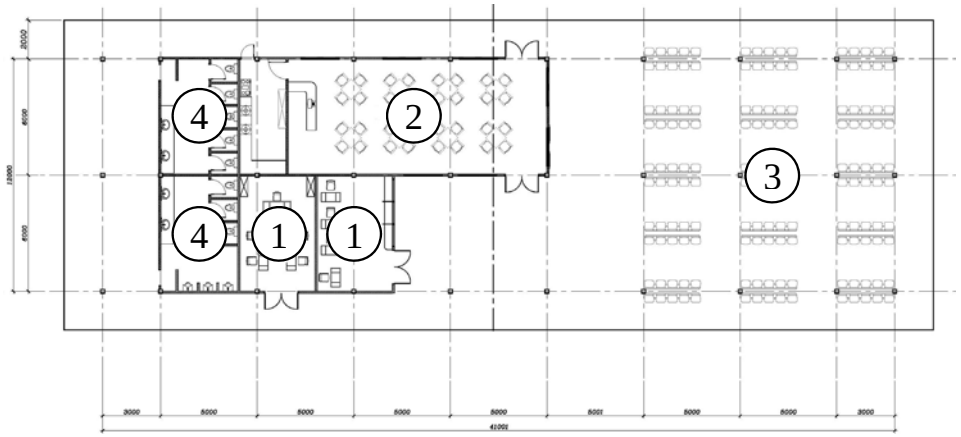
The bus station will also function as information center for factory workers and outsiders for events and recruitment activities. A huge information board will be placed inside the bus station.

Floor plan and design outline of the bus station are shown in the Table 3.12.3 and Figures 3.12.9 to 3.12.11.

Table 3.12.3: Floor Plan for Bus Station

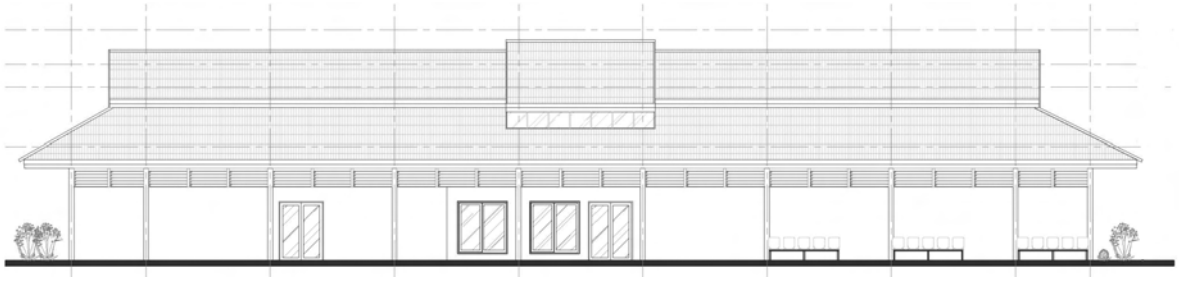
Space/Function	Unit	Unit Area (m^2)	Area (m^2)
1. Office for bus company	2	24	48
2. Canteen	1	96	96
3. Common space	1		528
4. Lavatory	2	24	48
TOTAL			**720**

Source: JICA Survey Team



Source: JICA Survey Team

Figure 3.12.9: Floor Plan of Bus Station



Source: JICA Survey Team

Figure 3.12.10: Front Elevation of Bus Station

Source: JICA Survey Team

Figure 3.12.11: Perspective of Bus Station

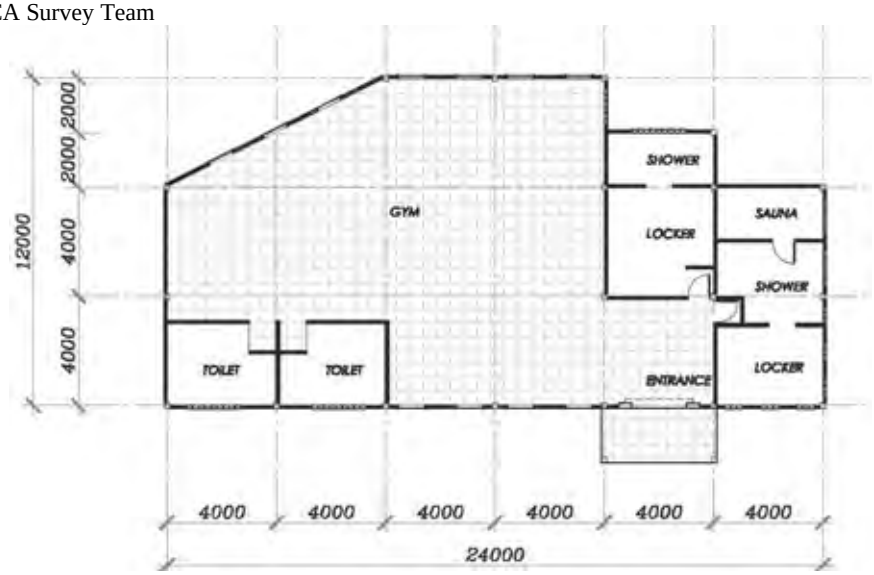
(4) Gymnasium and Sports Facilities

Common daily sports facilities, such as petang (Lao pétanque), tennis courts, swimming pool, and gymnasium, will be developed in the IPC. The floor plan and design outline of the sports facilities are shown in the Table 3.12.4 and Figures 3.12.12 to Figure 3.12.13.

Table 3.12.4: Floor Plan for Gymnasium and Sport Facilities

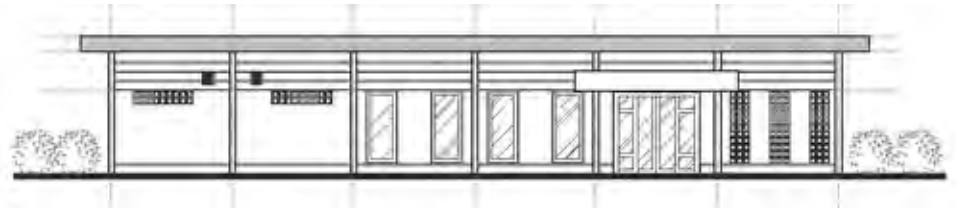
Space/Function	Unit	Unit Area (m^2)	Area (m2)
1. Gymnasium	1	248	248
- *Gym*	*1*	*170*	*170*
- *Locker/shower*	*1*	*24*	*24*
- *Locker/shower/sauna*	*1*	*32*	*32*
- *Lavatory*	*2*	*11*	*22*
2. Swimming Pool (25m x 15m)	1		no building structure
3. Tennis Court	1		no building structure
4. Petang Court	3		no building structure
TOTAL			**248**

Source: JICA Survey Team



Source: JICA Survey Team

Figure 3.12.12: Floor Plan of Gymnasium



Source: JICA Survey Team

Figure 3.12.13: Front Elevation Plan of Gymnasium

3.12.2 Technical Training Center (TTC)

Technical Training Center (TTC) will be located in the residential area, at the most convenient site for the trainee and workers.

TTC aims to provide laborers of tenants with sufficient quality and quantity. Therefore, it is required to have space for the following activities:

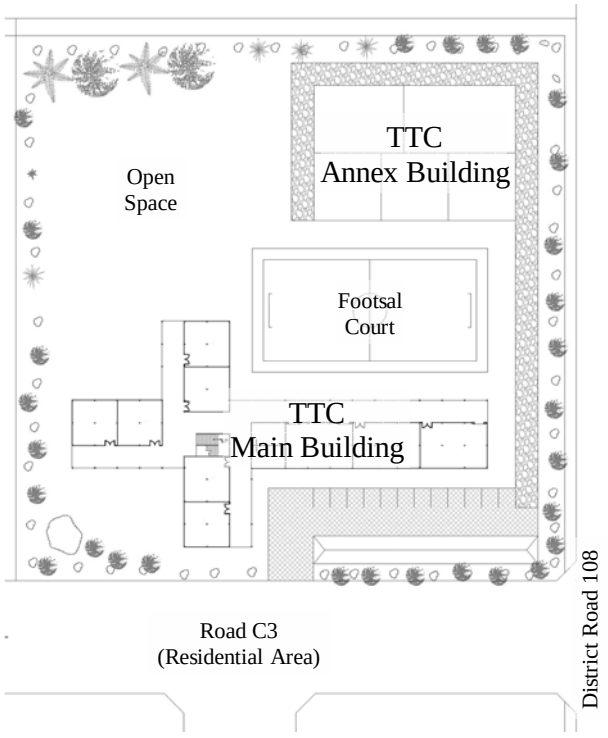
(1) Management and operation works for TTC, attraction, and trainings

(2) Information and knowledge center

(3) Food and entertainment

Training centers for courses that produce noise, will be separated from the rest and placed in the annex building together with the food court. Futsal courts will be located between those the main and annex buildings to serve as buffer zone for noise. Moreover, it maybe necessary to provide a dormitory for trainees located either at the open space in TTC or other lot in the residential area.

The layout plan and perspective of TTC is shown in Figure 3.12.14 and Figure 3.12.15, respectively.



Source: JICA Survey Team

Figure 3.12.14: Layout Plan of TTC

Source: JICA Survey Team

Figure 3.12.15: Perspective of Overall TTC

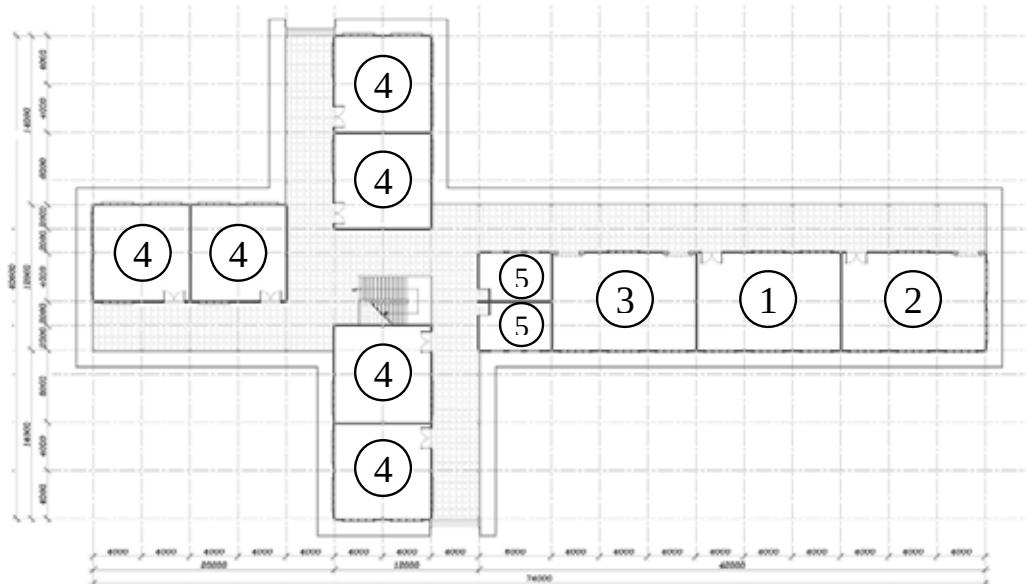
(1) TTC Main Building

TTC Main Building is designed to secure privacy for each room and the most suitable atmosphere for learning. Floor plan and design outline of the TTC Main Building are shown in Table 3.12.5 and Figures 3.12.16 to 3.12.18.

Table 3.12.5: Floor Plan for TTC Main Building

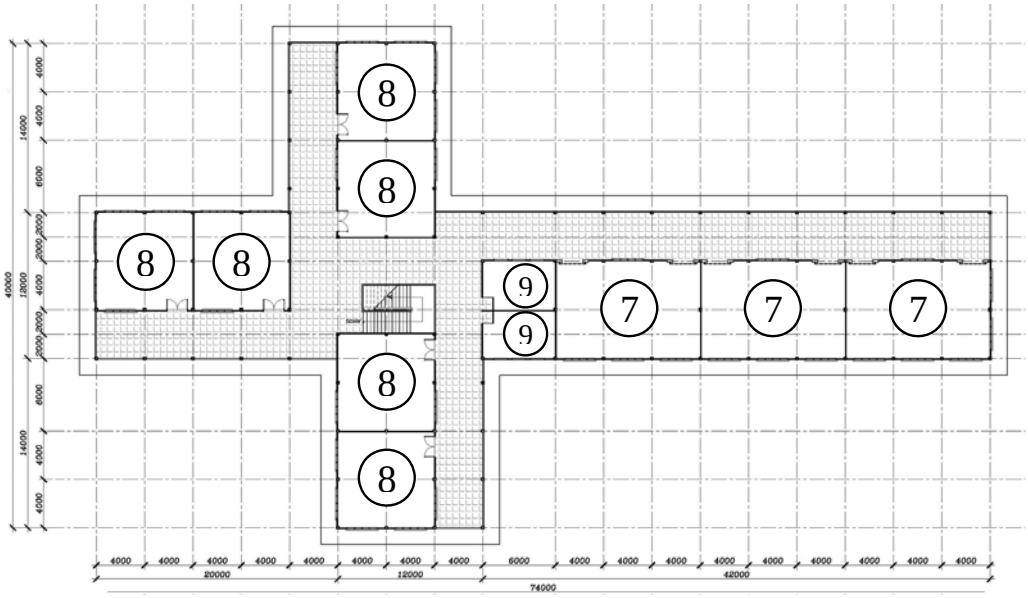
Space/Function	Unit	Unit Area (m^2)	Area (m2)
1st Floor			**1,224**
1. Teacher's room	1	96	96
2. Library/information center	1	96	96
3. Workshop	1	96	96
4. Class room	6	64	384
5. Lavatory	2	24	48
6. Common space	L.S.	1	504
2nd Floor			**1,224**
7. Workshop	3	96	288
8. Class room	6	64	384
9. Lavatory	2	24	48
10. Common space	L.S.	1	504
TOTAL			**2,448**

Source: JICA Survey Team



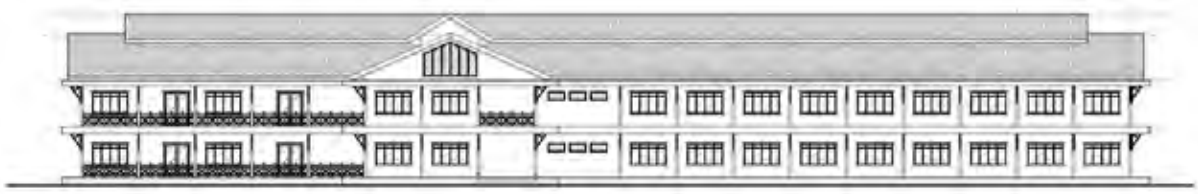
Source: JICA Survey Team

Figure 3.12.16: 1st Floor Plan of IPC Main Building



Source: JICA Survey Team

Figure 3.12.17: 2nd Floor Plan of IPC Main Building



Source: JICA Survey Team

Figure 3.12.18: Front Elevation of IPC Main Building

(2) TTC Annex Building

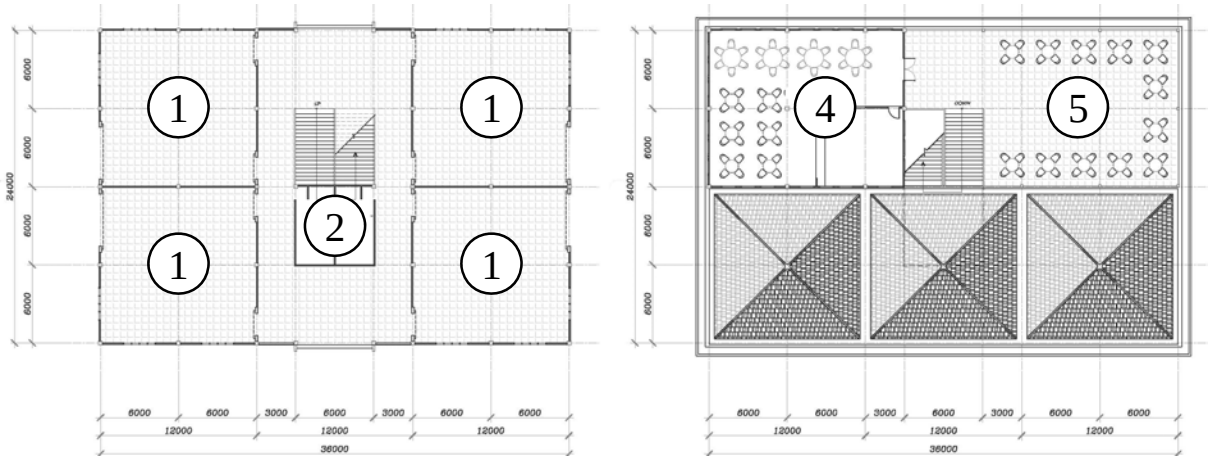
Workshop for courses that produce noise disturbances will be located in the first floor, considering the loads of mechanical equipments. The food court or canteen will be separated into indoor and open deck, which can function as an auditorium during events at the sports facilities and courts.

The floor plan and design outline of the TTC Annex Building are shown in Table 3.12.6 and Figures 3.12.19 and 3.12.20.

Table 3.12.6: Floor Plan for TTC Annex Building

Space/Function	Unit	Unit Area (m^2)	Area (m2)
1st Floor			**864**
1. Workshop	4	144	576
2. Lavatory	2	18	36
3. Common space	L.S.	1	256
2nd Floor			**432**
4. Canteen	1	180	180
5. Open deck	6	6	24
6. Common space	L.S.	1	180
TOTAL			**1,296**

Source: JICA Survey Team



Source: JICA Survey Team

Figure 3.12.19: Floor Plan of TTC Annex Building (1st and 2nd Floor)

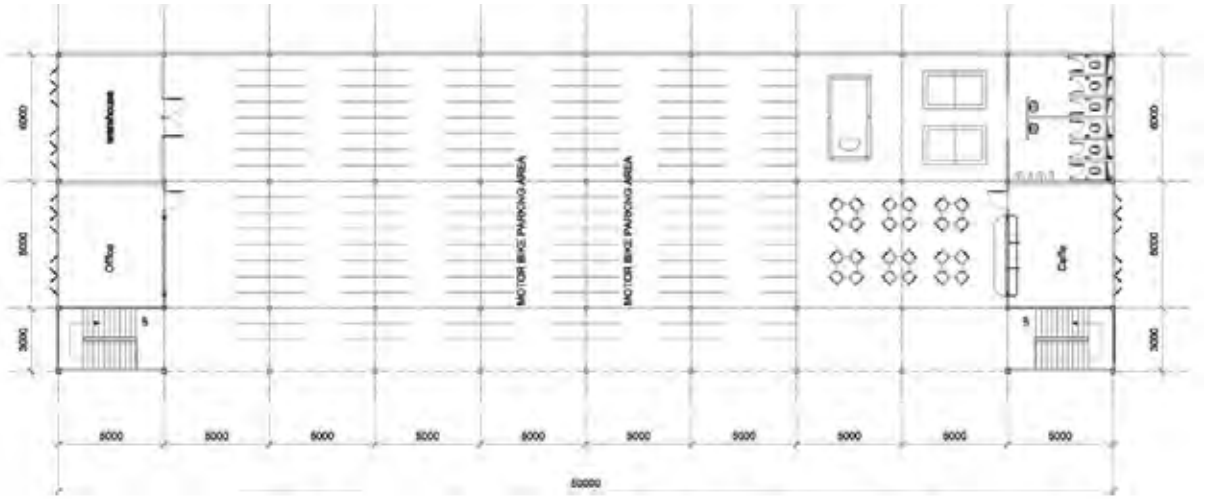
Source: JICA Survey Team

Figure 3.12.20: Front Elevation of TTC Annex Building

(3) Typical Type of Dormitory

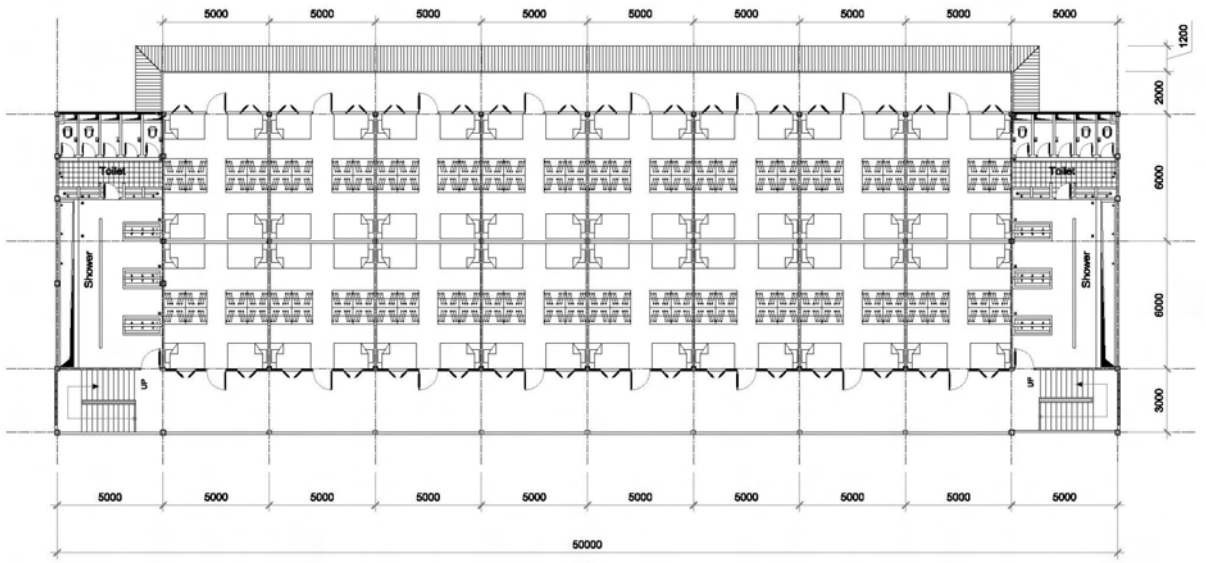
Just as a reference for further consideration during the study on the TTC establishment, the typical type of dormitory is proposed in this section. Typical dormitory was designed based on the current dormitories in Vientiane Capital, such as in the National University of Laos and Pakpasak Technical College.

The first floor will be used as a public space for motorcycles and bicycle parking, and for relaxation and leisure, such as cafés with billiard, darts and table tennis. One room will be occupied by eight persons with personal booth for each separated by partitions and drawers. Common activities can be done along the corridor of the dormitories or in the balcony. Design outline of the typical dormitory are shown in Figures 3.12.21 to 3.12.23.



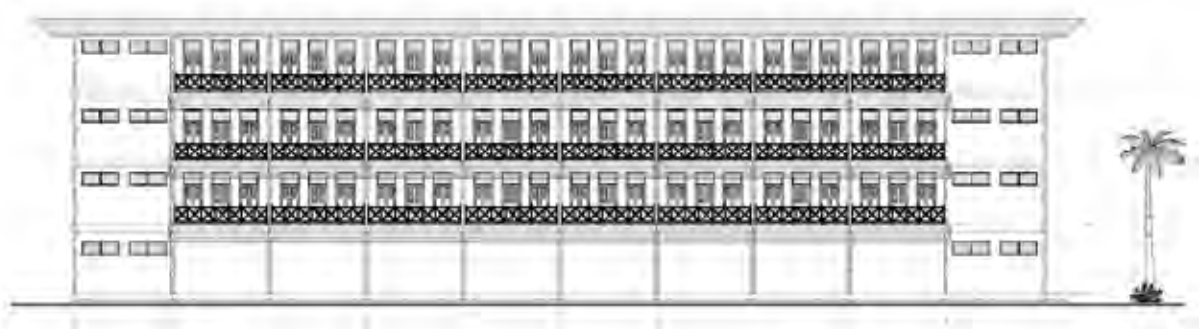
Source: JICA Survey Team

Figure 3.12.21: 1st Floor Plan of Typical Dormitory



Source: JICA Survey Team

Figure 3.12.22: 2nd to 4th Floor Plan of Typical Dormitory



Source: JICA Survey Team

Figure 3.12.23: Front Elevation of Typical Dormitory

3.12.3 Operation and Maintenance (O&M) Plan

(1) Industrial Park Center (IPC)

O&M works for the IPC will be conducted by the technical section under Technical & Environmental Department of VIPA. Main activities of the O&M works cover the following:

1) Regular patrolling and cleaning of buildings, gardens, parks and open spaces, internal roads and parking area.
2) O&M works for common utilities, such as lighting.
3) Seasonal maintenance and rehabilitation of plantation.
4) Management of sublet rehabilitation, which cannot be handled by the Technical Section.

Major expenses for O&M works of the IPC cover electricity, water supply, and other consumable equipment. Annual direct O&M cost, excluding the salary of staff, is estimated at about LAK60 million (JPY630,000), which can be charged to tenants in IPC.

(2) Technical Training Center (TTC)

TTC will be maintained by its own implementing organization. Therefore, no O&M work should be handled by the technical section of VIPA.

(3) Dormitory and Other Buildings

Dormitory and other buildings will be maintained by the implementing organization of said facilities. Therefore, no O&M work should be handled by the Technical Section of VIPA.

3.12.4 Conclusion and Recommendations

(1) Industrial Park Center (IPC)

The main and annex building of IPC is recommended to be constructed during the early stage of construction in order for VIPA to utilize these buildings in implementing marketing and promotional activities. The main building also can become the sales point for tenants, which can be used during the preparatory period before their factory and other buildings are constructed.

The sports complex and bus station can be constructed after factory lots are almost occupied and activities in the VIP become attractive, considering the benefits that can be collected from customers. Construction in the early stage may have insufficient initial cost impact due to fewer users.

(2) Technical Training Center (TTC)

Design, especially for the floor area and the number of rooms of TTC, should be reviewed soon after the training program is developed. The major concept and layout plan will be kept as proposed.

(3) Dormitory and Other Buildings

To support the sufficient lifestyle of workers and trainees, it is necessary to have basic urban functions, such as shops, cafes/restaurants, parks, and other daily entertainment facilities.

CHAPTER 4 LEGAL ARRANGEMENT

4.1 Legal Basis for the Development of Vientiane Industrial Park (VIP)

The Law on Investment Promotion stipulates the definitions of special and specific economic zones, establishment procedures, contents of the decree for each zone, activities of the special and specific economic zones under Article 3 and from Article 33 to Article 43. These articles are the legal bases for the development of the VIP.

4.1.1 Definition and Principles of Building of Special and Specific Economic Zones

According to Article 3 and Article 33, special economic zones are defined as economic zones in which the government allows investors to develop and build a sort of "new city" with an area of more than 1,000 ha including various economic zones such as Industrial Zone, Export Processing Zone (EPZ) and Free Trade Zone. On the other hand, the specific economic zone is the collective term used to refer to a single-functional economic zone.

The law stipulates the principles of building special and specific economic zones as follows:

(a) The zones must have clear objectives;

(b) The benefits for the state, developers and people are clearly defined;

(c) The zones are suitable for the objectives of each special and specific economic zone;

(d) The areas and borders of the zones must be clearly identified;

(e) There are promotion policies for the zones;

(f) There is an independent management system for the zones;

(g) The zones are either under the administration of the government or local authorities depending on government's approval;

(h) The zones' management has the right to independently provide land rental and define rental cost under the terms of the concession agreement;

(i) The zones' management can independently develop special and specific economic zones;

(j) The zones' management can attract investment of personal or legal entities; and

(k) There is a guarantee that the zones' environment is maintained, i.e., the zones are secure and safe.

4.1.2 Establishment and Development Procedures

In this section, the establishment and development procedures are discussed mainly based on the provisions of the Law on Investment Promotion. The concrete details of the institution for the VIP are discussed in Chapter 5.

(1) Submission of an Application

Developers or investors wishing to establish a special or specific economic zone shall submit an application to the planning and investment sector for consideration and examination.

(2) Approval by the Government

The government approves the establishment of special or specific economic zone pursuant to the proposal of the Ministry of Planning and Investment, which is based on examination, coordination with concerned sectors and local authorities, in line with the socioeconomic development plan of the provinces and the government, and potentials of the zone.

(3) Creation of the Establishment Committee

The establishment committee for special or specific economic zone shall be created. The committee is appointed by the government pursuant to the proposal of the planning and investment sector in coordination with concerned sectors and local authorities.

(4) Management Committee and the Contents of the Decree

The establishment committee shall be replaced by the management committee of the zone when the Prime Minister's decree on the activities and management of the special or specific economic zone is issued. However, the structure of the management committee is not specified under the law.

The management committee shall conduct research, formulate investment promotion policies and other economic policies in the zone and inform concerned government agencies.

(5) Development of the Zone

The development of the special or specific economic zone focuses on the construction of the necessary infrastructure in order to create a favorable environment for attracting investments.

According to the objectives of each special or specific economic zone, it is expected that the investor will implement the project that gives the maximum benefit to the country and contributes to local development.

(6) Term of Investment in the Special and Specific Economic Zones

The term of investment in the special and specific economic zones depends on the nature, size and conditions of each special or specific economic zone but shall not exceed 99 years and may be extended upon the approval of the government.

(7) Application for Investment in the Special and Specific Economic Zones by Investors within the Zone

Besides the developer, other investors wishing to invest within the special or specific economic zone must submit an application to the one stop service unit of the management committee of the concerned economic zone for consideration.

4.1.3 One Stop Service for Investment

According to the Law on Investment Promotion, one stop service that fully facilitates investors by providing information, undertaking investment consideration and issuing enterprise registration or investment license are established in the following: (a) planning and investment sector for investments in the concession and special and specific economic zones (b) industrial and commerce sector for investments in general businesses, and (c) special or specific economic zones (the management committee) for investments in these zones.

4.1.4 Promotion of Investment (Incentives)

Incentives to be provided vary depending on the patterns of the promoted sectors and promoted zones. Details will be determined in the specific regulations (the implementation decree). Additional incentives can be provided through the Prime Minister's decree for each zone.

4.2 Prohibited Subsidies by World Trade Organization

4.2.1 Agreement on Subsidies and Countervailing Measures

Since 1997, the Lao PDR has been negotiating with concerned parties for its accession to the World Trade Organization (WTO). Moreover, it has been making efforts in advance to amend or abolish some incentives in laws and decrees, which are designated as "prohibited subsidies" under the Agreement on Subsidies and Countervailing Measures (the SCM Agreement).

(1) Structure of the SCM Agreement

The SCM Agreement addresses two separate but closely related topics, namely, multilateral disciplines regulating the provision of subsidies and the use of countervailing measures to offset injury caused by subsidized imports.

Part I provides that the SCM Agreement applies only to subsidies that are specifically provided to an enterprise or group of enterprises or industries, and defines both the term "subsidy" and the concept of "specificity." Parts II and III classify all specific subsidies into two categories, namely, prohibited and actionable, and establish certain rules and procedures with respect to each category.

Part V establishes the substantive and procedural requirements that must be fulfilled before a member may apply a countervailing measure against subsidized imports. Parts VI and VII establish the institutional structure and notification/surveillance modalities for implementation of the SCM Agreement. Part VIII contains special and differential treatment rules for various categories of developing country members. Part IX contains transition rules for developed country and former centrally-planned economy members. Parts X and XI contain dispute settlement and final provisions.

(2) Definition of Subsidy

The SCM Agreement contains a definition of the term "subsidy". The definition contains three basic elements, namely: (i) a financial contribution (e.g., grants, loans, equity infusions, loan guarantees, fiscal incentives, provision of goods or services, and purchase of goods); (ii) by a government or any public body within the territory of a member; and (iii) which confers a benefit. All three of these elements must be satisfied in order for a subsidy to exist.

The SCM Agreement creates two basic categories of subsidies, namely: (i) those that are prohibited and (ii) those that are actionable. All specific subsidies fall into one of these categories.

(3) Prohibited Subsidies and Other Subsidies

Two categories of subsidies are prohibited by Article 3 of the SCM Agreement. The first category consists of subsidies contingent, in law or in fact and whether wholly or as one of several conditions, on export performance ("export subsidies"). The second category consists of subsidies contingent, whether solely or as one of several other conditions, upon the use of domestic over imported goods ("local content subsidies"). These two categories of subsidies are prohibited because they are designed to directly affect trade and are thus most likely to have adverse effects on the interests of other members.

On the other hand, most subsidies such as production subsidies fall under the "actionable" category. Actionable subsidies are not prohibited. However, they are subject to challenge, either through multilateral dispute settlement or through countervailing action, in the event that they cause adverse effects to the interests of another member.

(4) Categories of Developing Country Members with Favorable Treatment

The SCM Agreement recognizes three categories of developing country members, namely: (a) least-developed country members (or LDCs), (b) members with a GNP per capita of less than US$1,000 per year which are listed in Annex VII of the SCM Agreement, and (c) other developing countries.

The lower a member's level of development, the more favorable the treatment it receives with respect to subsidies. Thus, for example, LDCs and members with a GNP per capita of less than US$1,000 per year listed in Annex VII of the SCM Agreement are exempted from the prohibition on export subsidies. Other developing country members have an eight-year period to phase out their export subsidies (they cannot increase the level of their export subsidies during this period). With respect to import-substitution subsidies, LDCs have eight years while other developing country members have five years to phase out such subsidies.

Currently, the Lao PDR continues negotiation to become an LDC member of the WTO with favorable treatment.

4.2.2 Case of Savan-Seno Decree

Savan-Seno Decree stipulates that the exemption from or reduction period for the profit tax are determined based on the export performance (or export proportion) and local content ratio as shown below.

From the viewpoint of the SCM Agreement, these incentives are regarded as prohibited subsidies and shall be modified or repealed. As a result, these kinds of incentives are not applied to VIP investors or licensed enterprises.

Savan-Seno Decree, Article 25: Tax Exemptions and Policies / Article 25.6: Profit Tax

The value of the profit tax, its reduction and its exemption for a SASEZ-registered enterprise, with regard to each business category, are determined as follows:

a. Production Business Category

Production business means the production, manufacture, assembly, processing, and transforming of raw materials or various material objects into a new product; production business includes, for example, the following: furniture manufacture; vehicle assembly manufacture; electronic parts assembly manufacture and other production businesses.

Production and manufacture of goods for export to foreign countries shall be either exempted from profit tax or granted a deduction rate of profit tax, depending on the proportion of export in the total production quantity, as follows:

1. For an export proportion equal to 70% or more than 70% of the total production quantity, or for the manufacture or assembly of high-technology equipment, instruments and products, the business entity shall be exempted from profit tax for a period of 10 years starting from the profit-making year of its operations. Beyond that period, it shall be subject to a profit tax of 8%. (The definitions and examples of high-technology products are given in an Annex, herewith attached.)

2. For an export proportion from 30% to 69% of the total production quantity, the business entity shall be exempted from profit tax for a period of 7 years starting from the profit-making year of its operations; beyond that period, it shall be subject to a profit tax of 8%.

3. In case of a business of general production or a business producing for export less than 30% of the total production quantity, the business entity shall be exempted from profit tax for a period of 5 years starting from the profit-making year of its operations; beyond that period, it shall be subject to a profit tax of 8%.

4. Apart from the tax policies mentioned above, special tax privilege shall be granted to production business which utilizes domestic/local raw materials at a proportion higher than 50% of the total quantity of raw materials required for their production and processing activities in the form of an additional profit tax reduction of 50% of the tax rates mentioned above, for the first 2 years of the profit tax payment application.

4.3 Draft Decree on the Development and Management of VIP

As discussed in the preceding sections, the formulation of the decree on the development and management of the VIP is indispensable according to the Law on Investment Promotion.

A sample draft decree is being prepared for consideration. The draft consists of 24 articles, stipulating the essential elements of the implementation and management of the zone. The composition of the draft decree is shown in Table 4.3.1. The draft decree itself is attached as Appendix III.2.

(1) Objective of the VIP Decree

This decree determines the organization, activities and policies on VIP, which shall be designated as a specific economic zone, in order to attract and promote foreign and domestic investments in compliance with the general investment policies of the government to foster production and exports, to create employment and to provide opportunities for learning experiences in the fields of business management and new technology.

(2) Institutional Arrangement

The formulation of an authority under MoIC, which is called Vientiane Industrial Park Authority (VIPA), is proposed. It is assumed that the board of directors of VIPA will act as the management committee which is designated by the Law on Investment Promotion.

The structure of VIPA consists of operational sections such as secretariat, one stop services, technical and maintenance services and investment promotion. The VIPA under MoIC shall function as a developer and an implementing agency for the VIP, although a joint venture group with the private developer may be taken into consideration. Details of the VIPA are discussed in Chapter 5.

One stop service unit including the issuance of investment license will be formulated under the VIPA according to the Law on Investment Promotion.

(3) Procedures of the VIP

Applications to obtain VIP license shall be submitted by enterprise owners to the one stop service unit of VIPA. The Director General of VIPA shall inform the applicant no later than two weeks from the date of submission of complete documentation of its decision to accept. The VIP license may be revoked if the investors/licensed enterprise are proven to violate, on more than one occasion, any provision of the law, regulations and instructions.

Activities allowed in the VIP include manufacture or processing activities of production businesses and their support service activities.

(4) No Requirements for Exports

The investors/registered enterprises within the VIP are not required for a certain rate or amount of exports. This is mainly because (a) export subsidies (incentives based on export performance) are prohibited by the agreement among the member countries of the WTO and (b) there are some potential investors which target the domestic market in the Lao PDR based on the demand survey by the JICA Survey Team.

(5) Incentives for Investors

Incentives stipulated in the draft are basically similar to those under the Savan-Seno Special Economic Zone Authority (SEZA) decree, which currently gives the highest preferences for investors in the Lao PDR. However, paying sufficient attention to the SCM Agreement by the WTO, incentives for VIP investors/licensed enterprises are not provided based on export performance and ratios of local contents.

As for profit tax, the exemption period shall be ten years after the profit-making year. After such exemption period, a tax rate of 8% shall be applied.

Investors/licensed enterprises within VIP shall be exempted from customs duties for the importation of raw materials, machineries, equipment and vehicles used directly for the production, even if some products are shipped to the domestic markets.

Investors within VIP shall be exempted from business turnover tax (or value-added tax (VAT) when the business turnover tax is replaced by VAT), excise tax and minimum tax.

Table 4.3.1: Composition of the Draft Decree on VIP

Chapter in Draft Decree	Provision in Draft Decree	Remarks
Chapter I: General Provisions and Definitions	Article 1 (Objectives)	./.
	Article 2 (Definitions)	The area of VIP is defined within Vientiane Industrial Zone.
	Article 3 (Establishment of VIPA)	Establishment of a public authority of VIPA under MoIC is stipulated.
Chapter II: Tasks and Structure of VIPA	Article 4 (Tasks of VIPA)	./.
	Article 5 (Organization Structure of VIPA)	./.
Chapter III: Board of Directors	Article 6 (Board of Directors of VIPA)	The Board of Directors shall function as the management committee stipulated in Article 38 of the Law on Investment Promotion.
	Article 7 (Responsibility of Board of Directors)	./.
	Article 8 (Duties of Director General of VIPA)	./.
Chapter IV: Finance of VIPA	Article 9 (Finance of VIPA)	./.
Chapter V: Development and Operation of VIP	Article 10 (Development and Operation of VIP)	./.
Chapter VI: Procedures of VIP	Article 11 (VIP procedures)	./.
	Article 12 (Activities allowed in VIP)	Processing and production activities and supporting service activities are allowed to locate within the VIP. There are no requirements for exports.
Chapter VII: Movement of Goods In and Out of VIP	Article 13: (Movement of goods in and out of VIP)	./.
Chapter VIII: Investment Promotion Policies within VIP	Article 14 (General policy)	./.
	Article 15 (Tax exemption/reduction)	./.
	Article 15.1 (Customs duties)	Investors shall be exempted from duties and taxes for importation of raw materials, machineries, equipment and vehicles used directly for the production.
	Article 15.2 (Profit tax)	The exemption period for profit tax is 10 years from the profit making year, followed by the tax reduction period of 10 years at a rate of 8%.
	Article 15.3 (Personnel income tax)	This draft decree applies the same incentive (5%) as in the SEZA decree.
	Article 15.4 (Business turnover tax)	This draft decree applies the same incentive as in the SEZA decree. (Investors shall be exempted from value-added tax (VAT) when business turnover tax is replaced by VAT.)
	Article 15.5 (Excise tax)	This draft decree applies the same incentive as in the SEZA decree.
	Article 15.6 (Minimum tax)	This draft decree applies the same incentive as in the SEZA decree.
	Article 15.7 (Import custom duty for vehicles)	This draft decree applies the same incentive as in the draft Vientiane EPZ decree.
	Article 15.8 (Temporary import of vehicles)	This draft decree applies the same incentive as in the draft Vientiane EPZ decree.
	Article 15.9 (Sales and replacement of the vehicles imported)	This draft decree applies the same incentive as in the draft Vientiane EPZ decree.
	Article 15.10 (Forbearance regarding vehicles)	This draft decree applies the same incentive as in the draft Vientiane EPZ decree
	Article 16 (Utilization of profit for investment)	This draft decree applies the same incentive as in the SEZA decree.
	Article 17 (Deduction of annual loss from the following year's profit)	This draft decree applies the same incentive as in the SEZA decree.
	Article 18 (Repatriation of business operations profit)	This draft decree applies the same incentive as in the SEZA decree.

Chapter in Draft Decree	Provision in Draft Decree	Remarks
Chapter IX: Rights and Duties of Investors within VIP	Article 19 (Rights and duties of investors)	./.
Chapter X: Dispute Resolution	Article 20 (Resolution of disagreement)	./.
Chapter XI: Penalties	Article 21 (Penalties against violators)	./.
Chapter XII: Final Provisions	Article 22 (Implementation)	./.
	Article 23 (Exceptions)	./.
	Article 24 (Effectiveness)	./.

Source: JICA Survey Team
Note: (1) SEZA Decree: Decree No. 177 of the Prime Minister on the Management Regulations and Incentives Policies regarding the Savan-Seno Special Economic Zone (Nov. 2003)
(2) Draft Vientiane EPZ decree is prepared by the MoIC based on the draft decree of EPZ in the country and SEZA decree.

4.4 Expansion of the VIP Decree to the Decree on the Vientiane Industrial Zone

In this feasibility study, the draft decree is confined to VIP as a Specific Economic Zone.

As shown in Figure 2.5.1, VIP is located in the Stage 1 development area of the Vientiane Industrial Zone (2,000 ha) and may be a component within the Special Economic Zone if said industrial zone is designated as one in the future.

Consequently, it would be required to review the following items in order to expand the VIP decree to the decree on the Vientiane Industrial Zone as a Special Economic Zone;

(a) Reorganization of the management committee and VIPA in terms of finance, operation and development;

(b) Review of the procedures of the investment in the zone;

(c) Review of the movement of goods in and out of the zone;

(d) Review of the investment promotion policy and setting up of the incentives for trade and commercial activities and logistics services.

CHAPTER 5 OPERATION AND MANAGEMENT

5.1 Relevant Institutional Framework for Vientiane Industrial Park

5.1.1 Establishment of National Steering Committee

As explained in "1.6.1 Current Legal System for Industrial Development" (in Section 1.6 Legal and Institutional System, Chapter 1 National Economy and Industrial Sector, Part I National Industrial Development), the Law on Investment Promotion classifies investment into 3 types, namely: 1) General business, 2) Concession, and 3) Activities in the development of special and specific economic zones.

In June 2009, the National Steering Committee for the development of the special and specific economic zones was established according to Decision No. 057/PMO, which was initiated by MoIC. However, on the initiative of MPI, this decision was superseded by the new Decision No. 165/PMO issued on December 14, 2009.

The committee, consisting of seven members as shown in Table 5.1.1, is in charge of policy planning and decision-making at the national level in relation to the development and management of special and specific economic zones. The secretariat of the National Steering Committee is based in the Investment Promotion Department of MPI.

Table 5.1.1: National Steering Committee Members for Specific Economic Zone Development

1	Vice Prime Minister	Chairman
2	Minister of Ministry of Planning and Investment	Standing Vice Chairman*
3	Minister of Ministry of Industry and Commerce	Vice Chairman
4	Minister of Ministry of Public Works and Transport	Vice Chairman
5	Minister of Ministry of Finance	Member
6	Minister of Ministry of Justice	Member
7	Deputy Director General of National Land Management Authority	Member

Note: * Minister of MPI is entitled to stand in for Chairman.
Source: Decision of PMO, No. 165, 14 December 2009

The following are the tasks of the National Steering Committee:

- To consult and manage Special Economic Zone and Specific Economic Zone such as Industrial Zone and Industrial Estate, EPZ, Free Trade Zone, Border Economic Zone, Logistics Center, Tourism City in the country;
- To analyze the policies and legal system on the development and management of such zones;
- To create the plans and general strategies for the development and management of such zones;
- To consult regarding the fund resources and cooperation with foreign donors for developing the zones;

- To consult regarding the tasks of the Savan-Seno Special Economic Zone; and
- To analyze the institutional structure, personnel and roles and duties of administrative committee in each zone.

5.1.2 The Law on Investment Promotion

According to the Law on Investment Promotion, the Vientiane Industrial Park (VIP) is categorized as a Specific Economic Zone. The procedure and organizational setting for the establishment of Specific Economic Zones are prescribed as follows:

(1) Procedure for Establishing Specific Economic Zone

The major steps to establish a Specific Economic Zone, as stipulated by the law, are summarized as follows:

1) In consideration of the national and provincial socioeconomic development plan and potential of the area where the specific economic zone will be established, MPI shall conduct initial examination for its establishment in cooperation with relevant organizations and local authorities.
2) MPI shall propose the establishment of the Specific Economic Zone to the government based on the result of the initial examination.
3) The government shall agree to the establishment of the Specific Economic Zone.
4) The party, which aims to develop the zone, shall submit a proposal with an application to the planning and investment agencies[1].
5) The proposal shall be examined through the procedure similar to that for concession.

   (Examination for investment in concession: as reference)[2]

   - Benefits to the government, investor and people should be secured. If transfer of land use right to the government is required, compensation cost should be calculated by the Land Management Authority based on the market price.
   - The investor shall be advised to prepare the documents such as feasibility study report, social and environmental impact assessment report and lists of vehicles, equipment and materials for production necessary for import tax exemption.
   - Planning and investment agencies and relevant agencies shall initiate consultation and drafting of the initial agreement.
   - The result of consultation shall be examined at the meeting organized by the one stop service office[3].
   - The result of the meeting shall be submitted to the government and local authorities for consideration and approval.

[1] Planning and investment agencies include MPI and its local agencies/offices in the provinces.
[2] Article 23, the Law on Investment Promotion, 2009
[3] The one stop service office for investment in concession shall be established at the planning and investment agencies. (Article 44, the Law on Investment Promotion, 2009)

- The investor shall be advised to deposit cash as collateral for project commencement according to the type and size of investment. The deposit shall be returned when the project starts.

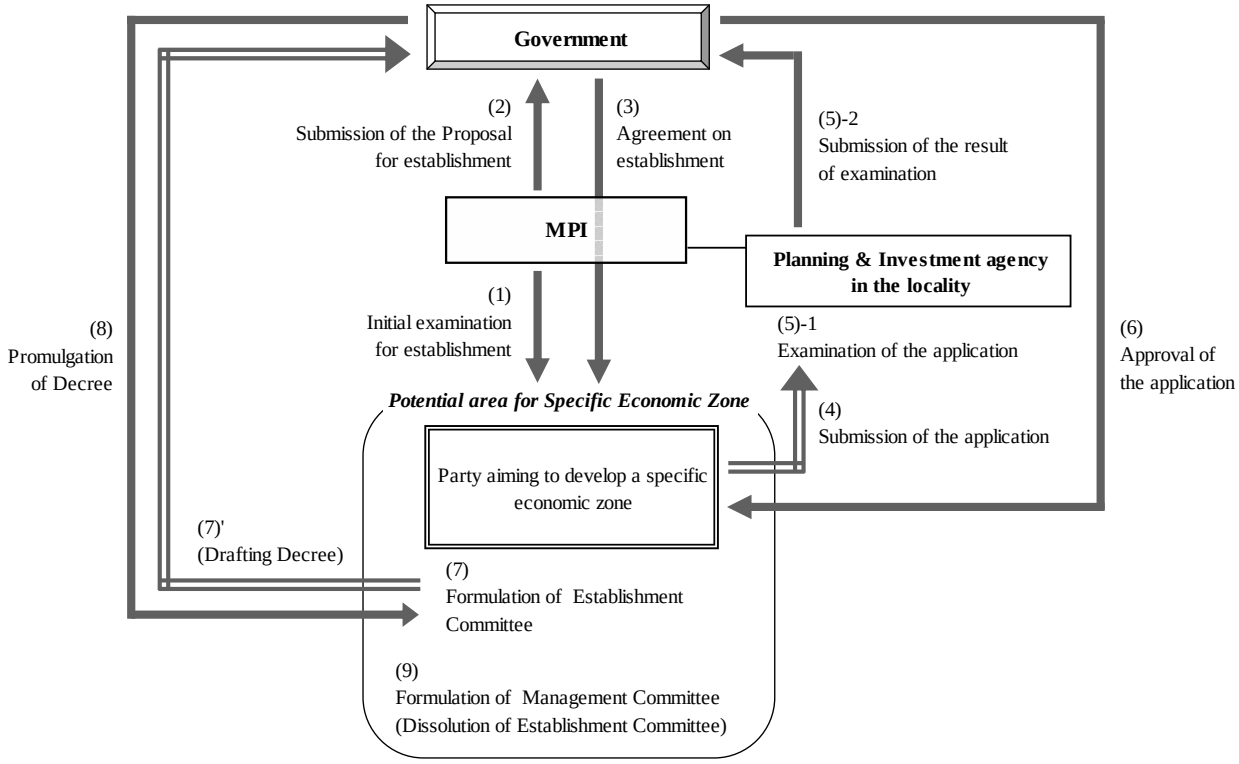
6) The government shall approve the application.

7) The Specific Economic Zone Establishment Committee shall be formed.

8) The government shall promulgate a decree on the activities and management of the Specific Economic zone. The Specific Economic Zone Establishment Committee shall terminate its terms after promulgation of the decree.

9) The Specific Economic Zone Management Committee shall be established.

When the articles in the law are interpreted literally as described above, the steps of the establishment are illustrated as shown in Figure 5.1.1.



Source: JICA Survey Team

Figure 5.1.1: Procedure for Establishing Specific Economic Zone

The figure reveals some points, summarized below, which are not clearly stipulated in the law. Since the detailed enforcement regulations for the law are under preparation by the MPI, these points should be clarified once the new regulations are available.

- In the beginning, it is not clear which party shall apply for the initial examination by the MPI (Step 1) and what should be prepared for the examination.

- The responsible department in MPI, which shall conduct initial examination and submit the proposal to the government, is not clearly specified. However, the present situation implies that the Investment Promotion Department, where the secretariat of the National Steering Committee is based (see Section 5.1.1), would be the one to play these roles.

- The final decision-maker, prescribed as "the government", is not clearly defined. However, it could be assumed that the National Steering Committee would act as the final decision-maker.

(2) Present Phase of the VIP Establishment

The establishment of the VIP was officially accepted by the government. Therefore, step 1) to 3) in (1) is already completed. Since its establishment is acknowledged as a national project, the planning and investment agency at the central level, or MPI, will be the agency to receive the application for the establishment. Moreover, MoIC is defined as the developer who will implement the VIP project as a public project. Thus, MoIC is obliged to prepare and submit the application to the MPI.

The feasibility study report, which would be finalized by the JICA Survey Team (JST) in June 2010, could be utilized as the main part of the application documents for obtaining the government approval for the VIP development. It means that step 4) through 6) would be expected to be finished soon. In addition, the decree of VIP is already drafted by the JST.

Therefore, it is now necessary for MoIC to prepare for the formulation of the establishment committee and make necessary arrangement for the committee to be able to carry out its tasks as described below.

(3) Organizational Setting

According to the Law on Investment Promotion, the Specific Economic Zone Establishment Committee shall consist of the developer, representatives from relevant sectors, local authorities and the national front organization in the area where the Specific Economic Zone is located. Its rights and duties are prescribed as follows:

(Rights and Duties)

- To research the relevant issues, make suggestions and coordinate with concerned authorities for the establishment of the zone,
- To complete the development of the zone in accordance with its objectives, targets and time schedule, and
- To resolve problems related to the establishment of the zone such as problems with the developer and the benefits of the people living within the site for the zone.

The Specific Economic Zone Management Committee is defined as the authority responsible for the management of investment in the zone and establishment of the one stop service office. Its rights and duties are stipulated as follows:[4]

(Rights and Duties)

- To research and formulate investment promotion policies for the zone,
- To research and formulate activities and projects to attract investments in the zone,
- To implement investment promotion policies in order to attract both domestic and foreign investments,
- To facilitate investors in conducting their business operations in the zone,

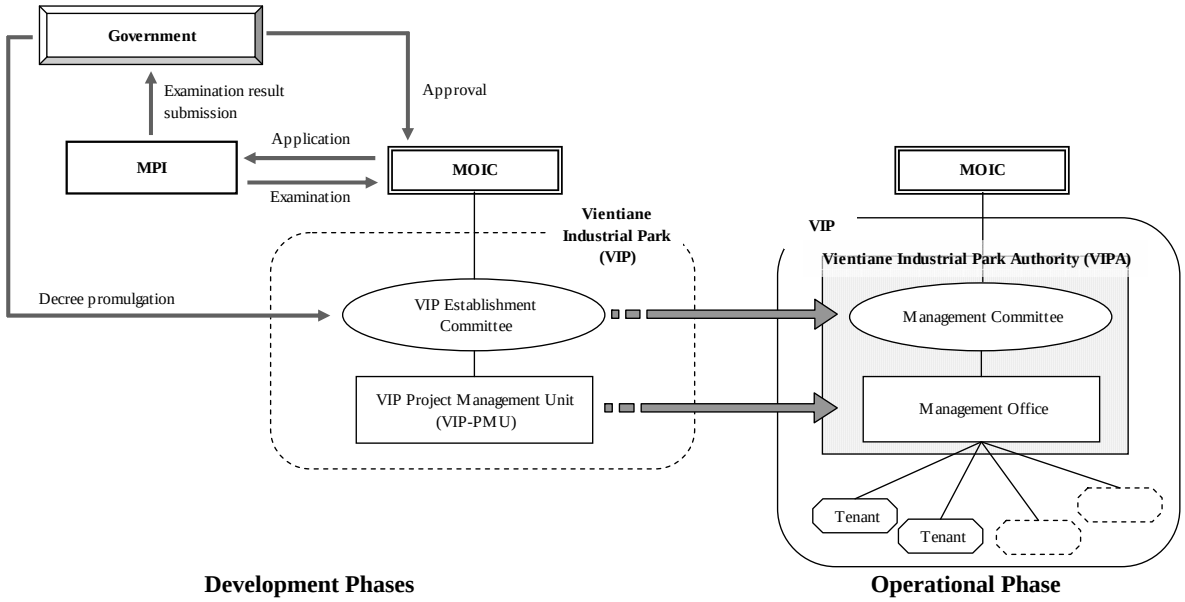
[4] Article 90, the Law on Investment Promotion, 2009

- To collect duties and taxes, rent, service fees, and other fees as set in the agreement and regulations within the zone,
- To manage and use the budget for the zone in accordance with agreements, laws and regulations,
- To keep good relationship and coordinate with all concerned parties, including both domestic and foreign, in order to effectively manage the zone in accordance with laws and regulations,
- To establish a system to protect facilities and infrastructure and secure the environment against dangers within the zone,
- To regularly summarize the investment situation in the zone and report to its supervisors, and
- To undertake other rights and duties set out in the laws and regulations.

5.2 Operation and Management of VIP

5.2.1 Overall Structure for Operation and Management

Based on the institutional framework explained in Section 5.1, the organization structure for the operation and management of VIP is proposed as shown in Figure 5.2.1.



Source: JICA Survey Team

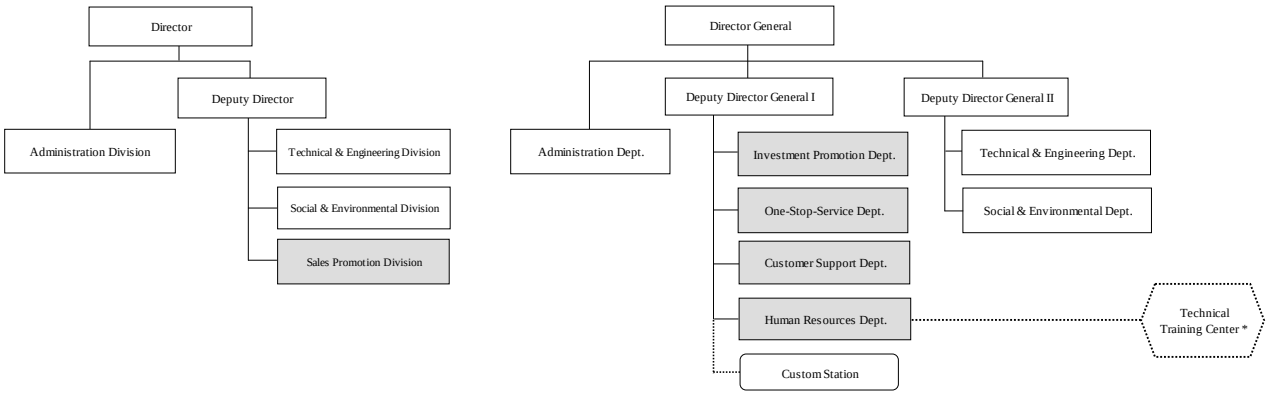
Figure 5.2.1: Proposed Organization Structure for VIP Operation and Management

During the development phase, the VIP Establishment Committee will be formed after the proposal for the VIP development is approved by the government. The committee will be primarily responsible for the completion of the physical works for VIP. Under said committee, the VIP Project Management Unit (VIP-PMU) is proposed to be set up as an organization to actually carry out the duties and responsibilities of the committee, which would function as an executive and supervisory body. During the operational phase, the establishment of the Vientiane Industrial Park Authority (VIPA) is proposed for the VIP operation. VIPA will consist of the Management Committee and Management Office. The Management Committee will serve as the board of directors of VIPA while the Management Office will execute duties and responsibilities on behalf of the committee.

Since the tasks during the development and operational phases will be consecutive and overlapping, it is practical that the functions and personnel of the VIP-PMU would be seamlessly succeeded to the VIPA Management Office.

5.2.2 Functions and Tasks of VIP-PMU and VIPA Management Office

Based on the overall organization structure suggested in Section 5.2.1, the recommended structure of the VIP-PMU and VIPA Management Office is shown in Figure 5.2.2.

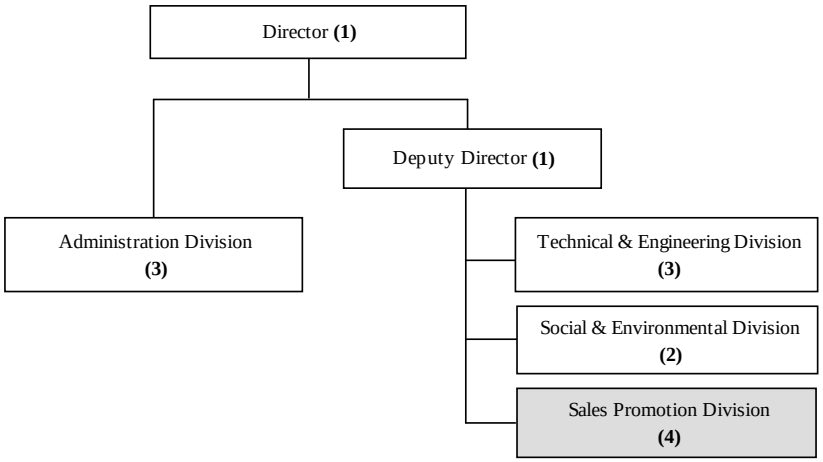


Note: * Technical Training Center will be an independent institute associated with VIPA.
Source: JICA Survey Team

Figure 5.2.2: Proposed Formation of VIP-PMU and VIPA Management Office

(1) VIP Project Management Unit (VIP-PMU)

VIP-PMU shall be in charge of VIP development on behalf of the Establishment Committee. The proposed VIP-PMU will consist of four divisions, namely: Administration Division, Technical and Engineering Division, Social and Environmental Division, and Sales Promotion Division (Figure 5.2.3). Its total number of personnel will be 14.



Source: JICA Survey Team

Figure 5.2.3: Organization Structure of VIP-PMU

The Director shall be responsible for the overall management of the VIP-PMU, direct the Administration Division and deal with any problems arising from the activities of the VIP-PMU. He/she shall be a member of the Establishment Committee and also be responsible for reporting the progress of the VIP development to the committee.

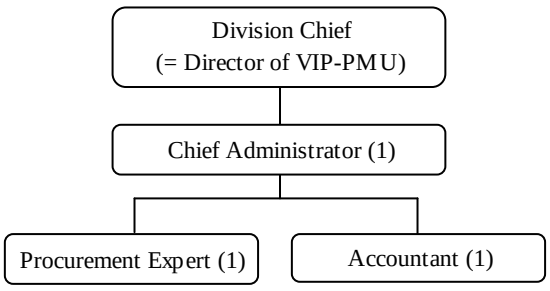
The Deputy Director shall direct the Technical and Engineering Division, Social and Environmental Division, and Sales Promotion Division as well as be responsible for reporting the activities in these sections to the Director. He/she shall work as Acting Director when the Director could not perform his/her duties.

1) Administration Division

Administration Division will be responsible for financing the VIP development and general administrative affairs in the VIP-PMU. The following are the major tasks of the division:

- Supervision of the rules and regulations on the activities of the VIP-PMU
- Management of financial affairs including billing and accounting
- Asset management
- Procurement
- Supervision of bidding and contract management
- Personnel development and management
- Public relations
- Other general and legal affairs

Staffing of the division is proposed as shown in Figure 5.2.4. The Director will concurrently act as the Division Chief.



Source: JICA Survey Team

Figure 5.2.4: Staffing of Administration Division

2) Technical and Engineering Division

The Technical and Engineering Division will be responsible for managing the infrastructure development of VIP. In addition, the section should undertake any preparations for the operation and maintenance (O&M) of the infrastructure to be constructed in VIP. The major tasks of the division are listed as follows:

- Management of detailed design work

  - Overall planning and preparation of the terms of reference (TOR)
  - Technical support for the procurement of the consultant
  - Supervising the work of the consultant

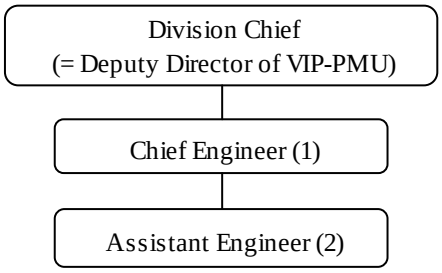
- Management of construction work

  - Overall planning and preparation of the TOR
  - Technical support for the procurement of the consultant
  - Supervising the work of consultant including preparation of tender document, bidding management, construction supervision, final inspection and other technical work

- Coordination with relevant government organizations in change of infrastructure development

- Preparation for O&M of infrastructure in the VIP such as making O&M manual

Staffing of the division is proposed as shown in Figure 5.2.5. The Deputy Director will concurrently act as the Division Chief.



Source: JICA Survey Team

Figure 5.2.5: Staffing of Technical and Engineering Division

3) Social and Environmental Division

The Social and Environmental Division will be responsible for dealing with social and environmental issues arising during the infrastructure development of the VIP. In addition, the division should undertake any preparations for environment control during the operation of the VIP. The major tasks of the division are listed as follows:

- Management of land acquisition and resettlement

  - Overall planning and preparation of the TOR
  - Procurement of the consultant
  - Supervising the work of the consultant according to the resettlement action plan (RAP)

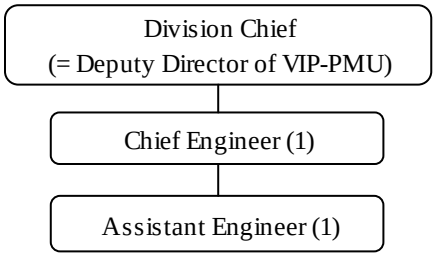
- Monitoring the construction work according to the Environmental Management Plan (EMP)

- Coordination with relevant government organizations in charge of social and environmental issues

- Resolving other social and environmental issues during the infrastructure development of the VIP

- Preparation for environment control during operation of the VIP such as making environment control manual

Staffing of the division is proposed as shown in Figure 5.2.6. The Deputy Director will concurrently act as the Division Chief.

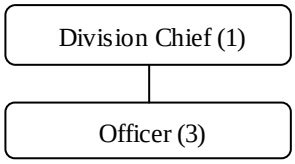


Source: JICA Survey Team

Figure 5.2.6: Staffing of Social and Environmental Division

4) Sales Promotion Division

The Sales Promotion Division will undertake preparatory work to establish the necessary sections for the VIPA during the operation stage such as investment promotion, one stop service, customer support, and human resources departments. Preparation of institutional setup, personnel arrangement, and operation manuals will be required based on the tasks of the new sections in VIPA as described in the next part (see (2) for details). Staffing of the division is proposed as shown in Figure 5.2.7.



Source: JICA Survey Team

Figure 5.2.7: Staffing of Sales Promotion Division

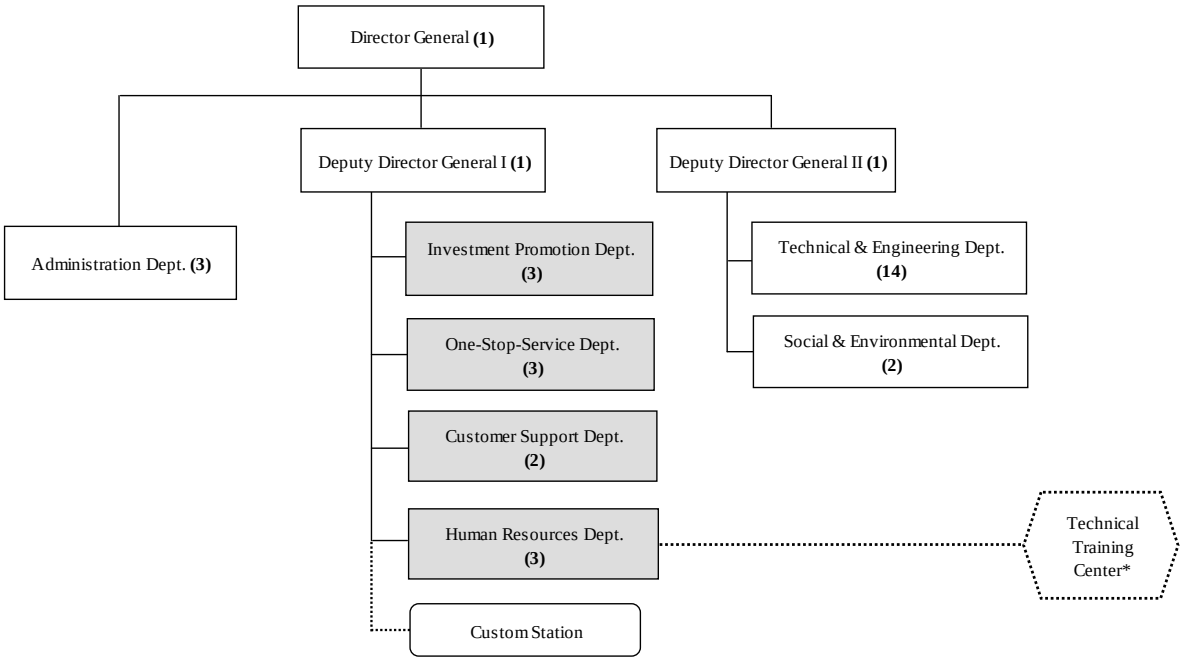
(2) VIPA Management Office

It is supposed that the VIPA decree would be finalized in the beginning of the development phase. Since the Law on Investment Promotion provides that the establishment committee should terminate its term after promulgation of the decree followed by the formulation of the management committee, it is suggested that the VIP-PMU will delegate its duties and responsibilities to the VIPA soon after the promulgation of the decree. Therefore, the VIPA Management Office should be established during the construction work of the development phase.

The VIPA Management Office will be in charge of the overall operation of VIP. According to the Law on Investment Promotion, each Specific Economic Zone should have a one stop service office that will provide investors with the following services:

- Providing information
- Undertaking investment consideration
- Issuing an enterprise registration certificate
- Giving notice on investment
- Resolving problems encountered with investors

From the foregoing, it could be interpreted that the VIPA Management Office, as a whole, should serve as one stop service office for tenants from the pre-investment stage through the operational stage. Based on this understanding, the proposed VIPA Management Office will consist of seven departments (i.e., Administration, Investment Promotion, One Stop Service, Customer Support, Human Resources, Technical and Engineering, and Social and Environmental), and one government branch (Customs Station). The proposed organization structure of the VIPA Management Office is illustrated in Figure 5.2.8. Its total number of personnel will be 33.



Note: * Technical Training Center will be an independent institute associated with VIPA.
Source: JICA Survey Team

Figure 5.2.8: Organization Structure of VIPA Management Office

The Director General shall be responsible for the overall management of the VIPA. He/she shall also be responsible for dealing with any problems arising from the activities of the VIPA and reporting the outcome of VIPA's operation to the Management Committee. He/she shall also direct the Administration Department.

Two deputy director generals shall be assigned. One shall direct the investment promotion, one-stop-service, customer support and human resources departments as well as report the activities of these departments to the Director General. The other meanwhile shall direct the technical and engineering and social and environmental departments as well as report the activities of these two departments to the Director General. The Director General shall assign either of them to act as the Acting Director General when the Director General could not perform his/her duties..

In addition, these three executive staffs will be responsible for planning the VIP operation based on the direction of the Management Committee. Their major tasks are summarized as follows:

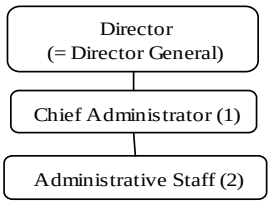
- Formulation of overall VIP policy and strategy
- Preparation of VIP operation plan, financial plan, annual activity and budget plan
- Seeking for financial support and technical assistance from inside/outside the country for VIP operation

1) Administration Department

The Administration Department will be responsible for general administrative affairs in the VIPA. The following are the major tasks of the division:

- Management of financial affairs including billing and accounting
- Asset management
- Procurement
- Supervision of bidding and contract management
- Supervision of the rules and regulations related to the activities of VIPA
- Personnel development and management
- Public relations including website management
- Management of documentation and document compilation
- Other general and legal affairs

Staffing of the department is proposed as shown in Figure 5.2.9. The Director General will concurrently act as the Department Director.



Source: JICA Survey Team

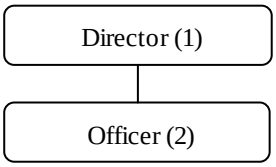
Figure 5.2.9: Staffing of Administration Department

2) Investment Promotion Department

The Investment Promotion Department will be responsible for the management of various promotion activities to attract investors to the VIP and for the negotiation with and contract procedures regarding lease of investors. The tasks of the division are as follows:

- Formulating overall marketing policy and strategy
- Conducting various promotion activities
  - Research and information collection of potential investors
  - Development and management of website
  - Development and dissemination of promotion materials such as brochure
  - Dissemination of information through different media
  - Conduct investment seminars in the Lao PDR and foreign countries
  - Directly visit potential investors inside and outside the country
  - Invitation to potential investors from inside and outside the country to the site tour
- Price setting of factory lots
- Negotiation with potential investors on lease
- Management of lease procedure and contract agreement with investors

Staffing of the department is proposed as shown in Figure 5.2.10.



Source: JICA Survey Team

Figure 5.2.10: Staffing of Investment Promotion Department

3) One Stop Service Department

The One Stop Service Department will be responsible for providing the necessary authorizations for tenants to start and continue their business in VIP. The "one stop service" here is narrowly defined as a single window for tenants to obtain various authorizations from the government for their businesses. The tasks of the department are as follows:

- Providing tenants with information and advice on the preparation of application documents and fees
- Accepting application documents and fees from tenants
- Providing authorization to tenants in case issuance of the authorization is delegated to the department
- Submitting application documents and following necessary procedures on behalf of the tenants to obtain the authorizations in case issuance is not delegated

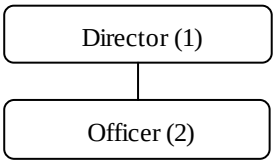
The major necessary authorizations are listed in Table 5.2.1.

Table 5.2.1: Necessary Authorizations for Tenants

Before Starting Business	During Business Operation
- Investment license - Business registration certificate - Seal authorization - Factory construction permit and operation license - Environmental Compliance Certificate - Taxpayer registration - Visa - Work permit - Resident permit	- Approval of annual import plan - Certificate of origin - Renewal of necessary licenses/permits/registrations

Note: The information is based on present regulations.
Source: JICA Survey Team

Staffing of the department is proposed as shown in Figure 5.2.11.



Source: JICA Survey Team

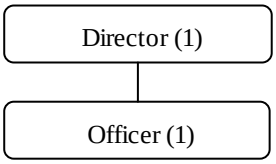
Figure 5.2.11: Staffing of One-Stop-Service Department

4) Customer Support Department

The Customer Support Department will be in charge of providing various services to tenants to facilitate their smooth business operations except for utilities handled by the Technical and Engineering Department. The following services are proposed but the final decision on the set of services should be determined based on the needs of the tenants:

- Collecting rent and other service fees from tenants as set forth in the agreement and regulations within VIP
- Collecting taxes and other fees prescribed in the government regulations from tenants and paying to the relevant agencies
- Providing information on firms that will supply necessary services to the tenants (e.g. law firms, accounting offices, consultants, contractors, equipment suppliers, internet service providers, freight forwarders, etc.)
- Providing tenants with information and notices from related agencies such as an urgent notice of blackout and revised government laws and regulations
- Organizing conferences for the tenants and related agencies to deal with issues common to every tenant (e.g., countermeasures for new legal document, labor difficulty and change in taxation)
- Taking necessary actions advising the responsible organizations to respond to the complaints/requests of the tenants

Staffing of the department is proposed as shown in Figure 5.2.12.



Source: JICA Survey Team

Figure 5.2.12: Staffing of Customer Support Department

5) Human Resources Department

Since the demand for labor force demand for VIP would be very high (see Section 5.3), considerable labor force must be employed. Therefore, the Human Resources Department will be in charge of assisting tenants in manpower recruitment and training in cooperation with the Technical Training Center (TTC).

(a) Manpower Recruitment

The tasks regarding manpower recruitment are summarized as follows:

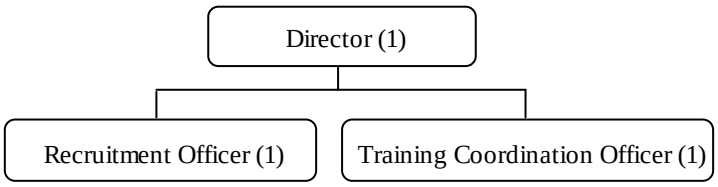
- Holding recruitment seminar
- Conducting recruitment visit to schools (universities, technical schools, vocational training schools, and secondary schools)
- Inviting primary and secondary school principals to the VIP to show its working environment and to build relationship between schools and tenants
- Disseminating information on job opportunities through various media

(b) Coordination with Technical Training Center

It is proposed that the TTC would be established in the VIP as an independent training institute. A primary objective of TTC is to meet the needs of tenants in the VIP to ensure qualified labor force by providing them with pre-service and in-service technical training (the concept of TTC is briefly explained in 9) below).

The department will coordinate with TTC to grasp and reflect the needs and requests of tenants in the training programs of TTC, to recruit trainees, and to place TTC graduates with tenants.

Staffing of the department is proposed as shown in Figure 5.2.13.



Source: JICA Survey Team

Figure 5.2.13: Staffing of Human Resources Department

6) Customs Station

In the previous part of this report, the JST proposed that the VIP should be designated as a bonded area. If this proposal is accepted by the Lao government, cargo inspection will be exempted from customs clearance procedure for VIP tenants when they import and export goods. In the case of import, for example, the customs authority at Thanaleng (in the future, at Vientiane Logistic Park or VLP) will only conduct documentary check. Then, the goods will be consigned to the tenants in the VIP without either physical inspection or customs payment at Thanaleng or VLP. In general, tenants should pay customs after the arrival of goods.

However, since the customs authority has a right to carry out checks on goods in VIP at any time, it is proposed that the customs station should be set up in the VIPA.

If customs clearance system will be networked in future, it is possible to equip customs station with several computers for tenants to make pre-declaration.

7) Technical and Engineering Department

The Technical and Engineering Department will be responsible for managing the O&M of infrastructure within VIP.

(a) Management of O&M of Main Infrastructure and Utilities

In principle, the VIPA will be in charge of the maintenance of infrastructure in common areas while individual tenant will be responsible for the construction and O&M of infrastructure within its own factory lot depending on its own needs. For example, the VIPA will carry out regular clean-up, repair, and other maintenance work for the storm water system, roads and relevant facilities including retention pond, street lamps, and road side plantation in common areas.

Regarding utilities such as water supply, power supply and telecommunication, each service provider will conduct operation after VIP prepares the basic infrastructure for them.

Individual tenant will be responsible for preparing the connection to the utilities within its own area and making a contract with the service providers. The service providers will collect service charge directly from the tenants.

For building construction and installation and utilization of utilities, the Customer Support Department will assist tenants by providing necessary information about consultants, contractors, and service providers as well as mediating during dispute resolution upon the request of tenants.

Table 5.2.2 summarizes the O&M system of main infrastructure and utilities in VIP.

Table 5.2.2: O&M of Main Infrastructure and Utilities in VIP

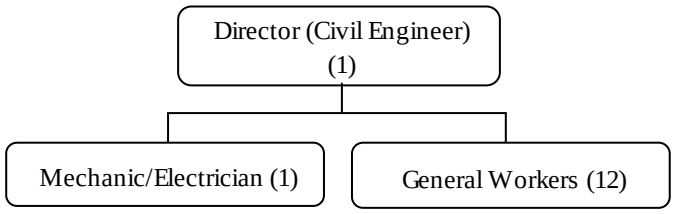
Utility	Infrastructure in common areas		Infrastructure within the factory lot		Fee collection from tenant
	Operation (Service provider)	Maintenance	Construction/ Installation	O&M	
Water Supply System	Nam Papa	Nam Papa	Tenant	Tenant	Nam Papa
Storm Water System	--	VIPA*	Tenant	Tenant	VIPA**
Wastewater System	--	VIPA*	Tenant	Tenant	VIPA**
Roads	--	VIPA	Tenant	Tenant	VIPA**
Power Supply System	EDL	EDL	Tenant	Tenant	EDL
Telecommunication	Telecom company	Civil work: VIPA Others: Telecom company	Tenant	Tenant	Telecom company
Solid Waste Management System	VUDAA (Waste collection)	--	Tenant (If necessary)	Tenant (If necessary)	VUDAA

Note: * Discharge of storm water and wastewater will use the same system so VIPA will conduct O&M of storm water system and monitor water quality.
** VIPA will collect fee as a maintenance fee for VIP based on the size of factory lot
Source: JICA Survey Team

(b) Other Tasks

The department will cooperate with the police and fire fighting department to manage security and fire control in the VIP.

Staffing of the department is proposed as shown in Figure 5.2.14.



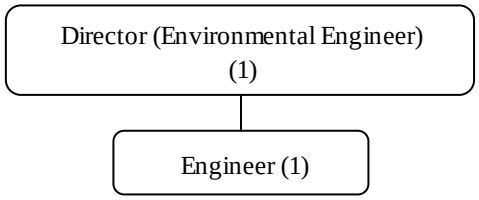
Source: JICA Survey Team
Figure 5.2.14: Staffing of Technical and Engineering Department

8) Social and Environmental Department

The Social and Environmental Department will be responsible for environmental control within VIP. Its tasks regarding environmental control are summarized as follows:

- Assisting tenants in the environmental assessment for factory construction as follows:
  - Providing information on environmental regulations and local consultants
  - Facilitating communication with WREA
- Monitoring the quality of water discharged from the factory lot
- Handling complaints related to environment from people living in the surrounding areas
- Conducting necessary reporting to WREA

Staffing of the department is proposed as shown in Figure 5.2.15.



Source: JICA Survey Team

Figure 5.2.15: Staffing of Social and Environmental Department

9) Technical Training Center

It is predicted that it would be difficult for tenants to secure sufficient number of qualified labor as analyzed in Section 5.3. Therefore, the establishment of the TTC is strongly proposed. The TTC will be an independent training institute to provide training opportunities for trainees to acquire technical skills to meet the needs and demands of tenants in VIP. The graduates will receive priority to be employed in VIP. The TTC will also provide workers in the VIP with in-service training based on the needs and requests of VIP tenants.

In order to materialize the establishment of the TTC, another separate study is required for developing institutional and operational mechanism and designing training programs. Since it is predicted that that VIP would need to employ significant amount of labor who have never been accustomed to working in the industrial sector (see also Section 5.3), the training programs should include the course on basic rules and disciplines to work in a factory. Table 5.2.3 shows some examples of training courses.

Table 5.2.3: Training Courses of TTC (Example)

Course	Type of Training	Target Trainees	Note
- Electrical maintenance - Mechanical maintenance - Electronics - Mechatronics	Pre-service	Technical school graduates Junior/Senior high school graduates	The courses at different levels (basic, intermediate, and advanced) are offered according to educational background and experience of trainees.
	In-service	Technical staff in the factory	
Work ethics and discipline	In-service	General factory workers	Trainees who have no experience working in a factory
Basic Japanese used in a factory	In-service	General factory workers	The language which the tenants are going to use in their factories is taught.

Source: JICA Survey Team

5.2.3 Recommendations

Recommendations for the VIP-PMU and VIPA Management Office from institutional and capacity development viewpoints are as follows:

- The following should be conducted by MoIC in cooperation with other relevant ministries to enable VIPA to serve as one stop service office for providing necessary authorizations for tenants to start and continue their businesses:
  - Examining the present application documents and procedures related to business operation and deciding the policy to streamline and delegate them to the VIPA (or in general, the one stop service office in the Specific Economic Zone),
  - Revising the relevant government regulations based on the above policy,
  - Revising the application documents and procedures based on the revised regulations,
  - Translating revised application documents into foreign language, and
  - Producing the guidelines to explain the application procedures in foreign language for tenants.
- The VIP-PMU and VIPA Management Office should have enough personnel with relevant capabilities and experience to ensure the efficient and sustainable management and operation of VIP. It is recommended that qualified persons should be recruited from inside and outside the government. If qualified persons are not available, high-potential persons should be recruited and then trained.
- The VIP-PMU Director shall possess ethical qualities, professional and leadership capabilities, and experience in management of similar projects. Those who are proficient in foreign languages relevant to the VIP development shall be prioritized.
- The Director General and/or Deputy Director Generals of the VIPA Management Office shall possess ethical qualities, professional and leadership capabilities, and experience in management of industrial parks or similar projects. Those who are proficient in foreign languages relevant to the VIP development shall be prioritized.
- Hiring experienced experts from agencies of neighboring countries such as Thailand, Philippines and Japan as advisors or in-house consultants for the VIP-PMU and VIPA Management Office might be taken into consideration.
- The establishment of the TTC is strongly recommended to secure sufficient labor force for VIP tenants. It will function as an independent training institute to 1) give technical training to trainees who will receive priority to be employed in VIP after completion of the training, and 2) provide workers in VIP with in-service training based on the needs and requests of the tenants. In order to materialize the establishment of the TTC, another separate study is required for the development of institutional and operational mechanism and designing training programs.

5.3 Demand and Supply of Employment

5.3.1 Employment Demand in VIP

(1) Annual Employment Demand

With the development of VIP, a large number of employment opportunities will be created. In line with the sales or occupancy ratio scheduled in Figure 6.1.1 (see Chapter 6), the necessary number of labor to be employed from 2015 to 2018 is estimated as shown in Table 5.3.1.

Table 5.3.1: Estimated Employment Demand in VIP

Year	Occupancy ratio (per year)	Turnover ratio	Calculation of necessary annual employment			Total employment demand (4)
			Required net employment demand (per year) (1)	Job leaver (per year) (2)	Gross employment (per year) (3)	
2015	30%	40%	2,250	900	3,150	2,250
2016	30%	40%	2,250	1,800	4,050	4,500
2017	20%	40%	1,500	2,400	3,900	6,000
2018	20%	40%	1,500	3,000	4,500	7,500

(Calculation basis)

(a) Necessary number of employees at 100% occupancy ratio = (b)*(c)*(d)	7,500	(b) Total development area (ha)	130	(c) Ratio of factory lots to total development area	70%	(d) Number of labor per ha	82

Note:
(1) = (a) * [occupancy ratio]
(2) = ((4) in previous year + (1)) * [turnover ratio]
(3) = (1) + (2)
(4) = (4) in previous year + (1)
Source: JICA Survey Team

Turnover ratio is set based on the actual situation at factories operating in the vicinity of Vientiane Capital. Interview with factory managers revealed that 40% to 50% of employees leave jobs within one year after being employed.

Since considerable number of employees is assumed to leave their jobs every year, number of people to be employed should be greater than the net employment demand as estimated in column (3) of Table 5.3.1.

(2) Employment Demand by Education Level

The estimated gross employment is divided according to educational level as shown in Table 5.3.2.

Table 5.3.2: Employment Demand by Educational Level

Year	(a) Total employment (per year)	Employment by education level		
		(b) Equal to or less than junior secondary school graduate level	(c) Senior secondary school graduate level	(d) Higher education graduate level
2015	3,150	2,835	236	79
2016	4,050	3,645	304	101
2017	3,900	3,510	293	98
2018	4,500	4,050	338	113

Note: (a) = (3) in Table 5.3.1.
(b) = (a) * 0.9 (90%)
(c) = (a) * 0.075 (7.5%)
(d) = (a) * 0.025 (2.5%)
Ratios of (b), (c), (d) are assumed by JICA Survey Team
Source: JICA Survey Team

The most necessary laborers for VIP are factory workers. Interview with managers of the factories operating in the vicinity of Vientiane Capital indicated that education level was not an important requirement for factory workers. Actually, many factory workers completed only primary school. Therefore, the educational level in column (b) in Table 5.3.2, assumed to be factory workers, is set to be equal to or less than junior secondary school graduate.

The laborers in column (c) are expected to be supervisors of production lines, mechanics, and office clerks who are required to be more competent than factory workers. Therefore, their educational attainment should be senior secondary school graduate level.

The laborers in column (d) will be engineers tasked to manage the production machinery and other equipment and facilities in the factory or employees who are expected to be administrators in charge of accounting, personnel management and other administrative affairs. They are also expected to be local manager-level employees in the future. Therefore, they should be graduates of higher education institutes such as technical schools, colleges and universities.

5.3.2 Availability of Labor

(1) General Situation

From the information obtained through interviews at factories, technical schools, and vocational training centers in the vicinity of Vientiane Capital, the situation of the labor market for the industrial sector is summarized as follows:

- It is difficult to hire young people in Vientiane Capital as factory workers. The higher their educational attainments are, the more they prefer to work in the service sector rather than in the industrial sector. They think that the salary in the industrial sector is too low to compensate for their hard work. However, young people do not have an adequate idea of how working in the industrial sector is.

- Accounting is the most popular subject to study for young people in Vientiane Capital. For example, about 64% of 4,000 students are majoring in accounting in Pakpasak Technical College, which is one of the oldest and famous technical schools in the Lao PDR. Major employment places for its students are banks, government sector and accounting sections in various companies.

- In technical schools and vocational training centers in Vientiane Capital, student enrollment in courses with mechanical subjects is decreasing.

- From an employer's point of view, training is more or less necessary for newly employed factory workers regardless of their educational background in order to enable them to work with skills and follow procedures specific to the factory. Therefore, employers do not need to hire people with higher educational attainment who are demanding in terms of salary and working condition.

- In most factories, majority of workers are young females. It might be due to the fact that most of the factories in Vientiane Capital fall under labor-intensive industries.

- Employers face various difficulties in personnel management which are possibly attributed to the characteristics of an agriculture-oriented society. For instance, factory workers do not come to work on time, are absent without any notice, and take leave without returning during busy farming seasons. In reality, many of them cannot adapt to the working environment in the factory and quit the job. Employers are trying to take enough time for their employees to acquire discipline and right manner to work in a factory. In addition, employers say that a high salary is not enough to retain workers. They think that a friendly and comfortable working environment is also necessary.

- There are many workers from rural areas outside Vientiane Capital that can work in factories due to the insufficient labor available in and nearby Vientiane Capital. Since those who come from outside Vientiane Capital neither have an idea of urban lifestyle nor have worked in the industrial sector, employers especially take care of them. Otherwise, they will soon quit the job and go back home. The assistance and concern start during the recruitment stage. The employer invites school principals to the factory to show the working environment and explain the detailed employment conditions in order to ease their worry to send their graduates to the factory. Then, the employer prepares its own dormitory or rents an apartment for employees who come from distant areas. Those who come from the same village are arranged to live side by side.

(2) Availability of Factory Workers

In the statistics of the Lao PDR, the population with ages between 15 and 64 is defined as the working age population. The people in the working age population are divided into "Economically Non-Active Population"[5] and "Economically Active Population". The former is further divided into two groups, namely: "Employed" and "(Involuntarily) Unemployed". Then, "Employed" consists of four categories of people, namely: "Paid Employee" of public and private sectors, "Employer", "Own Account Worker", and "Unpaid Family Worker". The potential supply of factory workers VIP is estimated based on the existing statistics and following assumptions:

- The most probable source of labor will be the "Unemployed" and "Unpaid Family Worker" groups.
- Majority of tenants in VIP will be factories classified under labor-intensive industries.
- Because of the above tendency, young females[6], who are good at delicate hand work, will be the major target of employment.

[5] "Economically Non-Active Population" includes those who are studying, exclusively engaged in household duties, retired, or sick.

[6] According to the present education system, children can complete junior secondary school at the age of 14. It should be noted that the labor law has provisions to protect the young aged between 14 and 18 by limiting working hours. In addition, the education system will be changed from 2010. Total schooling period will be 12 years which consist of 5-years primary school, 4-years junior secondary school and 3-years senior secondary school (currently, 5-years primary school, 3-years junior secondary school and 3-years senior secondary school).

The results of the estimation are presented in Table 5.3.3.

Table 5.3.3: Potential Supply of Young Female Labor

Area	(1) Female aged between 15 and 24	(2) Involuntarily unemployed	(3) Unpaid family worker	(4) Potential labor supply: (2) + (3)
Vientiane Capital	76,932	3,308	26,894	30,202
Vientiane Province	45,980	828	22,180	23,008
Other 15 Provinces	500,805	9,014	241,584	250,598

Note: (1): Estimated based on population by age group and by province. Data in Statistical Yearbook 2007 is used because the composition of provinces in National Census 2005 is different from that at present (Xaysomboon SR does not exist anymore).
(2) = (1) * [ratio of involuntarily unemployed]
The following ratio is applied for each area:
Vientiane Capital: 4.3% (Average ratio to female aged between 15 & 24 in urban areas)
Vientiane province and other 15 provinces: 1.8% (National average ratio to female aged between 15 & 24)
(3) = (1) * [ratio of employed to female aged between 15 & 24]* [ratio of unpaid family worker to employed female]
The following ratio is applied for each area:
Ratio of employed for Vientiane Capital: 53.7% (Average ratio to female aged between 15 & 24 in urban areas)
Ratio of employed for Vientiane province and other 15 provinces: 74.1% (National average ratio to female aged between 15 & 24)
Ratio of unpaid family worker: 65.1% (National average ratio to employed female)
Source: National Census 2005 and Statistical Yearbook 2007

In addition, Table 5.3.4 shows the potential supply of male labor calculated as reference.

Table 5.3.4: Potential Supply of Young Male labor

Area	(1) Male aged between 15 and 24	(2) Involuntarily unemployed	(3) Unpaid family worker	(4) Potential labor supply: (2) + (3)
Vientiane Capital	77,373	3,250	9,248	12,498
Vientiane Province	48,000	912	8,066	8,978
Other 15 Provinces	499,598	9,492	83,950	93,442

Note:(1): Same as Table 5.3.3.
(2) = (1) * [ratio of involuntarily unemployed]
The following ratio is applied for each area.
Vientiane Capital: 4.2% (Average ratio to male aged between 15 & 24 in urban areas)
Vientiane Province and other 15 provinces: 1.9% (National average ratio to male aged between 15 & 24)
(3) = (1) * [ratio of employed to male aged between 15 & 24]* [ratio of unpaid family worker to employed male]
The following ratio is applied for each area:
Ratio of employed for Vientiane Capital: 44.6% (Average ratio to male aged between 15 & 24 in urban areas)
Ratio of employed for Vientiane Province and other 15 provinces: 62.7% (National average ratio to male aged between 15 & 24)
Ratio of unpaid family worker: 26.8% (National average ratio to employed male)
Source: National Census 2005 and Statistical Yearbook 2007

The potential labor supply estimated above consists of people whose educational level is equal to or higher than senior secondary school. It also includes those who do not want to work in factory at all, do not have an aptitude for factory work, or cannot leave family to work. Therefore, actual labor availability will be much less than the figures presented in Tables 5.3.3 and 5.3.4.

As mentioned in Table 5.3.2, 3,000 to 4,000 employments will be constantly created in VIP every year. Given the fact that existing factories in and nearby Vientiane Capital have already started seeking labor outside Vientiane Capital and Vientiane Province, labor recruitment from other provinces should also be taken into consideration.

(3) Availability of Workers at Senior High School and Higher Education Graduate Level

It is estimated that around 300 jobs would be created for senior high school graduates every year in VIP as shown in Table 5.3.2. As Table 5.3.5 pointed out, it seems that there would be sufficient graduates in Vientiane Capital and its surrounding areas to meet the employment demand in VIP. However, the unfavorable image of the industrial sector inculcated in the minds of young people should be taken into consideration.

Table 5.3.5: Number of New Graduates from Senior High Schools in 2007/08

Area	Senior high school graduates
Vientiane Capital	8,118
Vientiane Province	4,535
Other 15 provinces	30,210
Total	42,863

Source: Annual School Census 2007-08, Ministry of Education

In general, it is difficult to estimate how many students graduate from higher education institutes every year. It is because the course term differs from 2 to 5 years by the type of institutes. Moreover, some students have jobs and spend more years to complete the course. However, it will be not so difficult to meet the employment demand for the graduates from higher education institutes due to its small number as shown in Table 5.3.2. In addition, most of the competent higher education institutes such as technical schools and colleges (e.g., National University of Laos where more than 20,000 students enroll are concentrated in Vientiane Capital).

5.3.3 Recommendations

Recommendations for VIP operation to mitigate the burden on tenants to secure sufficient labor force are summarized as follows.

- VIP shall assist tenants in manpower recruitment. For instance, the VIPA shall hold recruitment seminar, conduct recruitment visit to schools inside/outside Vientiane Capital (including universities, technical schools, vocational training schools, and secondary schools), and invite primary and secondary school principals especially from outside Vientiane Capital to VIP to show its working environment and to build relationship between schools and tenants. As proposed in (2) in Section 5.2.2, the Human Resources Department of the VIPA Management Office will be in charge of these tasks.

- VIP shall conduct training sessions for newly employed factory workers to learn basic discipline and work ethics in the factory as well as in urban life. The idea of the Technical Training Center is discussed (2) -9) in Section 5.2.2.

- VIP shall provide training programs for employees (e.g., mechanics, engineers, and production line supervisors) to acquire specific technical skills based on the needs of each tenant. The training curriculum shall be developed in collaboration with the VIPA and tenants.

- VIP shall prepare housing facilities for employees who come to work from distant areas.

CHAPTER 6 PROJECT COST ESTIMATE

6.1 Procurement Plan

6.1.1 Contract Packages

The features of the Vientiane Industrial Park Development Project (the Project) are described in the associated chapters. It involves horizontal development, covers vast rural areas and earthmoving works of more than a million cubic meters for land reclamation, and coordination with the presently ongoing works near the Project such as the 450 Year Road construction project and 25th SEA Games Road construction project, including the improvement of District Road No. 108 (DR-108).

These factors, together with its magnitude, limited accesses to the construction sites and the need for its speedy completion, are considered unsuitable to implement the Project under one contract package. The packaging and programming of the works are carried out in an iterative process. The first step is to subdivide the overall scheme into elements and to prioritize them based on the requirements. This preliminary ranking gives priority to securing access to the construction site in coordination with the ongoing developments near the Project.

The preliminary priorities for the Official Development Assistance (ODA) scheme are given to the following:

1) Land reclamation for the early start of infrastructural development works
2) Road network
3) Drainage, water supply and sewerage collection as incidental utilities to the road network
4) Power supply and telecommunication

The contract package (CP) plan is formulated based on the following: (i) present ability of the contractors, (ii) characteristics and volumes of the works, (iii) minimization of the implementation period, and (iv) minimization of the number of packages to reduce the burden and responsibility of the Vientiane Industrial Park-Project Management Unit (VIP-PMU). Based on the preliminary priorities above, the following three contract packages are proposed for the Project:

a) CP-1: Land reclamation under international competitive bidding (ICB)

Cutting work	: 1,316,000 m^3
Filling work	: 1,317,000 m^3

b) CP-2: Major infrastructure development under ICB

Road length	: 5.7 km
Drainage channel/ditch line	: 16.1 km with 2 retention ponds
Water supply line	: 12.8 km with 2 reservoirs and a tower
Monitoring pits for individual sewerage	: 206 units with collection sewer

treatment system	
Telecommunication line	: 45.7 km

c) CP-3: Power supply system under ICB

Relocation of overhead transmission line	: 4.8 km
115/22 kV substation	: 1 unit
22 kV distribution line	: 11.0 km

It is recommended that all contract packages should be carried out through ICB in order to ensure a reasonable price for the Project and keep the construction under strict and effective quality control. It is also proposed that the power supply works should be separated from the other packages, which are mainly civil works. Hence, it should be carried out under CP-3 since the characteristics of power supply works are very different than those of CP-1 and CP-2.

6.1.2 Project Implementation Schedule

The duration of the Project is set at three years starting with the detailed design from the 2nd Quarter of the 3rd Year, considering the loan procedures for the Project, procedures for the selection of consultants and contractors, and more than 2.6 million m^3 of earthmoving works for land reclamation. Presently, three access roads are available and passable to the earthmoving fleets surrounding the private lands in the Vientiane Industrial Zone. The earthmoving fleets for heavy loads of more than 20 tons are preferable for large quantities of land reclamation works since earthmoving works will be conducted only inside the Vientiane Industrial Zone with an area of 2,000 ha. Thus, the combination of equipment with large loading and hauling capacity should be considered.

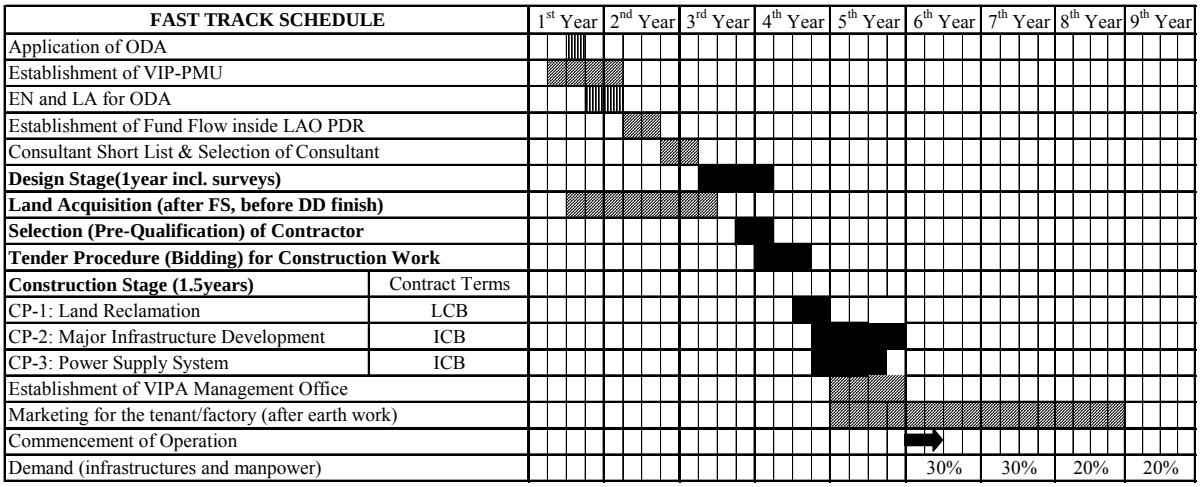
Considering a daily rainfall amount of 3 mm based on the available past rainfall data from 1975 to 2005 of the National Statistics Centre, the annual number of workable days for earthmoving works is approximately estimated at 240 days. During the rainy season, dump trucks for hauling soil materials to the land reclamation site are assumed to experience difficulty and slow down and thus operate with little progress. In principle, working hours are set at 8 hours a day and 48 hours a week.

Considering all but not limited to the conditions above, it is tentatively envisaged that the stages of the detailed design, pre-construction bidding and construction would be implemented in the following periods:

- Detailed design: from the 2nd Quarter of the 3rd Year till the 1st Quarter of the 4th Year
- Pre-qualification and bidding: from the 4th Quarter of the 3rd Year till the 3rd Quarter of the 4th Year
- Construction: from the 3rd Quarter of the 4th Year till the end of the 5th Year

Land acquisition shall be conducted by the Laotian government from by the 2nd Quarter of the 3rd Year and completed before the commencement of the full-scale detailed design work.

The Project is planned to be completed by the 5th Year. Its implementation is planned in a manner that would ensure proper execution of the work by taking into consideration the conditions of the Project including the contractors and suppliers, procurement of materials and labor force, procurement of imported materials, and construction methodology. The tentative implementation schedule is presented in Figure 6.1.1.



Source: JICA Survey Team

Figure 6.1.1: Implementation Schedule of VIP Project

6.2 Project Cost Estimate

6.2.1 Estimate Basis

The Project cost estimates are prepared through an iterative process, based on the estimated unit costs and the following basic conditions:

(1) Price Level in the end of March 2010

Unit costs of construction resources were collected from three local contractors and one local consultant from October 2009 to March 2010. Moreover, construction prices in related projects such as 450 year road project and Dongbang water supply project were also investigated. After evaluation of four kinds of unit construction costs and construction prices in related projects, the unit costs from the local consultant are considered most suitable to be adopted for the estimates of the Project cost. Direct costs for construction and land acquisition are estimated considering price level at the end of March 2010.

(2) Exchange Rate

Exchange rate is estimated based on the announcement of JICA monthly exchange rate in March 2010. The following annual average is adopted as exchange rate:

USD1.0 = JPY90.52
LAK1.0 = JPY0.01

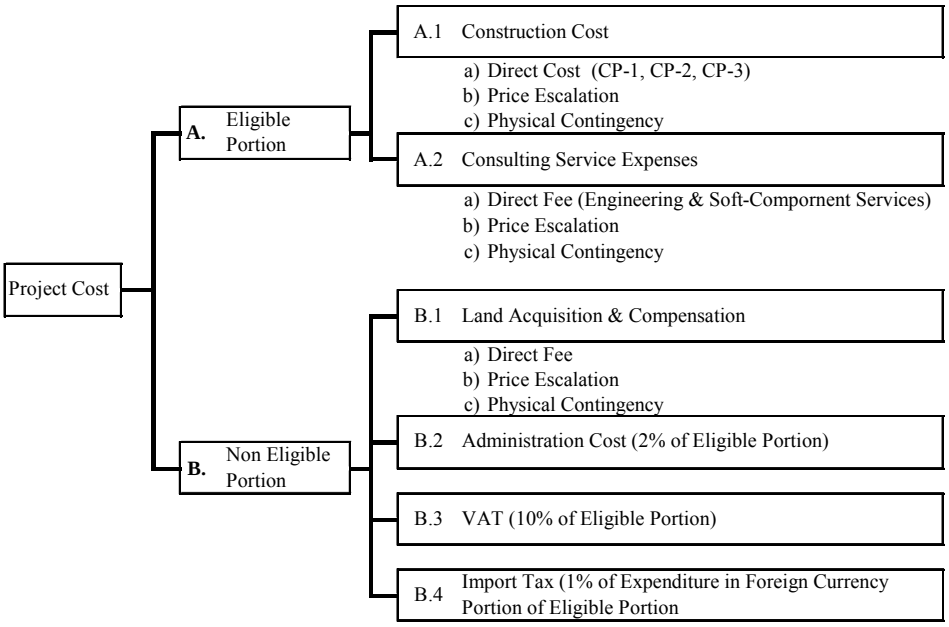
(3) Allocation of Foreign Currency Portion and Local Currency Portion

The foreign currency portion (F.C.) includes the cost, insurance and freight (CIF) price of equipment and materials to be imported. The local currency portion (L.C.) includes the costs of labor, equipment and materials procured locally, custom clearance costs and inland transportation costs of imported equipment and materials. The cost of CP-1, i.e., land reclamation with unit construction costs that are mostly estimated on the basis of local currency, is estimated at 100% of L.C. Although CP-2

and CP-3 include imported materials and equipment, their unit costs are still in local currency. Thus, the unit costs of CP-2 and CP-3 are allocated at 30% of F.C. and 70% of L.C.

(4) Composition of Project Cost

The project cost is composed of an eligible portion and non-eligible portion as shown in Figure 6.2.1. The eligible portion consists of construction cost and consulting service expenses. The non-eligible portion is made up of land acquisition and compensation expenses, administration cost, value added tax (VAT) and import tax.



Source: JICA Survey Team

Figure 6.2.1: Composition of Project Cost

(5) Price Escalation Rates for Foreign and Local Currencies

Price escalations are assumed to be 1.8% for foreign currency of direct cost and 9.1% for local currency of direct cost with reference to similar projects in Asian and price indexes published by the National Statistics Centre as shown in Table 6.2.1.

Table 6.2.1: Local Price Escalation Rate

Construction Material	Statistical Yearbook of Vientiane Capital 2006-2008	Statistical Yearbook 2008	Lao Monetary Statistics Q2	Average
Lao Tin Plates	4.3%	4.7%		4.5%
Plywood	1.7%			1.7%
Lumber	4.3%			4.3%
Stone	14.2%			14.2%
Sand	24.7%			24.7%
Steel	9.7%			9.7%
Cement	6.8%	5.7%		6.2%
Gasoline	25.0%	9.0%		17.0%
Housing			9.4%	9.4%
Average	11.3%	6.5%	9.4%	9.1%

Source: National Statistic Centre, MPI

(6) Physical Contingency

Physical contingency is assumed to be 10% of the sum of direct cost and price escalation for construction works, consulting services and land acquisition.

(7) Consulting Service Expenses

Consulting service fee consisting of engineering and soft-component services is estimated based on the man-month (MM) required for the services. It is estimated to be about 15.6% of the direct construction cost.

(8) Administration Cost

Administration cost is assumed to be 2% of the sum of the eligible portion.

(9) Value Added Tax

In the Lao PDR, implementation of the VAT has started from January 1, 2010. VAT is 10% of the contract amount.

(10) Import Tax

In case of national projects, the import tax is applied to be 1% of the CIF prices of materials and equipment to be procured from abroad.

6.2.2 Estimated Direct Construction Cost

During the feasibility study of the Project, estimates of the project construction costs were prepared through the following three steps:

1) First step is to collect the following cost data for reference:
   - Construction prices for related projects, such as 450 Year Road construction project, 25th SEA Games linking roads construction project and Dongbang water supply project,
   - Unit costs from three local contractors to estimate the preliminary project cost, and
   - Unit costs from one local engineering consultant to be utilized for reviewing the cost estimates.
2) Second step is to prepare unit costs in compliance with the Lao PDR's standard and criteria
3) Third step is to prepare the construction cost through an iterative process

Due to the lack of readily available data, a considerable effort was made to collect and derive the base data needed to come up with the cost estimate. In order to find realistic costs with the degree of accuracy required at the feasibility study level, unit cost analysis was attempted with reference to the collected cost data derived from recent tender documents of similar projects.

Lump sum costs were also estimated on the basis of the collected cost data, experience and engineering judgement, and standard criteria available in Japan. The costs of preparatory works were estimated at 5% of the total expenditure combined with foreign currency and local currency portions of the sectoral construction cost based from experience.

The estimated direct construction costs for the respective contract packages are summarized in Table 6.2.2.

Table 6.2.2: Direct Construction Cost

Contract Package	Infrastructure	Direct Construction Cost		Total
		FC (JPY)	LC (LAK)	(Equivalent: JPY)
CP-1	**Land reclamation**			
	I. Preparatory woks	0	4,332,000,000	43,316,000
	II. Land reclamation	0	69,970,000,000	699,703,000
	III. Boundary Fencing	0	8,603,000,000	86,028,000
	IV. Gate	0	8,060,000,000	80,598,000
	Sub-total CP-1	**0**	**90,965,000,000**	**909,645,000**
CP-2	**Major infrastructure development**			
	I. Preparatory Works	8,245,000	4,472,000,000	52,966,000
	II. Road and transportation system	178,977,000	41,770,000,000	596,674,000
	III. Drainage system	170,141,000	39,694,000,000	567,079,000
	IV. Water supply	88,649,000	20,684,000,000	295,492,000
	V. Individual sewerage treatment system	7,582,000	1,303,000,000	20,608,000
	VI. Telecommunication line	41,859,000	9,764,000,000	139,499,000
	VII. Building	62,408,000	14,561,000,000	208,019,000
	Sub-total CP-2	**557,861,000**	**132,248,000,000**	**1,880,337,000**
CP-3	**Power supply**			
	I. Preparatory woks	9,943,000	664,000,000	16,582,000
	II. Power supply	662,868,000	18,968,000,000	852,551,000
	Sub-total CP-3	**672,811,000**	**19,632,000,000**	**869,133,000**
	Total (CP-1, 2 and 3)	**1,230,672,000**	**242,845,000,000**	**3,659,115,000**

Source: JICA Survey Team

6.2.3 Estimated Consulting Service Fee

Based on the implementation schedule, the proposed consulting service and its cost estimate are prepared as follows:

- The proposed consulting service consists of engineering service and soft-component service.
- Tentative terms of reference (TOR) for the consulting service is prepared based on the result of the feasibility study for the Project.
- The assignment schedule for engineering staff is prepared based on the detailed design, pre-construction and construction stages.
- Billing rate is assumed from the rates commonly used for Japanese ODA projects.
- Technical assistance, so called soft-component, is also included in the proposal so that the local government staff would be able to manage the project implementation, investment promotion and enhance the coordination structure among the project management office, developer and supplier.

The TOR for the consulting service is outlined in Table 6.2.3.

Table 6.2.3: Summary of TOR

1.	**ENGINEERING SERVICE during DESIGN STAGE**
1.1	Review of Previous Related Studies
1.2	Preparation of Necessary Project Document
1.3	Field Investigation
	1) Geotechnical Investigation
	2) Inventory Survey for existing constructed work items
	3) Topographical and Boundary Survey with scale of 1/500
1.4	Determination of Design Standards and Criteria
	1) Design parameters
	2) Design standards and specifications
	3) Methodology and criteria for design calculations
1.5	Detailed Design Works
	1) Land development for industrial area and residential area
	2) Major infrastructure, including land preparation, road, drainage, water supply, sewerage, power supply and telecommunication conduit
	3) Power supply system, including 115 kVA transmission line from Khoksaad, 115/22 kVA sub-station with capacity of 20 MVA x 2 units
1.6	Bill of Quantity and Specifications
	1) Type and kind of materials and construction equipment including their specification and quantity
	2) Material's specifications including strength, performance and others
1.7	Construction Plan and Schedule
	1) Construction methods including the description of associated temporary facilities
	2) Construction time schedule in the form of a bar chart, showing the sequence of execution of various works
1.8	Cost Estimate
1.9	Pre-qualification Documents
1.10	Tender Documents
2.	**ENGINEERING SERVICE during PRE-CONSTRUCTION STAGE**
2.1	Pre-Qualification
2.2	Assistance in Tender
2.3	Assistance in Contract Award
3.	**ENGINEERING SERVICE during CONSTRUCTION SUPERVISION STAGE**
3.1	Preparatory Works/Mobilization
3.2	Preparation of Construction Drawings and Specifications
3.3	Check of the Contractor's Drawings and Specifications
3.4	Check of Construction Plan
3.5	Control of Quantity and Quality
3.6	Monitoring and Control of Work Progress
3.7	Environmental Monitoring during Construction Period
3.8	Control of Payment
3.9	Supervising Preparation of As-built Drawings and Completion Report
3.10	Supervising Preparation of Operation and Maintenance Manuals
3.11	Final Inspection and Completion Certificate
3.12	Assistance in Institutional Development
3.13	OJT-based Transfer of Technical Knowledge

4.	**TECHNICAL ASSISTANCE (SOFT-COMPONENT) during WHOLE STAGE**
4.1	Empowerment and Assistance for Project Implementation
	1) Designing/supervising works based on OJT
	2) Method of contractor procurement
	3) Systematic and smooth document and drawings workflow
	4) Method to ensure transparency and accountability
4.2	Empowerment and Assistance for VIP Management
	1) Supports on formulation of one stop service system, including investment approval and implementation procedure.
	2) Supports on establishment of sufficient operation and maintenance organization and workflow of the Project, for all relevant bodies including investors/tenants.
	3) Assistance for establishment of monitoring/inspection system on industrial pollution source.
4.3	Empowerment and Assistance for Investment Promotion
	1) Supervision of investment promotion
	2) Preparation of sufficient material for the promotion activities
	3) Conducting promotion tour abroad (3 potential investing countries in Asia)
4.4	Empowerment for Social & Environmental Monitoring
	1) Assistance for water quality sampling survey
	2) Assistance for establishment of monitoring/inspection system on industrial pollution source

Source: JICA Survey Team

In line with the assumed TOR above, the following inputs of competent engineers are required during each stage:

Table 6.2.4: Input of Required Engineers

Implementation Stage	Foreign Engineer (Man-Month)	Local Engineer (Man-Month)
1. Engineering Services	**109**	**389**
1.1 Design Stage	36	62
1.2 Pre-Construction Stage	4	7
1.3 Construction Stage	69	320
2. Soft-Component Services	**16**	
2.1 Design Stage	5	-
2.2 Construction Stage	11	-
Total	**125**	**389**

Source: JICA Survey Team

Based on the above assumption of required engineers' input, the total consulting service fee during the implementation period is estimated at JPY572 million, which consists of engineering service fee of JPY496 million and soft-component service fee of JPY76 million. The total consulting service fee corresponds to about 15.6% of the total direct construction cost.

6.2.4 Estimated Project Implementation Cost

Except for interests during implementation, the project cost is tentatively estimated through an iterative process. The estimated project implementation cost is summarized in Table 6.2.5. The total project implementation cost is estimated at about JPY7.03 billion. The project implementation cost is largely divided into two portions, namely: eligible cost for the ODA scheme portion and non-eligible cost for the Laotian government portion as shown in Table 6.2.5. The eligible and non-eligible costs are estimated at JPY5.75 billion and JPY1.28 billion, respectively.

Table 6.2.5: Project Implementation Cost

Component	Project Implementation Cost		
	FC (JPY 1,000)	LC (LAK million)	TOTAL (JPY 1,000)
I. Eligible Cost: ODA Scheme Portion	**1,956,641**	**379,095**	**5,747,592**
1. Construction Cost (a+b+c)	1,437,041	360,967	5,046,715
a. Direct Construction Cost	1,230,671	242,844	3,659,112
b. Price Escalation	75,730	85,308	928,810
c. Physical Contingency	130,640	32,815	458,792
2. Consulting Service Cost (d+e+f)	519,599	18,128	700,877
d. Direct Consulting Service Fee	448,020	12,385	571,867
e. Price Escalation	24,343	4,095	65,294
f. Physical Contingency	47,236	1,648	63,716
II. Non Eligible Cost: Laotian Government Portion	**0**	**128,161**	**1,281,609**
1. Land Acquisition & Compensation Cost (a+b+c)	0	57,233	572,332
a. Direct Land Acquisition & Compensation Fee	0	47,600	476,000
b. Price Escalation	0	4,430	44,301
c. Physical Contingency	0	5,203	52,030
2. Administration Cost	0	11,495	114,952
3. VAT	0	57,476	574,759
4. Import Tax	0	1,957	19,566
TOTAL PROJECT COST (I + II)	**1,956,641**	**507,256**	**7,029,201**

Source: JICA Survey Team

CHAPTER 7 FINANCIAL AND ECONOMIC EVALUATION

7.1 Introduction

The objectives of financial and economic evaluation are to assess the financial viability and economic effect of the Vientiane Industrial Park (VIP) Project from the national economy standpoint. Discounted cash flow method is employed in both analyses. Internal Rate of Return (IRR) and Net Present Value (NPV) are calculated for the financial and economic evaluation of the VIP Project.

The following five alternatives of the VIP Project are analyzed in this chapter.

- Alternative 1: This is the base case for financial and economic evaluation. This alternative includes all infrastructure (road network, drainage network, telecommunication system, water supply system, and power supply system).
- Alternative 2: This alternative excludes power supply system. The power supply system will be developed as a general public investment program.
- Alternative 3: This alternative excludes power supply system and water supply system. These systems will be developed as general investment programs.
- Alternative 4: This alternative includes all infrastructure as same as the Alternative 1, but cost for land tenure increases from USD 3/m^2 to USD 25/m^2.
- Alternative 5: This alternative includes all infrastructure as same as the Alternative 1, but cost for land tenure increases from USD 3/m^2 to zero[1].

At first, the financial and economic feasibility of Alternative 1 as the base case are assessed. The financial and economic feasibility of the other four alternatives are analyzed after the evaluation of the base case.

7.2 Financial Evaluation

7.2.1 Basic Assumptions

The following basic assumptions are employed for the financial evaluation:

(1) "With-Project" and "Without-Project"

The "with-project" case means that the VIP Project will be carried out and factories will be constructed and operated as scheduled. On the other hand, the "without-project" case means that the VIP Project will not be carried out and seasonal rice farming will be continued at the VIP Project site.

[1] This situation could be translated into the following sentence: Lao PDR government purchase land for the project and provide to the project implementation body.

(2) Project Implementation Schedule

The project implementation schedule presented in Figure 6.1.1 is applied in the analysis. Land acquisition will start in the middle of 2010 and construction works will start in the middle of 2013. Marketing activity will start in the beginning of 2014 and the factory lot will be contracted out to the tenants according to the following proportions: 30% in 2015, 30% in 2016, 20% in 2017 and 20% in 2018.

(3) Project Life

The project life for the cash flow analysis is 59 years from 2010 to 2068 considering the lease period of the factory lots. The project life consists of the following periods:

- Land acquisition, engineering and consultant service (both engineering and soft-component services) and construction period from 2010 to 2015 (6 years), and
- Land lease period from 2015 to 2068 (54 years).

On the other hand, the project life for repayment capacity analysis is 42 years from 2010 to 2051 considering the loan period of a soft loan. It consists of the following periods:

- Land acquisition, engineering and consultancy services (both engineering and soft-component services) and construction period from 2010 to 2015 (6 years), and
- Loan period from 2012 to 2051 (40 years).

(4) Price and Exchange Rate

Basically, the same conditions in Section 6.2.1 are employed regarding the price and exchange rate. Price escalation is considered in the repayment capacity analysis but not considered in the calculations of NPV and Financial IRR (FIRR). All calculations in this chapter are made in Japanese yen.

(5) Calculation of Revenue and Cost

Financial investment cost including land acquisition, consultant service and construction are listed annually. However, the operation and maintenance (O&M) cost, reinvestment cost, administration cost and annual revenue from tenants are not listed in this analysis because the annual expense which will be collected from tenants is set in order to match these costs.

The revenue of the VIP Project comes from the land rent from tenants. It is assumed that the project implementation body of the VIP and each tenant enter into a contract for the use of a factory lot for a period of 50 years, which is the basic foreign investment term set by the Law on Promotion of Foreign Investment. As with the cost items, the total of the rents from tenants is listed as annual project revenue.

7.2.2 Project Expenditure

The total financial investment cost of the VIP (Alternative 1) is summarized in Table 7.2.1. Its annual disbursement amounts are indicated in Table 7.2.2.

Table 7.2.1: Financial Investment Cost of the VIP Project (Alternative 1)

(Unit: JPY 000)

	Foreign Currency	Local Currency	Total	Remarks
CP-1: Land Reclamation	0	1,000,610	1,000,610	
CP-2: Major Infrastructure Development	613,647	1,454,724	2,068,371	
CP-3: Power Supply	740,092	215,954	956,046	
Total of Construction Cost	1,353,739	2,671,287	4,025,027	Sum of CP-1, CP-2 and Cp-3
Total of Consultant Service	492,822	136,232	629,054	Sum of engineering service and soft component service
Land Acquisition	0	523,600	523,600	
Administration Cost	0	93,082	93,082	2% of construction cost and consultant cost
VAT	0	465,408	465,408	10% of construction cost and consultant cost
Import Tax	0	18,466	18,466	1% of foreign portion of construction cost and consultant cost
Grand Total	1,846,561	3,908,074	5,754,635	

Source: JICA Survey Team

Table 7.2.2: Annual Disbursement Amounts of the VIP Project (Alternative 1)

(Unit: JPY 000)

	2010	2011	2012	2013	2014	2015
Foreign Currency	0	0	150,306	1,027,540	500,824	167,891
Local Currency	130,900	261,800	175,072	1,837,094	1,070,699	432,509
Total	130,900	261,800	325,379	2,864,634	1,571,523	600,400

Source: JICA Survey Team

7.2.3 Project Revenue

The revenue of the VIP Project comes from the land rent from tenants. The total area of land to be lent to tenants is 96.5 ha, and the project implementation body will make contracts with tenants at the following pace indicated in Table 7.2.3.

Table 7.2.3: Area of Factory Lot to be contracted

	2015	2016	2017	2018	Total
Percentage (%)	30	30	20	20	100
Area (ha)	28.95	28.95	19.30	19.30	96.5

Source: JICA Survey Team

7.2.4 Financial Analysis of Alternative 1 (Base Case)

(1) Land Rent Examined from Repayment Capacity

In setting the land rent, the level which fulfills the loan repayment capacity is examined first. The introduction of a soft loan program which has the following conditions is assumed:

- Loan period: 40 years with a grace period of ten years
- Loan amount: Loan is disbursed according to the total development amount excluding non-eligible portion (i.e., cost for land acquisition, administration cost, VAT and import tax). The total loan amount is JPY4.8 million, which is 81.1% of the total development cost.

- Price escalation: The repayment capacity analysis is made in nominal terms. Weighted rate of price escalation is calculated from the proportion of foreign currency, local currency, rate of price escalation for local currency (9.1%) and rate of price escalation for foreign currency (1.8%). The calculated rate of price escalation is 6.8%.

Table 7.2.4 indicates the annual inflow and outflow of cash and cash balance excluding interest during construction when land rent is USD1.59/m^2/year (JPY148/m^2/year). If the rent changes to USD1.58/m^2/year, the balance in the final year would be –111.4 million yen. Therefore, the land rent which fulfills the repayment capacity is USD1.59 /m^2/year in the base case. The land rent of USD1.59/m^2/year is equivalent to land price of USD80/m^2 (JPY7,423/m^2) if factory lots will be sold to tenants.

Table 7.2.4: Analysis of Repayment Capacity in Alternative 1 (Base Case)

Loan Period	Year	Cost	Revenue	Loan	Repay-ment	Interest	Weight for price escalation	Cash Outflow	Cash Inflow	Net Cash Flow	Balance*
	2010	130,900					1.0	130,900	0	-130,900	
	2011	261,800					1.1	279,602	0	-279,602	
1	2012	325,379		263,830		26	1.1	371,165	300,930	-70,235	
2	2013	2,864,634		2,322,754		259	1.2	3,489,973	2,829,547	-660,426	
3	2014	1,571,523		1,274,250		386	1.3	2,045,090	1,657,829	-387,261	
4	2015	600,400	42,979	486,827		435	1.4	834,855	736,161	59,114	59,114
5	2016		85,957			435	1.5	645	127,559	126,914	186,028
6	2017		114,610			435	1.6	689	181,644	180,955	366,983
7	2018		143,262			435	1.7	736	242,494	241,759	608,741
8	2019		143,262			435	1.8	786	258,984	258,198	866,940
9	2020		143,262			435	1.9	839	276,595	275,756	1,142,695
10	2021		143,262			435	2.1	896	295,403	294,507	1,437,202
11	2022		143,262		8,794	434	2.2	20,322	315,491	295,169	1,732,371
12	2023		143,262		88,889	425	2.4	210,062	336,944	126,882	1,859,253
13	2024		143,262		134,398	412	2.5	338,625	359,856	21,232	1,880,485
14	2025		143,262		152,429	396	2.7	409,981	384,327	-25,654	1,854,831
15	2026		143,262		152,429	381	2.9	437,816	410,461	-27,355	1,827,475
16	2027		143,262		152,429	366	3.1	467,541	438,372	-29,169	1,798,307
17	2028		143,262		152,429	351	3.3	499,284	468,182	-31,102	1,767,205
18	2029		143,262		152,429	335	3.5	533,182	500,018	-33,164	1,734,041
19	2030		143,262		152,429	320	3.7	569,381	534,019	-35,362	1,698,679
20	2031		143,262		152,429	305	4.0	608,039	570,332	-37,706	1,660,972
21	2032		143,262		152,429	290	4.3	649,320	609,115	-40,205	1,620,767
22	2033		143,262		152,429	274	4.5	693,405	650,535	-42,870	1,577,897
23	2034		143,262		152,429	259	4.8	740,483	694,771	-45,711	1,532,186
24	2035		143,262		152,429	244	5.2	790,757	742,016	-48,741	1,483,445
25	2036		143,262		152,429	229	5.5	844,444	792,473	-51,971	1,431,474
26	2037		143,262		152,429	213	5.9	901,776	846,361	-55,415	1,376,059
27	2038		143,262		152,429	198	6.3	963,000	903,913	-59,087	1,316,972
28	2039		143,262		152,429	183	6.7	1,028,382	965,380	-63,002	1,253,970
29	2040		143,262		152,429	168	7.2	1,098,202	1,031,025	-67,177	1,186,794
30	2041		143,262		152,429	152	7.7	1,172,763	1,101,135	-71,627	1,115,166
31	2042		143,262		152,429	137	8.2	1,252,385	1,176,012	-76,373	1,038,793
32	2043		143,262		152,429	122	8.8	1,337,414	1,255,981	-81,433	957,361
33	2044		143,262		152,429	107	9.4	1,428,215	1,341,388	-86,827	870,533
34	2045		143,262		152,429	91	10.0	1,525,181	1,432,602	-92,579	777,954
35	2046		143,262		152,429	76	10.7	1,628,731	1,530,019	-98,712	679,242
36	2047		143,262		152,429	61	11.4	1,739,311	1,634,061	-105,250	573,992
37	2048		143,262		152,429	46	12.2	1,857,398	1,745,177	-112,222	461,771
38	2049		143,262		152,429	30	13.0	1,983,503	1,863,849	-119,654	342,116
39	2050		143,262		152,429	15	13.9	2,118,169	1,990,590	-127,579	214,537
40	2051		143,262		152,429	0	14.8	2,261,979	2,125,951	-136,028	78,509

Note: Balance excluding interest rate during construction period
Source: JICA Survey Team

Table 7.2.5 indicates the calculation of NPV and FIRR for a land rate of USD1.59/m^2/year. The discount rate, which is calculated from the policy interest rate of the Bank of Lao PDR (more than one

week) and the rate of increase of consumer price index (CPI) from March 2009 to February 2010, is 0.29%[2]. An NPV of JPY979 million and FIRR of 0.9% are calculated from Table 7.2.5.

Table 7.2.5: Calculation of NPV and FIRR for a Land Rent of USD1.59/m^2/year

(Unit: JPY000)

Year	Cost	Revenue	Net Cash Flow	Weight (0.29% of discount rate)	Discounted Net Cash Flow
2010	130,900		-130,900	1.00	-130,900
2011	261,800		-261,800	1.00	-261,043
2012	325,379		-325,379	0.99	-323,500
2013	2,864,634		-2,864,634	0.99	-2,839,855
2014	1,571,523		-1,571,523	0.99	-1,553,425
2015	600,400	42,979	-557,421	0.99	-549,408
2016		85,957	85,957	0.98	84,477
2017		114,610	114,610	0.98	112,310
2018		143,262	143,262	0.98	139,982
2019		143,262	143,262	0.97	139,577
2020		143,262	143,262	0.97	139,173
2021		143,262	143,262	0.97	138,771
2022		143,262	143,262	0.97	138,369
2023		143,262	143,262	0.96	137,969
2024		143,262	143,262	0.96	137,570
2025		143,262	143,262	0.96	137,173
2026		143,262	143,262	0.95	136,776
2027		143,262	143,262	0.95	136,380
2028		143,262	143,262	0.95	135,986
2029		143,262	143,262	0.95	135,593
2030		143,262	143,262	0.94	135,201
2031		143,262	143,262	0.94	134,810
2032		143,262	143,262	0.94	134,420
2033		143,262	143,262	0.94	134,031
2034		143,262	143,262	0.93	133,644
2035		143,262	143,262	0.93	133,257
2036		143,262	143,262	0.93	132,872
2037		143,262	143,262	0.92	132,488
2038		143,262	143,262	0.92	132,105
2039		143,262	143,262	0.92	131,723
2040		143,262	143,262	0.92	131,342
2041		143,262	143,262	0.91	130,962
2042		143,262	143,262	0.91	130,583
2043		143,262	143,262	0.91	130,206
2044		143,262	143,262	0.91	129,829
2045		143,262	143,262	0.90	129,454
2046		143,262	143,262	0.90	129,079
2047		143,262	143,262	0.90	128,706
2048		143,262	143,262	0.90	128,334
2049		143,262	143,262	0.89	127,963
2050		143,262	143,262	0.89	127,593
2051		143,262	143,262	0.89	127,224
2052		143,262	143,262	0.89	126,856
2053		143,262	143,262	0.88	126,489
2054		143,262	143,262	0.88	126,124
2055		143,262	143,262	0.88	125,759
2056		143,262	143,262	0.88	125,395

[2] Policy interest rate of the Bank of Lao PDR is 5.00% as of March 2010 (http://www.bol.gov.la/english/interestrate.html), and rate of increase of CPI from March 2009 to February 2010 is 4.71% (http://www.bol.gov.la/english/index1.php). Real discount rate is calculated from 5.00% minus 4.71%.

Year	Cost	Revenue	Net Cash Flow	Weight (0.29% of discount rate)	Discounted Net Cash Flow
2057		143,262	143,262	0.87	125,033
2058		143,262	143,262	0.87	124,671
2059		143,262	143,262	0.87	124,311
2060		143,262	143,262	0.87	123,951
2061		143,262	143,262	0.86	123,593
2062		143,262	143,262	0.86	123,235
2063		143,262	143,262	0.86	122,879
2064		143,262	143,262	0.86	122,524
2065		143,262	143,262	0.85	122,169
2066		100,284	100,284	0.85	85,271
2067		57,305	57,305	0.85	48,586
2068		28,652	28,652	0.85	24,223
		FIRR	0.9%	NPV	978,867

Source: JICA Survey Team

(2) Land Price of the Potential Competitors

In reality, land rent should be set at competitive level with potential competitors. The potential competitors in this case are industrial estates in Thailand, particularly in the north and northeast parts. As described in Appendix I 4.3, the typical land price in Thailand is indicated in Table 7.2.6.

Table 7.2.6: Typical Land Price at Industrial Estates in Thailand

Area	Sales Price (General Industrial Estate, USD)	Estimation of Land Rent (50 years, USD/m^2/year)	Remarks
Central and West	35 to 60	0.70 to 1.20	Pathum Thani, Ayutthaya, Saraburi, Singburi and Ratchaburi
East	35 to 60	0.70 to 1.20	Chonburi, Rayong and Prachiburi
Northeast and South	25 to 27	0.50 to 0.54	Nakhon Ratchasima and Songkhla

Source: Compiled by JICA Survey Team based on Table I.1.8 of Appendix I 4.3 (p. Appendix I-1-14)

Since the rental period at the VIP is set at 50 years, the estimated land rents for these industrial estates are calculated by dividing the land prices by 50. The estimated rents are indicated in the 3rd column of Table 7.2.6. The land rent of industrial estates in the central and eastern parts of Thailand is USD0.70 to 1.20/m^2/year. The rent in industrial estates in the northeast and south parts of Thailand is USD0.50 to USD0.54/m^2/year.

The land rent at the Savan-Seno Special Economic Zone Site C is cheaper. It is USD0.3 to USD0.7/m^2/year. In light of these situations, it is necessary to set the land rent at the VIP at USD0.50/m^2/year (JPY47/m^2/year).

Table 7.2.7: Calculation of NPV and FIRR for a Land Rent of USD0.50/m^2/year

(Unit: JPY 000)

Year	Cost	Revenue	Net Cash Flow	Weight (0.29% of discount rate)	Discounted Net Cash Flow
2010	130,900		-130,900	1.00	-130,900
2011	261,800		-261,800	1.00	-261,043
2012	325,379		-325,379	0.99	-323,500
2013	2,864,634		-2,864,634	0.99	-2,839,855
2014	1,571,523		-1,571,523	0.99	-1,553,425
2015	600,400	13,515	-586,885	0.99	-578,448
2016		27,031	27,031	0.98	26,565
2017		36,041	36,041	0.98	35,318

Year	Cost	Revenue	Net Cash Flow	Weight (0.29% of discount rate)	Discounted Net Cash Flow
2018		45,051	45,051	0.98	44,019
2019		45,051	45,051	0.97	43,892
2020		45,051	45,051	0.97	43,765
2021		45,051	45,051	0.97	43,639
2022		45,051	45,051	0.97	43,512
2023		45,051	45,051	0.96	43,387
2024		45,051	45,051	0.96	43,261
2025		45,051	45,051	0.96	43,136
2026		45,051	45,051	0.95	43,011
2027		45,051	45,051	0.95	42,887
2028		45,051	45,051	0.95	42,763
2029		45,051	45,051	0.95	42,639
2030		45,051	45,051	0.94	42,516
2031		45,051	45,051	0.94	42,393
2032		45,051	45,051	0.94	42,270
2033		45,051	45,051	0.94	42,148
2034		45,051	45,051	0.93	42,026
2035		45,051	45,051	0.93	41,905
2036		45,051	45,051	0.93	41,784
2037		45,051	45,051	0.92	41,663
2038		45,051	45,051	0.92	41,542
2039		45,051	45,051	0.92	41,422
2040		45,051	45,051	0.92	41,302
2041		45,051	45,051	0.91	41,183
2042		45,051	45,051	0.91	41,064
2043		45,051	45,051	0.91	40,945
2044		45,051	45,051	0.91	40,827
2045		45,051	45,051	0.90	40,709
2046		45,051	45,051	0.90	40,591
2047		45,051	45,051	0.90	40,474
2048		45,051	45,051	0.90	40,357
2049		45,051	45,051	0.89	40,240
2050		45,051	45,051	0.89	40,124
2051		45,051	45,051	0.89	40,008
2052		45,051	45,051	0.89	39,892
2053		45,051	45,051	0.88	39,776
2054		45,051	45,051	0.88	39,661
2055		45,051	45,051	0.88	39,547
2056		45,051	45,051	0.88	39,432
2057		45,051	45,051	0.87	39,318
2058		45,051	45,051	0.87	39,205
2059		45,051	45,051	0.87	39,091
2060		45,051	45,051	0.87	38,978
2061		45,051	45,051	0.86	38,866
2062		45,051	45,051	0.86	38,753
2063		45,051	45,051	0.86	38,641
2064		45,051	45,051	0.86	38,529
2065		45,051	45,051	0.85	38,418
2066		31,536	31,536	0.85	26,815
2067		18,020	18,020	0.85	15,278
2068		9,010	9,010	0.85	7,617
		FIRR	-2.9%	NPV	-3,600,065

Source: JICA Survey Team

Table 7.2.7 indicates the calculation of NPV and FIRR when the land rent is set at USD0.50/m^2/year (JPY47/m^2/year). FIRR is -2.9% and NPV amounts to -3.6 billion yen. In order to implement the VIP Project under this condition, the public sector has to disburse money from the general budget.

7.2.5 Financial Analysis of the Alternatives 2 and 3: changes of infrastructure to be invested

The financial feasibility of Alternatives 2 and 3 of the VIP Project is assessed under the same conditions as in the previous section. FIRR and NPV are calculated under the following land rents:

- Land rent is set at the level that would fulfill the repayment capacity, and
- Land rent is set at USD0.50/m^2/year.

Tables 7.2.8 and 7.2.9 indicate the financial investment costs of Alternatives 2 and 3, respectively. The total development cost of Alternative 2 is JPY4.5 billion, which is 79% of Alternative 1. Likewise, the total development cost of Alternative 3 is JPY4.1 billion, which is 71% of Alternative 1.

Table 7.2.8: Financial Investment Cost (Alternative 2)

(Unit: JPY 000)

	Foreign Currency	Local Currency	Total	Remarks
CP-1: Land Reclamation	0	1,000,610	1,000,610	
CP-2: Major Infrastructure Development	613,647	1,454,724	2,068,371	
CP-3: Power Supply	0	0	0	
Total of Construction Cost	613,647	2,455,333	3,068,980	Sum of CP-1, CP-2 and CP-3
Total of Consultant Service	395,240	104,148	499,387	Sum of engineering service and soft component service
Land Acquisition	0	523,600	523,600	
Administration Cost	0	71,367	71,367	2% of construction cost and consultant cost
VAT	0	356,837	356,837	10% of construction cost and consultant cost
Import Tax	0	10,089	10,089	1% of foreign portion of construction cost and consultant cost
Grand Total	1,008,887	3,521,374	4,530,261	

Source: JICA Survey Team

Table 7.2.9: Financial Investment Cost (Alternative 3)

(Unit: JPY 000)

	Foreign Currency	Local Currency	Total	Remarks
CP-1: Land Reclamation	0	1,000,610	1,000,610	
CP-2: Major Infrastructure Development	516,133	1,227,196	1,743,330	
CP-3: Power Supply	0	0	0	
Total of Construction Cost	516,133	2,227,806	2,743,939	Sum of CP-1, CP-2 and CP-3
Total of Consultant Service	193,642	261,661	455,303	Sum of engineering service and soft component service
Land Acquisition	0	523,600	523,600	
Administration Cost	0	63,985	63,985	2% of construction cost and consultant cost
VAT	0	319,924	319,924	10% of construction cost and consultant cost
Import Tax	0	7,098	7,098	1% of foreign portion of construction cost and consultant cost
Grand Total	709,775	3,404,074	4,113,849	

Source: JICA Survey Team

Table 7.2.10 indicates the level of land rent that would fulfill the repayment capacity and the values of FIRR and NPV under this condition. In accordance with the drop in the financial investment cost, levels of land rent are also reduced. In Alternative 2 in which power supply is not included, land rent drops to USD1.23/m^2/year (JPY115/m^2/year). On the other hand, in Alternative 3 in which power and water supply systems are not included, land rent drops to USD1.11/m^2/year (JPY104/m^2/year).

Table 7.2.10: Land Rent to Fulfill Repayment Capacity and FIRR and NPV

Alternatives of VIP	Land Rent (USD/m^2/year)	FIRR (%)	NPV (JPY)
Alternative 2: without Power Supply	1.23 (JPY115/m^2/year)	0.8	679 million
Alternative 3: without Power Supply and Water Supply	1.11 (JPY104/m^2/year)	0.8	587 million

Source: JICA Survey Team

Table 7.2.11: FIRR and NPV for Land Rent of USD0.50/m^2/year

Alternatives of VIP	FIRR (%)	NPV (JPY)
Alternative 2: without Power Supply	-2.2	-2,388 million
Alternative 3: without Power Supply and Water Supply	-1.9	-1,976 million

Source: JICA Survey Team

Table 7.2.11 indicates the FIRR and NPV if the land rent is set at USD0.50/m^2/year (JPY47/m^2/year). The results are better than Alternative 1 but FIRR values are still negative. The amounts of NPV are -2,388 million yen for Alternative 2 and -1,976 million yen for Alternative 3.

7.2.6 Financial Analysis of the Alternatives 4 and 5: change of land price

The financial feasibility of Alternatives 4 and 5 of the VIP Project is assessed under the same conditions as in the previous sections. FIRR and NPV are calculated under the following land rents:

- Land rent is set at the level that would fulfill the repayment capacity, and
- Land rent is set at USD0.50/m^2/year.

Tables 7.2.12 and 7.2.13 indicate the financial investment costs of Alternatives 4 and 5, respectively. The total development cost of Alternative 4 is JPY8.7 billion, which is 151% of Alternative 1. Cost for land acquisition is 8times bigger than the Alternative 1. Likewise, the total development cost of Alternative 5 is JPY5.2 billion, which is 91% of Alternative 1.

Table 7.2.12: Financial Investment Cost (Alternative 4)

(Unit: JPY 000)

	Foreign Currency	Local Currency	Total	Remarks
CP-1: Land Reclamation	0	1,000,610	1,000,610	
CP-2: Major Infrastructure Development	613,647	1,454,724	2,068,371	
CP-3: Power Supply	740,092	215,954	956,046	
Total of Construction Cost	1,353,739	2,671,287	4,025,027	Sum of CP-1, CP-2 and CP-3
Total of Consultant Service	492,822	136,232	629,054	Sum of engineering service and soft component service
Land Acquisition	0	3,485,030	3,485,020	
Administration Cost	0	93,082	93,082	2% of construction cost and consultant cost
VAT	0	465,408	465,408	10% of construction cost and consultant cost
Import Tax	0	18,466	18,466	1% of foreign portion of construction cost and consultant cost
Grand Total	1,846,561	6,869,494	8,716,055	

Source: JICA Survey Team

Table 7.2.13: Financial Investment Cost (Alternative 5)

(Unit: JPY 000)

	Foreign Currency	Local Currency	Total	Remarks
CP-1: Land Reclamation	0	1,000,610	1,000,610	
CP-2: Major Infrastructure Development	613,647	1,454,724	2,068,371	
CP-3: Power Supply	740,092	215,954	956,046	
Total of Construction Cost	1,353,739	2,671,287	4,025,027	Sum of CP-1, CP-2 and CP-3
Total of Consultant Service	492,822	136,232	629,054	Sum of engineering service and soft component service
Land Acquisition	0	0	0	
Administration Cost	0	93,082	93,082	2% of construction cost and consultant cost
VAT	0	465,408	465,408	10% of construction cost and consultant cost
Import Tax	0	18,466	18,466	1% of foreign portion of construction cost and consultant cost
Grand Total	1,846,561	3,384,474	5,231,035	

Source: JICA Survey Team

Table 7.2.14 indicates the land rent or land prove to secure financial feasibility in the Alternative 4. Since cost for land tenure which is not covered in the soft loan increases to more than 8 times, land rent at which NPV changes to positive is higher than the land rent at which the project could fulfill repayment capacity of a soft loan. Land rent to fulfill repayment capacity is USD 1.7/m^2/year, which is translated into USD85/m^2 of land price. On he other hand, land rent to enable positive NPV is USD2.1/m^2/year, which is translated into USD105/m^2 of land price.

Table 7.2.14: Land Rent and Land Cost to Secure Financial Feasibility in Alternative 4

Conditions	Land Rent	Calculated Land Price
Land Rent (Land Price) to Fulfill Repayment Capacity	USD1.70/m^2/year (JPY159/m^2/year)	USD85/m^2 (JPY7,936/m^2)
Land Rent (land price) to enable positive NPV	USD2.10/m^2/year (JPY196/m^2/year)	USD105/m^2 (JPY9,804/m^2)

Source: JICA Survey Team

Table 7.2.15: Land Rent, and FIRR and NPV of Alternative 5

	Land Rent (Land Price)	NPV (FIRR)
Land Rent to Fulfill Repayment Capacity	USD1.55/m^2/year (USD78/m^2)	JPY1.3 billion (1.2%)
Land Rent of USD0.50/m^2/year	-	JPY-3.1 billion (-2.6%)

Source: JICA Survey Team

Table 7.2.15 indicates the land rent at which the project could fulfill repayment capacity, and the FIRR and NPV if the land rent is set at USD0.50/m^2/year (JPY47/m^2/year). Land rent to fulfill repayment capacity is USD1.55/m^2/year, USD0.04 lower than the Alternative 1. However, the price is still far higher than the target price, USD0.50/m^2/year.

7.2.7 Financial Analysis for General Investment Projects

In Alternatives 2 and 3, a part of infrastructure development such as power supply and water supply is not included in the VIP Project. Instead, the JICA Survey Team (JST) proposes to develop this infrastructure as general investment programs. In this section, the financial feasibility of the power supply system and water supply system is assessed.

(1) Power Supply System

The annual disbursement of direct construction cost for the power supply system is tabulated in Table 7.2.16.

Table 7.2.16: Project Direct Cost for Power Supply System

(JPY 000)

	2013	2014	2015
Foreign Portion	518,064	185,023	37,005
Local Portion	43,191	129,573	43,191
Total of Direct Construction Cost	561,255	314,596	80,195

Source: JICA Survey Team

The other costs will be estimated from the following assumptions:

- Physical contingency: 10% of direct cost and cost for consultant service,
- VAT: 10% of the sum of direct cost and physical contingency, and 10% of the sum of cost for consultant service and physical contingency, and
- Imported service: 1% of the sum of foreign direct cost and physical contingency, and 1% of the sum of cost for foreign consultant service and physical contingency.
- Cost for consultancy services: Cost of consulting service is calculated from consultant cost for Alternative 1 times the proportion of CP-3 (cost for power supply) to total direct cost. The same proportion of cost for foreign consultant's service and that of local consultant of Alternative 1 is applied.
- Cost for reinvestment: 40% of the direct construction cost will be reinvested in the 16th year after starting operation.

In this analysis, a project life of 33 years from 2012 to 2044 is applied considering the lifetime of power supply facilities.

Consumption of electric power will start in 2015 when factories start operation. Annual power consumption volume will increase as indicated in Table 3.9.3. At present, electricity charge for industrial use in Lao PDR is 532 kip/kWh (equivalent to 5,629 JPY/MWh).[3] Therefore, annual revenue from power supply system at the VIP will increase as indicated in Table 7.2.17.

Table 7.2.17: Increase of Revenue from Power Supply System at the VIP

	2015	2016	2017	2018	After 2019
Power Consumption Volume (MWh)	7,486	60,747	96,388	123,085	123,085
Revenue (JPY 000)	42,135	341,918	542,526	692,791	692,791

Source: JICA Survey Team

Table 7.2.18 indicates the net cash flow of the power supply project. The calculated FIRR is 33.0%, which is much higher than the real discount rate (0.29%) and real loan rate of commercial banks (4.78%).[4]

[3] EDL has a plan to raise electric power rate annually, that is to say, 10% in 2009, 17.3% in 2010, and 16.3% in 2011. However, the plan was not implemented in 2009.

[4] According to the Bank of Lao PDR web page, long-term loan (3 to 6 years) rate of USD account is 9.49% (average of year 2009). Real loan rate is calculated from 9.49% minus 4.71% (rate of increase of CPI from March 2009 to February 2010).

Table 7.2.18: Net Cash Flow of the Power Supply System Project

(Unit: JPY 000)

Year	Cost						Revenue	Net Cash Flow
	Direct Construction Cost	Consultant Service	Contingency	VAT	Import Tax	Total		
2012		47,151	4,715	5,187	389	57,442		-57,442
2013	561,255	23,576	58,483	8,206	5,893	657,413		-657,413
2014	314,596	29,470	34,407	6,388	2,278	387,138		-387,138
2015	80,195	17,682	9,788	2,747	553	110,965	42,135	-68,829
2016							341,918	341,918
2017							542,526	542,526
2018							692,791	692,791
2019							692,791	692,791
2020							692,791	692,791
2021							692,791	692,791
2022							692,791	692,791
2023							692,791	692,791
2024							692,791	692,791
2025							692,791	692,791
2026							692,791	692,791
2027							692,791	692,791
2028							692,791	692,791
2029						262,965	692,791	429,826
2030						154,855	692,791	537,936
2031						44,386	692,791	648,405
2032							692,791	692,791
2033							692,791	692,791
2034							692,791	692,791
2035							692,791	692,791
2036							692,791	692,791
2037							692,791	692,791
2038							692,791	692,791
2039							692,791	692,791
2040							692,791	692,791
2041							692,791	692,791
2042							692,791	692,791
2043							692,791	692,791
2044							692,791	692,791
							FIRR	33.0%

Source: JICA Survey Team

(2) Water Supply System

The financial feasibility of the water supply system is analyzed based on the same conditions as the power supply system. The direct construction cost is indicated in Table 7.2.19.

Table 7.2.19: Project Direct Cost for Water Supply System

	2013	2014	2015
Foreign Portion	53,189	31,027	4,432
Local Portion	62,053	103,422	41,369
Total of Direct Construction Cost	115,242	134,449	45,801

Source: JICA Survey Team

Regarding the cost of consulting service, the same assumption in the feasibility study of the power supply system is employed in the analysis. It is calculated from the consultant cost for Alternative 1 times the proportion of the sum of CP-3 (cost of power supply) and the cost of water supply to total direct cost. The same proportion of foreign consultant's service and that of local consultant is applied.

Water demand after the full operation of the VIP in 2018 will be 12,000 m^3/d. It is supposed that water demand from 2015 to 2017 will increase gradually, i.e., 30% in 2015, 60% in 2016 and 80% in 2017, in accordance with the sales of factory lots. As described in Table 2.3.16 of the Part II Report, water rate in case water consumption is larger than 50 m^3/month is 5,000 kip/m^3 (equivalent to JPY53/m^3). Therefore, the revenue from the water supply at the VIP is tabulated as shown in Table 7.2.20.

Table 7.2.20: Increase of Revenue from Water Supply System at the VIP

	2015	2016	2017	2018	After 2019
Water Consumption Volume (m^3/d)	3,600	7,200	9,600	12,000	12,000
Revenue (JPY 000)	69,511	139,021	185,362	231,702	231,702

Source: JICA Survey Team

Table 7.2.21 indicates the net cash flow of the water supply project. The calculated FIRR is 37.6%, which is much higher than the real discount rate (0.29%) and real loan rate of commercial banks (4.78%).

Table 7.2.21: Net Cash Flow of the Water Supply System Project

(Unit: JPY 000)

Year	Cost						Revenue	Net Cash Flow
	Direct Construction Cost	Consultant	Contingency	VAT	Import Tax	Total		
2012		16,031	1,603	1,763	123	19,521		-19,644
2013	115,242	12,023	12,727	13,999	678	154,669		-155,346
2014	134,449	8,015	14,246	15,671	403	172,784		-173,188
2015	45,801	4,008	4,981	5,479	80	60,348	69,511	9,083
2016							139,021	139,021
2017							185,362	185,362
2018							231,702	231,702
2019							231,702	231,702
2020							231,702	231,702
2021							231,702	231,702
2022							231,702	231,702
2023							231,702	231,702
2024							231,702	231,702
2025							231,702	231,702
2026							231,702	231,702
2027							231,702	231,702
2028							231,702	231,702
2029						61,867	231,702	169,835
2030						69,114	231,702	162,588
2031						24,139	231,702	207,563
2032							231,702	231,702
2033							231,702	231,702
2034							231,702	231,702
2035							231,702	231,702
2036							231,702	231,702
2037							231,702	231,702
2038							231,702	231,702
2039							231,702	231,702
2040							231,702	231,702
2041							231,702	231,702
2042							231,702	231,702
2043							231,702	231,702
2044							231,702	231,702
							FIRR	37.6%

Source: JICA Survey Team

7.3 Economic Evaluation

7.3.1 Basic Assumptions

Same assumptions for the "with-project" and "without-project" cases and project implementation schedule are applied in the economic analysis. Project life, price and exchange rate are revised as follows:

(1) Project Life

Project life is 35 years from 2010 to 2044. It consists of land acquisition, consultancy services, construction period from 2010 to 2015 (6 years), and operation period from 2015 to 2044 (29 years).

(2) Price and Exchange Rate

Physical contingency of 10% is not considered in the economic analysis. The other conditions regarding price and exchange rate are the same as in the financial analysis.

7.3.2 Methodology of Economic Analysis

(1) Economic Effects of the VIP Project

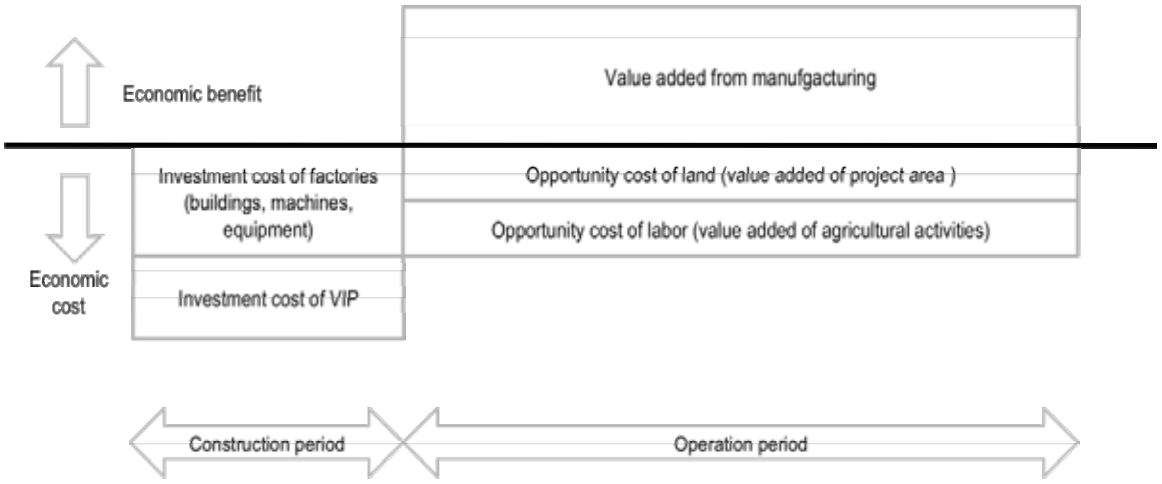
The following items are identified as economic effects of the VIP Project:

- Value added generated from factories located at the VIP,
- Increase of workers' income though increase of value added described above,
- Increase of tax revenue though increase of tempo in economic activities,
- Industrial advances such as development of modernized factories and introduction of capital-intensive manufacturing,
- Development of support industries including small and medium enterprises,
- Enhancement of policy and institutional aspects of industrial development though development, marketing and operation activities of VIP,
- Mitigation of traffic jam for manufacturing factories, and
- Mitigation of pollution problem.

Among these economic effects, the increase of value added from factories at the VIP is direct, comprehensive and easy to measure in numerical terms. Therefore, the increase of value added is employed as the economic benefit of the VIP Project.

(2) Calculation of Economic IRR

The discounted cash flow method is employed in the financial analysis while the economic IRR (EIRR) is calculated in the economic analysis.



Source: JICA Survey Team

Figure 7.3.1: Economic Benefit and Economic Cost of the VIP Project

Economic benefit and economic cost are illustrated in Figure 7.3.1. During the construction period, investment costs of the VIP and factories, which include the construction of factory buildings and installation of machines and equipment, are components of the economic cost. During the operation period, value added generated from factories is the economic benefit; on the other hand, opportunity cost of land, which is value added generated from the project site if it continues to be used as rice field, and opportunity cost of labor, which is value added generated from labors if they continue to work as farmers, are economic costs.

Economic benefit is calculated in Section 7.3.3 and economic cost is calculated in Section 7.3.4.

7.3.3 Economic Benefit

(1) Value Added from Factories at the VIP

Value added from factories is calculated from the following process:

- Calculation of current value added per employee in manufacturing and estimation of the future increase, which is described in (2),
- Calculation of number of employees at factories, which is described in (3),
- Calculation of value added from factory per employee, which is described in (4),

(2) Value Added per Employee

According to Statistical Yearbook 2008, the value added of the manufacturing sector and number of employees in industry and handicraft are estimated as follows:

- Value added of manufacturing sector[5]: LAK3,999 billion, and
- Number of employee[6]: 121,879 persons.

[5] Table 20 (p.28), Statistical Yearbook 2008, DoS
[6] Table 18 (p.26) Statistical Yearbook 2008, DoS

From these figures, the value added per employee is calculated at LAK33 million (equivalent to JPY347,000) in 2008. The figure is consistent with other figures such as the value added of agriculture, industry and service sectors. The value added per employee in the industry sector is LAK45 million (JPY479,000) in 2010[7].

In the Part I Report, the rate of future increase of value added per employee in the industrial sector is estimated. It is 4.5% from 2010 to 2015, 5.2% from 2015 to 2020, and 3.3% from 2020 to 2025. In this analysis, it is assumed that the value added per employee in the manufacturing sector will follow such growth rates. Table 7.3.1 indicates the increase of value added per employee in the manufacturing sector. It is assumed that the rate of increase will be 4.5% from 2008 to 2010 and 3.3% from 2025 to 2044.

Table 7.3.1: Increase of Value Added per Employee in the Manufacturing Sector

	2008	2015	2020	2025	2030	2040	2049
Value Added (JPY 000)	347	472	609	716	842	1,167	1,563

Source: JICA Survey Team based on Table 2.2.1 of Part I Report

(3) Number of Employee at Factories

As described in section 2.5 of the Part I Report, "Japanese Guideline for Industrial Estate Planning" (JGIEP) is applied to estimate the necessary number of employees. According to the JGIEP, the average required number of employees per hectare is 81.7. Therefore, the total factory employees at the VIP (96.5 ha) is 7,884.

Factory lot will be contracted out and developed at 30% of the total lot in the first year, 30% in the second year, 20% in the third year and 20% in the fourth year. Number of employees will also increase at the same proportion year by year as indicated in Table 7.3.2.

Table 7.3.2: Increase of Number of Employees in Factories

	2015	2016	2017	2018
Percentages of land to be contracted out (%)	30	30	20	20
Number of employees at factories (accumulated, persons)	2,365	4,730	6,307	7,884

Source: JICA Survey Team calculated from JGIEP

(4) Calculation of Value Added from Factories

Table 7.3.3 indicates the value added per employee as described in (2), number of employees at factories as described in (3), and gross value added from factories (value added per employee times number of employees). The value added from factories will increase rapidly in accordance with the development of the VIP from 2015 to 2019 and will continue due to the increase of the value added per employee after 2019. It will increase from JPY1.1 billion in 2015 to JPY12.3 billion in 2049.

Table 7.3.3: Net Value Added from Factories

Year	Value Added per Employee in Manufacturing Sector (JPY 000)	No. of Employee (Persons)	Gross Value Added from Factories (JPY 000)
2015	472	2,365	1,116,280
2016	497	4,730	2,350,810
2017	523	6,307	3,298,561
2018	550	7,884	4,336,200

[7] Regarding to calculation of value added by industries, refer to section 2.2.5 of Part I Report.

Year	Value Added per Employee in Manufacturing Sector (JPY 000)	No. of Employee (Persons)	Gross Value Added from Factories (JPY 000)
2019	579	7,884	4,564,836
2020	609	7,884	4,801,356
2021	629	7,884	4,959,036
2022	650	7,884	5,124,600
2023	671	7,884	5,290,164
2024	693	7,884	5,463,612
2025	716	7,884	5,644,944
2026	740	7,884	5,834,160
2027	764	7,884	6,023,376
2028	789	7,884	6,220,476
2029	815	7,884	6,425,460
2030	842	7,884	6,638,328
2031	870	7,884	6,859,080
2032	899	7,884	7,087,716
2033	929	7,884	7,324,236
2034	960	7,884	7,568,640
2035	992	7,884	7,820,928
2036	1,025	7,884	8,081,100
2037	1,059	7,884	8,349,156
2038	1,094	7,884	8,625,096
2039	1,130	7,884	8,908,920
2040	1,167	7,884	9,200,628
2041	1,206	7,884	9,508,104
2042	1,246	7,884	9,823,464
2043	1,287	7,884	10,146,708
2044	1,329	7,884	10,477,836
2045	1,373	7,884	10,824,732
2046	1,418	7,884	11,179,512
2047	1,465	7,884	11,550,060
2048	1,513	7,884	11,928,492
2049	1,563	7,884	12,322,692

Source: JICA Survey Team

7.3.4 Economic Cost

As described in Section 7.3.2, the economic cost consists of investment cost for the VIP, opportunity cost of land, and opportunity cost of labor[8]. These costs are estimated in the following sections.

(1) Estimation of Economic Investment Cost

The economic investment cost is calculated from the financial investment cost, which is presented in Section 7.2.3. Physical contingency under the financial investment cost is excluded, and domestic portion (non-traded portion) of the financial investment cost is converted using a standard conversion factor (SCF). According to the "Study on Integrated Distribution Center in Savannakhet and Vientiane in Lao PDR" conducted by JETRO in 2005, an SCF of 96.4% was employed. The same figure is also applied in this analysis.

Table 7.3.5 indicates the economic investment cost for the VIP Project (Alternative 1). The total economic investment cost is JPY4.2 billion, which is 73.4% of the financial investment cost.

Reinvestment is also included in the economic cost. It is disbursed every 15 years after the start of operation. Reinvestment amount is 40% of the following items:

[8] Investment cost of factories has been calculated in Section 7.3.3 already.

- CP-1: Gate;
- CP-2: Road and transportation system, drainage system, water supply system (Alternative 1 and Alternative 2), individual sewerage treatment system, telecommunication line and building; and
- CP-3: Power supply system (Alternative 1).

Table 7.3.4 indicates the annual distribution of the economic investment cost.

Table 7.3.4: Economic Investment Cost of the VIP Project (Alternative 1)

(Unit: JPY 000)

	2012	2013	2014	2015	Total
Direct Construction Cost	0	2,102,977	1,114,405	354,319	3,571,701
Cost for Consultant Service	156,636	165,513	129,036	120,682	571,867
Administration Cost	3,133	45,370	24,869	9,500	82,871
Annual Total Cost	159,769	2,313,860	1,268,310	484,501	4,226,439

Source: JICA Survey Team

(2) Investment Cost for Factories

The Department of Industry and Commerce in Vientiane Capital prepares a list of business establishments as of 31st December 2008, which has the following information:

- Name of factory,
- Years of establishment and start of operation,
- Products (kind of industry),
- Location (name of district and village),
- Number of employee,
- Fixed assets (include factory buildings, machines and equipment), and
- Operating capital.

The fixed asset per employee varies from factory to factory but the data in Table 7.3.5 indicates fixed asset per employee in typical modernized factories in each industry.

Table 7.3.5: Fixed Asset and Number of Employee in Typical Modernized Factories

Kind of Industry	Fixed Asset (LAK million)	Number of Employee (persons)	Fixed Asset per Employee (LAK million/person)
Chemical	14,956	51	293
Garment	12,925	249	52
Electric Machinery Parts	8,962	300	30
Food	127,500	303	421
Metal	270,124	112	270
Transport Machinery Parts	7,238	115	63
Wood Processing	30,100	74	407

Source: List of Factories as of 31st December 2008 prepared by Department of Industry and Commerce, Vientiane Capital

Based on Table 7.3.5, the JST sets the following two scenarios regarding fixed asset per employee at the VIP:

- Scenario 1: Major factories located in the VIP consist of higher fixed asset per employee such as chemical, food, metal and wood processing (industries which have high capital-labor ratio). Average fixed asset per employee is set at LAK380 million/person (equivalent to JPY4,020,000/person).
- Scenario 2: Major factories located in the VIP consist of lower fixed asset per employee such as garment, electric machinery parts, and transport machinery part (industries which have low capital-labor ratio). Average fixed asset per employee is set at LAK250 million/person (equivalent to JPY2,645,000/person).

Scenario 1 is employed as the main scenario in this analysis. Economic analysis under Scenario 2 is made in the sensitivity analysis.

Reinvestment will be disbursed in the 16th year of operation. During that time, 50% of the initial investment amount will be disbursed.

(3) Opportunity Cost of land

If the VIP Project is not implemented, land for the industrial park would continue to be used as seasonal rice field which can be harvested once a year. Value added generated from the land is calculated from the total price of harvested rice minus the total price of seed rice at the VIP Project site (140 hectares).

The following conditions are employed to calculate the value added:

- Price of harvested rice is LAK2,000/kg,
- Price of seed rice is LAK5,000/kg,
- Productivity of land at the VIP Project site is 3.5 tons/ha, according to Statistics of Dung cluster[9], and
- 60 kg of seed rice is needed for 1 hectare of rice field.

The result of the calculation is indicated in Table 7.3.6. Sales of harvested rice from 140 ha of land is LAK2,450 million. On the other hand, intermediate input is LAK42 million. Therefore, value added from 140 ha of land is LAK2,408 million (JPY25.5 million) per year.

Table 7.3.6: Annual Value Added from Rice Cultivation at the VIP Project Site

Sales of Harvested Rice	LAK2,450 million
Intermediate Input	LAK42 million
Value Added	LAK2,408 million (JPY25,477,000)
Value Added per Farmer	LAK3.3 million (JPY35,000)

Source: JICA Survey Team

According to the "State of Food and Agriculture 2008" published by the Food and Agriculture Organization (FAO), arable land per farmer in the Lao PDR is 0.19 ha. Therefore, 736 farmers would be engaged in rice farming at the VIP Project site. As a result, the average annual value added is LAK3.3 million (JPY35,000) per farmer.

[9] Please refer to Table 2.5.11 (p.7) of a report, "Resettlement Action Plan for Vientiane Industrial Park Infrastructure Development."

(4) Opportunity Cost of Labor

Almost all laborers at the VIP belong to the younger generation who come from rural villages in Vientiane Capital and surrounding provinces. If the VIP Project is not implemented, these laborers will continue to work as farmers at their home villages. Value added from their farming activities is calculated from the following conditions:

- Price of harvested rice and seed rice and productivity of land are the same as set in the previous section. Average value added per farmer per year is LAK3.3 million (JPY35,000).
- Number of farmers is 7,884, which is calculated in Section 7.3.2.
- Farmers could earn the same value added from other farming activities, i.e., total value added of a farmer is LAK6.6 million (JPY70,000) per year.

As a result, the value added of labor amounts to JPY559.2 million per year.

7.3.5 Calculation of EIRR

Table 7.3.7 indicates the cash flow of the VIP Project (Alternative 1). The economic investment cost (Section 7.3.3 (1)), investment cost of factories (Section 7.3.3 (2)), opportunity cost of land (Section 7.3.3 (3)), opportunity cost of labor (Section 7.3.3 (4)) and economic benefit (Section 7.3.2) calculated in each section are tabulated. The EIRR calculated from the net cash flow (7th column of Table 7.3.7) is 13.3%.

Table 7.3.7: Cash Flow of the VIP Project (Alternative 1)

(Unit: JPY 000)

Year	Economic Cost				Economic Benefit	Net Cash Flow
	Economic Investment Cost	Investment Cost of Factories	Opportunity Cost of Land	Opportunity Cost of Labor		
2010	0		6,369		0	-6,369
2011	0		19,107		0	-19,107
2012	159,769		25,477		0	-185,246
2013	2,313,860		25,477		0	-2,339,336
2014	1,268,310		25,477		0	-1,293,786
2015	484,501	9,508,246	25,477	165,550	1,116,280	-9,067,494
2016		9,508,246	25,477	331,100	2,350,810	-7,514,013
2017		6,340,171	25,477	441,490	3,298,561	-3,508,576
2018		6,340,171	25,477	551,880	4,336,200	-2,581,327
2019			25,477	551,880	4,564,836	3,987,479
2020			25,477	551,880	4,801,356	4,223,999
2021			25,477	551,880	4,959,036	4,381,679
2022			25,477	551,880	5,124,600	4,547,243
2023			25,477	551,880	5,290,164	4,712,807
2024			25,477	551,880	5,463,612	4,886,255
2025			25,477	551,880	5,644,944	5,067,587
2026			25,477	551,880	5,834,160	5,256,803
2027			25,477	551,880	6,023,376	5,446,019
2028			25,477	551,880	6,220,476	5,643,119
2029			25,477	551,880	6,425,460	5,848,103
2030	555,420	4,754,123	25,477	551,880	6,638,328	751,428
2031	555,420	4,754,123	25,477	551,880	6,859,080	972,180
2032		3,170,085	25,477	551,880	7,087,716	3,340,274
2033		3,170,085	25,477	551,880	7,324,236	3,576,794
2034			25,477	551,880	7,568,640	6,991,283
2035			25,477	551,880	7,820,928	7,243,571

Year	Economic Cost				Economic Benefit	Net Cash Flow
	Economic Investment Cost	Investment Cost of Factories	Opportunity Cost of Land	Opportunity Cost of Labor		
2036			25,477	551,880	8,081,100	7,503,743
2037			25,477	551,880	8,349,156	7,771,799
2038			25,477	551,880	8,625,096	8,047,739
2039			25,477	551,880	8,908,920	8,331,563
2040			25,477	551,880	9,200,628	8,623,271
2041			25,477	551,880	9,508,104	8,930,747
2042			25,477	551,880	9,823,464	9,246,107
2043			25,477	551,880	10,146,708	9,569,351
2044			25,477	551,880	10,477,836	9,900,479
2045			25,477	551,880	10,824,732	10,247,375
2046	582,619		25,477	551,880	11,179,512	10,046,735
2047	582,619		25,477	551,880	11,550,060	10,417,283
2048			25,477	551,880	11,928,492	11,351,135
2049			25,477	551,880	12,322,692	11,745,335
					EIRR	13.3%

Source: JICA Survey Team

7.3.6 EIRR of Alternatives 2 and 3

Tables 7.3.8 and 7.3.9 indicate two different alternatives on economic investment cost for the VIP Project. The total economic investment cost and its ratio to the financial investment cost for each alternative are as follows:

- Alternative 2: JPY3.2 billion (71.3% of financial investment cost)
- Alternative 3: JPY2.9 billion (70.3% of financial investment cost)

Table 7.3.8: Economic Investment Cost of the VIP Project (Alternative 2)

(Unit: JPY 000)

	2012	2013	2014	2015	Total
Direct Construction Cost	0	1,594,158	832,649	282,828	2,709,635
Cost for Consultant Service	127,361	130,271	101,829	95,774	455,236
Administration Cost	2,547	34,489	18,690	7,572	63,297
Annual Total Cost	129,908	1,758,918	953,168	386,174	3,228,168

Source: JICA Survey Team

Table 7.3.9: Economic Investment Cost of the VIP Project (Alternative 3)

(Unit: JPY 000)

	2012	2013	2014	2015	Total
Direct Construction Cost	0	1,481,150	701,924	238,516	2,421,590
Cost for Consultant Service	94,317	118,265	108,851	93,780	415,213
Administration Cost	1,886	31,988	16,215	6,646	56,736
Annual Total Cost	96,203	1,631,403	826,990	338,942	2,893,539

Source: JICA Survey Team

Table 7.3.10 indicates the comparison of EIRR among the three alternatives. In accordance with the reduction of the economic investment cost, EIRR improves gradually from 13.3% in Alternative 1 to 13.7% in Alternative 2 and 13.9% in Alternative 3.

Table 7.3.10: Comparison of EIRR Among the Three Alternatives of the VIP Project

Alternatives	EIRR (%)
Alternative 1: All infrastructure	13.3
Alternative 2: Without Power Supply	13.7
Alternative 3: Without Power Supply and Water Supply	13.9

Source: JICA Survey team

7.3.7 Sensitivity Analysis

The sensitivity of EIRR is analyzed from two different viewpoints, namely:

- Employment of low fixed asset per employee in calculating the value added generated from factories, and
- Change of economic investment cost (10% up and 10% down).

(1) Low Capital-Labor Ratio of Factories

The EIRR under a low capital-labor ratio (scenario 2) is mentioned in Section 7.3.4 (2). In the analysis in this section, it is estimated that the average capital-labor ratio would be higher if major tenants consist of chemical, food, metal and wood processing industries. On the other hand, it is assumed that the average capital-labor ratio would be lower if major tenants consist of garment, electric machinery parts manufacturing, and transport machinery parts manufacturing. From a high to low capital-labor ratio scenario, the average fixed asset per employee would drop from LAK380 million/person (equivalent to JPY4.0 million/person) to LAK250 million/person (equivalent to JPY2.6 million/person).

Table 7.3.11 indicates the change of EIRR in the three alternatives under a low capital-labor ratio. In the base case (Alternative 1), the EIRR improves by 5.0%, and increases to 18.3%. The smaller the economic investment cost, the higher the EIRR. In Alternative 3, the EIRR would be 19.6%.

Table 7.3.11: Change of EIRR under Low Capital-Labor Ratio

Alternatives	EIRR (%)	Improvement (% points)
Alternatives 1: All infrastructure	18.3	5.0
Alternatives 2: W/O Power Supply	19.1	5.5
Alternatives 3: W/O Power Supply and Water Supply	19.6	5.7

Source: JICA Survey team

(2) Change of Economic Investment Cost

The change in EIRR in case the economic investment cost increases and decreases by 10% are calculated. Table 7.3.12 indicates the result. Such increase and decrease would not make a significant impact on EIRR figures.

Table 7.3.12: Change in EIRR under Increasing (10% Up) and Decreasing (10%Down) Economic Investment Cost

Alternatives	10% up (%)	10% down (%)
Alternative 1: All infrastructure	13.1	13.5
Alternative 2: W/O Power Supply	13.5	13.8
Alternative 3: W/O Power Supply and Water Supply	13.7	14.0

Source: JICA Survey team

7.4 Conclusions

7.4.1 Financial Analysis

In order to achieve financial feasibility, land rent must be set as USD1.59/m^2/year (JPY148/m^2/year). Repayment capacity (repayment of a soft loan) would be fulfilled at that level. The land rent of USD1.59/m^2/year is equivalent to a land price of USD80/m^2 (JPY7,423/m^2) if factory lots will be sold to tenants. However, a land rent of USD0.50/m^2/year (JPY47/m^2/year) is needed to compete with other industrial estates in the northeast part of Thailand and Savannakhet. If land rent is set at USD0.50/m^2/year, the public sector needs to disburse JPY3.6 billion (LAK340 trillion) to balance out the negative cash flow.

Even if a component is excluded from the VIP Project, the results are basically the same. In Alternative 2 (excluding power supply), the land rent to fulfill the repayment capacity is USD1.23/m^2/year (JPY115/m^2/year). In Alternative 3 (excluding power supply and water supply), the rent is USD1.11/m^2/year (JPY104/m^2/year).

If cost for land tenure increases from current USD3/m^2 to USD25/m^2, land rent have to be set as USD2.10/m^2/year (equivalent to USD105/m^2 of land price) to enable positive NPV (Alternative 4). On the other hand, land rent will drop to USD1.55/m^2/year (equivalent to USD78/m^2 of land price) if land for VIP is obtained by Lao PDR government and provided to project implementation body.

7.4.2 Economic Analysis

The calculated EIRR is 13.3% for Alternative 1 (base case), 13.7% for Alternative 2 and 13.9% for Alternative 3. These figures are higher than the opportunity cost of capital (12%). The VIP Project is feasible from the standpoint of the national economy.

The EIRR figures are calculated under severe condition in which fixed asset per employee is much higher than the current level. Even so, the project is still economically feasible. If the fixed asset per employee drops toward the current level, the EIRR of the three alternatives of the VIP Project would further improve. In this case, the EIRR improves to 18.3% in Alternative 1, 19.1% in Alternative 2 and 19.6% in Alternative 3.

CHAPTER 8 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

8.1 Alternatives from the Environmental and Social Viewpoints

8.1.1 Outline of Vientiane Industrial Zone (VIZ)

The VIZ was designated in the Vientiane Capital Master Plan (2000) and approved by the Government of the Lao PDR. Also, the VIZ was certificated by Vientiane Capital as an industrial development zone since 2005 with a total area of about 2,000 ha.

- Protection area

  There is no protection area located in the VIZ. The closest protection area is Dong Makkhay Provincial Protection Area which is located at a distance of about 3.5 km northwest as shown in Figure 8.1.1.

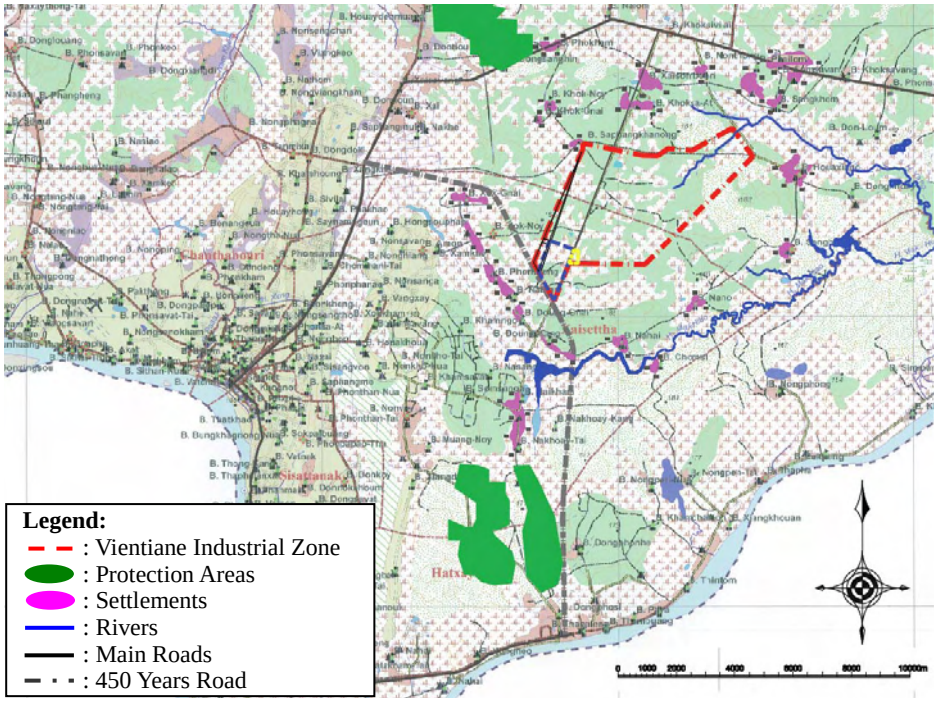
- Resettlement

  The VIZ belongs to two districts, namely, Xaithani District and Xaisettha District. There are 13 villages in and around the VIZ. As main settlements of the villages are located outside the VIZ as shown in Figure 8.1.1, residents living in the VIZ are assumed to be quite few.

- Topography and geology

  The ground of the VIZ is flat or gently sloping with a height of 160 m to 175 m above sea level, according to the topographic survey conducted by the Public Works and Transportation Institute. Besides, no big lakes or swamps and main rivers are located in the VIZ.

Hence, it is judged that the location of VIP has potential for industrial development also from the environmental and social viewpoints.



Source: JICA Survey Team

Figure 8.1.1: Location Map of the Study Area

8.1.2 Alternatives for VIZ Development

Alternative scenarios for the VIZ development were prepared to precisely analyze the advantages and disadvantages of each alternative scenario.

Alternative 1: VIZ Development with Integrated Functions

Alternative 1 is the development scenario in which VIZ will be developed not only with industrial and supporting logistics and public infrastructure areas but also with residential, commercial and amenity areas for workers in the VIZ.

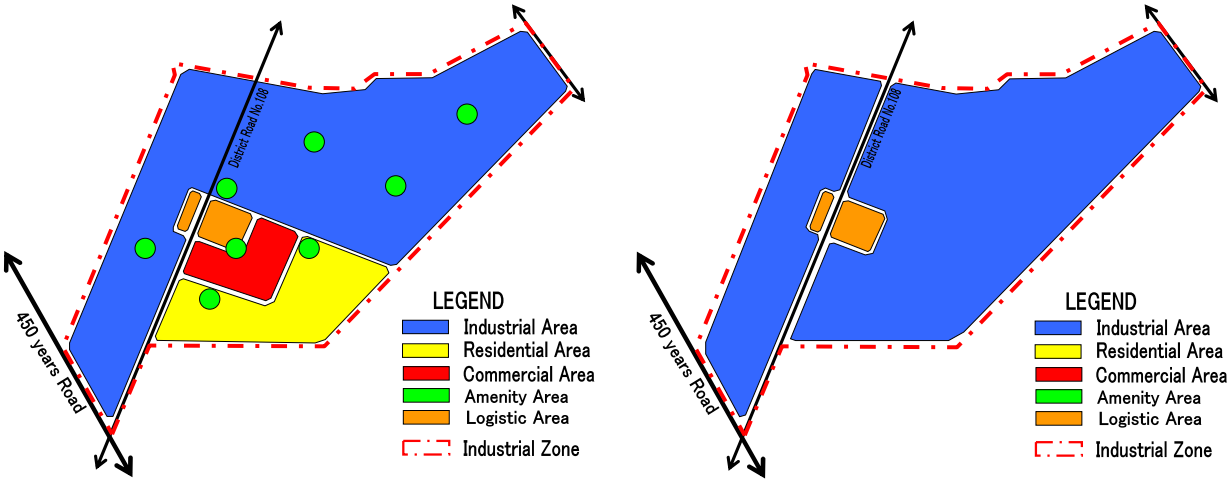
Alternative 2: VIZ Development with Industrial Function Only

Alternative 2 is the development scenario in which the VIZ is utilized solely as an industrial area. Logistics and public infrastructure areas are provided to support the industrial zone.

Alternative 3: Without VIZ Development (Zero-Option)

The zero-option is the do-nothing case. There is no improvement from current the industrialization trend in Vientiane Capital and current status of the VIZ.

Figure 8.1.2 shows the conceptual designs of Alternatives 1 and 2.



Alternative 1 **Alternative 2**

Source: JICA Survey Team

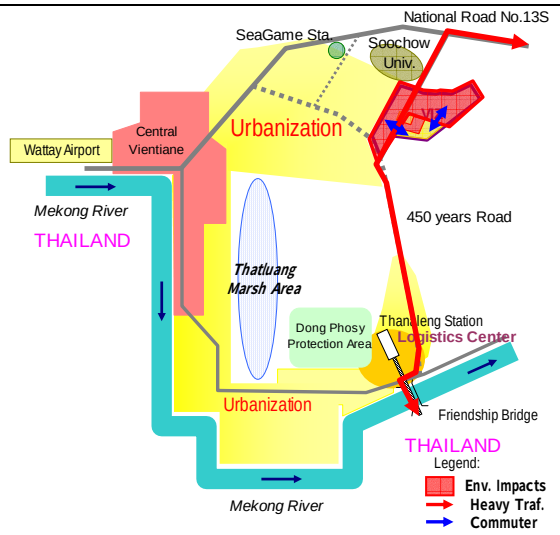
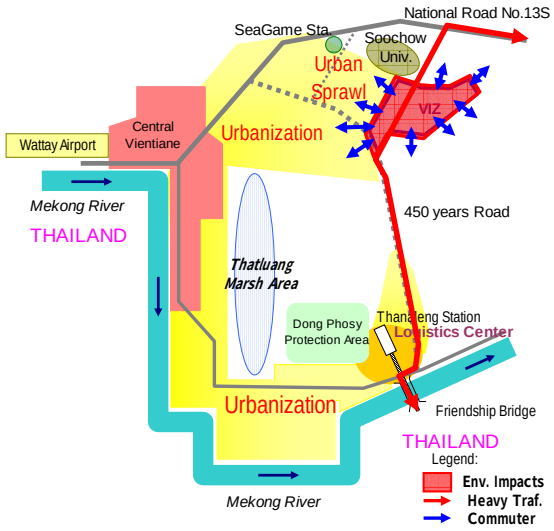
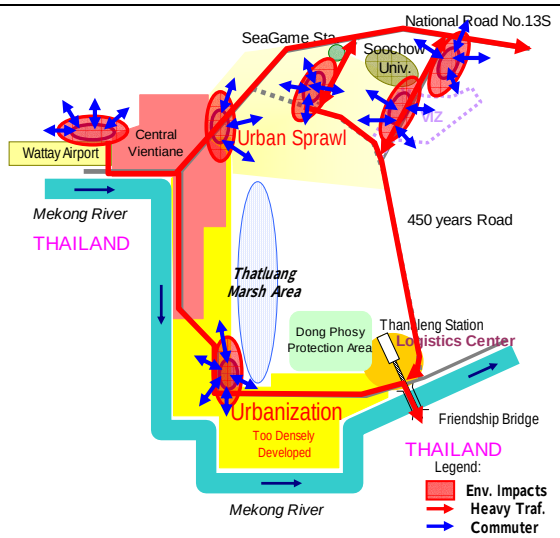
Figure 8.1.2: Conceptual Designs of VIZ Alternatives 1 and 2

As a result of the discussion with the MoIC and JICA Survey Team (JST), advantages and disadvantages of each alternative were confirmed as shown in Figure 8.1.3.

Besides, a quantitative environmental impact assessment in terms of transportation was conducted using JICA-STRADA as shown in Table 8.1.1. The result is summarized as follows:

- Alternative 1 would cause least environmental impact in terms of NO_x, CO_2, noise and accident at every stage.
- Although the difference of each environmental indicator is only 1% to 2% among the alternatives during Stage 1, the difference would increase during Stages 2 and 3.

Therefore, Alternative 1 was adopted as the optimum development scenario.

	**Alternative 1:** **VIZ Development with Integrated Functions** In this scenario: 1. Industrial development would be well managed and controlled within the VIZ; 2. Urban area including residential and related functions such as amenity area would be sufficiently developed within the VIZ; 3. Urbanization of Vientiane Capital would be sufficiently controlled and managed due to the establishment of the satellite urban core (VIZ) which may ease the overcrowding in the existing city center and the southern area.
	**Alternative 2:** **VIZ Development with Industrial Function Only** In this scenario: 1. Industrial development would be well managed and controlled within the VIZ; 2. Based on the urban development framework, the labor potential until year 2025 requires only around 480 ha industrial lot/area which is equivalent to 840 ha industrial park (including public infrastructure). VIZ, which has an area of 2,000 ha, would be too huge and it would take long time to attract investors; 3. Urban area, especially residential area for the workers in the VIZ, would be developed in and around the VIZ without sufficient controls, and it would cause urban sprawl.
	**Alternative 3:** **Without VIZ Development (Zero-Option)** In this scenario: 1. Industrial factories would be constructed without any guideline and sufficient controls in every available space; 2. Transportation and construction vehicles would go around the city; 3. Difficult to monitor and manage the environmental impacts such as wastewater, solid waste and air pollution; 4. Urbanization in the city would be continuously concentrated in the south due to the major economical activities which may be related to Thailand.

Source: JICA Survey Team

Figure 8.1.3: Comparison of Alternatives for the VIZ Development including Without Project Case

Table 8.1.1: Environmental Impact Assessment for Each Alternative

Parameter		Stage 1: 2015			Stage 2: 2025			Stage 3: After 2025		
		Value	Difference	Rate	Value	Difference	Rate	Value	Difference	Rate
NOx (kg/day)	Alt-1	2,920	—	—	4,590	—	—	5,390	—	—
	Alt-2	2,960	40	1.4%	4,850	260	5.7%	6,040	650	12.1%
	Alt-3	2,960	40	1.4%	4,850	260	5.7%	5,880	490	9.1%
CO_2 (kg-c/day)	Alt-1	466,840	—	—	727,430	—	—	781,570	—	—
	Alt-2	476,770	9,930	2.1%	782,310	54,880	7.5%	870,880	89,310	11.4%
	Alt-3	475,310	8,470	1.8%	776,420	48,990	6.7%	855,720	74,150	9.5%
Noise dB (A)	Alt-1	18,210	—	—	23,620	—	—	24,020	—	—
	Alt-2	18,300	90	0.5%	23,720	100	0.4%	24,410	390	1.6%
	Alt-3	18,290	80	0.4%	23,690	70	0.3%	24,300	280	1.2%
Accidents (no./year)	Alt-1	3,190	—	—	4,900	—	—	5,010	—	—
	Alt-2	3,240	50	1.6%	5,200	300	6.1%	5,410	400	8.0%
	Alt-3	3,230	40	1.3%	5,140	240	4.9%	5,370	360	7.2%

Note: The rate is based on Alt-1
The default configuration of JICA-STRADA was used for the calculation.
NOx; $\xi=(p_1a_1+p_2a_2)Q$
a_1:Car ratio(%), a_2:Truck ratio(%), Q :Traffic volume(pcu/day), p_1, p_2:unit
CO_2; $\xi=(p_1a_1+p_2a_2)Q$
a_1:Car ratio(%), a_2:Truck ratio(%), Q :Traffic volume(pcu/day), p_1, p_2:unit
Noise; $\xi=p+10\log(a_1+\beta a_2)+10\log(Q/24)$
a_1:Car ratio(%), a_2:Truck ratio(%), Q :Traffic volume (pcu/day), B :pcu factor, p :unit
Accidents; $Y=p_1X_1+p_2X_2$
X_1:Total volume-km (1000pcu-km/day), X_2:Total volume-Crossing (1000pcu-no./day), p_1, p_2:unit
Source: JICA Survey Team

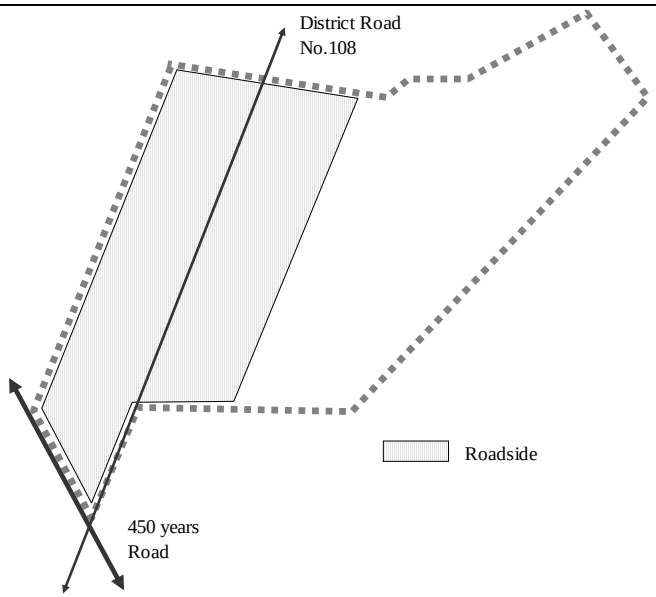
8.1.3 Stepwise Development Strategy for the VIZ and Selection of the Priority Area

According to the demand projection for industrial zone development in Vientiane Capital, the necessary areas for industrial park with integrated functions are 140 ha in 2015 and 845 ha in 2025. Therefore, the stepwise development strategy for the VIZ was adopted.

The priority area (140 ha) for Stage 1 (2015), which is the feasibility study (F/S) area, was located at the southwest edge of the VIZ. The procedure for the selection of the priority area is shown in Figure 8.1.4.

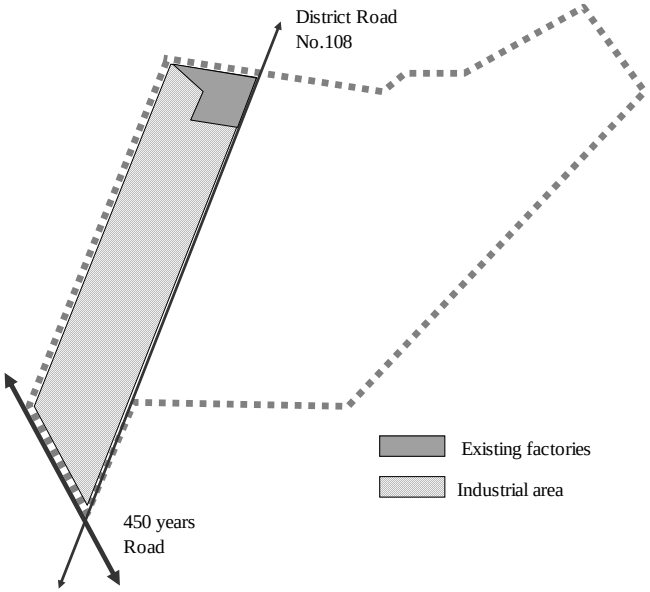
Required Condition 1:
To be located along the main roads

The only existing main road in the VIZ is District Road No. 108 (DR-108) which runs north to south. DR-108 is the sub-main road in the eastern suburbs of Vientiane Capital. Although it is presently a gravel road, 5 m to 6 m wide, it is planned to be improved to a paved 4-lane road through Chinese Aid by 2010.
Besides, 450 Year Road, which will be a great arterial road for logistics movement, is planned to be opened to traffic in 2010 which edges the southernmost side of the westernmost part of the VIZ.



Required Condition 2:
To coordinate with current land use

The existing 16 industrial factories are located at the northwest edge of the VIZ. As the VIZ will be developed as an integrated industrial area with residential and commercial areas, it is desirable that the eastern part of DR-108 would be zoned as a residential area while the western part would be classified as an industrial zone considering the current land use in the VIZ.



Source: JICA Survey team

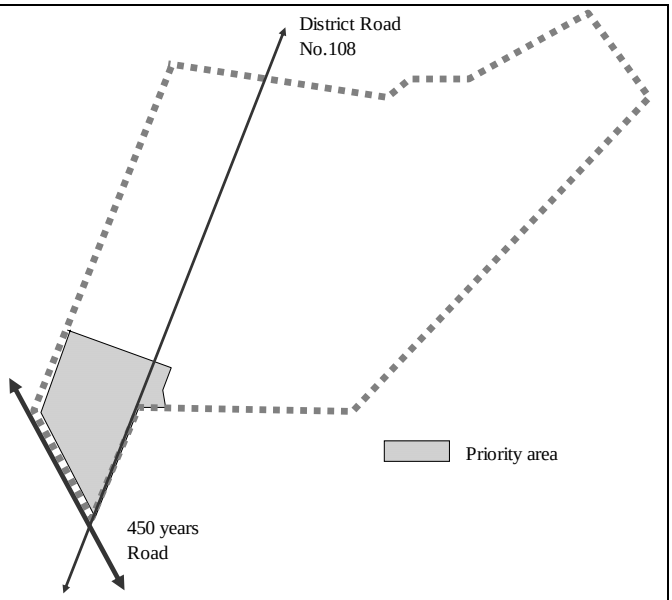
Figure 8.1.4: Site Selection of Priority Area (1/2)

Required Condition 3:
Other requirements

In addition to the abovementioned two conditions, the following criteria are considered. Judging from the advantages in Items 1, 2 and 3, which are especially important, the southwest edge of the VIZ was selected as the priority area.

Item 1: Advertising effect appealing to investors;
Item 2: Influence of the existing factories;
Item 3: Accessibility to 450 Year Road;
Item 4: Accessibility to DR-108;
Item 5: Advantage of water supply;
Item 6: Advantage of power supply;
Item 7: Advantage of wastewater drainage;
Item 8: Adjoining land availability for extension
Item 9: Land price
Item 10: Intention of the Lao PDR

Besides, in selecting the priority area, avoidance of the local village (Nanokkhien Village Temple) and as many houses as possible have been attempted.



Source: JICA Survey team

Figure 8.1.4: Site Selection of Priority Area (2/2)

8.2 Public Consultations

8.2.1 Outline of Public Consultations

(1) Stakeholders Meetings

In accordance with the progress of the Study, stakeholders meetings were held as shown in Table 8.2.1. The Ministry of Industry and Commerce (MoIC), as the proponent, organized the meetings. C/Ps made presentations and answered questions from attendees.

Table 8.2.1: Outline of Stakeholders Meetings

No.	Agenda	Scheduled Period
1st	- Outline of the Study - TOR for Environmental and Social Consideration Survey	July 3, 2009
2nd	- Progress of F/S - Result of Field Survey	December 7, 2009
3rd	- Explanation of Draft Final Report (DF/R) - Explanation of Draft EIA and P:reliminary RAP	April 7, 2010

Source; JICA Survey Team

Based on the discussion between the MoIC and JST, concerned and relevant participants for the stakeholders meetings were identified as follows to obtain various opinions and to encourage the exchange of information and discussion:

- District governors and village leaders related to the VIZ;

- Environmental Administration of PMO and Vientiane Capital;
- Land Management Authority (LMA) of PMO and Vientiane Capital;
- Department of Industry of MoIC and Vientiane Capital; and
- Other stakeholders such as NGOs and relevant institutes.

(2) Village Consultations

In addition to the stakeholders meetings, which were held to obtain feedbacks from concerned central and/or local governmental and other relevant organizations, the village consultations for the residents were held as shown in Table 8.2.2 to ensure public participation and information disclosure. The MoIC organized the meetings in cooperation with concerned village leaders.

Further village consultations will be organized by the MoIC after the Government of the Lao PDR has approved the VIP project and ensured the budget for resettlement and compensation.

Table 8.2.2: Outline of Village Consultations

No.	Agenda	Scheduled Period
1st	- Outline of the Study - TOR for Environmental and Social Consideration Survey	August 5 – 7, 2009

Source; JICA Survey Team

8.2.2 Result of Public Consultations

(1) 1st Stakeholders Meeting

The first stakeholders meeting was held on July 3, 2009 at the MoIC conference room. The representatives from concerned districts and villages, Vientiane Capital, WREA, LMA, MPWT, PTI, ADB, JICA, MoIC, local consultant and JST attended the meeting. A total of 28 participants attended the meeting.

The following issues were discussed and agreed upon during the meeting:

- The terms of reference (TOR) for the environmental and social consideration study was agreed among the attendees.
- Concerned organizations will cooperate regarding the data collection in the study, and local authorities will distribute information to the residents for their understanding and cooperation.
- Field survey shall be conducted in the presence of representatives from concerned authorities such as village leaders.
- Questionnaire for socioeconomic condition survey shall be prepared by referring to examples of similar projects and approved by village leaders and other relevant organizations.
- Measures on resettlement and compensation shall be fair and suitable to the actual condition in the project site.

(2) 1st Village Consultations

The first village consultations were held in the four concerned villages as shown in Table 8.2.3. The meetings were held at village meeting rooms or village temples. A total of 239 participants attended the meetings.

Table 8.2.3: Outline of 1st Village Consultation

Village	Date	Attendance
Xok Noi Village	August 7, 2009	74 (Male: 47, Female: 27)
Phong Thong Village	August 6, 2009	66 (Male: 20, Female: 46)
Na Bien Village	August 5, 2009	48 (Male: 17, Female: 31)
Dung Yei Village	August 7, 2009	51 (Male: 22, Female: 29)

Source: JICA Survey Team

In each meeting, the outline of the Study and the TOR for the environmental and social consideration study were explained to the residents.

The main issues raised by the residents are as follows:

- Measures to prevent environmental impact such as air pollution and water pollution are necessary.
- Measures on resettlement and compensation shall be fair and suitable to the actual condition in the project site.
- Job opportunity for the residents shall be expanded through the development of VIP.

(2) 2nd Stakeholders Meeting

The second stakeholders meeting was held on December 7, 2009 at the MOIC conference room. The representatives from concerned districts and villages, Vientiane Capital, WREA, LMA, MOAF, MPWT, PTI, ADB, JICA, MoIC, local consultant and JST attended the meeting. A total of 20 participants was present.

After explaining the progress of the F/S for the VIP and the result of the environmental and social condition survey in the study area, the following issues were discussed and agreed during the meeting:

- In the preparation of the environmental and social impact assessment (ESIA) report, evaluation of environmental condition shall be conducted by referring to the existing standards in the Lao PDR, standards in neighboring countries as well as international standards;
- In the preparation of the ESIA report, pre- and post-project condition shall be identified through impact forecast, and environmental management plan (EMP) shall be proposed;
- In the preparation of the resettlement action plan (RAP), concerned legislation shall be studied in detail and compensation for project-affected people shall be similar with other on-going projects;
- The MoIC shall consider providing new job opportunities for project-affected people and compensation shall be fair and appropriate.

(3) 3rd Stakeholders Meeting

The third stakeholders meeting was held on April 7, 2010 at the MoIC conference room. The representatives from concerned districts and villages, Vientiane Capital, WREA, LMA, MOAF,

MPWT, PTI, ADB, JICA, MoIC, local consultant and JST attended the meeting. A total of 24 participants was present.

After explaining the result of the F/S for the VIP and the outline of the draft ESIA report and preliminary RAP, the following issues were discussed and agreed during the meeting:

- The EIA of the project was well studied;
- The project owner should conduct environmental monitoring and prevent environmental pollution caused by factories;
- The resettlement and compensation for the project-affected people must be conducted to improve their livelihoods. If possible, job opportunity in the VIP should be provided;
- Although the land price is evaluated by the LMA, the project owner should examine it in detail after the feasibility study stage;
- If the project-affected people will be given cash compensation only, they might spend it all for their consumption. Therefore, livelihood rehabilitation assistance should be considered;
- When planning relocation sites for the project-affected people after the F/S stage, the sites must have sufficient social infrastructure as in the existing location;
- The participants will cooperate continuously and further discuss the issues raised during the meeting after the F/S stage.

8.3 Scoping of Environmental and Social Impact

In order to assess the likely significant environmental and social impacts, the related conceivable impacts of the project were preliminary identified as shown in Table 8.3.1. The impacts of social environment, natural environment and pollution were classified as A to D in accordance with the JICA environmental and social considerations guideline.

Table 8.3.1: Conceivable Adverse Environmental and Social Impacts of the Proposed Project (1/3)

Item			Rating	Reasons
Social Environment	1	Involuntary Resettlement	B-	Though the involuntary resettlement caused by land acquisition is firstly avoided and minimized, around 10 households would be unavoidably resettled by the project, according to preliminary site visit and satellite photos.
	2	Local Economy such as Employment and Livelihood, etc.	A-	The livelihood of households who have land in the study area would be affected due to land acquisition by the project.
			A+	Positive impacts on local economy would be expected since the project aims at facilitating the economic activities in Vientiane Capital and the Lao PDR. More job opportunities and improvement of livelihood could be expected.
	3	Land Use and Utilization of Local Resources	A-	Farmland and forest with area of around 140 ha would be converted into industrial area and other purposes.
			B+	Green areas could be created as urban amenities.
	4	Social Institutions such as Regional Severance	C	Changes in land use and industrial area development could negatively affect social institutions such as regional severance and change in life styles. However, the magnitude of the impact would not be significant as the villages' main communities are not located in the study area.
	5	Existing Social Infrastructure and Services	C	Existing social infrastructure such as transportation may be affected by the project though the extent of the impact is unknown at this stage.
	6	The Poor, Indigenous and Ethnic People	B-	Livelihood of low-income households may be affected by changing/loosing jobs in the resettlement. Ethnic minority groups and squatters are unlikely to exist in the study area, and it would be confirmed.
	7	Maldistribution of Benefit and Damage	C	Inequality among project-affected people may occur if renting residents or tenant farmers exist and not compensated adequately. The existence of renting residents and tenant farmers would be confirmed in the study.
	8	Cultural Heritage	C	At this stage, no cultural heritage is identified in the study area. Also, the boundary of industrial area is decided to avoid the existing village temple. Existence of remains and cultural assets shall be confirmed before the construction.
	9	Local Conflicts of Interest	C	Conflicts of interests related to the project may occur among project-affected people if renting residents or tenant farmers exist and not compensated adequately. The existence of renting residents and tenant farmers would be confirmed.
	10	Water Usage or Water Rights and Communal Rights	C	Impact on local water usage may occur if surface water would be taken during the construction work of the project.
			D	During operation phase, piped water would be supplied to the industrial area by the public water supply cooperation in Vientiane Capital (Nam PaPa), and surrounding surface water/groundwater will not be taken by the project.
	11	Sanitation	C	During construction phase, deterioration of sanitary condition may occur in and around the construction site due to construction of labor camps for the project. However, the extent of impact is unknown at this stage.
			B+	Positive impacts on sanitation could be expected due to the planned infrastructure development of water supply and wastewater treatment.
	12	Hazards (risk) Infectious Diseases such as HIV/AIDS	C	Influx of laborers that have infectious diseases may cause the spread of diseases in and around the industrial area. However, the extent of impact is unknown at this stage.
	13	Accidents	B-	Accidents may increase due to the operation of construction machinery and increase of traffic volume during the construction phase.
			B-	Traffic accidents may increase due to the increase of traffic volume during the operation phase.

Rating: A: Serious impact is expected, B: Some impact is expected, C: Extent of impact is unknown, D: No impact is expected. IEE/EIA is not necessary.
Source: JICA Survey Team

Table 8.3.1: Conceivable Adverse Environmental and Social Impacts of the Proposed Project (2/3)

Item			Rating	Reasons
Natural Environment	14	Topography and Geographical Features	B^-	Land collapse may occur to some extent due to construction works of the project.
	15	Soil Erosion	C	Soil erosion caused by deforestation may occur. However, it is assumed that no significant impact would occur as there is no steep slope in the study area. The land slope in the project area would be studied in the topography survey.
	16	Groundwater	C	Although groundwater would not be taken by the project, deforestation and land preparation by the project may cause some impact on groundwater level.
	17	Hydrological Situation	C	Flow regime of river would not be changed by the project. Running off of rainwater may cause some impact on hydrological situation. Therefore, retention system of rainwater would be examined.
	18	Coastal Zone	D	There is no coastal zone in Vientiane or the Lao PDR.
	19	Flora, Fauna and Biodiversity	A^-	Although there is no protection area located in the VIZ, conversion of farmland and forest with an area of around 140 ha into an industrial area would affect biodiversity in the study area.
	20	Meteorology	D	The project itself does not affect climate. However, local natural conditions related to climate are important for examination of the industrial area infrastructure planning and design. Therefore, relevant data on climate shall be collected.
	21	Landscape	C	Positive and negative impacts on landscape are assumed. Consistent and harmonized design of industrial area would improve landscape.
	22	Global Warming	B^-	Carbon dioxide would be discharged by construction machineries and vehicles during the construction phase.
			B^-	Vehicle traffic during the operation phase would affect carbon dioxide emissions. Green house gas emissions by tenant industrial factories would be assumed.

Rating: A: Serious impact is expected, B: Some impact is expected, C: Extent of impact is unknown, D: No impact is expected. IEE/EIA is not necessary.
Source: JICA Survey Team

Table 8.3.1: Conceivable Adverse Environmental and Social Impacts by the Proposed Project (3/3)

Item			Rating	Reasons
Pollution	23	Air Pollution	B-	Deterioration of ambient air quality caused by construction machineries and vehicles would temporarily occur during the construction phase.
			B-	Deterioration of ambient air quality caused by increase of vehicle traffic would occur during the operation phase. Gas emissions by tenant industrial factories would be assumed.
	24	Water Pollution	B-	Inadequate wastewater disposal during the construction phase such as discharge of muddy water would cause water pollution in the surrounding surface water.
			B-	Inadequate wastewater treatment and disposal during the operation phase would cause water pollution in the surrounding surface and ground water.
	25	Soil Contamination	D	Soil contamination during the construction phase would not be assumed.
			C	Soil contamination may occur through inadequate waste and wastewater discharge during the operation phase.
	26	Waste	B-	Inadequate disposal of construction residue soil and waste may cause water pollution in and around the disposal site.
			B-	Waste discharge by tenant industrial factories would be assumed.
	27	Noise and Vibration	B-	Increase of noise level due to construction machineries and vehicles would temporarily occur during the construction phase.
			B-	Increase of noise level due to increase of vehicle traffic would occur during the operation phase.
	28	Ground Subsidence	C	Although groundwater would not be taken by the project, deforestation and land preparation by the project may cause some impact on ground subsidence.
	29	Offensive Odor	D	Offensive odor during the construction phase would not be assumed.
			B-	Offensive odor caused by tenant industrial factories would be assumed.
	30	Bottom Sediment	B-	Inadequate wastewater disposal during the construction phase such as discharge of muddy water would cause water pollution and impact on bottom sediment.
			B-	Inadequate wastewater treatment and disposal during the operation phase would cause water pollution and impact on bottom sediment.

Rating: A: Serious impact is expected, B: Some impact is expected, C: Extent of impact is unknown, D: No impact is expected. IEE/EIA is not necessary.
Source: JICA Survey Team

8.4 TOR for Environmental and Social Consideration Study

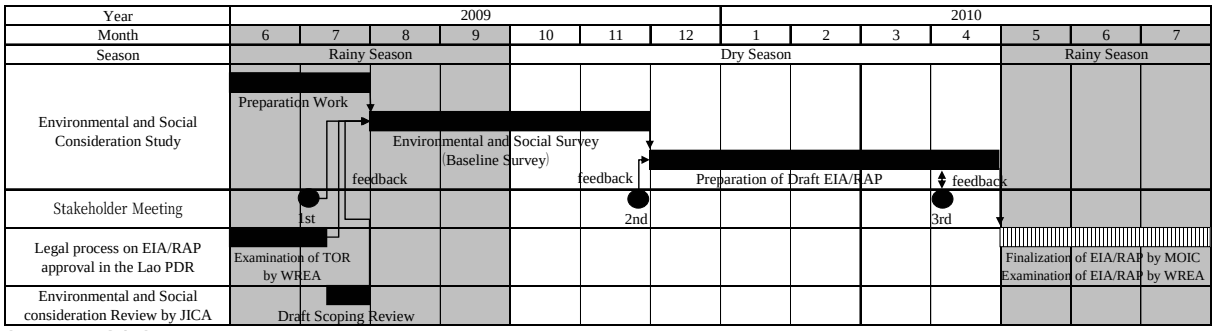
8.4.1 Overall Framework

The legal process of the EIA and RAP in the Lao PDR was executed for the project in parallel with the environmental and social consideration study under the JICA guidelines on environment and social considerations.

The TOR for environmental and social consideration study was prepared based on the scoping results and discussions in the 1st stakeholders meeting held on July 3, 2009. The MoIC filed the application for TOR approval with WREA. The TOR was officially approved by the WREA on July 28, 2009. Also, the JICA board reviews were held on July 13, 2009 and July 27, 2009 and the advice/suggestion of the reviewing committee was issued on August 7, 2009.

In this JICA Survey, the environmental and social study (baseline study) was conducted. The draft EIA and preliminary RAP were prepared according to the TOR approved by the WREA. After this JICA Survey, the EIA and RAP shall be finalized by the MoIC and then examined and approved by the WREA.

The overall framework of environmental and social consideration study was presented in Figure 8.4.1.



Source: JICA Survey Team

Figure 8.4.1: Overall Framework of Environmental and Social Consideration Study

8.4.2 Study Area

The study area basically covered the F/S area for the VIP (140 ha). The location and area studied varied among the environmental and social impact items based on their features.

8.4.3 Study Item

The main items for the environmental and social consideration study are shown in Table 8.4.1. The study was conducted in cooperation with the C/Ps and JST. Part of the works was subcontracted by the JST to the local environmental and social consultants registered with the WREA.

Table 8.4.1: Study Items for Environmental and Social Considerations

Study Item
1. EIA study
(1) Study on present environmental and social conditions (baseline study)
(2) Environmental and social impact forecasts and estimates for each alternative
(3) Evaluation of environmental and social impacts and selection of optimum alternative
(4) Examination of environmental mitigation measures and social consideration measures
(5) Preparation of environmental and social management plan
(6) Preparation of draft EIA report
2. Preparation of preliminary resettlement action plan (Preliminary RAP)
3. Conduct of stakeholders meetings

Source: JICA Survey Team

8.4.4 Study Method

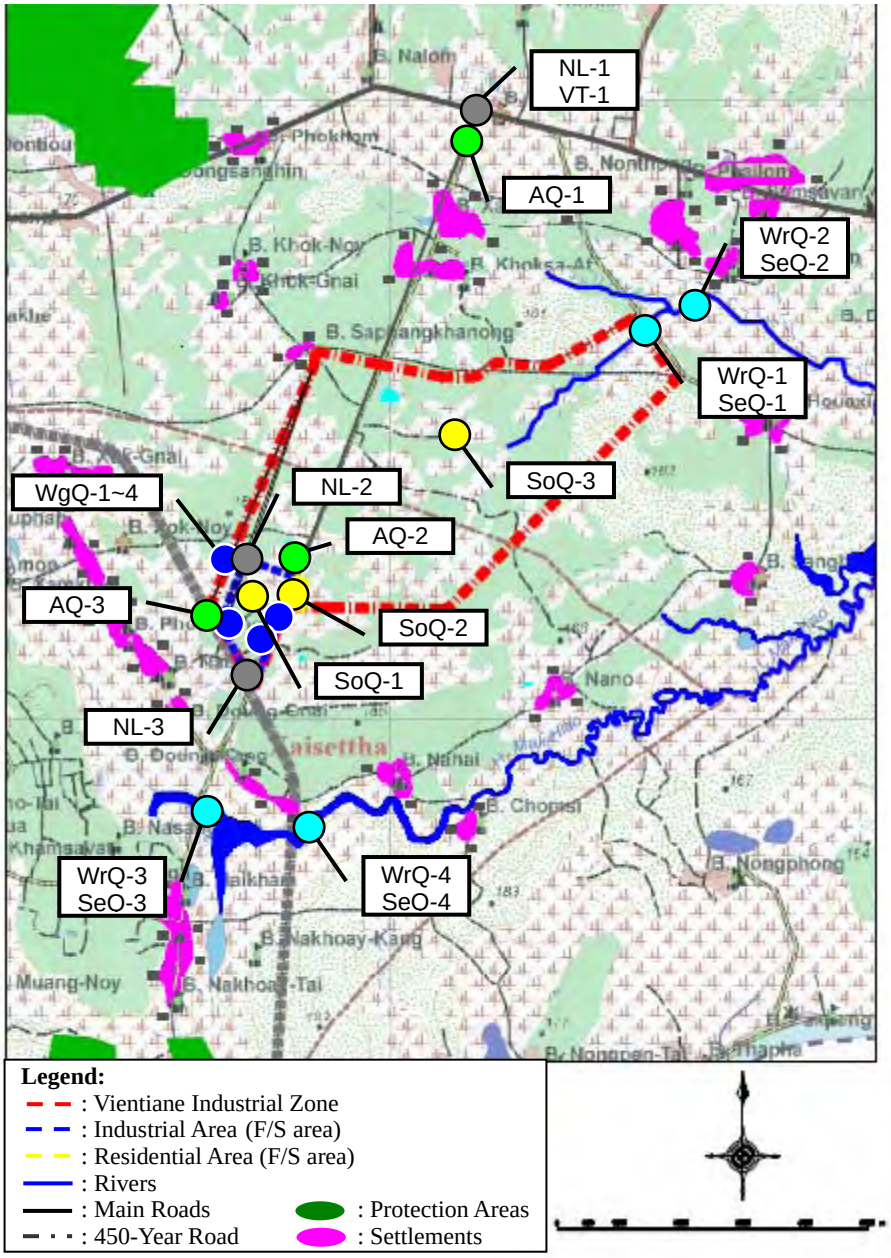
(1) Study on Present Environmental and Social Conditions (Baseline Study)

Data on the present environmental and social conditions in the study area were collected and examined against various relevant aspects. The baseline study consisted of secondary data collection, field reconnaissance, environmental survey (surface and ground water quality, sediment and soil quality, air quality, noise level, vehicle traffic, flora and fauna), and socioeconomic survey (land use, inventory and interview with project-affected people). The summary of the environmental and socioeconomic survey is shown in Table 8.4.2 while the sampling points for the environmental survey are shown in Figure 8.4.2.

Table 8.4.2: Summary of Environmental and Socioeconomic Survey

Water Quality (River)	Parameter	5-Day Biochemical Oxygen Demand (BOD_5) (at 20°C); Suspended Solid (SS), Total Suspended Solids (TSS); Settable Solid; Total Dissolved Solids (TDS); Chemical Oxygen Demand (COD); Sulfide (S), Hydrogen Sulfide (H_2S); Total Kjeldahl Nitrogen (TKN); Fat Oil and Grease; Temperature (water); pH (as stipulated in Standard for Wastewater Discharge, STEA (1998)) Fecal Coliform; Total Coliform; E. Coli; Aluminum (Al); Ammonia (NH_3), Ammonia Nitrogen (NH_3-N); Chloride (Cl^-); Copper (Cu); Iron (Fe); Manganese (Mn); Sodium (Na); Sulfate (SO_4^{2-}); Electrical Conductivity (EC); Salt (NaCl); Hardness; Turbidity; Color; Taste and Odor; Residual Chloride; Antimony (Sb); Arsenic (As); Barium (Ba); Boron (B); Cadmium (Cd); Chromium (Cr); Cyanide (CN^-); Fluoride (F^-); Lead (Pb); Mercury (Hg); Nitrate (NO_3^-); Nitrite (NO_2^-); Selenium (Se) (as stipulated in Drinking Water and Household Water Quality Standard, MOH(2005) Phenol; Silver (Ag); Zinc (Zn); Free Chlorine; Nickel (Ni); Chromium (VI) (Cr^{6+}) (as stipulated in Provision on Discharge of Domestic Sewage and Wastewater from Industrial Factories, MoIC (2006)) Temperature (atmosphere); Dissolved Oxygen (DO); Total Nitrogen (T-N); Total Phosphorous (T-P); Total Organic Compounds (TOC)
	Period	Rainy and dry season. (2 times in total.)
	Location	Upstream and downstream of 2 rivers surrounding the VIZ. (4 sampling points.)
Water Quality (Groundwater, Lake, etc.)	Parameter	Same as river water quality survey. (50 parameters in total.)
	Period	Rainy and dry season. (2 times in total.)
	Location	4 sampling points in and around the priority area as shown in Figure 8.4.2.
Sediment Quality	Parameter	Cadmium (Cd), Total Cyanide (CN), Lead (Pb), Chromium (Cr(VI)), Arsenic (As), Total Mercury (Hg), Selenium (Se), Fluoride (F), Boron (B). (9 parameters in total.)
	Period	1 time in dry season.
	Location	Same as river water quality survey. (4 sampling points in total.)
Soil Quality	Parameter	Same as sediment quality survey. (9 parameters in total.)
	Period	1 time in dry season.
	Location	3 sampling points in and around the priority area as shown in Figure 8.4.2.
Air Quality	Parameter	Nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), total suspended particle (TSP) and particle matter 10 (PM10). (5 parameters in total.)
	Period	7 days each for rainy and dry season. (14 days in total.)
	Location	2 sampling points in and around the priority area, and 1 sampling point along National Road 13, as shown in Figure 8.4.2. (3 sampling points in total.)
Noise Level	Parameter	L_{Aeq} (A-weighted loudness equivalent).
	Period	7 days each for rainy and dry season. (14 days in total.)
	Location	Same as air quality survey.
Vehicle Traffic	Parameter	Volume of traffic and traveling velocity of vehicles.
	Period	7 days each for rainy and dry season. (14 days in total.)
	Location	1 sampling point along National Road 13, as shown in Figure 8.4.2.
Flora and Fauna	Item	Interview, field observation and secondary data collection.
	Area	VIP project site (about 140 ha)
	Period	Whole survey period.
Land Use	Item	Land register information.
	Area	VIP project site (about 140 ha).
	Period	Whole survey period.
Resettlement	Item	Inventory and interview survey for project-affected people.
	Area	VIP project area (about 140 ha).
	Period	Whole survey period.

Source: JICA Survey Team



Note: AQ: Air Quality (3 points); NL: Noise Level (3 points); VT: Vehicle Traffic (1 point);
WrQ: River Water Quality (4 points); SeQ: Sediment Quality (4 points);
WgQ: Groundwater/Lake water Quality (4 points); SoQ: Soil Quality (3 points).
Source: JICA Survey Team

Figure 8.4.2: Location of Sampling Points for the Environmental Survey

(2) Environmental and Social Impact Forecasts and Estimates for Each Alternative

As a result of the scoping mentioned above, environmental and social impact forecasts and estimates were conducted on the potential environmental and social negative impact items caused by the project. The impact forecasts and estimates were conducted as quantitatively as possible by overlaying maps on the project plan and various existing natural and social features in the study area, analyzing construction plan, examining similar case studies, and conducting numerical simulation for both construction and operation phases of the project. However, some of the environmental and social impact items could only be examined in a qualitative manner.

(3) Evaluation of Environmental and Social Impacts and Selection of Optimum Alternative

The optimum alternative for the VIP development was selected by estimating various evaluation indices, setting evaluation criteria, and conducting comprehensive evaluation.

(4) Examination of Environmental Mitigation Measures and Social Consideration Measures

As a result of the environmental and social impact forecasts and estimates, adequate environmental preventive measures and social consideration measures were examined. Items to be examined for the proposed measures were environmental and social impact items, mitigation measure, conceivable effect and impact of the proposed measures, implementation timing and period, responsible body, and cost.

(5) Preparation of Environmental and Social Management Plan

An environmental and social management plan was prepared to grasp the environmental and social impacts and to monitor adequate implementation and effect of the proposed mitigation measures for feedback and follow-up activities, if necessary. The environmental and social management plan consisted of the environmental and social items, environmental mitigation measures and social consideration measures, monitoring method, location and frequency, implementation timing and period, responsible body, and cost.

(6) Preparation of Draft EIA Report

Based on the above items (1) to (5), a draft EIA report was prepared in compliance with the designated contents and format of the report as stipulated in the concerned legislations in the Lao PDR.

(7) Preparation of Preliminary RAP

Although involuntary resettlement caused by land acquisition was firstly avoided and minimized, it may not be avoided to some extent. Therefore, a preliminary RAP was prepared to ensure livelihood recovery of the project-affected people and minimize social impacts caused by the resettlement.

In the preparation of the preliminary RAP, the data collected through the activities mentioned in the above items (1) to (4) were examined in detail. The background study for the preparation of the preliminary RAP was conducted in the form of socioeconomic and inventory surveys for households to be potentially resettled. In the preparation process, opinions from stakeholders were collected during the stakeholders meetings.

According to the legislations in the Lao PDR, the RAP should be developed during the F/S stage. However, in the case of this JICA Survey, only the preliminary RAP was prepared. Nevertheless, this preliminary RAP will be submitted with the ESIA to the WREA through the MoIC in order to obtain

the Environmental Compliance Certificate (ECC) after the F/S. In this case, the preliminary RAP shall identify the gaps that remain in the RAP. After such stage, the preliminary RAP should be updated to fulfill all the requirements. Once updated, reviewed and found acceptable by the relevant project authorities and the WREA, the RAP will become legally enforceable and the ECC becomes effective. Table 8.4.3 shows the requirements of the RAP, actions taken by the JICA Survey during the F/S stage and actions to be taken by the MoIC after said stage.

8.4.5 MoIC's Obligation

The MoIC, as the proponent, shall be responsible for the following works after the JICA Survey for EIA/RAP approval:

[EIA]

- Finalization of EIA report in consultation with WREA and other relevant organization and obtaining of WREA's approval; and
- Formulation of detailed EMP and obtaining of WREA's approval.

[RAP]

- Declaration of cut-off date by conducting complete census and inventory survey to determine the project-affected people and project-affected assets;
- Consultation with the project-affected people, LMA and other relevant organization on measures for resettlement, compensation and rehabilitation;
- Survey and selection of resettlement site, planning and designing of resettlement facilities and selection of alternative land for compensation such as farmland;
- Formulation of procedures for grievance redress and social monitoring plan;
- Finalization of implementation schedule and cost/budget on measures for resettlement, compensation and rehabilitation; and
- Finalization of RAP in consultation with WREA and other relevant organizations and obtaining WREA's approval.

Table 8.4.3: Requirements for Developing the RAP and Actions Taken during and after the F/S Stage (1/3)

No.	Item	Proposed Action	Action Taken by JICA during F/S Stage	Action Taken by MoIC after F/S Stage
1	Collect data on land use in project area	Collect information on land tenure in the project area.	Collect information on land tenure (with 100% coverage) in the project area.	
2	Hold stakeholders meeting	Disseminate information on the project to central/local government officials and local representatives in project area in order to agree on the RAP approach.	Organize stakeholders meeting in cooperation with the MoIC.	
3	Conduct site survey on Affected Peoples (APs)	Formulate census of APs, inventory of affected land/other assets and socioeconomic data through site survey and set up cut-off date in order to establish eligibility for entitlements of compensation.	Conduct census, inventory of land/other assets and socioeconomic data of all APs found to be residing in the project area. Census, inventory of land/other assets and socioeconomic data for APs who are doing business or cultivating land or having rights over resources in the project area are covered only as a means of sampling survey.	Conduct census, inventory of land/other assets and socioeconomic data of all APs (with 100% coverage) found to be residing, doing business, cultivating land or having rights over resources in the project area. Set up cut-off date in order to establish eligibility for entitlements of compensation.
4	Prepare an entitlement matrix	Analyze data to identify different categories of APs depending upon the degree and scale of impacts of the project components. Address the result as a form of entitlement matrix.	Prepare draft entitlement matrix.	Prepare finalized entitlement matrix.
5	Hold consultation with the key stakeholders to design compensation package	Formulate compensation payment framework (formula for compensation estimation), allowances and rehabilitation assistance through consultation.	Formulate draft compensation package .(outline only)	Finalize compensation package by holding a stakeholder consultation. Compensation package includes compensation for affected assets, in cash or in kind, allowances (materials transportation allowance, transition subsistence allowance, repair allowance, etc.), and rehabilitation assistance.
6	Select and design relocation site(s) as appropriate	Considering the following principles, proceed with the selection and design of relocation site(s): -The plots size for house construction should be based on earlier homestead size; -APs should be allowed the option to build their own house structure; -The new (replacement) residential land must have environmental, social, cultural and economic characteristics similar to the previous site	Formulate a procedure on the selection and design of relocation site(s) referring to available second source information	Prepare site and design the relocation site(s) when APs preferred to choose "in kind compensation" (i.e., replacing their lost residential land in new relocation site). The options and alternative sites should be developed through a consultative process with the APs.

Source: JICA Survey Team

Table 8.4.3: Requirements for Developing the RAP and Actions Taken during and after the F/S Stage (2/3)

No.	Item	Proposed Action	Action Taken by JICA during F/S Stage	Action Taken by MoIC after F/S Stage
7	Conduct site survey on host population as appropriate	Obtain and analyze information which includes: settlement patterns and arrangements of location, population density and production capacity of the land, socioeconomic and demographic composition, common property resources, territorial claims to land and resources, land utilization patterns, need for new infrastructure development, willingness and acceptability of host population, existing community organizations, cultural sites and networks.		Conduct site survey on host population when the AP preferred to relocate to another site.
8	Select replacement land for loss of productive assets (agricultural and commercial land) as appropriate	In consideration of the following principles, proceed with the selection of replacement land: -Land for land is considered to be the most desirable option for compensating the private and community land acquired for the project. -Replacement land should have equivalent productive potential as the previous land. -Where suitable land at locations acceptable to APs is not available, and at "informed choice" of APs, compensation in cash may be paid. -If APs opt for individual or self-relocation, the project should assist them rather than force them to accept the site selected by the project for relocation. -Where suitable land with reasonable quality for agriculture is not available, skills upgrading training schemes, income generating schemes and agriculture intensification programs may be suitable options.		Prepare replacement land based on the project requirements and APs' preferences.

Source: JICA Survey Team

Table 8.4.3: Requirements for Developing the RAP and Actions Taken during and after the F/S Stage (3/3)

No.	Item	Proposed Action	Action Taken by JICA at F/S Stage	Action Taken by MoIC after F/S Stage
9	Formulate time-bound schedule for the implementation of the RAP	Provide resettlement implementation schedule showing specific timeframe and linking resettlement to civil works in the RAP.	Prepare outline of implementation procedures of the RAP.	Prepare time-bound schedule for the acquisition of assets, full payment of compensation and rehabilitation activities for segment/section or phase (except where long-term rehabilitation measures such as vocational training or other measures are recommended).
10	Formulate procedures for grievance redress	Provide procedures in order to address any complaints and grievances arising out of issues such as determining entitlements to compensation, allowances and other assistance in the RAP.	Prepare outline of grievance redress procedures.	Prepare detailed grievance redress procedures.
11	Determine monitoring procedures	Provide monitoring procedures during and after the project period and identify a competent external monitoring agency for external monitoring.	Prepare outline of monitoring procedures.	Prepare procedures and plan on monitoring.
12	Prepare detailed cost estimates for the implementation of the RAP	Estimate compensation, relocation costs, rehabilitation (or income restoration) costs, administrative costs, preparation costs and technical assistance costs. Provide budgetary plan linked to the resettlement timetable. Assign financial responsibility.	Prepare outline of cost estimation for implementing the RAP.	Prepare detailed cost estimates, budgetary plan and institutional arrangement on the RAP budget.
13	Hold consultations with key stakeholders on the draft RAP	Consult with representatives of APs, and local/central authorities in order to finalize the RAP.		Finalize the draft RAP to reflect the result of stakeholders consultation.
14	Submit the RAP report to WREA to be legally enforceable	Submit the RAP report to WREA for approval.	Identify the gaps that remain in the RAP prepared during the feasibility phase.	Fulfill all requirements on the RAP and submit the RAP report to WREA for approval.

Source: JICA Survey Team

8.5 Result of Environmental and Social Consideration Study

The result of environmental and social consideration study was presented in draft ESIA report and preliminary RAP prepared in the course of the JICA Survey. The detail of the result shall be referred to the draft ESIA report and preliminary RAP.

8.5.1 Description of Study Area (Baseline Data)

The description of the study area, which was utilized as the baseline data of the project area, was studied. The documentary survey on social and natural environment, pollution and contamination, and legal framework of ESIA as well as land acquisition and resettlement was conducted. The field surveys consisting of the surveys on water (surface water and groundwater) quality, sediment and soil quality, air quality, noise level, vehicle traffic, flora and fauna, land use and resettlement (inventory and interview with the project-affected people) were conducted.

As a result, it was confirmed that the living environment in the study area was generally good except for some parameters of surface water and groundwater, and dusts (TSP and PM10) along main roads during the dry season. The project area mainly consists of paddy fields and degraded forest area. Moreover, 128 plant species and 98 animal species including 68 important species were identified in the study area.

As regards social environment, it was confirmed that there were ten resident households (53 persons) and 159 land owners in the project area. Besides, the project-affected assets such as houses, huts and other structures, crops and trees were identified. Furthermore, the socioeconomic conditions of the project-affected people were examined through interviews.

8.5.2 Environmental and Social Impact Assessment

The environmental and social impact forecasts and estimates were conducted on the potential environmental and social negative impact items caused by the project as identified by the scoping matrix. The impact forecasts and estimates were conducted as quantitatively as possible. Overall, it was confirmed that the environmental and social negative impacts of the project were avoided, mitigated and compensated as much as possible through the proposed VIP infrastructure development plan/design and mitigation/consideration measures taken during the planning, construction and operation phases. The summary of environmental and social impact was presented in Table 8.5.1.

The alternative study on wastewater treatment plan in the EIA stage, i.e., examination of the centralized and individual wastewater treatment systems, was conducted. In conclusion, the individual wastewater treatment system was adopted for the VIP infrastructure development from the viewpoints of environmental protection and operational reliability.

Table 8.5.1: Summary of Environmental and Social Impact Assessment for the Project (1/3)

No.	Item	Summary of Environmental and Social Impact Assessment
1	Involuntary Resettlement	Although the project site was selected so as to minimize involuntary resettlement as much as possible, 10 households would be inevitable to be relocated by the project. Therefore, the relocation policy considering the preferences of the project-affected people was proposed in preliminary RAP so that the project owner shall provide cash compensation for self-relocation and/or resettlement land and constructed houses in compliance with project-affected households' requests. At the same time, sufficient transportation allowance and/or transition subsistence allowance shall be provided when necessary. Furthermore, economic rehabilitation assistance shall be provided for the project-affected peoples whose livelihoods would be severely aggravated.
2	Local Economy	The compensation cost for VIP infrastructure development including contingency fund was estimated to be LAK 47,496 million (US$ 5.59 million) and the livelihood of project-affected peoples would be appropriately compensated to improve or maintain their pre-project incomes and living standards through the enforcement of RAP. On the other hand, the required laborers and the population increased in Stage 1 (Year 2015) were estimated to be 7,500 persons and 6,000 persons respectively, and it would bring huge and extensive positive impact on the employment and economy in the surrounding area.
3	Land Use	By the construction work of VIP infrastructure development, the land use in the project area would be altered from the present natural land use to artificial land use such as structures and roads. However, the land use plan for VIP was prepared so as to secure greenery as much as possible by adopting channel and tree planting at sidewalks and public spaces.
4	Social Institution	As the main settlements of the affected villages are located outside the project area, no social infrastructure and service such as schools, hospital/clinic, temples exist in the project area. Besides, as the main roads in the affected villages such as National Road No.13, District Road No.108 and 450 Year Road would not be affected by the project, accessibility of the villagers to the social infrastructure and service would be secured and the impact on social institution such as regional severance would not be assumed.
5	Social Infrastructure and Service	As the main settlements of the affected villages are located outside the project area, no social infrastructure and service such as schools, hospital/clinic, temples exist in the project area. Besides, as the main roads in the affected villages such as National Road No.13, District Road No.108 and 450 Year Road would not be affected by the project, accessibility of the villagers to the social infrastructure and service would be secured.
6	Poor, Indigenous and Ethnic Peoples	According to the result of interview with the project-affected peoples who lose their permanent houses as well as the project-affected peoples who lose their temporary structures, no vulnerable groups was identified. Besides, no squatters were residing and no measures regarding special assistance for ethnic minority shall be necessary for the project. On the other hand, there might be some tenant farmers in the project area. By taking the above mentioned condition into account, the entitlement matrix and rehabilitation assistances for the project were proposed as shown in Table 8.5.8~9.
7	Misdistribution of Benefit and Damage	The livelihood of project-affected peoples including vulnerable peoples would be appropriately compensated and assisted to improve or maintain their pre-project incomes and living standards through the enforcement of RAP as examined in 1: Involuntary Resettlement; 2: Local Economy; and 6: Poor, Indigenous and Ethnic Peoples. Hence, it is judged the misdistribution of benefit and damage among the project-affected peoples would not be caused by the project.
8	Cultural Heritage	The boundary of VIP was selected so as to avoid the existing village temple; Wat Nanokhien Temple, and the accessibility from villages to the temple was secured. Besides, as the result of topography survey, there was not any significant cultural heritage in the project area. The existence of remains and cultural assets shall be confirmed by the contractor.
9	Local Conflicts of Interest	The livelihood of project-affected peoples including vulnerable peoples would be appropriately compensated and assisted to improve or maintain their pre-project incomes and living standards through the enforcement of RAP as examined in 1: Involuntary Resettlement; 2: Local Economy; and 6: Poor, Indigenous and Ethnic Peoples. Hence, it is judged the local conflict of interests among the project-affected peoples would not be caused by the project
10	Water Usage and Water Rights	In construction phase, water shall be used to some extent as sprinkle water for construction work and so on. The volume of water required for construction work would not be large in quantity and the required water shall be appropriately procured by the contractor. In operation phase, piped water would be supplied to VIP by the public water supply cooperation in Vientiane Capital (Nam PaPa), and surrounding surface water/groundwater would not be taken by the project.

Source: JICA Survey Team

Table 8.5.1: Summary of Environmental and Social Impact Assessment for the Project (2/3)

No.	Item	Summary of Environmental and Social Impact Assessment
11	Sanitation	In construction phase, there is a possibility that sanitary condition in and around the project area would be deteriorated by operation of temporal construction office and so on. Therefore, measures to maintain sanitary condition in and around VIP shall be taken by contractor. On the other hand, it is assumed that the sanitary condition in and around the project area would be improved by the infrastructure development of VIP
12	Hazards, Risk and Infectious Diseases	As for the hazards, risk and infectious diseases such as disaster and HIV/AIDS which might occur in construction work, safety measures shall be taken by contractor. In operation phase, the hazards, risk and infectious diseases such as HIV/AIDS which might be caused by immigrant workers shall be well controlled and managed by tenant industries in VIP.
13	Accident	As for the accident which might occur in construction work, safety measures shall be taken by contractor. The traffic distribution was analyzed by utilizing JICA-STRADA and it was concluded that no serious impact on traffic flow in Vientiane Capital would be caused by VIZ development. Besides, the number of traffic accident which would be increased by traffic volume generated in VIP was initially avoided and mitigated as much as possible by adopting Alternative-1: Integrated VIP Development approach.
14	Topographical and Geographical Features	The topography of the project site could be concluded as the flat ground without any notable features such as mountain, river, lake, etc. Besides, the land elevation was planned so as to conserve current land elevation as well as to avoid flooding and to harmonize with surrounding area.
15	Soil Erosion	Although approximately 31.5 ha (22.5 %) of the project area with the area of 140 ha consisted of the degraded forest area, topography of the area was quite flat and would not cause significant soil erosion in construction phase. Also, the impact on soil erosion is not assumed as the prepared land would be well preserved and managed as industrial area.
16	Groundwater	In construction phase, the earthwork would be conducted during dry season when the groundwater level at the project site would be low enough. There is no plan to draw up groundwater for construction work and only seeped out groundwater might be excluded when necessary. In operation phase, not any impact on groundwater level would be caused as no activities that would cause change on groundwater level such as drawing up groundwater is planned.
17	Hydrological Situation	The storm water in VIP would be discharged to Houy Makkhiao River through the existing culverts installed at 450 Year Road after the development of drainage system and finally discharged to the Mekong River. The proposed storm water drainage plan shall cope well with the variety of public facilities and services, industrial lots and environmental requirements particular to VIP. The retention pond in VIP was designed so as to equip with the required capacity to cope with 10-years flood return period.
18	Flora, Fauna and Biodiversity	The main composition of vegetation in the project area was paddy field and degraded forest. By the construction work of VIP infrastructure development, the vegetation in the project area would disappear and replaced with artificial land use. However, the land use plan for VIP was prepared so as to secure greenery as much as possible, and 37 % of forest area and 47 % of paddy field would remain in VIZ. There identified 128 plant species and 98 animal species in the study area. Among these identified species, 23 plants, 10 mammals, 23 birds, 10 reptiles, and 2 fish are designated as important species by IUCN Red List and National Red List of Lao PDR. However, there is no important species which was identified at only inside of the project area. Hence, it is judged the biodiversity and ecosystem in the project area and its surrounding will be well managed and conserved as a whole.
19	Landscape	It was confirmed there was not any significant landscape resources. The landscape and spatial plan for VIP was prepared so as to secure the safe and comfortable space for workers and residents in VIP as well as environmental friendliness. Besides, the building restriction in VIP shall be regulated by referring to "The Rule of Vientiane Master Plan."
20	Global Warming	The GHG emission by construction machineries and vehicles shall be controlled and minimized by the contractor. The increase of CO_2 emission was initially avoided and mitigated as much as possible by adopting Alternative-1: Integrated VIP Development approach. The GHG emission by tenant industries shall be controlled and minimized by tenants.
21	Air Pollution	The air pollutants discharged by construction machineries and vehicles shall be controlled and minimized by the contractor. The average NO_2 and SPM concentrations along main roads in operation phase were estimated and it was confirmed that all the forecasted concentrations with project case would satisfy the environmental standard (1-day) in Japan and Thailand. The air pollutants which might be discharged by operations of tenant industries in VIP would be well controlled and managed by tenants.

Source: JICA Survey Team

Table 8.5.1: Summary of Environmental and Social Impact Assessment for the Project (3/3)

No.	Item	Summary of Environmental and Social Impact Assessment
22	Water Pollution	In construction stage, muddy water would be discharged from VIP as the result of rainfall on the construction naked area. The contractor would examine the implementation schedule of construction work so as to minimize generation of naked area as much as possible and set up settling ponds if necessary. The effluent standard for wastewater discharged from VIP was proposed and shall be applied for all tenants in VIP. Hence, it is judged the water pollution caused by VIP in operation phase would be well controlled and managed.
23	Soil Contamination	The stripped soil generated in construction work would not cause any soil contamination in the surrounding area, as the soil quality of the project site satisfied the environmental standards in Thailand and Japan. In operation phase, the wastewater discharged from VIP would be well controlled and managed by the proposed wastewater treatment system for VIP. The operations of tenant industries in VIP related to soil contamination would be well controlled and managed by tenants.
24	Solid Waste	In construction phase, stripped soil (total volume of 560,560 m^3) shall be taken out of the project site and filled back into the existing borrow pits located within the VIZ. The solid waste discharged from VIP will be well controlled and managed by tenants, VIP-MO and VUDAA according to the proposed solid waste management system.
25	Noise	The noise generated by construction machineries and vehicles shall be controlled and minimized by the contractor. The A-weighted equivalent sound levels along main roads in operation phase were estimated and it was confirmed that all forecasted sound levels with project case would satisfy the environmental standard (1-day) in Thailand. The noise which might be generated by operations of tenant industries in VIP would be well controlled and managed by tenants.
26	Ground Subsidence	The depth of ground subsidence by the construction work was estimated to be 0.07 m at the worst case. In the implementation of land reclamation for VIP infrastructure development, this condition would be dully taken into account and additional filling will be conducted.
27	Offensive Odor	The wastewater discharged from VIP would be well controlled and managed by the proposed wastewater treatment system in VIP. Therefore, it is judged that wastewater discharged from VIP would not cause significant offensive odor in surrounding area. Besides, the offensive odor which might be generated by operations of tenant industries in VIP would be well controlled and managed by tenants.
28	Bottom Sediment	The sediment quality of the project site satisfied the environmental standards in Thailand and Japan. The wastewater discharged from VIP would be well controlled and managed by the proposed wastewater treatment system in VIP.

Source: JICA Survey Team

8.5.3 Environmental and Social Management Plan

The environmental and social management plan (ESMP) for the project was prepared as below. This ESMP will be detailed in D/D stage as stipulated in the related legislation in the Lao PDR.

The environmental mitigation and social consideration measures taken in the course of project implementation were examined. Mitigation and consideration measures during the planning, construction and operation phases were proposed and the responsible body for each measure was identified as shown in Table 8.5.2~4.

The environmental and social monitoring plan, which consists of assistance for the project-affected people, environmental monitoring in VIP and environmental inspection for tenants, was proposed as shown in Table 8.5.5~6. The institutional arrangement for environmental and social management was preliminary proposed. The Social and Environmental Section of the VIP Project Management Unit (VIP-PMU) during the construction phase and the O&M, technical and environmental departments of the VIPA Management Office during the operation phase shall be responsible for the implementation and supervision of the environmental and social consideration of the VIP.

Table 8.5.2: Mitigation and Consideration Measures in Planning Phase (1/2)

No.	Item	Mitigation and Consideration Measures in Planning Phase
1	Involuntary Resettlement	- Involuntary resettlement caused by land acquisition of the project was firstly tried to avoid and minimize as much as possible. There identified 10 households in the project area. - The Resettlement Action Plan (RAP) was drafted by referring related legislations and guidelines.
2	Local Economy	- The project-affected peoples were preliminary identified in the survey. - Compensation and rehabilitation measures for the project-affected peoples were examined by referring related legislations and guidelines. - Increase of employment and population to be brought by VIP development was estimated. The positive impact on local economy was examined.
3	Land Use	- Greenery planting plan in VIP (Chapter 3.2) was designed so as to compensate for land reclamation by the project.
4	Social Institution	- The project area was sited where no main settlements and social infrastructure such as schools, hospitals/clinics, temples etc. of the village are located. Transportability of the villagers was secured as the main roads surrounding the project area were preserved.
5	Social Infrastructure and Service	- The project area was sited where no main settlements and social infrastructure such as schools, hospitals/clinics, temples etc. of the village are located. Transportability of the villagers was secured as the main roads surrounding the project area were preserved.
6	Poor, Indigenous and Ethnic Peoples	- It was confirmed that no indigenous and ethnic peoples was living in the project area. - RAP was drafted so that the livelihood of poor project-affected peoples would be compensated and assisted to improve or maintain their pre-project incomes and living standards.
7	Misdistribution of Benefit and Damage	- RAP was drafted so that the livelihood of project-affected peoples would be compensated and assisted to improve or maintain their pre-project incomes and living standards.
8	Cultural Heritage	- The project area was sited to avoid the local village (Nanokkhien Village Temple). - It was confirmed that there is no cultural heritage in the project area.
9	Local Conflicts of Interest	- RAP was drafted so that the livelihood of project-affected peoples would be compensated and assisted to improve or maintain their pre-project incomes and living standards.
10	Water Usage and Water Rights	- Water supply plan for VIP (Chapter 3.7) was designed so that piped water shall be supplied to VIP by the public water supply cooperation (Nam PaPa) in Vientiane Capital.
11	Sanitation	- Wastewater treatment plan (Chapter 3.8), storm water management plan (Chapter 3.6) and solid waste management plan (Chapter 3.11) was designed so as to maintain or improve the sanitary condition in VIP.
12	Hazards, Risk and Infectious Diseases	None.
13	Accident	- Integrated VIP development (Alternative-1) was adopted for VIP development scenario so as to minimize the increase of traffic accidents.
14	Topographical and Geographical Features	- Land elevation plan for VIP (Chapter 3.4) was designed so as to conserve current land elevation as much as possible.
15	Soil Erosion	- Land elevation plan for VIP (Chapter 3.4) was designed so as to conserve current land elevation as much as possible.
16	Groundwater	- Water supply plan for VIP (Chapter 3.7) was designed so that piped water shall be supplied to VIP by the public water supply cooperation (Nam PaPa) in Vientiane Capital.
17	Hydrological Situation	- Retention ponds for VIP were designed to cope with 10-years flood return period.
18	Flora, Fauna and Biodiversity	- The project area was sited where no protection area is located. - It was confirmed that there is no ecological community which needs special care in the project area. - It was confirmed all identified important plant and animal species are widely observed in the surrounding area. - Greenery planting plan in (Chapter 3.2) VIP was designed so as to compensate for land reclamation by the project.
19	Landscape	- It was confirmed there is no landscape resources in the project area. - Landscape and spatial plan for VIP (Chapter 3.2) was designed so as to secure safe and comfortable space for residents as well as environmental friendliness.

Source: JICA Survey Team

Table 8.5.2: Mitigation and Consideration Measures in Planning Phase (2/2)

No.	Item	Mitigation and Consideration Measures in Planning Phase
20	Global Warming	- Integrated VIP development (Alternative-1) was adopted for VIP development scenario so as to minimize the GHG emission by traffic vehicles.
21	Air Pollution	- Integrated VIP development (Alternative-1) was adopted for VIP development scenario so as to minimize the air pollutant emission by traffic vehicles. - It was confirmed the ambient air quality along the main roads surrounding VIP would satisfy related environmental standards.
22	Water Pollution	- Wastewater treatment plan for VIP (Chapter 3.8) was designed so as not to cause water pollution in the downstream area by following related effluent/environmental standards. - It was confirmed that the discharged wastewater would not significantly deteriorate the current water quality of Houy Makkhiao River in respect of BOD and SS.
23	Soil Contamination	- It was confirmed the soil quality in the project area satisfy related environmental standards. - Earth work plan for VIP (Chapter 3.4) was designed so as to minimize cutting and filling volume as much as possible.
24	Solid Waste	- Earth work plan for VIP (Chapter 3.4) was designed so as to minimize the volume of residual soil as much as possible. - Solid waste management plan for VIP (Chapter 3.4) was designed so as not to cause environmental pollution in the surrounding area.
25	Noise	- Integrated VIP development (Alternative-1) was adopted for VIP development scenario so as to minimize the noise emission by traffic vehicles. - It was confirmed the noise level along the main roads surrounding VIP would satisfy related environmental standards.
26	Ground Subsidence	- Land reclamation plan for VIP (Chapter 3.4) was designed so as to compensate for possible ground subsidence by pre-load.
27	Offensive Odor	None.
28	Bottom Sediment	- Wastewater treatment plan for VIP (Chapter 3.8) was designed so as not to cause water pollution in the downstream area by following related effluent and environmental standards.

Source: JICA Survey Team

Table 8.5.3: Mitigation and Consideration Measures in Construction Phase (1/2)

No.	Item	Mitigation and Consideration Measures in Planning Phase	Responsibility
1	Involuntary Resettlement	- RAP shall be finalized and approved by WREA in D/D stage. - Resettlement activity shall be implemented before construction by strictly following RAP.	MOIC/PMU
2	Local Economy	- RAP shall be finalized and approved by WREA in D/D stage. - Compensation and rehabilitation activity shall be implemented before construction by strictly following RAP.	MOIC/PMU
3	Land Use	- Greenery shall be planted by adopting channel and tree planting at sidewalks and public spaces.	Contractor
4	Social Institution	None.	-
5	Social Infrastructure and Service	None.	-
6	Poor, Indigenous and Ethnic Peoples	- RAP shall be finalized and approved by WREA in D/D stage. - Compensation and rehabilitation activity shall be implemented before construction by strictly following RAP.	MOIC/PMU
7	Misdistribution of Benefit and Damage	- RAP shall be finalized and approved by WREA in D/D stage. - Compensation and rehabilitation activity shall be implemented before construction by strictly following RAP.	MOIC/PMU
8	Cultural Heritage	- The existence of remains and other cultural assets shall be confirmed by contractor by following "Terms of Reference for VIP infrastructure construction works."	Contractor
9	Local Conflicts of Interest	- RAP shall be finalized and approved by WREA in D/D stage. - Compensation and rehabilitation activity shall be implemented before construction by strictly following RAP.	MOIC/PMU

Source: JICA Survey Team

Table 8.5.3: Mitigation and Consideration Measures in Construction Phase (2/2)

No.	Item	Mitigation and Consideration Measures in Planning Phase	Responsibility
10	Water Usage and Water Rights	- Required water for construction work shall be appropriately procured by contractor by following "Terms of Reference for VIP infrastructure construction works."	Contractor
11	Sanitation	- Sanitary condition of temporal construction office shall be controlled and managed by contractor by following "Terms of Reference for VIP infrastructure construction works." (e.g. education for workers.)	Contractor
12	Hazards, Risk and Infectious Diseases	- Safety measures to prevent hazards/risk/infectious diseases shall be taken by contractor by following "Terms of Reference for VIP infrastructure construction works." (e.g. education for workers.)	Contractor
13	Accident	- Safety measures in construction work shall be taken by contractor by following "Terms of Reference for VIP infrastructure construction works." (e.g. education for workers.)	Contractor
14	Topographical/Geographical Features	None.	-
15	Soil Erosion	None.	-
16	Groundwater	- Earthwork shall be conducted mainly in dry season when groundwater level would be low enough. - Groundwater shall not be drawn up and only seeped out water shall be excluded when necessary.	Contractor
17	Hydrological Situation	None.	-
18	Flora, Fauna and Biodiversity	- A detailed survey on important species such as distribution in and around the project area as well as ecological features of important species shall be studied in D/D stage. - Further mitigation measures such as transplanting shall be examined in detailed environmental management plan (EMP) if necessary.	MOIC/PMU
19	Landscape	None.	-
20	Global Warming	- GHG emission in construction work shall be controlled and minimized by contractor by following "Terms of Reference for VIP infrastructure construction works." (e.g. prevention of idling.)	Contractor
21	Air Pollution	- Air pollution in construction work shall be controlled and minimized by contractor by following "Terms of Reference for VIP infrastructure construction works." (e.g. prevention of idling.)	Contractor
22	Water Pollution	- Water pollution such as muddy water discharged in construction work shall be controlled and minimized by contractor by following "Terms of Reference for VIP infrastructure construction works." (e.g. installation of settling ponds.)	Contractor
23	Soil Contamination	- The stripped soil shall be filled back into existing borrow pits located within VIZ by contractor.	Contractor
24	Solid Waste	- Stripped soil shall be filled back into existing borrow pits located within VIZ by contractor. - Cut down trees shall be reused and recycled as much as possible by contractor by following "Terms of Reference for VIP infrastructure construction works."	Contractor
25	Noise	- Noise in construction work shall be controlled and minimized by contractor by following "Terms of Reference for VIP infrastructure construction works." (e.g. prevention of idling.)	Contractor
26	Ground Subsidence	- Pre-load to compensate for possible ground subsidence shall be implemented by contractor.	Contractor
27	Offensive Odor	None.	-
28	Bottom Sediment	- Water pollution such as muddy water discharged in construction work shall be controlled and minimized by contractor by following "Terms of Reference for VIP infrastructure construction works." (e.g. installation of settling ponds.)	Contractor

Source: JICA Survey Team

Table 8.5.4: Mitigation and Consideration Measures in Operation Phase (1/2)

No.	Item	Mitigation and Consideration Measures	Responsibility
1	Involuntary Resettlement	- VIPA shall assign staff in charge of environmental and social consideration. - The livelihoods of project-affected peoples shall be monitored by VIPA and assisted when necessary.	MOIC/VIPA
2	Local Economy	- VIPA shall assign staff in charge of environmental and social consideration. - The livelihoods of project-affected peoples shall be monitored by VIPA and assisted when necessary.	MOIC/VIPA
3	Land Use	None.	-
4	Social Institution	None.	-
5	Social Infrastructure and Service	None.	-
6	Poor, Indigenous and Ethnic Peoples	- VIPA shall assign staff in charge of environmental and social consideration. - The livelihoods of project-affected peoples shall be monitored by VIPA and assisted when necessary.	MOIC/VIPA
7	Misdistribution of Benefit and Damage	- VIPA shall assign staff in charge of environmental and social consideration. - The livelihoods of project-affected peoples shall be monitored by VIPA and assisted when necessary.	MOIC/VIPA
8	Cultural Heritage	None.	-
9	Local Conflicts of Interest	- VIPA shall assign staff in charge of environmental and social consideration. - The livelihoods of project-affected peoples shall be monitored by VIPA and assisted when necessary.	MOIC/VIPA
10	Water Usage and Water Rights	- Piped water shall be supplied to VIP by the public water supply cooperation (Nam PaPa) in Vientiane Capital.	Nam PaPa/VIPA
11	Sanitation	- VIPA shall manage retention ponds (such as daily operation and periodical cleaning) and wastewater treatment plant (such as maintenance and water quality monitoring). - Tenant industries shall be responsible for management of wastewater, solid waste, etc. by following "Internal Regulation on Environmental Management for VIP."	VIPA/Tenants
12	Hazards, Risk and Infectious Diseases	- Safety measures to prevent hazards/risk/infectious diseases might be caused by workers shall be taken by tenants by following "Internal Regulation on Environmental Management for VIP."	Tenants
13	Accident	- Safety measures in operation shall be taken by tenants by following "Internal Regulation on Environmental Management for VIP."	Tenants
14	Topographical and Geographical Features	None.	-
15	Soil Erosion	None.	-
16	Groundwater	- Piped water shall be supplied to VIP by the public water supply cooperation (Nam PaPa) in Vientiane Capital.	Nam Papa/VIPA
17	Hydrological Situation	- VIPA shall manage retention ponds (such as daily operation and periodical cleaning)	VIPA
18	Flora, Fauna and Biodiversity	None.	-
19	Landscape	- Channel and greenery at sidewalk and public space in VIP shall be managed by VIPA. - Tenant industries shall follow the building restriction regulated in "Internal Regulation on Environmental Management for VIP."	VIPA Tenants

Source: JICA Survey Team

Table 8.5.4: Mitigation and Consideration Measures in Operation Phase (2/2)

No.	Item	Mitigation and Consideration Measures	Responsibility
20	Global Warming	- GHG emission in operation phase shall be controlled and minimized by tenant industries by following "Internal Regulation on Environmental Management for VIP."	Tenants
21	Air Pollution	- Air pollution in operation phase shall be controlled and minimized by tenant industries by following "Internal Regulation on Environmental Management for VIP."	Tenants
22	Water Pollution	- Water pollution in operation phase shall be controlled and minimized by tenant industries by following "Internal Regulation on Environmental Management for VIP." - VIPA shall be responsible for periodical water quality monitoring in VIP.	Tenants VIPA
23	Soil Contamination	- Soil contamination in operation phase shall be controlled and minimized by tenants industries by following "Internal Regulation on Environmental Management for VIP."	Tenants
24	Solid Waste	- Solid waste in operation phase shall be controlled and minimized by tenant industries by following "Internal Regulation on Environmental Management for VIP." - Vientiane Urban Development and Administration Authority (VUDAA) shall be responsible for collection, transportation treatment and disposal of non-recyclable ordinary waste, sewerage sludge and cleaning waste of VIP by making contracts with tenants and VIPA.	Tenants VUDAA
25	Noise	- Noise in operation phase shall be controlled and minimized by tenant industries by following "Internal Regulation on Environmental Management for VIP."	Tenants
26	Ground Subsidence	None.	-
27	Offensive Odor	- Offensive odor in operation phase shall be controlled and minimized by tenant industries by following "Internal Regulation on Environmental Management for VIP."	Tenants
28	Bottom Sediment	- Water pollution in operation phase shall be controlled and minimized by tenant industries by following "Internal Regulation on Environmental Management for VIP."	Tenants

Source: JICA Survey Team

Table 8.5.5: General Environmental and Social Monitoring Plan

No.	Monitoring Item	Monitoring Method	Period	Responsibility
1	Implementation of mitigation and consideration measures	- PMU/VIPA shall adequately implement and/or supervise the environmental and social consideration measures taken in construction and operation phase.	at all time	MOIC (PMU/VIPA)
2	Assistance for project-affected peoples	- PMU/VIPA shall set up a desk to monitor livelihoods of project-affected peoples and assist them when necessary.	at all time	
3	Wastewater quality monitoring for VIP	- PMU/VIPA shall monitor the quality of wastewater discharged from VIP as shown in Table 9.2.2.	Refer to Table 8.5.6	
4	Environmental Inspection for Tenants	- VIPA shall review the environmental monitoring reports on air pollution, water pollution, soil contamination, solid waste, noise and vibration, offensive odor, global warming, etc. by tenant industries as stipulated in "Internal Regulation on Environmental Management for VIP", and inspect factories and request improvement when necessary.	at all time	

Source: JICA Survey Team

Table 8.5.6: Detailed Water Quality Monitoring Plan

Phase	Purpose	Parameter	Frequency (times/year)	Location
Detailed Design	Monitor pre-project condition of water quality in the surrounding area.	BOD_5, NH_3-N, TSS, pH, Temperature, COD, Phenols, P, Oil and grease	1 times each for rainy & dry season.	2 locations in the project area; 2 locations at Houy Makkhiao River.
Construction	Monitor wastewater discharged by construction work			
Operation	Monitor wastewater discharged from VIP	BOD_5, NH_3-N, TSS, pH, Temperature, TDS, COD, TKN, Phenols, P, Ag, Zn, S, Chlorine, Cl, Fe, F, CN, Cu, Pb, Oil and grease, Ni, Hg, Mn, As, Ba, Cd, Cr(VI), Total Cr	Every quarter.	Retention ponds.

Source: JICA Survey Team

8.5.4 Preparation of Preliminary RAP

By referring to the activities mentioned above, the preliminary RAP was prepared. The compensation cost for the project was estimated by referring to the registered land and asset prices of the LMA and MPWT. As a result, the compensation cost including the cost for finalizing the RAP and establishing the compensation committee will be LAK47,496 million (LAK34,000/m^2) as shown in Table 8.5.7.

Table 8.5.7: Estimated Compensation Cost for the Project

No.	Item	Estimated Compensation Cost (million LAK)
1	Land acquisition	41,548.6
2	Permanent houses	1,042.2
3	Tree	7.7
4	Crop (Rice)	579.4
5	Contingency fund	4,317.8
	Total	47,495.7

Note: Contingency cost includes cost for finalizing RAP with detailed land register survey, cost for compensation committee activities including compensation fee negotiation, compensation cost for huts and other structures, etc.

Source: JICA Survey Team

The entitlement matrix and the rehabilitation assistance for the project-affected peoples were proposed as shown in Table 8.5.8~9. At the same time, rehabilitation measures for the project-affected people whose livelihoods will be severely affected, relocation policy for the residents in the project area, as well as the framework on public participation and information disclosure including grievance and redress mechanisms were examined. Finally, the details of the institutional arrangement and monitoring/supervision plan to implement the RAP were proposed.

Table 8.5.8: Entitlement Matrix for the Project-Affected Peoples

Type of Loss	Entitlements	Description of Entitlement and Implementation Procedures	Remarks
Permanent loss of agricultural land	All persons or households who as at the cut-off date utilize their agricultural land in the project impact area.	- Cash compensation for lost land based on "Registered Cost Evaluation Allocated Area for Vientiane Capital;" Or - Land-for-land arrangements with the replacement land of an equivalent productivity and at a location acceptable to the affected peoples. - Replacement land will be provided to the affected peoples with full security of tenure, free of any tax, transfer costs, registration fee or other charges. - If the available plot size of replacement land is smaller than the lost plot size, cash compensation to cover the difference in size will be given to the affected peoples.	Financial compensation in all cases can be payable in cash or land by land at the affected peoples' request.
Permanent loss of residential land	All persons or households who as at the cut-off date reside in the land within the project impact area.	- Cash compensation for lost land based on "Registered Cost Evaluation Allocated Area for Vientiane Capital;" Or - Land-for-land arrangements with the replacement land of an equivalent quality (water supply, electricity and road access) and at a location acceptable to the affected peoples. - Replacement land will be provided to the affected peoples with full security of tenure, free of any tax, transfer costs, registration fee or other charges. - If the available plot size of replacement land is smaller than the lost plot size, cash compensation to cover the difference in size will be given to the affected peoples.	Financial compensation in all cases can be payable in cash or land by land at the affected peoples' request
Loss of permanent houses	All persons or households who as at the cut-off date possess the permanent house within the project impact area.	- Cash compensation for lost house based on "Registered Cost Evaluation Allocated Area for Vientiane Capital."	
Loss of structures (such as well, hand-pump, animal raising hut, rice store, etc.)	All persons or households who as at the cut-off date possess structures such as well, hand-pump, animal raising hut, rice store, etc within the project impact area.	- Cash compensation at replacement cost.	There is no uniform unit price stipulated for these structures. Mode of compensation shall be finalized at affected peoples' request
Loss of crop (rice)	All persons or household who as at the cut-off date possess paddy field within the project impact area.	- Cash compensation for estimated one year yield of glutinous rice at producers' market price.	
Loss of fruit trees and commercial trees	All persons or households who as at the cut-off date possess fruit trees and/or commercial trees within the project impact area.	- Cash compensation based on "Registered Cost Evaluation Allocated Area for Vientiane Capital"	

Source: JICA Survey Team

Table 8.5.9: Rehabilitation Assistances for the Project-Affected Peoples

Type of Assistance	Entitlements	Description of Entitlement and Implementation Procedures	Remarks
Materials transportation assistance or allowance	All persons or households who will be displaced by the project and will relocate to new site.	Transportation assistance or cash allowance for affected peoples' personal household effects and salvaged building materials to new relocation sites in addition to the entitlement proposed in Table 5.6.1.	
Transition subsistence allowance	All persons or households who will be affected by the loss of 20 % or more of their productive assets (agricultural or commercial land) or loss of primary source of household incomes and in need to be relocated to new site or reorganizing on existing location.	Six (6) months food support for each person in the affected household in addition to the entitlement proposed in Table 5.6.1.	The number of affected peoples shall be finalized after F/S. Duration of the support should be finalized after F/S.
Economic rehabilitation assistance	All persons or households who will be affected by the loss of 20% or more of their productive assets (agricultural or commercial land) or loss of primary source of household incomes.	A range of income generating options at affected people's request in addition to the entitlement proposed in Table 5.6.1.	A farmer renting agricultural land (tenant farmer) in the project Area is to be eligible for the assistance. The existence of tenant farmer in the project area and impacts on their livelihoods shall be surveyed after F/S.
Special assistance	The household who fall under the vulnerable groups. (women headed households with low income; households with disabled or invalid persons; households with persons under the indicator for poverty as defined by Saysetha District; elderly households with no means of support.)	A range of income generating options at affected people's request in addition to the entitlement proposed in Table 5.6.1.	The number of the vulnerable households among affected peoples losing agricultural land with no fixed assets shall be surveyed after F/S.

Source: JICA Survey Team

CHAPTER 9 CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions on the VIP Development Project

9.1.1 Outline of Infrastructure Development

It is recommended that the following projects proceed smoothly to the implementation stage and that the proposed schedule be complied with to minimize the issues and problems under the Vientiane Industrial Park (VIP) Development Project. The proposed projects are summarized below:

1) Land reclamation works with earthwork volume of 1,316,000 m^3 for cutting work and 1,317,000 m^3 for filling work that would meet a ten year return period.
2) Road network development with length of 5.7 km.
3) Drainage system with sewer line consisting of channels and ditches with length of 16.1 km and retention ponds with a capacity of 100,000 m^3.
4) Water supply system consisting of pipeline with length of 12.8 km, reservoirs with a capacity of 4,200 m^3 and a water tower with a height of 26 m.
5) Individual sewerage treatment system with inspection and water sampling pits of 206 units for collection of treated wastewater of tenants.
6) Power supply system with 11.0 km cables, 115/22 kV sub-station, and relocation of 4.8 km overhead transmission line.
7) Telecommunication system with 45.7 km telecommunication conduit and 228 hand holes.
8) Building construction of an industrial park center with floor area of 3,015 m^2 and a technical training center with floor area of 3,822 m^2.

9.1.2 Project Implementation Plan

(1) Procurement Package Plan

The procurement package plan is formulated based on the following: (i) present ability of the contractors, (ii) characteristics and volumes of the works, (iii) minimization of implementation period, and (iv) minimization of the number of packages to reduce the burden and responsibility of the VIP-Project Management Unit (VIP-PMU). The following three contract packages (CP) are proposed according to the priority for carrying out the works:

1) CP-1: Land reclamation (earthwork, two main gates and boundary fencing)
2) CP-2: Major infrastructure development (road, drainage, water supply, monitoring pits for individual sewerage treatment system, telecommunication and buildings)

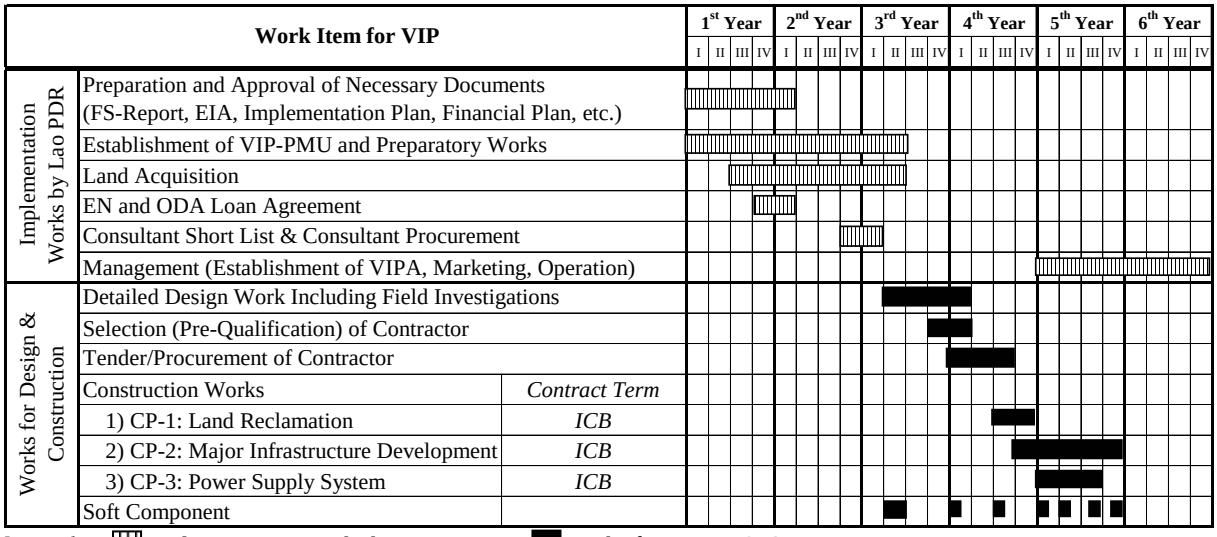
3) CP-3: Power supply system (power line and 115/22kV sub-station)

The following issues on the procurement package plan are recommended:

- All CPs should be conducted through international competitive biding (ICB) in order to ensure a reasonable price for the Project and keep the construction period under strict and effective quality control.
- CP-1 should be given high priority since it is required in order to secure the access to the construction site for early commencement of the infrastructure development works.
- The power supply work or CP-3 should be separated from the other works, which are mainly civil works, since its characteristics are very different from those of CP-1 and CP-2.

(2) Implementation Schedule

The duration of the Project is set at three years starting with detailed design from the 2nd Quarter of the 3rd Year considering the requirements of project loan procedure, procedures for the selection of consultant and contractors, and more than 2.6 million m^3 of earthmoving works for land reclamation. The Project implementation schedule is recommended as shown in Figure 9.1.1.



Legend: Implementation Works by Lao PDR Works for Design & Construction
Source: JICA Survey Team

Figure 9.1.1: Project Implementation Schedule

9.1.3 Financial and Economic Evaluation

The results of the financial evaluation and the economic evaluation are as summarized below.

(1) Financial Evaluation

In order to achieve financial feasibility, land rent must be set as USD1.59/m^2/year (JPY148/m^2/year). Repayment capacity (repayment of a soft loan) would be fulfilled at that level.. Such land rent is equivalent to a land price of USD80/m^2 (JPY7,423/m^2) if factory lots will be sold to tenants.

However, a land rent of USD0.50/m^2/year (JPY47/m^2/year) is needed to compete with other industrial estates in the northeast part of Thailand and Savannakhet. If land rent is set at USD0.50/m^2/year, the public sector needs to disburse JPY3.6 billion (LAK340 trillion) to fulfill the balance of the cash flow.

Even if a component is excluded from the VIP project, the results are basically the same. In Alternative 2 (excluding power supply), the land rent to fulfill the repayment capacity is USD1.23/m^2/year (JPY115/m^2/year). In Alterative 3 (excluding power supply and water supply), the rent is USD1.11/m^2/year (JPY104/m^2/year).

If cost for land tenure increases from current USD3/m^2 to USD25/m^2, land rent have to be set as USD2.10/m^2/year (equivalent to USD105/m^2 of land price) to enable positive NPV (Alternative 4). On the other hand, land rent will drop to USD1.55/m^2/year (equivalent to USD78/m^2 of land price) if land for VIP is obtained by Lao PDR government and provided to project implementation body.

(2) Economic Evaluation

The calculated EIRR is 13.3% for Alternative 1, 13.7% for Alternative 2 and 13.9% for Alternative 3. These figures are higher than the opportunity cost of capital (12%). The VIP project is thus feasible from the standpoint of national economy.

The EIRR figures are calculated under severe condition in which the fixed asset per employee is much higher than the current level. Even so, the project has enough economic feasibility. If the fixed asset per employee drops toward the current level, the EIRR of the three alternatives of the VIP project would improve further. In this case, the EIRR improves to 18.3% in Alternative 1, 19.1% in Alternative 2 and 19.6% in Alternative 3.

The following points are also identified as economic benefits although these were not considered in the calculations:

- Mitigation of traffic jam for manufacturing factories, and
- Mitigation of pollution problem.

The VIP project contributes to the industrialization, economic development and organized urban development of Vientiane Capital.

9.2 Recommendations for Smooth Implementation of the Project

9.2.1 Approval of Feasibility Study (F/S) and Environmental Impact Assessment (EIA) Reports

The Ministry of Industry and Commerce (MoIC) needs to start the VIP Development Project by getting the approval of the F/S Report immediately after the submission by JICA. At the same time, EIA Report should be approved by the Water Resource and Environment Administration (WREA).

Table 9.2.1: Recommendations on Approval of FS and EIA Reports

Required Action		Responsible Organization	Schedule
1	Obtaining the approval of the F/S Report after coordinating views with related ministries and agencies	MoIC	Immediately after submission of the Final Report Part III
2	Obtaining the approval of the EIA from WREA	MoIC	Immediately after submission of the final version of the of Environmental and Social Study (Draft ESIA)

Source: JICA Survey Team

9.2.2 Land Acquisition and Resettlement

Land acquisition and resettlement are critical tasks under the project implementation schedule. Delay in these tasks has adverse affects on a lot of tasks of the Project. Therefore, the MoIC immediately needs to launch the tasks for land acquisition and resettlement including establishment of Social and Environmental Management Committee (SEMC), finalization of Resettlement Action Plan (RAP), delivering of compensation to all Project Affected Peoples (PAPs) and acquisition of land.

Table 9.2.2: Recommendations on Land Acquisition and Resettlement

Required Action		Responsible Organization	Schedule
1	Establishment of SEMC	MoIC	As soon as possible
2	Finalization of RAP	MoIC	Complete by the end of the 1st Year
3	Delivering of compensation to all PAPs and acquisition of land	MoIC	Complete by the end of 2nd Quarter of the 3rd Year

Source: JICA Survey Team

9.2.3 Legal Arrangement and Institutional Set-up

The VIP Decree should be drafted by the MoIC and issued by the Prime Minister as soon as approval for the establishment of the VIP, including the F/S Report, has been obtained. Details are given in Chapters 4 and 5 of Part III. The draft decree has already been prepared by the JICA Survey Team (JST) and attached as Appendix III.2.

As regards the institutional arrangement, the MoIC should establish the VIP-PMU under the VIP Establishment Committee as the project implementing body under the MoIC. Similarly, the Vientiane Industrial Park Authority (VIPA) should be set up for the operation and maintenance (O&M) of VIP. Moreover, in order to enable the VIPA to function as one stop service office for tenants, the current business authorization procedures should be restructured. This task should be undertaken by the MoIC as soon as possible.

Detailed descriptions are given in Chapters 4 and 5.

Table 9.2.3: Recommendations on Legal Arrangement and Institutional Set-up

Required Action		Responsible Organization	Schedule
1	Drafting and obtaining the approval of decree on the development and management of the VIP	MoIC	As soon as possible
2	Establishment of the VIP-PMU under the VIP Establishment Committee	MoIC	As soon as possible
3	Building a prototype of one stop service system for Specific Economic Zone	MoIC	As soon as possible
4	Establishment of the VIPA (VIPA Management Committee and Management Office)	MoIC	By the end of the 4th Year

Source: JICA Survey Team

9.2.4 Funding

In case of funds under an Official Development Assistance (ODA) loan, Exchange of Notes (EN) and Loan Agreement (LA) in conformity with the criteria of the regulatory agency of the donor country are required upon request of the borrower.

Table 9.2.4: Recommendation on Funding

Required Action		Responsible Organization	Schedule
1	EN and LA of ODA loan	MoIC	4th Quarter of the 1st Year to 1st Quarter of the 2nd Year

Source: JICA Survey Team

9.2.5 Procurement of Consultant and Contractor

Assuming the VIP development project is implemented by taking out an ODA loan, the VIP-PMU needs to procure the consultant consisting of experts who can provide detailed design services and assistance in contractor procurement, construction management, and soft components such as O&M. The VIP-PMU also needs to procure the contractor for the construction works based on the procurement package plan.

Table 9.2.5: Recommendations on Procurement of Consultant and Contractor

Required Action		Responsible Organization	Schedule
1	Procurement of consultant to be engaged in detailed design, assistance for contractor procurement, assistance for construction management, and soft components	VIP-PMU	4th Quarter of the 2nd Year to 1st Quarter of the 3rd Year
2	Procurement (including pre-qualification) of contractor for construction works	VIP-PMU with support from consultant	4th Quarter of the 3rd Year to 3rd Quarter of the 4th Year

Source: JICA Survey Team

9.3 Recommendations on Outstanding Issues

9.3.1 Technical Training Center

It is important for the MoIC to develop a Technical Training Center (TTC) adjacent to VIP to supply capable laborers to its tenants. It is recommended that the MoIC separately conduct the study on the TTC development project.

Table 9.3.1: Recommendations on TTC

Required Action		Responsible Organization	Schedule
1	Study on TTC development project	MoIC	As soon as possible
2	Construction of TTC including building, equipment and materials for training	VIP-PMU	To be investigated by the study on TTC development project
3	Coordination with TTC including grasping the tenants needs and transferring to TTC operation organization, gathering trainees, recruitment of TTC graduates	VIPA	To be investigated by the study on TTC development project
4	Operation of TTC including training works, development/revision of training program based on the tenants' needs, employment of lecturers	TTC operation organization	To be investigated by the study on TTC development project

Source: JICA Survey Team

9.3.2 Housing

Housing is needed for tenant/factory workers especially for those residing from remote areas. The VIP-PMU needs to develop a residential area to invite investors to engage in housing construction.

Table 9.3.2: Recommendations on Housing

Required Action		Responsible Organization	Schedule
1	Development of the residential area	VIP-PMU	As part of the VIP
2	Investment promotion for housing construction in the residential area by public and/or private investor	MoIC	To be investigated and decided by MoIC
3	Construction of housing	Public and/or Private Investor	During operation period of VIP, when the demand for housing is raised

Source: JICA Survey Team

9.3.3 Agreement for External Infrastructure

It is recommended that the VIP project shall be harmonized with the infrastructure outside VIP (external infrastructure). The following actions for external infrastructure are recommended to be timely implemented by the responsible agencies.

Table 9.3.3: Recommendations on External Infrastructure

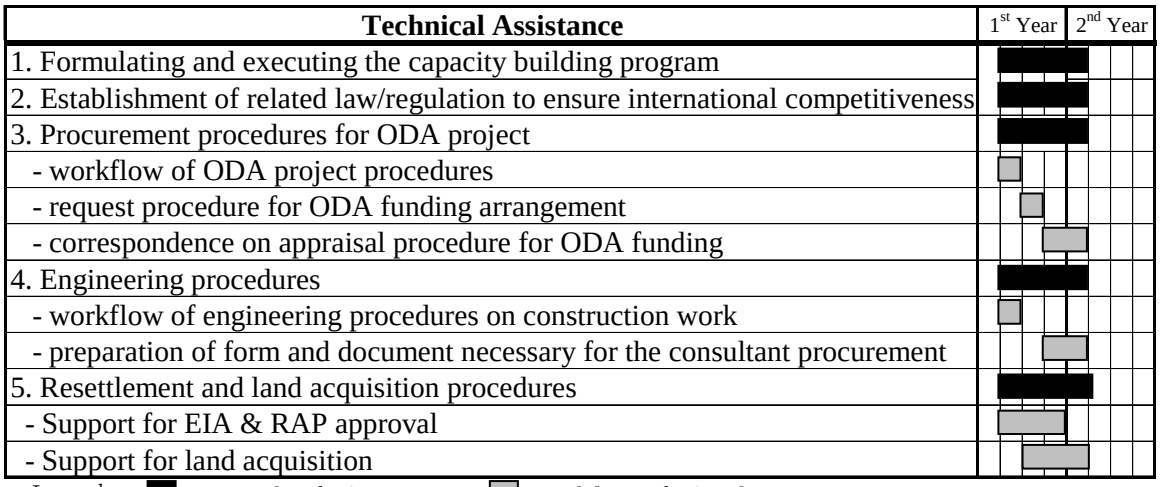
Required Action		Responsible Organization	Schedule
1	Conclude agreement with Ministry of Public Work and Transportation (MPWT) to improve DR-108 with drainage system located on the east boundary in order to secure the accessibility between the inside and outside road networks of the VIP	VIP-PMU	After completion of DR-108 improvement project
2	Conclude agreement with Nam Papa Vientiane Capital (NPVC) to expand distribution main with DN400mm along DR-108 from NR-13S to secure stable supply of water for the VIP	VIP-PMU	2nd Quarter of the 3rd Year
3	Conclude agreement with EDL to improve the existing power supply system including network for securing of power supply to the VIP and relocation of overhead transmission line inside the VIP area	VIP-PMU	2nd Quarter of the 3rd Year
4	Conclude agreement with a main provider to be selected by the VIP-PMU to install telecommunication cables in order to introduce proper telecommunication system in the VIP	VIP-PMU	By the end of the 5th Year

Source: JICA Survey Team

9.4 Capacity Building

The MoIC lacks experience in industrial estate development projects as well as ODA loan projects. Therefore, capacity building of the MoIC is required for the smooth implementation of the VIP implementation project.

Considering no governmental agency in the Lao PDR that has an experience in industrial estate development, it is recommended to request for Technical Assistance (TA) program from international donors according to the assistance items and schedule shown in Figure 9.4.1.



Source: JICA Survey Team

Figure 9.4.1: Technical Assistance Schedule

It is suggested that the TA team consists of the following experts for the preparatory works of the VIP development project:

1) Capacity Building Expert (5 man-months, team leader) who has experience in formulating capacity building programs for organizations of similar projects;

2) Institutional Expert (6 man-months) who has knowledge and experience in institutional and organizational aspects of similar projects.

3) Legal Expert (3 man-months) who is capable of legal matters especially for industrial estates;

4) Engineering Procedure Expert (6 man-months) who has experience in implementing similar projects and in negotiating with governmental authorities to acquire the necessary approvals or to conclude agreements on infrastructure development; and

5) Land Acquisition Expert (4 man-months) who has experience in executing resettlement and land acquisition for similar projects.

Appendices

APPENDIX III.1 INVESTIGATION ON TYPE OF VIP

Potential investors do not easily invest in an industrial estate unless they are attracted to its well-developed infrastructure. In addition to good infrastructure, institutional advantages are required for attractive industrial estates. In this appendix, investigation is made focusing on the type of industrial estate to achieve the success of VIP.

1 Consideration

1.1 Requirement of VIP

VIP can contribute to promotion of employment as well as industrialization in the Lao PDR after it has attracted a lot of investors. The following are considered as important requirements for investigating the type of VIP.

- Requirement-1: VIP can receive various types of manufacturers.
- Requirement-2: VIP provides sufficient incentives to investors to make it competitive over other industrial estates in the neighboring countries, in conformity with the WTO agreement.
- Requirement-3: VIP can speed up export and import of goods by simplifying the procedure.
- Requirement-4: VIP should have an impressive name to attract customers.

1.2 Consideration of VIP Type

As is shown by Table III.1.1, considerations are needed based on each of the four requirements, when type of VIP is investigated.

Table III.1.1: Considerations for Investigating Type of VIP

4 Requirements	Considerations for Investigating Type of VIP
Requirement-1 VIP can receive various types of manufacturers.	1. The development area of VIP (130 ha) is based on the potential investors who intend to produce goods for both export and domestic markets. 2. The type of manufacturers which are allowed to invest varies depending on type of the industrial estate, viz.: ● General industrial estate (GIE): All types of manufacturers including export oriented, domestic market oriented, foreign investors, and domestic investors, are allowed to invest in GIE. Because of this nature, GIE can attract comprehensive range of manufacturers. ● Export Processing Zone (EPZ): EPZ allows only export oriented manufacturers, and usually restricts the investors by export ratio of products. Because EPZ cannot attract comprehensive range of manufacturers, the occupancy ratio is potentially low.
Requirement-2 VIP provides sufficient incentives to investors to make it competitive over other industrial estate in the neighboring countries in conformity with the WTO agreement.	1. Agreement on Subsidies and Countervailing Measures (SCM Agreement) of WTO prohibits the member countries to give export subsidies or local contents subsidies. WTO gives a certain transition period to some late developing countries, although such conditions are determined during a long accession negotiation. SCM agreement prohibits member countries from giving subsidies including tax incentives provided that products are exported. 2. Preferential treatment of profit tax has no advantage over preferential corporate income tax in Thailand or Vietnam according to the draft law of investment promotion as of September 2009. Comparison of the tax incentives are shown on Fingure III.1.1. 3. It is required that VIP grant special incentive on profit tax, which should be better than the profit tax stipulated in the law on investment promotion, in order to attract foreign investors competing with industrial estates in Thailand. In compliance with SCM agreement of WTO, such special incentive on profit tax is offered to tenants in GIE, but not for those in EPZ
Requirement-3 VIP can speed up export and import of goods by simplifying the procedure.	1. Rapid export and import procedure is a challenge for promoting foreign investment in the Lao PDR. 2. In the case of EPZ where tenants are engaged only in export processing and given the same incentives unexceptionally, the export and import procedure is simplified and results in accelerated trade of goods. 3. In the case of GIE where there are various kinds of tenants, different procedures are required for each type of tenants. Therefore, export and import procedure is complicated and results in slow trading system. If VIP is classified as GIE, it is necessary to take measures for simplifying the export and import procedure.
Requirement-4 VIP should have an impressive name to attract customers.	1. It is necessary for VIP to have an appealing name related to its offered incentives in order to attract the attention of potential investors.

Source: JICA Survey Team

1.3 Comparison of Corporate Income Tax

Figure III.1.1 shows the comparison of profit tax rate in the Lao PDR and the corporate income tax rates in Thailand and Vietnam under the following assumptions.

- Profit tax rates in the Lao PDR are calculated based on the law on investment promotion issued on 20 July 2009. Calculated profit tax rates are for the manufacturers categorized by the investment promotion law as level 1, level 2, and level 3, which are located in Zone 3 of the Lao PDR.
- Corporate income tax rates in Thailand are calculated based on incentives given by BOI for manufacturers in industrial estates in Zone 3 of Thailand.
- Corporate income tax rates in Vietnam are calculated based on the Law on Corporate Income Tax for manufacturers in high-tech parks in Vietnam.
- The manufacturer is assumed to generate taxable income from the second year, from the commencement of commercial operation.

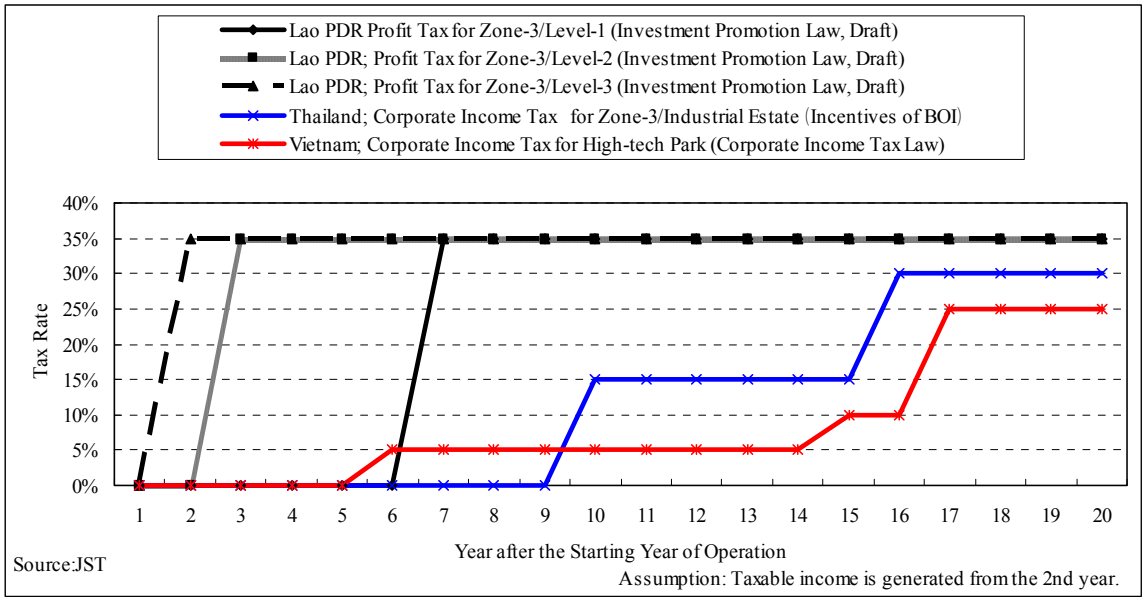


Figure III.1.1: Comparison of Profit Tax Rate with Thailand and Vietnam

2 Premise and Alternatives

2.1 Premise

(1) Scale and Schedule of VIP Development Project

1) Manufacturing area of VIP is 130 ha.

2) VIP development project is scheduled to be completed in 2015.

(2) Limitation of Inducible Tenants

1) In the case of EPZ, promotion will be limited to manufacturers exporting a minimum of 70% of the production volume.

2) In the case GIE, promotion to manufacturers are not limited regardless of the percentage of production volume which are exported

2.2 Alternatives

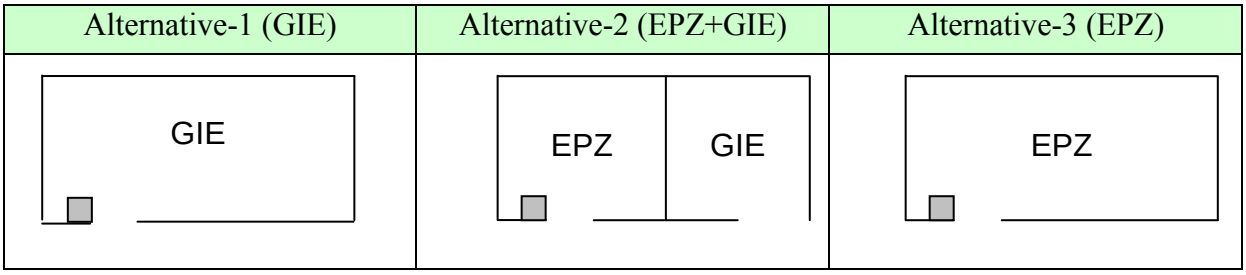
The following three alternatives are compared.

1) Alternative-1: GIE

2) Alternative-2: EPZ + GIE

3) Alternative-3: EPZ

Alternatives are defined as illustrated in Figure A.III.1.2.



Source: JICA Survey Team

Figure III.1.2: Definition of Alternatives

3 Strengths and Weaknesses of the Alternatives

Table III.1.2 compares the strengths and weaknesses of the alternatives from viewpoints of investors and developers. Althernative-1 seems to be the best alternative, but is worse than Alternatives-2 and 3 in terms of simplified and rapid export and import procedures.

Table III.1.2: Strength and Weakness of Alternatives

		Alternative-1 (GIE)	Alternative-2 (EPZ+GIE)	Alternative-3 (EPZ)
Strong Point	Viewpoint of Tenants	• Because tenants could engage in both export and domestic market oriented production, they can rapidly switch the type of goods to market depending on time and situation of global market. • Because the supporting industry can invest near the key industry, it is attractive to both key and supporting industries. • Domestic market oriented industry can invest as well. • Even when tenants export their products to WTO member countries with subsidies from the Lao PDR, there are no risks of retaliation.	• The supporting industry can invest near the key industry, outside its premises. • Domestic market oriented industry can invest as well.	• Because all tenants are export processing industry and can enjoy the same incentives, export and import procedure is simple which tenants can adopt easily.
	Viewpoint of Developer	• Because VIP can attract comprehensive range of manufacturers, high occupancy ratio is expected. • Because VIP is independent from export, it can give tax incentives in compliance with WTO agreement.	• It could possibly appeal for the investment promotion of export-oriented industry.	• It could possibly appeal for the investment promotion of export-oriented industry.
Weak Point	Viewpoint of Tenants	• Because there are various kinds of tenants and different procedures are required for each type of tenants, export and import procedure is complicated resulting in slow trading system. (It is necessary to take a measure to simplify the export and import procedure.) • The name is too common, and will not easily attract the attention of potential investors.	• Tenants are not engaged in both export and domestic market oriented production. • In the part of GIE where there are various kinds of tenants and different procedures are required for each type of tenants, export and import procedure is complicated resulting in slow trading system.	• Because tenants are not convertible between export and domestic market oriented production, they cannot switch market rapidly depending on time and situation of global market. • Domestic market oriented industry cannot invest. • The supporting industry cannot invest.
	Viewpoint of Developer		• There may be imbalance of occupancy between the two different types. • Occupancy rate is lower, compared with Alternative-1. • Because it is required to comply with WTO agreement, tax incentives cannot be given to the tenants in EPZ part.	• Because VIP can attract limited types of manufacturers, occupancy ratio is low. • Because VIP is only for export oriented industry, it cannot give tax incentives in compliance with WTO agreement.

Source: JICA Survey Team

4 Degree of Satisfaction Considering the Four Requirements

Table III.1.3 shows which of the three alternatives satisfy each of the requirement.

Table III.1.3: Degree of Satisfaction Considering the Four Requirements

4 Factors	Alternative-1	Alternative-2	Alternative-3
Requirement-1 VIP can receive various types of manufacturers.	○	×	×
Requirement-2 VIP provides sufficient incentives to investors to make it competitive over other industrial estate in the neighboring countries in conformity of WTO agreement.	○	×	×
Requirement-3 VIP can speed up export and import by simplifying the procedure.	×	×	○
Requirement-4 VIP should have a name that gives an attractive impression to customers.	×	○	○

(Remarks) ○：satisfactory ×：not satisfactory
Source: JICA Survey Team

No alternative completely satisfies all the four requirements as the table shows. However, it seems that enhancement of Alternative-1 could be the best type of industrial estate in Vientiane, because of the following reasons.

1) Requirements-1 and 2 are critical for selecting the best alternative because it is difficult to improve VIP by issuing a decree to satisfy such requirements.

2) On the other hand, it is possible to improve VIP by issuing a decree to satisfy requirements-3 and 4.

3) It is considered that the best way to make an attractive industrial estate, is to adopt Alternative-1 as it already satisfies requirements-1 and 2 while it needs to be improved to satisfy requirements-3 and 4 as well.

5 Conclusion

Alternative-1, which is the best alternative as mentioned above, should be improved through a decree to be issued by the Prime Minister as follows:

1) Designate VIP as a specific economic zone with bonded area
The government should designate Alternative-1 as the specific economic zone and bonded area.

2) Offer the same incentives to all the investors in VIP
The Prime Minister should issue a relevant decree so that all the investors in VIP could equally enjoy exemption on import customs duties imposed on materials and machines imported for manufacturing, as well as other incentives.
As a result, VIP could have a simplified export and import procedure to speed up the trading system and can have a competitive edge over other industrial estates in the neighboring countries

3) Give an impressive name to make it an attractive industrial estate
VIP should have a name that that would appeal to customers.

The conclusion mentioned above is not a drastic concept for VIP, taking into account the similar policy adopted in Thailand.

In Thailand, after becoming a member of WTO in 1995, EPZ lost its appeal under the agreement of WTO. Therefore, Thai Government reformed the Law of Industrial Estate in 2008 to establish a free zone as substitute for EPZ in compliance with the WTO agreement. Accordingly, manufacturers can invest in the free zone without depending on the exportation of products, and they can enjoy tax incentives such as exemption on import customs duties, export customs duties, value-added tax, and excise tax for machines for production, parts and raw materials.

APPENDIX III.2 DRAFT DECREE OF THE PRIME MINSTER ON VIP

Lao People Democratic Republic
Peace Independent Democracy Unity Prosperity

Prime Minister's Office No._____/PM
Vientiane, Date:_____

(Draft)
Decree of the Prime Minster on Vientiane Industrial Park

Referring to the Law on the Government of the Lao PDR (No. 02/NA), dated on 06/05/2003;
Referring to the Law on Investment Promotion (No. x/NA), dated on x/x/2009;
Referring to the Law on Land (No. 04/NA), dated on 21/10/2003;
Referring to the Law on Industrial Processing (No. 01/99/NA), dated on 3/4/1999;
Referring to the Decision (No.057/PMO) on the National Committee, dated on 11/06/2009;

CHAPTER I
General Provisions and Definitions

Article 1: Objectives

This Decree determines the organization, activities and policies on the Vientiane Industrial Park, which shall be designated as a specific economic zone, in order to attract and promote foreign and domestic investments in compliance with the general investment policies of the Government to foster production and exports, to create employment and to provide opportunities for learning experiences in the fields of business management and new technology.

Article 2: Definitions

In application of the provisions, the following words and phrases shall have the meanings designated for them below, unless otherwise stated:

Specific Economic Zone is a geographically defined area such as Industrial Zone, Export Processing Zone (EPZ), Tourism Zone, Free Trade Zone and so on, which are designated by the Government.

Vientiane Industrial Park or in brief as VIP is the area in Koksaad which covers approximately 140 ha as indicated on the map of the Main Report of the Preparatory Survey on Industrial Zone Development in the Lao PDR (2010).

Vientiane Industrial Park Authority or in brief as VIPA is the organization which is established by this Decree under the Ministry of Industry and Commerce for the purpose of development and management of VIP.

Developer is a qualified party benefiting from a concession deed to develop infrastructure in VIP.

Investor or licensed enterprise is a qualified party that is licensed to work inside VIP as manufacturer or service provider, in order to support manufacturers.

National Steering Committee is the committee chaired by the deputy prime minister, which was formed in December 2009 to supervise the development and management of special and specific economic zones. The Investment Promotion Department in Ministry of Planning and Investment is delegated as the secretariat for the committee.

Article 3: Establishment of VIPA

1. A. public authority called "VIPA" shall be established under the Ministry of Industry and Commerce with legal status and financial and administrative autonomy for the purpose of exercising its activities in accordance with the provisions.
2. The head office of VIPA shall be located within VIP.
3. VIPA shall be subordinated to the Minister of Industry and Commerce.

CHAPTER II
Tasks and Structure of VIPA

Article 4: Tasks of VIPA

VIPA shall be concerned with the following tasks:

1. Preparation of draft internal regulations on the management and operation of the VIP.
2. Licensing investors to establish enterprises to conduct permitted activities within VIP.
3. Determine fees and collection stipulations for services provided by VIPA to VIP investors/licensed enterprises.
4. Preparation of the annual budget of VIPA and submission to the Ministry of Industry and Commerce for ratification.
5. Monitoring the performance and compliance of investors/licensed enterprises with any relevant development agreements, laws, regulations and instructions and other relevant policies and procedures.
6. Investigation of violations of the law and its regulations, and instructions and imposition of penalties on investors/licensed enterprises found to violate the law and its regulations.
7. Protecting the environment, water resources, natural resources and biological diversity.
8. Administering customs policies and procedures to ensure the efficient movement of goods in and out of VIP and the storage of goods therein.
9. Administering income tax policies and procedures to ensure the efficient assessment and collection of income and other taxes within VIP and the effective audit of investors/licensed enterprises.
10. Regulating employment of workers, vocational training and ensuring compliance of investors/licensed enterprises with the principles that protect workers' rights within VIP

Note:
According to the Law on Investment Promotion, VIPA, which will be functioning as the management committee for the zone, seems to be established at the end of the implementation phase or at the beginning of the operational phase. However, in case that VIPA is established at the middle of implementation phase of VIP, other provisions that control the development of VIP may be added in this Chapter.

Article 5: Organization Structure of VIPA

The structure of the VIPA organization consists of operational sections such as secretariat, one-stop services, technical and maintenance services and investment promotion. Minister of Industry and Commerce shall appoint the Director General of VIPA, which has a duty to determine the tasks and rights of such organizations under VIPA.

CHAPTER III
Board of Directors

Article 6: Board of Directors of VIPA

1. VIPA shall have a Board of Directors consisting of five (5) members, as follows: This board shall function as the Management Committee as stipulated in Article 38 of Law of Investment Promotion.

   (1) A representative of the Ministry of Industry and Commerce, as the Chairman;
   (2) A representative of the Ministry of Planning and Investment;
   (3) A representative of Ministry of Finance;
   (4) A representative of Vientiane Capital;
   (5) A representative of private sector; representing investors/licensed enterprises.

2. The board member is appointed by the Minister of Industry and Commerce in coordination with the planning and investment sector and other concerned sectors and local authorities. The member of the establishment committee, which is designated in Article 36 of the Law on Investment Promotion, may also be selected as a member of the Board of Directors.

3. The Board of Directors shall meet at least once every month at the request of the Chairman of the Board, or his deputy in the event of his absence. The meeting will be considered valid if attended by a majority of two thirds of its members, including the chairman or his deputy. Decisions of the Board shall be taken by a majority of votes and in case of a tie, the side of the chairman shall be the deciding vote. The Board may convene an emergency meeting at the invitation of the Director General of VIPA, after securing approval from the Chairman of the Board.

4. The board members and the staff of VIPA, while carrying out their duties, shall observe the confidentiality of information related to the work of VIPA and investors/licensed enterprises.

Article 7: Responsibilities of Board of Directors

With the purpose of carrying out its mandate, the VIPA Board of Directors shall be responsible to the Minister of Industry and Commerce in taking all decisions and measures necessary, related to the development, management and operation of VIP. In particular, the Board shall have the following responsibilities:

1. Endorse the VIPA work plan within the framework of its general policy of the government.
2. Approve the organizational structure of VIPA, allocation of functions among operational sections and decision making authorities of key VIPA personnel.
3. Supervise VIPA in conducting the tasks set out in Article 4 of this Decree.
4. Promote VIPA, locally and internationally, with the aim of attracting investment. Cooperate with the appropriate sectors/authorities in this regard.
5. Prepare and submit regulations for approval of the Minister of Industry and Commerce, and issue instructions to facilitate the Board and VIPA in their mandates under this Decree to develop, manage and operate VIP.
6. Nominate VIPA Director General.
7. Develop and approve internal policies and procedures to manage the personnel, accounting, finance and procurement affairs of VIPA according to internationally accepted accounting standards and in a professional and transparent manner.
8. Submit an annual report to the Minister of Industry and Commerce on the financial and operational performance of VIPA.

Article 8: Duties of Director General of VIPA

Procedures of appointment and duties of the Director General are as follows.

1. VIPA's Director General shall be appointed by the Minister of Industry and Commerce, at the proposal of the Board of Directors.
2. The Director General shall participate in the meetings and discussions of the Board of Directors without having a right to vote.
3. The Director General shall be considered the executive official of VIPA and shall carry out the following duties:

   (a) Implement policies as determined by the Board of Directors.
   (b) Organize and supervise daily operations of VIPA.
   (c) Submit operation and performance reports to the Board of Director on a regular basis.

4. The Board of Directors shall determine the salary and other financial benefits of the Director General.
5. The Director General may not be a party to, or have any interest, directly or indirectly, in any investors/licensed enterprise or any contract entered into by VIPA.

CHAPTER IV
Finance of VIPA

Article 9: Finance of VIPA

1. VIPA's financial resources will be provided by:
   (a) The amounts allocated to VIPA from the general budget of the Government.
   (b) Fees collected from licenses granted for /or VIP investors/licensed enterprises.
   (c) Financial penalties collected pursuant to the provisions of the law.

(d) Grants and loans offered by other countries, international organizations and local and foreign non-governmental organizations.
(e) Any other revenues collected in accordance with the provisions hereof.

2. All proceeds and revenues of VIPA shall be deposited in a special account under the supervision of the Ministry of Finance, belonging to the general public treasury account.

3. VIPA's accounting and books shall be managed according to international accounting principles. The Board of Directors shall appoint a certified accountant to control and audit all accounts and books.

CHAPTER V
Development and Operation of VIP

Article 10: Development and Operation of VIP

1. The developer should be financially and technically capable. Those having past experience in the development and operation of specific economic zones shall be preferred.

2. If the developer fails to develop and operate VIP, the Minister of Industry and Commerce pursuant to the request of the Board of Directors, may appoint a third party to develop and operate VIP.

3. VIP shall be subject to control and supervision by VIPA, in order to verify implementation of the conditions agreed upon among the related parties. In case of a dispute arising, the related parties shall resort to arbitration in accordance with the provisions of the law.

4. With authorization from, and in coordination with the Board of Directors, the developer may promote VIP, with the purpose of attracting investors. The developer may also subscribe marketing and promotional contracts with any public or private corporation.

5. The developer shall maintain the infrastructure and other facilities required for operation of VIP in good operating condition.

Note:
Some provisions of this Chapter may be modified or deleted since relation and involvement between the management committee and the developer are not clearly stipulated in the Law on Investment Promotion.

CHAPTER VI
VIP Procedures

Article 11: VIP Procedures

1. Applications to obtain VIP license shall be submitted by enterprise owners to the One-Stop Service Unit of VIPA using the form prepared for this purpose. Within five (5) working days of receipt of the application, VIPA shall inform the applicant if further information is required including the completion of an environmental impact assessment and further documentation necessary for VIPA to obtain approval on behalf of the applicant from any public regulatory agency, pursuant to health, safety and security requirements applicable within VIP.

2. Unless VIPA informs the applicant of circumstances that require further processing time, the Director General of VIPA shall inform the applicant no later than two weeks from the date of

submission of complete documentation of its decision to accept, accept with conditions, or reject the application for a license. Every decision to deny the application must be reasoned.

3. VIP license may be revoked if proven that the licensed enterprise violated on more than one occasion any provision of the Law, its regulations and instructions, or if a period of six months has elapsed before initiation of actual work on the licensed enterprise, unless a reasonable excuse for the delay is presented.

Article 12: Activities allowed in VIP

Activities allowed in VIP are industrial and processing factories or manufacturers and supporting service activities for them. Types of industrial and processing factories are defined in Article 9 of Law on the Processing Industry (1999).

CHAPTER VII
Movement of Goods In and Out of VIP

Article 13: Movement of Goods In and Out of VIP

1. VIPA may declare any part of VIP to be duty and tax free customs controlled area.

2. Licensed enterprises may import all goods, materials, components, machinery and vehicles from a foreign country into the customs controlled area of VIP in furtherance of the activity for which the enterprise is licensed exempt from all customs duties, taxes and charges.

3. Notwithstanding any contrary provisions of the Customs Law and all other legislation regulating the import and export of goods prevailing in the customs territory, the Board shall issue a regulation setting out policies and procedures administering the import, export and transfer of goods into, out of and within the customs controlled area of VIP.

4. The owner of a licensed enterprise operating within the customs controlled area of VIP may sell any share of its production to the local market.

5. Local goods and products supplied to the customs controlled area of VIP from the customs territory in the rest of the country shall not be subject to any established procedures, taxes or duties.

6. All goods and products manufactured in the customs controlled area of VIP exported abroad shall not be subject to the rules and legal procedures established for export, export taxes and any other taxes.

CHAPTER VIII
Investment Promotion Policies within VIP

Article 14: General policy

The Government of the Lao PDR encourages and promotes investment in the area of VIP by means of various preferential policies stipulated in this Decree, rules of procedures and other regulations on VIP and the Law on Investment Promotion.

Article 15: Tax exemption/reduction

Tax exemptions and special tax rates granted to the investors/licensed enterprises within VIP are as follows:

15.1 Customs duties

Investors/licensed enterprises within VIP shall be exempted from duties and taxes for the importation of raw materials, machineries, equipment and vehicles used directly for the production.

15.2 Profit tax

The investors/licensed enterprises in VIP will receive profit tax exemption for 10 years from the profit making year and after finishing the exemption period, they will receive the reduced profit tax rate at 8% for 10 years.

15.3 Personal income tax

Personal income which is the total of salary; allowance, wages and other payment for managers, employees, technicians, workers of investor/licensed enterprises within VIP shall be subject to the following rates:

- 5% for an expatriate or foreign citizen

- The rate of personal income tax for a Lao citizen and a foreigner residing permanently in the Lao PDR, shall be subject to a reduced basic rate consisting of a personal income tax exemption for the "basic amount" of 400, 000 Kips of their monthly personal income and a payment of personal income tax at the rate of 5% for the remaining monthly personal income, once the above basic amount has been deducted.

15.4 Business turnover tax

Investors/licensed enterprises within VIP shall be exempted from business turnover tax, which is usually collected from the sale of goods and general services undertaken within the territory of the Lao PDR as well as on the importation of goods.

Note:
Investors/licensed enterprises within VIP shall be exempted from Value-added tax (VAT) when the business turnover tax is replaced by VAT.

15.5 Excise tax

Investors/licensed enterprises within VIP shall be exempted from excise tax, which is usually collected from certain types of luxury goods and services.

15.6 Minimum tax

Investors/licensed enterprises within VIP shall be exempted from minimum tax.

15.7 Import customs duty for vehicles used in administrative activities or indirect production within VIP

Cars such as sedan cars, 4WD, mini-buses, buses and jeeps used for investors/licensed enterprises in administrative activities or indirect production within VIP, shall be subject to an import customs duty at the rate of 1 %. VIPA is responsible for authorizing the import of such vehicles. The authorized number depends on the minimum value of the registered capital investment and number of workers/employees as indicated below.

Registered Capital (USD)	Authorized number of vehicles
100,000 to 499,999	Three (3) vehicles
500,000 to 999,999	Six (6) vehicles
1,000,000 or more	Nine (9) vehicles

The number of workers	Authorized number of large buses up to 50 seats
50 to less than 100	Two (2) buses
100 to less than 200	Five (5) buses
200 to less than 500	Ten (10) buses
500 or more	Up to Fifteen (15) buses

15.8 Temporary import of vehicles within VIP

Investors/licensed enterprises, which carry out activities of construction, surveys, investigations and others, or has to perform works requiring indispensable equipment, tools, heavy equipment and vehicles as described in their project proposal, project feasibility study or works implementation contract within VIP, shall be authorized by VIPA to import such equipment and vehicles on a temporary basis with an import customs duty exemption for a period of one year. In the event that the concerned enterprises found the necessity of using these equipment and vehicles for more than one year, VIPA shall consider the request for the one more year extension of the duty exemption period on the basis of a proposal made by investors/licensed enterprises.

15.9 Policies applicable to the sale and replacement of the vehicles and equipment imported by investors or licensed enterprises within VIPA

Vehicles, heavy equipments and heavy-payload trucks which are imported for use within VIPA by investors/licensed enterprises may be sold by the latter either when the import duration period, starting from the date of their import reaching 5 years or more, or when they have been damaged to such a degree that they are no more useable. Such sale is subject to the authorization by VIPA. In the event that the sale transaction takes place within VIP, exemption of all types of customs duties and taxes shall be granted. However, if the sale transaction takes place outside of VIP and inside the Lao PDR territory, it is subject to all customs duties and taxes in compliance with the laws and regulations.

15.10 Forbearance regarding vehicles

With regards to vehicles, heavy equipment, and heavy-payload trucks which have been imported according to the policies of customs duty exemption, it is forbidden for any investors/licensed enterprises to make transactions such as exchange, purchase-sale, or ownership transfer with another party, without permission by VIPA.

Note:
Effectiveness of Article 15.7, 15.8, 15.9 and 15.10 may be suspended since many illegal cases that abuse privilege or right to avoid customs duties on automobile are seen.

Article 16: The utilization of profit for investment

Investors/licensed enterprises that use its annual profit to re-invest in a business within VIP, after due auditing and acknowledgment by VIPA, shall be entitled to a profit tax reduction in pro rata to the percentage of the annual profit re-invested.

Article 17: Policy regarding the deduction of annual loss from following-year profit

After the end of the period of profit tax exemption, investors/licensed enterprises have the right to deduct its annual loss from its following year profit, provided that its financial accounting system has been duly audited and attested by VIPA. However, this policy of assistance for enterprises which suffer loss is applicable only for a maximum period of 5 years, starting from the first year of loss.

Article 18: Repatriation of business operations profit

Foreign investors/licensed enterprises operating business activities within VIP may repatriate their profits and personal income back to their country or to a third country, through VIPA-registered Bank or through a bank located in the Lao PDR, once their customs duties or tax obligations have been paid.

CHAPTER IX
Rights and Duties of Investors/Licensed Enterprises within VIP

Article 19: Rights and Duties of Investors/Licensed Enterprises

1. In addition to any other rights guaranteed in any other law, the investors/licensed enterprises shall be free to determine the prices of their products and services and to seek and import services and goods necessary for them from inside or outside the country.

2. Investors/licensed enterprises shall be obligated to:

   (a) Restrict their activities to those indicated in the license granted to each of them. It is permissible to change the type of activity in the zone after securing approval of VIPA.
   (b) Every licensed enterprise operating in the customs controlled area of VIPA shall maintain an inventory control system that records the entry, exit and duty-status of all goods acquired by the enterprise.
   (c) Cooperate with officials from VIPA or any other public regulatory agency monitoring compliance by the licensed enterprise of the rules and standards in force within VIP
   (d) Submit any documents, books or accounts, answer any questions and permit access to premises and employees when so required by VIPA, for the purpose of monitoring compliance with rules and standards.
   (e) Abide by any instructions or regulations established for the operation of VIPA
   (f) Notify VIPA at least three months in advance and in writing of the decision of the licensed enterprise to liquidate and terminate his enterprise.

3. Investor/licensed enterprise shall liquidate his enterprise in VIP within six months from the date of stopping work without justification. If he fails to do so, VIPA, in coordination with the Customs Department may, after the lapse of this period, sell it in auction, and all the liabilities and debts of the enterprise, if any, shall be deducted from the price and the rest transferred to his private account.

CHAPTER X
Dispute Resolution

Article 20: The resolution of disagreement

1. The dispute resolution of the contracting parties among developers, investors/licensed enterprises or VIPA shall be consulted in an amicable manner or set by the contract.

2. If cases are not resolved through consultation or by the contract, an arbitration agency can play the role in accordance with the relevant laws and regulations of the Lao PDR.

CHAPTER XI
Penalties

Article 21: Penalties against violators

1. Investors/licensed enterprises within VIP who do not follow the provisions of this Decree or any regulation or decision shall be penalized. VIPA has the right to suspend, cancel or withdraw the license.

2. Investors/licensed enterprises within VIP who create damage to the public, lives, assets and natural environment in violation of the laws and decrees shall be fined or punished based on penal regulations. Violators have to compensate all damages caused by them.

CHAPTER XII
Final provisions

Article 22: Implementation

The Board of Directors shall submit the regulations required for implementation of the provisions to the Minister of Industry and Commerce for their approval and shall issue instructions and decisions required for the implementation of provisions and regulations in force and shall publish all such documents when approved by the Minister of Industry and Commerce

Article 23: Exceptions

The provisions of this Decree present particularities. In spite of incompatibility between some provisions of this Decree and those of other legal acts including Laws, this Decree is effective because it is applicable only to the limited area of VIP.

Article 24: Effectiveness

All concerned legal entities, each within its jurisdiction, shall implement this Decree which shall take effect as of the date of its signing by the Prime Minister.

APPENDIX III.3 DRAFT INTERNAL REGULATIONS FOR INDUSTRIAL AREA OF VIP

1 Definitions and Purposes

1.1 Definitions

1.1.1 "VIP" means Vientiane Industrial Park, which consists of Industrial Area of 130 ha and Residential Area of 10 ha.

1.1.2 "VIPA" means Vientiane Industrial Park Authority, the management organization of VIP.

1.1.3 "DR-108" means the district road beside VIP which links 450 Year Road with National Road 13-South.

1.1.4 "Business day" means all days except national holidays in the Lao PDR, Sundays and any other days to be notified to the Tenant by VIPA from time to time.

1.1.5 "Common Areas and Facilities" means areas and facilities within VIP which include, but not limited to, the main road, the secondary roads, bridge, drainage system, water distribution pipeline, industrial park center, and such areas and structures owned by VIPA, as well as the equipment, machinery and whatsoever movable items located or installed in or on them.

1.1.6 "MoIC" means Ministry of Industry and Commerce.

1.1.7 "MPI" means Ministry of Planning and Investment.

1.1.8 "Improvements" means provision of any kind of structures, such as buildings, paved areas, fences, walls, poles, built, erected, installed or otherwise located and any landscaping or planting in VIP.

1.1.9 "Internal Roadways" means the main road and the secondary roads described in Article 1.5.

1.1.10 "Main Road" means roads with a width of fifty two (52) meters including a drainage channel in the middle. All other roads in the industrial area are defined as "Secondary Road".

1.1.11 "WREA" means Water Resources and Environment Administration.

1.1.12 "VUDAA" means Vientiane Urban Development Administration Authority.

1. 1.13 "Nam Papa" means the company that provides public water supply service.

1. 1.14 "EDL" means Electricite du Lao, the company that provides public power supply service.

1. 1.15 "Lot" means the part of VIP utilized or leased by the Tenant pursuant to a Utilization Agreement or a Lease Contract entered into with VIPA.

1. 1.16 "Protective Controls" means the restrictions set forth in Article 3 and elsewhere in these regulations.

1. 1.17 "Regulations" means the internal regulations which are embodied herewith and which may be replaced and amended from time to time by VIPA. These regulations shall be applied to the Tenant under the Utilization Agreement or Lease Contract, which shall be incorporated by reference in, and made an integral part of such contract, as though repeated in full therein.

1. 1.18 "the Lao PDR" means the Lao People's Democratic Republic.

1.1.19 "Tenant" or "Tenants" means persons, entities or organizations, which have executed a Utilization Agreement or Lease Contract for a Lot in the VIP, and their successors and assignees.

1. 1.20 "Utilization Agreement" means the agreement for the Right to Utilize the Lot signed by the Tenant.

1. 1.21 "Lease Contract" means the agreement for leasing the Lot signed by the Tenant.

1.2 Purpose of these Regulations

The purpose of these regulations is to achieve the following:

1.2.1 To ensure safety and security conditions for the activities, properties and benefits of the Tenants in VIP.

1.2.2 To protect the environment, landscape and scenery of VIP.

1.2.3 To maximize the utilization of the facilities in VIP.

1.2.4 To promote synergy among the activities in the VIP.

1.2.5 To ensure an eco-friendly environment, harmony of further development stage of VIP and linkages with surrounding related developments.

2 Operations and Uses

2.1 Prohibitions

The activities listed below are strictly prohibited:

2.1.1 Any activities against the objectives set forth in Section 1.

2.1.2 Any environmental pollution or contamination.

2.1.3 Any activities that destroy property or restrict activities in VIP.

2.1.4 Utilization of dangerous, hazardous or toxic materials without written approval of the VIPA and without the user providing a guarantee on safe handling, use, compliance with occupational health and safety laws, emergency containment, cleanup and disposal procedures.

2.1.5 Violation of the laws and regulations issued by the Government of Lao PDR and rules set by VIPA.

2.1.6 Specific prohibition for the following operations and uses:

a) Junk Yard
A facility engaged in the business of collecting, gathering, storing, and/or selling of discarded used machinery, equipment, tools, parts and/or any movable or other assorted similar items.

b) Animal Facility
A facility raising and/or slaughtering any kind of animals, including but not limited to insects. For security purposes the establishment and operation of such facilities shall be subject to VIPA's approval in advance.

c) Asbestos Products
A facility for any work related to asbestos.

d) Cement
A facility for the production of any kind of cement, fabrication of cement based products or any other similar activities.

e) Dangerous or Hazardous Materials
A facility using, producing, storing, handling or disposing of dangerous, hazardous, or explosive or toxic materials shall be subject to VIPA's approval in advance.

f) Petroleum, Asphalt and Fuel
Petroleum, asphalt, fuel and cooking gas refineries or storages shall be subject to VIPA's approval in advance.

g) Dyeing
A facility for tanning and dyeing leather, plants, plant fibers and wool.

2.2 Alteration and Improvement of the Operations and Uses

2.2.1 Any alteration and improvement of the operations and uses which is necessary to have physical modification shall acquire written approval from VIPA before implementing any modification works.

2.2.2 Changes which would cause damage, loss or disadvantage to other activities in VIP are prohibited.

2.2.3 In the case where the alteration is required to comply with governmental laws, a written approval from the VIPA shall be required.

2.2.4 The Tenant shall settle and solve any claims in connection with the occupation and use of the Lot and the Improvements erected thereon at its cost and responsibility, if raised by neighbors and/or any Tenant(s) in VIP or any other third party. In this regard, the Tenant shall keep VIPA indemnified and hold VIPA harmless against all inconveniences, claims and costs.

2.3 Specially Permission of the Operations and Uses

Operations and uses which are specifically prohibited herein may be permitted by VIPA and strictly complying with all governmental laws, regulations and requirements. In such a case, a written approval from VIPA is required and such approval may be subject to conditions imposed by VIPA.

In such event, the liability of VIPA and its successors or assignees with regard to the approval of such operations or uses shall be limited in accordance with Section 2.2.

2.4 Governmental Approvals and Permits

2.4.1 Activities within VIP shall be based on approvals, permits and licenses which required and may be required by the effective laws and regulations of the Lao PDR.

2.4.2 The Tenant shall provide VIPA with copies of all approvals, permits and licenses concerning the activities related to the operations and uses of the Lot in VIP, including the investment license and its revision, if any. Submission of a notarized copy certified by the public notary office in the Lao PDR may be required by VIPA as a condition precedent for the signing of a Utilization Agreement or Lease Agreement with the Tenant.

3 Protective Controls on Construction Works

Any and all construction work shall be examined and approved by VIPA in advance. The Tenant shall observe the procedures for the design and construction work in the Lot as mentioned in this Section and the provisions of Section 4 and Section 5.

3.1 Approval for the Plans from VIPA

3.1.1 Submission of the Plans
Design and specifications (hereinafter called as "the Plans") which shall be accompanied by a written request for approval of the proposed construction works or proposed alteration to the improvements shall consist of:

a) A lot plan with reference to the lot and structures adjoining the Lot.

b) A plan for fences and gate including shape, color, materials and size.

c) A plan for buildings including plans, elevations and exterior details (e.g. shape, color and material).

d) A plan for landscaping showing the planting place and type of plants and trees.

e) A plan for signs and exterior lighting in the Lot.

f) A plan for every connection to the public infrastructure including access road, water supply, electricity and drain.

g) Any other designs, drawings, plans or documents that VIPA may reasonably require.

3.1.2 Review and approval by VIPA

a) VIPA shall review the plans from the viewpoint of compliancy with the Protective Controls and other provisions in these regulations.

b) Approval of the Plans must be made in writing with the General Director's signature and company seal of VIPA. Such approval shall not be unreasonably withheld by VIPA.

c) The Tenant shall submit and acquire approval from VIPA before submission to the relevant government authorities.

d) VIPA shall reply to the request for approval within ten (10) business days.

3.2 Approval of the Authority for Construction

3.2.1 Submission to the Authority and VIPA

After the approval for the Plans by VIPA, the Tenant shall submit necessary documents to the Authority in accordance with existing relevant governmental regulations. A copy thereof and additional submission, if any, shall be simultaneously sent to VIPA. If any change or discrepancy may occur between the approved plans and said documents, the Tenant shall submit details to VIPA in accordance with Section 3.1 for approval prior to submission to Authority.

3.2.2 Approval of the Authority

After the Authority has approved the plans for its construction, the Tenant shall submit a copy of the said approval letter to VIPA prior to commencement of any construction work on the Lot.

3.3 Construction Period

3.3.1 Commencement of Construction

a) The Tenant shall inform VIPA in writing not less than seven (7) business days prior to the commencement of construction.

b) The Tenant shall submit the construction schedule to VIPA for security management. The Tenant also shall notify VIPA of the contractor's names and authorized person.

3.3.2 Protective Control during Construction Work

a) Any work not complying with Section 1.2 of these Regulations shall be suspended or remedied upon exclusive decision of VIPA, at the responsibility and cost of the Tenant.

b) No excavation shall be made except in connection with the approved construction works and it shall immediately be backfilled and leveled as original.

c) The Tenant shall ensure that no obstruction is caused to any common utility and property in VIP and takes any responsibility for all the works.

d) The Tenant shall compensate VIPA against all proceedings, claims, cost and expenses which VIPA may incur or for which VIPA may be held liable as a result of the Tenant's construction works and/or any act, neglect or default of the Tenant.

e) The Tenant shall inform VIPA in writing if any delay or changes in the schedule together with the justifiable reason(s).

3.4 Completion of Construction

3.4.1 Delays in Completion

a) In case the time limit for implementation (starting operation work) is not set out in the Investment License of the Tenant, two (2) years after the date of the Utilization Agreement or Lease Agreement is the said time limit.

b) In case of any delay of completion of construction work beyond any time limit of implementation occurred, VIPA will has exclusive option to declare the Tenant in default of the conditions of its utilization or sublease and to exercise any or all of its rights and/or remedies under Section 6 hereof.

c) In case of being declared in default by VIPA as set in this Section, the Tenant shall forfeit the unfinished building(s) and all other structures in the Lot as well as all expenses paid for the construction and vacate the Lot. Otherwise, VIPA shall be free to assume possession of the Lot and the unfinished construction works. VIPA may require the complete removal of the building, structure or any movable property found in the Lot and reinstatement of the Lot to the original condition before commencement of construction at the expense of the Tenant.

3.4.2 Requirement upon Completion

a) The Tenant shall remove and demolish all waste, materials, temporary buildings and other facilities arising from its construction work at own responsibility and cost, as soon as practicable after completion of the construction works.

b) As soon as construction works is completed, the Tenant shall notify VIPA in writing of the same for inspection and approval.

c) If any discrepancy is found in the plan submitted in accordance with Section 3.1 and 3.2, the Tenant shall immediately correct, at its own responsibility and cost, the deficiencies noted by VIPA without any objection prior to final inspection and approval of VIPA.

d) Any inspection and approval of VIPA as set out in this Section shall be carried out before any inspection of governmental authorities.

4 Protective Controls on Specific Improvements

4.1 Setback Lines

4.1.1 The Tenant shall observe the following setback lines:

For property lines fronting the DR-108:	Fifteen (15) meters from property line of the Lot.
For property lines fronting the Main Road:	Ten (10) meters from property line of the Lot.
For property lines fronting the Secondary Road:	Ten (10) meters from property line of the Lot.
For property lines fronting a neighboring Lot:	Ten (10) meters from property line of the Lot for Factory with labor number of over 200 and Warehouse with floor area of over 1,000m^2. Six (6) meters from property line of the Lot except for above.

4.1.2 The following structures and Improvements are specifically excluded from these setback provisions:

a) Flag poles

b) Underground pipelines and conduits

c) Landscaping

d) Streets, alleys, driveways, sidewalks and pavements without roof

e) Fences subject to Section 4.2

f) Gates and guardhouses for security purposes subject to Section 4.3

g) Parking place without roof, subject to Section 4.6

h) Water shade, such as retention pond, drainage system and wastewater pit

i) Electrical facilities or similar facilities

j) Facility for exterior and security lighting subject to Section 4.8

4.2 Fencing

4.2.1 The Tenant shall build the fences fully enclosing its Lot on the property lines as set out herein, only except for the entrance and exit as stated in Section 4.3. Before the Tenant starts construction of the fences, the Tenant and VIPA shall confirm the property line with written evidence. After the property line confirmation, the Tenant shall be able to start construction of the fences.

4.2.2 Fence along Roads and VIPA common area

a) The Tenant shall erect the fences along the Internal Roads and between the Tenant's lot and VIPA's common area in accordance with Section 4.2.1. The fences shall be erected within the Tenant's lot and adjacent to its established property line. During construction of the fences, VIPA shall assign supervisors to ensure that the fences are erected in accordance with the Internal Regulations of VIPA.

b) The maximum height of fences along roads shall be two point five (2.5) meters from ground level.

c) No fences made of bamboo, wooden or concrete block and barbed wire shall be constructed in front of any property line facing the road.

4.2.3 Fences between Lots

a) The fences shall be constructed to separate Lots of the Tenants. The center line of fences between Lots shall be set up by the first Tenant entering the Lot on the established property line between Lots. Subsequent Tenants entering the neighboring Lots shall bear 50% (fifty percent) of the construction cost of joint fences.

b) The maximum height of fences along roadways shall be two point eight (2.8) meters from ground level.

c) No fences made of bamboo, wooden or concrete block and barbed wire fence shall be constructed in front of any property line facing the road.

4.3 Lot Entrance and Exit (Gate)

4.3.1 The number of entrance and/or exit gates that are allowed for each Lot are as follows:

For a Lot which is less than thirty thousand (30,000) square meters:	one (1) gate
For a Lot which is thirty thousand (30,000) square meters and more:	two (2) gates

4.3.2 To ensure a safe and efficient flow of traffic, construction of gate(s) shall keep minimum distance of twenty (20) meters from the property lines.

4.3.3 The gate shall avoid the place where the road accessories, such as fire hydrant, street light, electric pole and road sign, are installed.

4.3.4 The width of entrance shall not exceed twenty (20) meters.

4.4 Landscaping

4.4.1 The Tenant shall be responsible for landscaping of the Lot and maintaining its condition including, but not limited to, trimming, watering and fertilization.

4.4.2 The entire area between the property line and the building(s) shall be landscaped with an effective combination of trees, ground cover and shrubbery.

4.4.3 The landscape must be in harmony with adjoining landscaping to maintain the identity of the Park.

4.4.4 No fruit trees, crops and any plants or trees that produce an offensive odor shall be used for landscaping and planting in the Lot.

4.4.5 Proper care and maintenance, not limited to watering, trimming and fertilizing, shall be the responsibility of the Tenant.

4.4.6 Any damage and/or claim for compensation arising from the landscaping shall be the full responsibility of the Tenant.

4.4.7 In case of insufficient care of landscaping by the Tenant, VIPA will serve a notice and the Tenant shall be obligated to take all necessary actions for improvement within fourteen (14) days.

4.5 Building

4.5.1 Maximum Building Area and Height

a) The total building coverage of building "footprint" shall not exceed seventy per cent (70%) of the total area of the Lot. The permissible floor-to-area ratio shall not exceed two hundred per cent (200%) of the total area of the Lot.

b) The maximum building height shall not exceed fifteen (15) meters vertical distance from the established ground elevation to the highest point of the roof. However, buildings in excess of fifteen (15) meters in height may be allowed with prior written approval of VIPA in specific cases.

4.5.2 External view shall be harmonized with the VIP environment, architecturally and aesthetically suitable and shall be properly maintained at all times.

4.6 Parking

4.6.1 On-street parking without permission of VIPA is prohibited within VIP. The Tenant shall take full responsibility for its visitors, contractors and employees. Any vehicle parked on the street without permission shall be removed at VIPA's discretion without prior notice and all costs involved in removal shall be compensated by the relevant Tenant(s).

4.6.2 The Tenant shall designate a sufficient number of paved and dust-free all-weather parking places within the Lot.

4.6.3 Open spaces on the setback areas can be utilized for parking place without a roof. In case the Tenant wishes to designate a roof-covered parking area for bicycles or motorcycles on these areas, the Tenant shall submit a plan to VIPA for its prior approval.

4.7 Signs

4.7.1 Signs or other advertising devices shall not be permitted without specific written approval from VIPA.

4.7.2 Signs shall not be permitted to extend above the top of the building. Signs eligible for approval will be only those identifying the name, logo, business and products of the Tenant.

4.8 Exterior Lighting

4.8.1 All exterior and security lighting shall be compatible and harmonious with VIP landscape and approved by VIPA.

4.8.2 All electrical lines for exterior and security lighting shall be in accordance with the plans duly approved in writing by VIPA in accordance with Section 3.1.

4.9 Water Requirements

4.9.1 The Tenant must not establish any water wells or similar facilities on any portion of the Lot and shall only use water supplied by Nam Papa through VIP's common water supply pipeline.

4.9.2 Contract agreement for the water supply service shall be sealed between the Tenant and Nam Papa.

4.9.3 Connection work for water supply service between the common water supply pipeline and water service connector in the Lot (including installation of water meters) shall be carried out on the Tenant's account by Nam Papa.

4.9.4 For the periodic or emergency maintenance of water supply facility, VIPA has the right to shutdown the water supply. The Tenant shall provide water storage tanks with a capacity of sufficient for more than six (6) hours of Tenant's water consumption.

4.10 Drainage System

4.10.1 Connection work for the Tenant's drain and the VIP inlet pit shall be carried out by the contractor approved by VIPA under the instruction of VIPA. This connection work shall be carried out with attendance of VIPA and/or its assigns.

4.10.2 The Tenant shall not dump any garbage, leftover food or solid waste into the drain.

4.11 Others

4.11.1 The Tenant shall comply with all the requirements imposed by all public utility providers within VIP (e.g. water supply, electricity, telecommunications, solid waste treatment, etc.).

4.11.2 The Tenant shall observe the service connections for public utilities in accordance with the contract or agreement between the Tenant and related providers.

5 Environmental Protective Controls

5.1 Wastewater

5.1.1 Connection to Common Discharge Point

a) Connection work for the Tenant's sewer line and the VIP inlet pit shall be carried out by the contractor approved by VIPA under the instruction of VIPA. This connection work shall be carried out with the attendance of VIPA and/or its assigns.

b) The Tenant shall treat the wastewater by own-self to meet the effluent standards set below.

Table III.3.1: Wastewater Effluence Standards

Parameter	Unit	Value (not higher than)
BOD_5	mg/l	30
Ammonia Nitrogen	mg/l	4
Total Suspended Solid (TSS)	mg/l	40
pH	mg/l	6-9.5
Temperature*	Degree Celsius	40
Total dissolved solid (TDS)*	mg/l	1,500
COD*	mg/l	120
Total Kjeldahl Nitrogen (TKN)*	mg/l	100
Phenols	mg/l	0.3
Phosphorus	mg/l	1
Silver	mg/l	0.1
Zinc	mg/l	1
Sulphide	mg/l	1
Free chlorine	mg/l	1
Chloride	mg/l	500
Iron	mg/l	2
Fluoride	mg/l	15
Cyanide	mg/l	0.1
Copper	mg/l	0.5
Lead	mg/l	0.2
Oil and grease	mg/l	5
Nickel	mg/l	0.2
Mercury	mg/l	0.005
Manganese	mg/l	1
Arsenic	mg/l	0.25
Barium	mg/l	1
Cadmium	mg/l	0.03
Chromium (+6)	mg/l	0.1
Total Chromium	mg/l	0.5

Source: Effluent Standard of MOIC, * Standard For Wastewater Treatment of WREA

c) The Tenant shall submit the wastewater monitoring report every four (4) months, which shall be conducted by the authority/company approved by VIPA for the items stated in the effluence standard. The report must be sent to VIPA directly from the laboratory within the first week of each month. If VIPA does not receive the monitoring report on time, VIPA has the right to monitor the wastewater of the Tenant and the Tenant shall bear the cost of monitoring.

d) VIPA may also monitor the wastewater of the Tenant by random sampling and/or regular sampling. If the Tenant violates any of the provisions found herein, without prejudice to any right of VIPA to terminate the Utilization Agreement or Lease Agreement, the Tenant shall be liable to pay compensation to VIPA for such breach as determined by VIPA, and this compensation shall be payable upon demand by VIPA.

5.2 Air Pollution

5.2.1 The Tenant shall install air pollution control devices for plant facilities that produce smoke, dust, fumes and/or other particles that may pollute the atmosphere. Air effluent quality shall not exceed the standard stated in the "National Environmental Quality Standard in the Lao PDR".

5.3 Noise Pollution

5.3.1 Noise emitting from any source within the Lot shall be effectively controlled with sound-absorbing materials or other suitable means so as to comply with the "National Environmental Quality Standard in the Lao PDR".

5.4 Solid Waste

5.4.1 The Tenant shall make own contract agreement with VUDAA for solid waste removal and disposal to sanitary landfill or other disposal systems.

5.4.2 In the case the contract agreement can not be reached between VUDAA or other similar sufficient authority approved by VIPA, the Tenant shall treat the solid waste by own self properly. All required approvals from VIPA and relevant government authorities to develop and operate own solid waste treatment facilities shall be acquired by the Tenant.

5.4.3 Outside storage of solid waste shall be allowed with VIPA's prior approval only when it is stored in solid waste receptacles or trash containers which must be large enough to facilitate storage and collection and which must be installed within the Lot.

5.4.4 The Tenant shall ensure that the said receptacles or outdoor trash containers are placed away from its neighbor's premises, and shall be designed and located not to be visible from the Internal Roads and the DR-108.

5.4.5 The Tenant shall make sufficient provision for the safe and efficient disposal of all wastes, including, but not limited to, pollutants generated from its Lot, to the requirement and satisfaction of VIPA and the relevant governmental authorities. In the event of any default by the Tenant under these regulations, the Tenant shall be responsible for taking remedial measures within fourteen (14) calendar days after being notified by VIPA except if VIPA requires the Tenant to take emergency measures at VIPA's discretion. Otherwise, VIPA may take such remedial measures deemed necessary at VIPA's discretion and charge all costs and expenses incurred thereby to the Tenant.

5.5 Others

5.5.1 The Tenant shall not use, produce, store, dispose or handle dangerous or hazardous materials in VIP as set out in Section 2.1. Should the Tenant strictly comply with applicable laws, regulations, notices and any requirements from VIPA from time to time, VIPA may allow the Tenant to conduct any activity defined as a specific prohibition herein.

5.5.2 The Tenant and its contractor or transport firm shall not dump or drop or scatter any garbage and similar materials such as, but not limited to, excess soil in any part of VIP and its vicinity with the exception of any designated places according to relevant provisions in these Regulations. In the event of failure by the Tenant or its contractor or transport firm, the Tenant shall take full responsibility to remove such garbage or reimburse any cost paid by VIPA.

6 Remedies

6.1 Violation

If the Tenant violates or fails to comply with any provision of these Regulations or fails to comply with the applicable laws or regulations and requirements of any competent governmental authority, VIPA has the right to send a notice of default to the Tenant identifying the Tenant's breach and setting out the remedy required of the Tenant. If the Tenant has not remedied the breach within fourteen (14) calendar days from the date of the notice, VIPA may exercise the following rights and remedies in addition to the rights and remedies contained in the Utilization Agreement or Lease Contract signed by the Tenant.

6.1.1 To enter upon the Lot where such said violation or fails exists and to remedy the Tenant's breach or failure to comply, maintain and enforce such remedy until corrective measures or safeguards have been instituted by the Tenant and accepted by VIPA at the full expense of the Tenant; and/or

6.1.2 To bring proceedings against the person or persons who have directly or indirectly caused such violation or prevent such persons from continuing such violation or to cause such violation to be remedied, and to recover any and all damages and expenses.

6.1.3 In the event of the exercise of any of the remedies above, VIPA shall not be liable for any damages for such exercise, provided good faith basis existed for such entry onto the Lot and remedy of the violations.

6.2 Inspection and Maintenance

VIPA and/or its assigns reserves the right to enter, inspect and maintain the Tenant's properties at any reasonable time and, except in case of emergency at VIPA's opinion, with twenty four (24) hours' prior notice.

APPENDIX III.4 CALCULATION SHEET

1 Drainage System

1.1 Retention Pond

(1) Capacity of Retention Ponds

Table III.4.1: Capacity of Retention Ponds

	Travaling Time (minutes)		Mean Velocity for Developed Area	Runoff Coefficient	Maximum Length of Drainage Line	Density of Drainage Line
	t1	t2				
Before Development	5.00	L/V/60	0.5 m/sec	0.30		
After Development	5.00	L/V/60	1.5 m/sec	0.85	km	m/ha

Catchment Area	Area Accumu.			Con-Time	Pi: Peak Flow					Pc: Allowable	Pc/2	Required
		Each Line	Length: L	t1+t2	P=2 years	P=5 years	P=10 years	P=20 years	P=50 years	Flow of Mak Hiao		Capacity
	(ha)	(m)	(m)	(min)	(m3/s)	(m3/s)	(m3/s)	(m3/s)	(m3/s)	River (m3/s)	(m3/s)	(m3)
Pond No.2										P=10 years		
Before Development	97.5	0	1,679	60.97	3.75	5.32	6.36	7.35	8.64	6.36	3.18	32,001
After Development	97.5	0	1,679	23.66	15.02	21.39	25.72	29.94	35.48			
Pond No.1												
Before Development	32.5	0	1,074	40.80	1.49	2.11	2.53	2.93	3.46	2.53	1.27	8,152
After Development	32.5	0	1,074	16.93	5.41	7.71	9.29	10.83	12.86			

Source: JICA Survey Team

(2) Regulating Gate

Table III.4.2: Regulating Gate

	Discharge:Qo (m3/s)		
Dimension of Regulating Gate	P=10 - P20	**P=10 - P=50**	Remark
(Steel Roller Sluice Gate)	4.22	9.75	
C: Discharge Coefficient	0.53	0.53	0.53 **Free Flow**
H1 (m): Water Height upstream	1.500	1.500	
H2 (m): Water Heigh downstream	0.500	0.500	
B (m): Width of Gate	1.467	3.392	
d (m): Height of Gate Opening	1.000	1.000	
H1/d	1.500	1.500	
H2/d	0.500	0.500	
C: Discharge Coefficient	0.5	0.5	0.5 Unfree Flow
H1 (m): Water Height upstream	1.500	1.500	
H2 (m): Water Heigh downstream	1.500	1.500	
B (m): Width of Gate	1.555	3.595	
d (m): Height of Gate Opening	1.000	1.000	
H1/d	1.500	1.500	
H2/d	1.500	1.500	
Gate of RP No.2			
B (m): Width of Gate	1.500	2 gates	
D (m): Height of Gate	1.500		
d (m): Height of Gate Opening	1.000		
Gate of RP No.1			
B (m): Width of Gate	1.500	1 gate	
D (m): Height of Gate	1.500		
d (m): Height of Gate Opening	1.000		

Source: JICA Survey Team

1.2 Hydraulic Analysis of Drainage System

Table III.4.3: Hydraulic Design Sheet

Hydraulic Design Sheet

Project Vientiane Industrial Park
Location Industrial Area, Vientiane
Drainage Basin: Mak Hiao River
Total Project Area: 140 ha

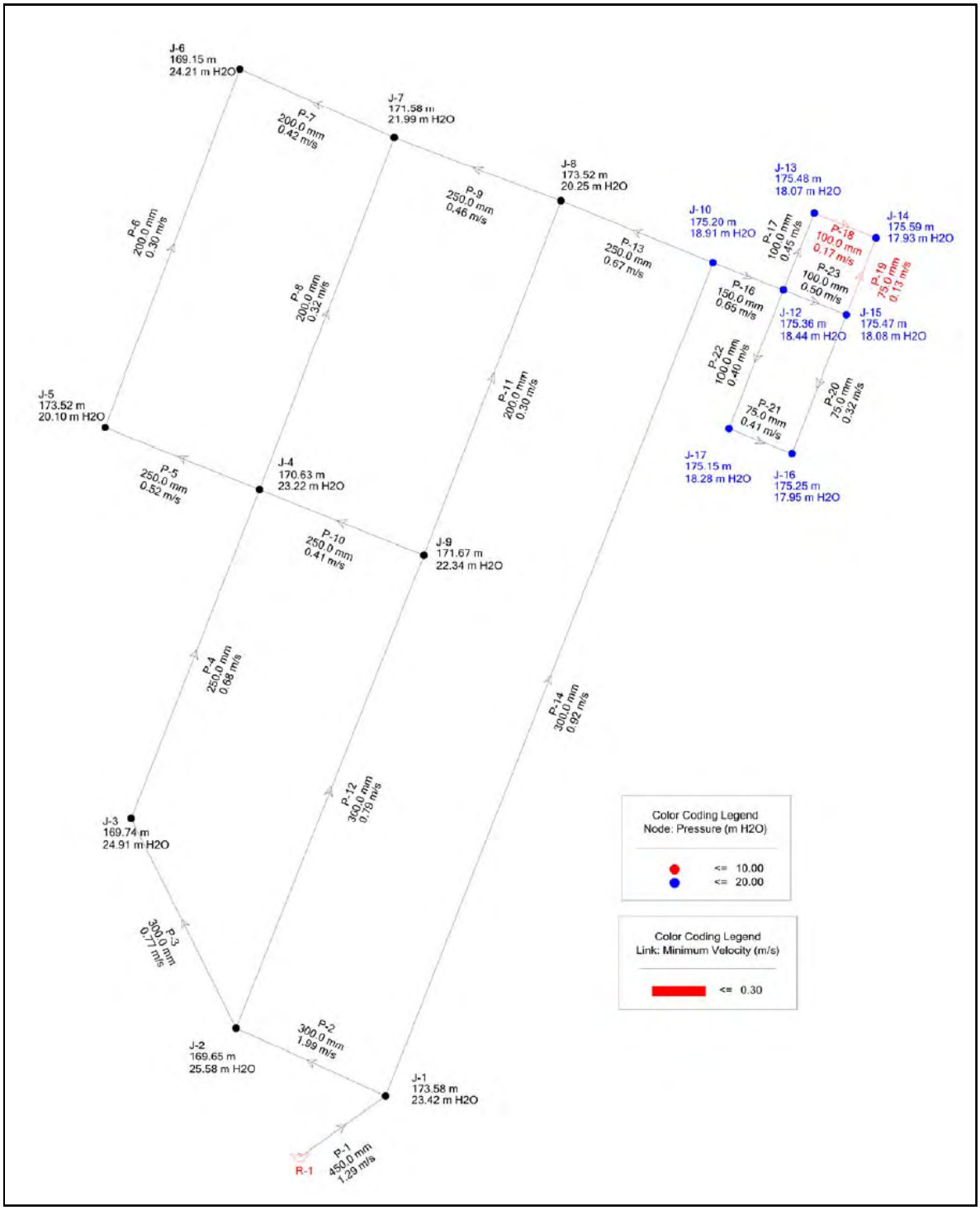
Formula Q=1/360xCxIxA; I=5835/(t + 65.4); Qi=A x 1/Mn x $R^{2/3}$ x $S^{1/2}$ (Manning)
Lo (m): 100 Return Period 2 Runoff Coefficient 0.85 Qi/Q 1.1-1.2
To (min) 5-10 Vmin. 0.8 m/s Vmax. 3 m/s

From Node	To Node	Length L (m)	Catchment Each Line (ha)	Catchment Relate d Line (ha)	Catchment Total A (ha)	Runoff co-efficient C	Concentration time Self T1 (min)	Concentration time Pass T2 (min)	Concentration time Tt (min)	Rainfall intensity I	Peak Flow Q (m3/s)	Open/Box Culvert Width b1 (m)	Open/Box Culvert Width b2 (m)	Open/Box Culvert Height H (m)	Sectional Area S (m2)	Wet perimeter S (m2)	Hydraulic Radius R (m)	Mannin g n	Hydraulic Gradient i (‰)	Ground Slope (‰)	Velocity V (m/s)	Flow Capacity Qi (m3/s)	Flow Ratio Qi/Q	Sewer: Ground elevation Up m	Ground elevation Down m	Top Level Up m	Top Level Down m	Invert Level Up m	Invert Level Down m	Soil Coverage depth Up m	Soil Coverage depth Down m
2	1	242	3.22		3.22	0.85	3.16	5.00	8.16	79.320	0.60	0.600	0.600	1.000	0.600	2.60	0.23	0.013	0.0078	0.0078	2.55	1.53	2.54	172.88	171.00	172.88	171.00	171.88	170.00	0.00	0.00
		242	3.22		3.22	0.85	3.16	5.00	8.16	79.320	0.60	0.600	0.600	1.000	0.600	2.60	0.23	0.013	0.0078	0.0078	2.55	1.53	2.54	172.88	171.00	172.88	171.00	171.88	170.00	0.00	0.00
1	3	552	7.36	3.22	10.58	0.85	13.33	5.00	18.33	69.687	1.74	1.500	1.500	1.000	1.500	3.50	0.43	0.013	0.0010	0.0010	1.38	2.07	1.19	171.00	170.45	171.00	170.45	170.00	169.45	0.00	0.00
		552	7.36	3.22	10.58	0.85	13.33	5.00	18.33	69.687	1.74	1.500	1.500	1.000	1.500	3.50	0.43	0.013	0.0010	0.0010	1.38	2.07	1.19	171.00	170.45	171.00	170.45	170.00	169.45	0.00	0.00
4	3	242	2.91		2.91	0.85	3.56	18.33	21.90	66.842	0.46	0.600	0.600	1.000	0.600	2.60	0.23	0.013	0.0061	0.0061	2.26	1.36	2.95	171.93	170.45	171.93	170.45	170.93	169.45	0.00	0.00
		242	2.91		2.91	0.85	3.56	18.33	21.90	66.842	0.46	0.600	0.600	1.000	0.600	2.60	0.23	0.013	0.0061	0.0061	2.26	1.36	2.95	171.93	170.45	171.93	170.45	170.93	169.45	0.00	0.00
3	RP1	280	2.74	13.49	16.23	0.85	6.75	21.90	28.65	62.045	2.38	1.500	1.500	1.000	1.500	3.50	0.43	0.013	0.0010	0.0010	1.38	4.15	1.74	170.45	170.17	169.95	169.67	168.95	168.67	0.50	0.50
		280	2.74	13.49	16.23	0.85	6.75	21.90	28.65	62.045	2.38	1.500	1.500	1.000	1.500	3.50	0.43	0.013	0.0010	0.0010	1.38	4.15	1.74	170.45	170.17	169.95	169.67	168.95	168.67	0.50	0.50
6	2	252	6.63		6.63	0.85	2.10	5.00	7.10	80.478	1.26	10.000	8.000	1.000	4.250	9.41	0.45	0.013	0.0078	0.0078	3.99	16.97	13.47	174.84	172.88	174.84	172.88	173.84	171.88	0.00	0.00
1Box	2	52		6.63	6.63	0.85	1.33	7.10	8.43	79.033	1.24	1.300	1.300	1.000	1.300	3.30	0.39	0.013	0.0010	0.0010	1.31	1.70	1.37	172.88	172.38	172.33	171.38	171.33	0.50	0.50	0.50
2	4	552	10.96	6.63	17.59	0.85	6.80	8.43	15.23	72.365	3.00	10.000	7.000	1.500	8.000	9.83	0.81	0.013	0.0016	0.0016	2.70	21.64	7.20	172.83	171.93	172.83	171.93	171.33	170.43	0.00	0.00
8	4	252	1.40		1.40	0.85	4.52	5.00	9.52	77.885	0.26	0.600	0.600	1.000	0.600	2.60	0.23	0.013	0.0041	0.0041	1.86	1.12	4.32	172.97	171.93	172.97	171.93	171.97	170.93	0.00	0.00
		252	1.40		1.40	0.85	4.52	5.00	9.52	77.885	0.26	0.600	0.600	1.000	0.600	2.60	0.23	0.013	0.0041	0.0041	1.86	1.12	4.32	172.97	171.93	172.97	171.93	171.97	170.93	0.00	0.00
2Box	4	52		20.39	20.39	0.85	1.13	15.23	16.36	71.364	3.44	2.000	2.000	1.000	2.000	4.00	0.50	0.013	0.0010	0.0010	1.53	6.13	1.78	171.93	171.43	171.38	170.43	170.38	0.50	0.50	0.50
4	5	508	17.21	20.39	37.60	0.85	6.10	16.36	22.47	66.408	5.90	10.000	7.000	1.500	8.000	9.83	0.81	0.013	0.0017	0.0017	2.78	22.20	3.77	171.93	171.06	171.93	171.06	170.43	169.56	0.00	0.00
5	10	367	10.85	37.60	48.45	0.85	4.67	22.47	27.14	63.057	7.21	10.000	7.000	1.500	8.000	9.83	0.81	0.013	0.0015	0.0015	2.62	20.96	2.91	171.06	170.50	171.06	170.50	169.56	169.00	0.00	0.00
7	6	220	5.74		5.74	0.85	1.84	5.00	6.84	80.775	1.09	10.000	8.000	1.000	4.250	9.41	0.45	0.013	0.0078	0.0078	3.99	16.96	15.50	176.55	174.84	176.55	174.84	175.55	173.84	0.00	0.00
1Box	6	52		5.74	5.74	0.85	1.13	6.84	7.97	79.530	1.08	2.000	2.000	1.000	2.000	4.00	0.50	0.013	0.0010	0.0010	1.53	3.06	2.84	174.84	174.79	174.34	174.29	173.34	173.29	0.50	0.50
6	8	542	14.54	5.74	20.28	0.85	4.59	7.97	12.56	74.851	3.58	10.000	7.000	1.500	8.000	9.83	0.81	0.013	0.0035	0.0035	3.94	31.51	8.79	174.84	172.97	174.84	172.97	173.34	171.47	0.00	0.00
2Box	8	52		20.28	20.28	0.85	1.05	12.56	13.61	73.852	3.54	2.500	2.500	1.000	2.500	4.50	0.56	0.013	0.0010	0.0010	1.64	8.22	2.32	172.97	172.92	172.47	172.42	171.47	171.42	0.50	0.50
8	10	717	53.73	20.28	74.01	0.85	6.14	13.61	19.75	68.529	11.98	10.000	7.000	1.500	8.000	9.83	0.81	0.013	0.0034	0.0034	3.89	31.15	2.60	172.92	170.50	172.92	170.50	171.42	169.00	0.00	0.00
9	10	191	3.53		3.53	0.85	0.62	5.00	5.62	82.162	0.68	10.000	7.000	1.500	8.000	9.83	0.81	0.013	0.0236	0.0236	10.29	82.35	120.31	175.00	170.50	175.00	170.50	173.50	169.00	0.00	0.00
2Box	10	100		125.99	125.99	0.85	1.52	52.5	54.02	48.861	14.53	4.000	4.000	1.500	6.000	7.00	0.86	0.013	0.0010	0.0000	2.19	26.34	1.81	170.50	170.50	170.00	169.90	168.50	168.40	0.50	0.60
2Box	RP2	150		125.99	125.99	0.85	2.28	54.0	56.30	47.947	14.26	4.000	4.000	1.500	6.000	7.00	0.86	0.013	0.0010	-0.0033	2.19	26.34	1.85	170.50	171.00	170.00	169.85	168.50	168.35	0.50	1.15
External Ditch																															
ED1		900										1.000	1.000																		
ED2		1550										1.000	1.000																		
ED3		1200										1.000	1.000																		
h1	h2	95	2.65		2.65	0.85	2.89	5.00	7.89	79.621	0.50	1.000	1.000	1.200	0.700	2.40	0.29	0.013	0.0011	0.0011	1.10	0.77	1.54	176.83	176.73	176.83	176.73	175.63	175.53	0.00	0.00
		95	2.65		2.65	0.85	2.89	5.00	7.89	79.621	0.50	1.000	1.000	1.200	0.700	2.40	0.29	0.013	0.0011	0.0011	1.10	0.77	1.54	176.83	176.73	176.83	176.73	175.63	175.53	0.00	0.00
h2	h4	117	2.71	2.65	5.36	0.85	3.29	7.89	11.18	76.197	0.97	1.000	1.000	1.500	1.000	3.00	0.33	0.013	0.0010	0.0010	1.18	1.18	1.23	176.73	176.61	176.73	176.61	175.23	175.11	0.00	0.00
h1	h3	117	2.67		2.67	0.85	3.60	5.00	8.60	78.852	0.50	1.000	1.000	1.200	0.700	2.40	0.29	0.013	0.0010	0.0010	1.08	0.76	1.53	176.83	176.71	176.83	176.71	175.63	175.51	0.00	0.00
h3	h4	95	0.32	2.67	2.98	0.85	2.78	8.60	11.38	75.993	0.54	1.000	1.000	1.300	0.800	2.60	0.31	0.013	0.0011	0.0011	1.14	0.91	1.70	176.71	176.61	176.71	176.61	175.41	175.31	0.00	0.00
		95	0.32	2.67	2.98	0.85	2.78	8.60	11.38	75.993	0.54	1.000	1.000	1.300	0.800	2.60	0.31	0.013	0.0011	0.0011	1.14	0.91	1.70	176.71	176.61	176.71	176.61	175.41	175.31	0.00	0.00
h4	h5	60	0.40	8.35	8.75	0.85	1.58	11.38	12.96	74.46	1.54	1.000	1.000	2.000	1.500	4.00	0.38	0.013	0.0010	0.0010	1.26	1.90	1.23	176.61	176.55	176.61	176.55	174.61	174.55	0.00	0.00
		60	0.40	8.35	8.75	0.85	1.58	11.38	12.96	74.46	1.54	1.000	1.000	2.000	1.500	4.00	0.38	0.013	0.0010	0.0010	1.26	1.90	1.23	176.61	176.55	176.61	176.55	174.61	174.55	0.00	0.00
h3	h6	215.5	5.31		5.31	0.85	6.01	5.00	11.01	76.359	0.96	1.000	1.000	1.550	1.050	3.10	0.34	0.013	0.0010	0.0010	1.19	1.25	1.31	176.71	176.49	176.71	176.49	175.16	174.94	0.00	0.00
		215.5	5.31		5.31	0.85	6.01	5.00	11.01	76.359	0.96	1.000	1.000	1.550	1.050	3.10	0.34	0.013	0.0010	0.0010	1.19	1.25	1.31	176.71	176.49	176.71	176.49	175.16	174.94	0.00	0.00
h6	h7	95	0.74	5.31	6.04	0.85	2.56	11.01	13.58	73.882	1.05	1.000	1.000	1.650	1.150	3.30	0.35	0.013	0.0011	0.0011	1.24	1.42	1.35	176.49	176.39	176.49	176.39	174.84	174.74	0.00	0.00
		95	0.74	5.31	6.04	0.85	2.56	11.01	13.58	73.882	1.05	1.000	1.000	1.650	1.150	3.30	0.35	0.013	0.0011	0.0011	1.24	1.42	1.35	176.49	176.39	176.49	176.39	174.84	174.74	0.00	0.00
h4	h7	215.5	0.54		0.54	0.85	7.65	5.00	12.85	74.566	0.10	0.800	0.800	0.800	0.240	1.40	0.17	0.013	0.0015	0.0015	0.91	0.22	2.31	176.71	176.39	176.71	176.39	175.91	175.59	0.00	0.00
		215.5	0.54		0.54	0.85	7.85	5.00	12.85	74.566	0.10	0.800	0.800	0.800	0.240	1.40	0.17	0.013	0.0015	0.0015	0.91	0.22	2.31	176.71	176.39	176.71	176.39	175.91	175.59	0.00	0.00
h7	h8	60	0.66	6.58	7.24	0.85	1.29	13.58	14.87	72.694	1.24	1.000	1.000	2.000	1.500	4.00	0.38	0.013	0.0015	0.0015	1.55	2.32	1.87	176.39	176.30	176.39	176.30	174.39	174.30	0.00	0.00
		60	0.66	6.58	7.24	0.85	1.29	13.58	14.87	72.694	1.24	1.000	1.000	2.000	1.500	4.00	0.38	0.013	0.0015	0.0015	1.55	2.32	1.87	176.39	176.30	176.39	176.30	174.39	174.30	0.00	0.00
External Ditch																															
ED4		230										0.800	0.800																		
ED5		500										0.800	0.800																		
ED6		230										1.000	1.000																		

Source: JICA Survey Team

2 Water Supply

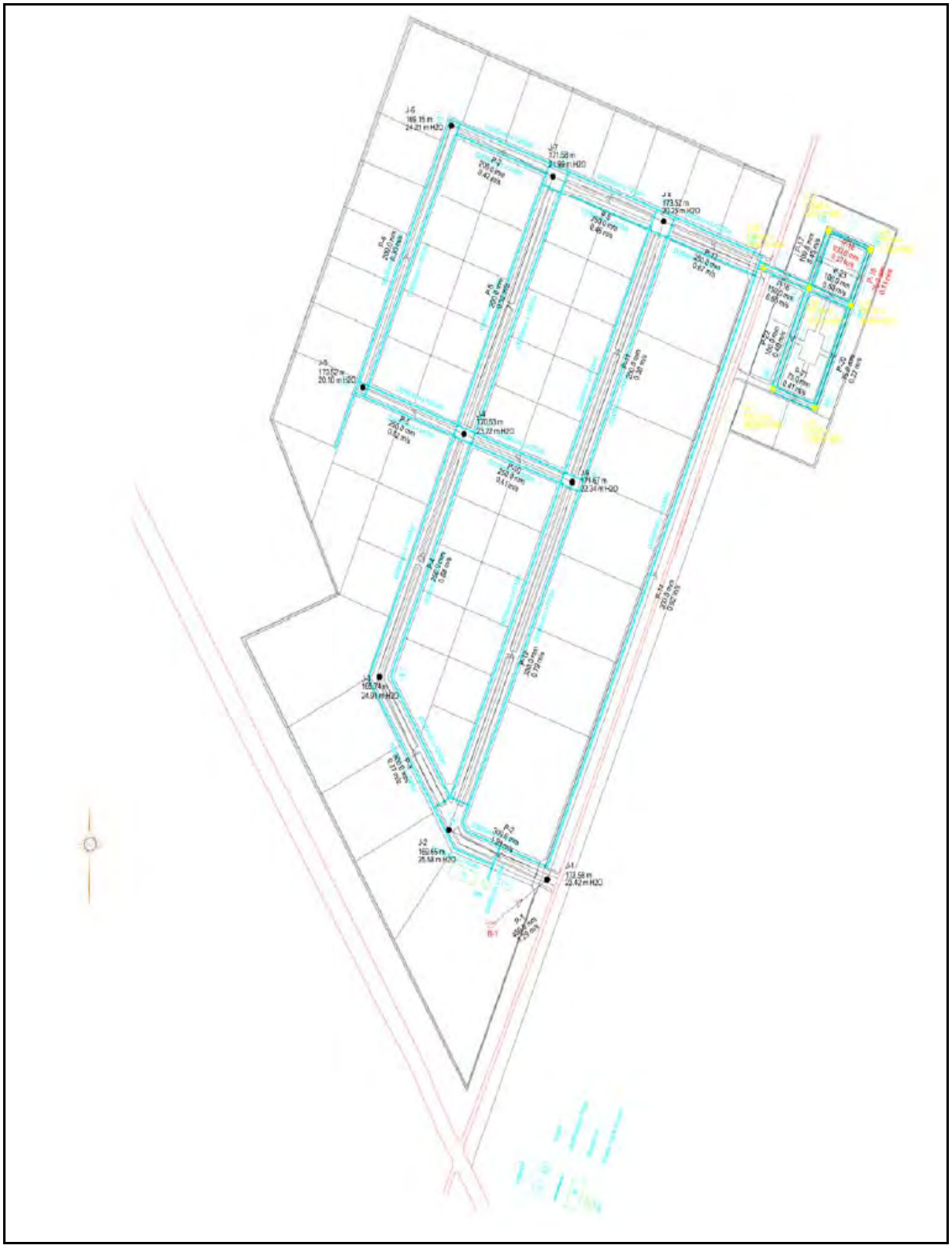
2.1 Junction Model



Source: JICA Survey Team

Figure III.4.1: Junction Model

2.2 Distribution Network Model



Source: JICA Survey Team

Figure III.4.2: Distribution Network Model

2.3 Hydraulic Analysis

(1) Hydraulic Analysis of Junctions

Table III.4.4: Hydraulic Analysis of Junctions

Label	Elveation	Zone	Type	Base Flow (l/s)	Pattern	Demand (Calculatedl) (l/s)	Calculated Hydraulic Grade (m)	Pressure (mH20)
J-1	173.58	Zone	Demand	0.00	Fixed	0.00	197.05	23.42
J-2	169.65	Zone	Demand	30.77	Fixed	30.77	195.28	25.58
J-3	169.74	Zone	Demand	20.58	Fixed	20.58	194.70	24.91
J-4	170.63	Zone	Demand	18.51	Fixed	18.51	193.89	23.22
J-5	173.52	Zone	Demand	15.84	Fixed	15.84	193.67	20.10
J-6	169.15	Zone	Demand	22.74	Fixed	22.74	193.41	24.21
J-9	171.67	Zone	Demand	25.87	Fixed	25.87	194.05	22.34
J-10	175.20	Zone	Demand	20.51	Fixed	20.51	194.15	18.91
J-12	175.36	Zone	Demand	0.83	Fixed	0.83	193.84	18.44
J-13	175.48	Zone	Demand	2.23	Fixed	2.23	193.59	18.07
J-14	175.59	Zone	Demand	1.92	Fixed	1.92	193.55	17.93
J-15	175.47	Zone	Demand	1.92	Fixed	1.92	193.59	18.08
J-16	175.25	Zone	Demand	3.23	Fixed	3.23	193.24	17.95
J-17	175.15	Zone	Demand	1.34	Fixed	1.34	193.47	18.28
J-7	171.58	Zone	Demand	19.61	Fixed	19.61	193.62	21.99
J-8	173.52	Zone	Demand	19.85	Fixed	19.85	193.81	20.25

Source: JICA Survey Team

(2) Hydraulic Analysis of Distribution Pipelines

Table III.4.5: Hydraulic Analysis of Distribution Pipelines

Label	Length (m)	Diameter (mm)	Material	HazenŒ Williams C	Check Valve	Minor Loss Coefficient	Control Status	Discharge (l/S)	Pstream Structure Hydraulic Grade (m)	Dewnstream structure Hydraulic Grade (m)	Pressure Pipe Hea dient (m)	Headloss Gradient (m/Km)	Velocity (m/s)
P-1	70.00	450	Dip	150	FALSE	0.00	Open	205.75	197.23	197.05	0.18	2.60	1.29
P-2	191.00	300	Dip	150	FALSE	0.00	Open	140.64	197.05	195.28	1.77	9.27	1.99
P-3	365.00	300	Dip	150	FALSE	0.00	Open	54.11	195.28	194.70	0.58	1.58	0.77
P-4	509.00	250	Dip	150	FALSE	0.00	Open	33.53	194.70	193.89	0.81	1.58	0.68
P-5	242.00	250	Dip	150	FALSE	0.00	Open	25.36	193.89	193.67	0.23	0.94	0.52
P-6	552.00	200	Dip	150	FALSE	0.00	Open	9.52	193.67	193.41	0.25	0.46	0.30
P-7	242.00	200	Dip	150	FALSE	0.00	Open	13.22	193.62	193.41	0.20	0.84	0.42
P-8	552.00	200	Dip	150	FALSE	0.00	Open	10.03	193.89	193.62	0.28	0.50	0.32
P-9	252.00	250	Dip	150	FALSE	0.00	Open	22.81	193.81	193.62	0.20	0.78	0.46
P-10	252.00	250	Dip	150	FALSE	0.00	Open	20.36	194.05	193.89	0.16	0.63	0.41
P-11	526.00	200	Dip	150	FALSE	0.00	Open	9.53	194.05	193.81	0.24	0.46	0.30
P-12	733.00	300	Dip	150	FALSE	0.00	Open	55.76	195.28	194.05	1.22	1.67	0.79
P-13	220.00	250	Dip	150	FALSE	0.00	Open	33.13	194.15	193.81	0.34	1.55	0.67
P-16	120.00	150	Dip	150	FALSE	0.00	Open	11.47	194.15	193.84	0.31	2.62	0.65
P-17	117.00	100	Dip	150	FALSE	0.00	Open	3.56	193.84	193.59	0.25	2.16	0.45
P-18	95.00	100	Dip	150	FALSE	0.00	Open	1.33	193.59	193.55	0.03	0.35	0.17
P-19	117.00	75	Dip	150	FALSE	0.00	Open	0.59	193.59	193.55	0.04	0.31	0.13
P-20	215.00	75	Dip	150	FALSE	0.00	Open	1.44	193.59	193.24	0.35	1.63	0.32
P-21	95.00	75	Dip	150	FALSE	0.00	Open	1.79	193.47	193.24	0.23	2.46	0.41
P-22	215.00	100	Dip	150	FALSE	0.00	Open	3.13	193.84	193.47	0.37	1.71	0.40
P-23	96.00	100	Dip	150	FALSE	0.00	Open	3.94	193.84	193.59	0.25	2.61	0.50
P-14	300.00	300	Dip	150	FALSE	0.00	Open	65.11	197.05	194.15	2.90	2.23	0.92

Source: JICA Survey Team

3 Sewerage System

3.1 Flow Rate of Pipelines for Centralized Sewerage Treatment System

Table III.4.6: Table of Flow Rate of Proposed Sewerage System

TABLE FLOW RATE OF PROPOSED SEWERAGE SYSTEM

Industrial Wastewater Flow		Domestic Wastewater Flow		Factor	
DAWF	0.93 l/s/ha	DAWF	1.66 l/s/ha	1.10	for Ground Water Influent
DMWF	1.07 l/s/ha	DMWF	2.20 l/s/ha	1.15	of DAWF
HMWF	1.34 l/s/ha	HMWF	2.74 l/s/ha	1.25	of DMWF

Formula	$Q=A \times 1/n \times R^{2/3} \times I^{1/2}$ (Manning)		
Min. Diameter of Pipe	200 mm	Q/Qi	more than 2.0
Minimum Velocity	0.6 m/s	Maximum Velocity	3.0 m/s

Line No. (Origin-End)	Area Each Line (ha)	Area Extension (ha)	Length Each Line (m)	Length Extension (m)	HMWF Qi (m3/s)	Pipe Diameter (m)	Pressured Pipe Diameter (m)	Pressured Pipe Pressure Height (m)	Sectional Area A (m2)	p (m)	Hydraulic Radius R (m)	E.L. of Ground Origin (m)	E.L. of Ground End (m)	E.L. of Pipe Bottom Origin (m)	E.L. of Pipe Bottom End (m)	Hydraulic Gradient I	n	Velocity V (m/s)	Flow Capacity Q (m3/s)	Q/Qi
Industrial Area																				
2-1	2.850	2.850	242	242	0.00381	0.20			0.03	0.63	0.05	172.88	171.00	171.18	170.33	0.0035	0.013	0.62	0.01939	5.09
	2.850	2.850	242	242	0.00381	0.20			0.03	0.63	0.05	172.88	171.00	171.18	170.33	0.0035	0.013	0.62	0.01939	5.09
1-5	6.480	9.330	552	794	0.01247	0.25			0.05	0.79	0.06	171.00	170.45	170.33	168.40	0.0035	0.013	0.72	0.03516	2.82
	6.480	9.330	552	794	0.01247	0.25			0.05	0.79	0.06	171.00	170.45	170.33	168.40	0.0035	0.013	0.72	0.03516	2.82
5-6	2.690	12.020	241	1,035	0.01606	0.25			0.05	0.79	0.06	170.45	171.93	168.40	167.68	0.0030	0.013	0.66	0.03256	2.03
	2.690	12.020	241	1,035	0.01606	0.25			0.05	0.79	0.06	170.45	171.93	168.40	167.68	0.0030	0.013	0.66	0.03256	2.03
3-2	2.300	2.300	252	252	0.00307	0.20			0.03	0.63	0.05	174.84	172.88	173.14	172.26	0.0035	0.013	0.62	0.01939	6.31
	2.300	2.300	252	252	0.00307	0.20			0.03	0.63	0.05	174.84	172.88	173.14	172.26	0.0035	0.013	0.62	0.01939	6.31
2-6	4.050	6.350	552	804	0.00849	0.30			0.07	0.94	0.08	172.88	171.93	172.26	170.60	0.0030	0.013	0.75	0.05294	6.24
	4.050	6.350	552	804	0.00849	0.30			0.07	0.94	0.08	171.93	171.93	172.26	170.60	0.0030	0.013	0.75	0.05294	6.24
7-6	1.000	1.000	252	252	0.00134	0.20			0.03	0.63	0.05	172.97	171.93	171.27	170.39	0.0035	0.013	0.62	0.01939	14.51
	1.000	1.000	252	252	0.00134	0.20			0.03	0.63	0.05	172.97	171.93	171.27	170.39	0.0035	0.013	0.62	0.01939	14.51
6-8	4.930	24.300	508	2,599	0.03247	0.35			0.10	1.10	0.09	171.93	171.06	167.68	165.90	0.0035	0.013	0.90	0.08625	2.66
	4.930	24.300	508	2,599	0.03247	0.35			0.10	1.10	0.09	171.93	171.06	167.68	165.90	0.0035	0.013	0.90	0.08625	2.66
8-9	5.890	30.190	367	2,966	0.04034	0.35			0.10	1.10	0.09	171.06	171.00	165.90	164.80	0.0030	0.013	0.83	0.07985	1.98
	5.890	30.190	367	2,966	0.04034	0.35			0.10	1.10	0.09	171.06	171.00	165.90	164.80	0.0030	0.013	0.83	0.07985	1.98
4-3	2.665	2.665	220	220	0.00356	0.20			0.03	0.63	0.05	176.55	174.84	174.85	174.08	0.0035	0.013	0.62	0.01939	5.45
	2.665	2.665	220	220	0.00356	0.20			0.03	0.63	0.05	176.55	174.84	174.85	174.08	0.0035	0.013	0.62	0.01939	5.45
3-7	5.865	8.530	542	762	0.01140	0.25			0.05	0.79	0.06	174.84	172.97	174.08	172.18	0.0035	0.013	0.72	0.03516	3.08
	5.865	8.530	542	762	0.01140	0.25			0.05	0.79	0.06	174.84	172.97	174.08	172.18	0.0035	0.013	0.72	0.03516	3.08
7-9	8.220	16.750	733	1,495	0.02238	0.30			0.07	0.94	0.08	172.97	171.00	171.27	168.70	0.0035	0.013	0.81	0.05718	2.55
	8.220	16.750	733	1,495	0.02238	0.30			0.07	0.94	0.08	172.97	171.00	171.27	168.70	0.0035	0.013	0.81	0.05718	2.55
10-9	2.535	2.535	191	191	0.00339	0.20			0.03	0.63	0.05	175.00	171.00	173.30	169.30	0.0209	0.013	1.51	0.04744	14.00
9-9'-PS1		96.415	191	9,304	0.12884	0.50			0.20	1.57	0.13	171.00	171.00	164.80	164.13	0.0035	0.013	1.14	0.22328	1.73
PS1-MH1 (Pressure Pipe: DIP)		96.415	2,200	2,200	0.12884							171.00	176.30	164.13	174.80				0.17189	1.33
PS1-MH1 Line.1		48.208	1,100	1,100	0.06442		0.25	23.00	0.05	0.79	0.06			164.13	174.80	0.0209	0.013	1.75	0.08595	1.33
PS1-MH1 Line.2		48.208	1,100	1,100	0.06442		0.25	23.00	0.05	0.79	0.06			164.13	174.80	0.0209	0.013	1.75	0.08595	1.33
MH1-WWTP			217	217	0.12884	0.50			0.20	1.57	0.13	176.30	176.49	174.30	173.54	0.0035	0.013	1.14	0.22328	1.73
Housing Area																				
h2-h1	0.119	0.119	48	48	0.00033	0.20			0.03	0.63	0.05	176.78	176.73	175.08	174.89	0.0040	0.013	0.66	0.02073	63.72
	0.119	0.119	48	48	0.00033	0.20			0.03	0.63	0.05	176.78	176.73	175.08	174.89	0.0040	0.013	0.66	0.02073	63.72
h1-h4	0.344	0.463	117	165	0.00127	0.20			0.03	0.63	0.05	176.73	176.61	174.89	174.23	0.0040	0.013	0.66	0.02073	16.35
	0.344	0.463	117	165	0.00127	0.20			0.03	0.63	0.05	176.73	176.61	174.89	174.23	0.0040	0.013	0.66	0.02073	16.35
h5-h4	0.108	0.108	48	48	0.00029	0.20			0.03	0.63	0.05	176.66	176.61	174.96	174.75	0.0045	0.013	0.70	0.02199	74.66
	0.215	0.215	48	48	0.00059	0.20			0.03	0.63	0.05	176.66	176.61	174.96	174.77	0.0040	0.013	0.66	0.02073	35.19
h4-h7	0.990	1.560	216	428	0.00428	0.20			0.03	0.63	0.05	176.61	176.39	174.75	173.88	0.0040	0.013	0.66	0.02073	4.85
	0.990	1.668	216	428	0.00457	0.20			0.03	0.63	0.05	176.61	176.39	174.77	173.91	0.0040	0.013	0.66	0.02073	4.54
h7-h8	0.135	1.695	48	475	0.00464	0.20			0.03	0.63	0.05	176.39	176.44	173.88	173.69	0.0040	0.013	0.66	0.02073	4.46
	0.135	1.803	48	475	0.00494	0.20			0.03	0.63	0.05	176.39	176.44	173.91	173.72	0.0040	0.013	0.66	0.02073	4.20
h2-h3	0.119	0.119	48	48	0.00033	0.20			0.03	0.63	0.05	176.78	176.83	175.08	174.89	0.0040	0.013	0.66	0.02073	63.72
	0.119	0.119	48	48	0.00033	0.20			0.03	0.63	0.05	176.78	176.83	175.08	174.89	0.0040	0.013	0.66	0.02073	63.72
h3-h6	0.403	0.521	117	165	0.00143	0.20			0.03	0.63	0.05	176.83	176.71	174.89	174.23	0.0040	0.013	0.66	0.02073	14.51
	0.403	0.521	117	165	0.00143	0.20			0.03	0.63	0.05	176.83	176.71	174.89	174.23	0.0040	0.013	0.66	0.02073	14.51
h5-h6	0.113	0.113	48	48	0.00031	0.20			0.03	0.63	0.05	176.66	176.71	174.96	174.77	0.0040	0.013	0.66	0.02073	67.26
	0.113	0.113	48	48	0.00031	0.20			0.03	0.63	0.05	176.66	176.71	174.96	174.75	0.0045	0.013	0.70	0.02199	71.34
h6-h9	0.665	1.299	216	428	0.00356	0.20			0.03	0.63	0.05	176.71	176.49	174.77	173.91	0.0040	0.013	0.66	0.02073	5.82
	0.665	1.299	216	428	0.00356	0.20			0.03	0.63	0.05	176.71	176.49	174.75	173.88	0.0040	0.013	0.66	0.02073	5.82
h9-h8	0.073	1.372	48	475	0.00376	0.20			0.03	0.63	0.05	176.49	176.44	173.91	173.72	0.0040	0.013	0.66	0.02073	5.52
	0.073	1.372	48	475	0.00376	0.20			0.03	0.63	0.05	176.49	176.44	173.88	173.69	0.0040	0.013	0.66	0.02073	5.52
h8-WWTP		6.242	50	1,950	0.01710	0.30			0.07	0.94	0.08	176.44	176.49	173.72	173.59	0.0025	0.013	0.68	0.04833	2.83

Source: JICA Survey Team

3.2 Wastewater Treatment Plant

(1) Centralized Wastewater Treatment Plant

Table III.4.7: Centralized Wastewater Treatment Plant

SUMMARY ON PROPOSED FACILITIES OF WASTEWATER TREATMENT PLANT
(CONVENTIONAL ACTIVATED SLUDGE PROCESS WITH DEWATERING FACILITIES)

Item	Genral Plan for WWTP of Stage 1			Construction Plan for WWTP of Stage 1				
	Phase I	Phase II	Total	WWTP No.1		WWTP No.2		Total
Area (ha)	70	70	140	70		70		140
Future Population	3,750	3,750	7,500					
-Resident	3,000	3,000	6,000					
-Non-resident	750	750	1,500					
Future Population Dencity (person /ha)	53.6	53.6	53.6					
Daily Ave. Wastewater Flow: DAWF (m3/d)	4,241	4,241	8,481	4,241		4,241		8,481
- Domestic	360	360	720					
- Industrial	3,881	3,881	7,761					
Daily Max. Wastewater Flow: DMWF (m3/d)	4,866	4,866	9,731	4,866		4,866		9,731
Hourly Max. Wastewater Flow: HMWF (m3/d)	6,082	6,082	12,164	6,082		6,082		12,164
Unit Pollutant Load								
- Domestic (g/c/d)	40	40	40	40		40		
- Industrial (mg/l of BOD)	200	200	200	200		200		
Future Pollutant Load (kg/d)	896	896	1,792	896		896		1,792
- Domestic	120	120	240					
- Industrial	776	776	1,552					
Raw Wastewater Quality (BOD:mg/l)	211	211	211	211		211		
(SS:mg/l)	264	264	264	264		264		
Proposed Removal	90	90	90	90		90		
Efficiency of BOD (%)	86	86	86	86		86		
Treated Wastewater Quality (BOD:mg/l)	30	30	30	30		30		
0. Inlet Tank Number (unit)	1	1	2	1				
Sectinal Area (m2)	0.23	0.23	0.47	0.5				
Effective Depth (m)	0.50	0.50		0.50				
Length (m)	1.30	1.30		3.50				
Width (m)	0.47	0.47		1.00				
1.Grit Chamber								
1.1 Number (Unit)	2	2	4	2		2		4
1.2 Surface Area (m2)	2.70	2.70	5.41	1.35	1.35	1.35	1.35	5.40
1.3 Size (m) Effective Depth	0.50	0.50	0.50	0.50	0.50	0.50	0.50	
Width	0.19	0.19	0.38	0.50	0.50	0.50	0.50	
Length	14.40	14.40	14.40	2.70	2.70	2.70	2.70	
1.4 Primary Aeration Tank (unit)	1	1	2	1		1		2
Required Volume (m3)	84.47	84.47	168.94	98.18		98.18		196
Effective Depth (m)	0.60	0.60	0.60	0.70		0.70		
Length (m)	12.80	12.80	25.60	11.00		11.00		
Width (m)	11.00	11.00	11.00	12.75		12.75		
Produced Sludge (m3)	0.05	0.05	0.11	0.05		0.05		0.11
2.Primary Settling Tank								
Necessary Volume (m3)	304	304	608	200	200	200	200	800
Necessary surface area (m2)	122	122	243	63	63	63	63	250
2.1 Number (Unit)	1.1	1.1	2.2	2		2		4
2.2 Size (m)								
Effective Depth	3.00	3.00	3.00	3.20	3.20	3.20	3.20	
Length				10.00	10.00	10.00	10.00	
Diameter/Width	12.00	12.00	12.00	6.25	6.25	6.25	6.25	
3.Aeration Tank								
3.1 Required Number (Unit)	2.1	2.1	4.19	2		2		4
3.2 Size (m)	1,419	1,419	2,838	713	713	713	713	2,850
Effective Depth	2.80	2.80	2.80	3.00	3.00	3.00	3.00	
Width	6.25	6.25	6.25	6.25	6.25	6.25	6.25	
Length	38.75	38.75	38.75	38.00	38.00	38.00	38.00	
4.Settling Tank								
Necessary Volume	507	507	1,014	278	278	278	278	1,113
Necessary surface area	195	195	389	99	99	99	99	397
4.1 Number (Unit)	2.2	2.2	4.5	2		2		4
4.2 Size (m)								
Effective Depth	2.60	2.60	2.60	2.80	2.80	2.80	2.80	
Diameter	10.50	10.50	10.50	11.25	11.25	11.25	11.25	
5. Designed Sludge (m3/d)	137	137	275	137		137		275
6. Chlorination Tank								
Necessary Volume	51	51	101	26	26	26	26	104
6.1 Number (Unit)	2.1	2.1	4.2	2		2		4
6.2 Size (m)								
Effective Depth	2.4	2.4	2.4	2.6	2.6	2.6	2.6	
Width	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Length	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
7.Thickener								
Necessary Volume	1,414	1,414	2,827	1,269		1,269		2,537
Necessary surface area	85	85	170	298.5		298.5		597
7.1 Number (Unit)	1.4	1.4	2.7	1		1		2
7.2 Size (m)								
Depth	3.50	3.50	3.50	4.25		4.25		
Diameter	19.50	19.50	19.50	19.50		19.50		
8.Thickened Sludge (m3/d)	38	38	77	38		38		77
10. Excess Sludge (m3/d)	12	12	23	12		12		23
Solid Volume of 95% (ton/d)	0.58	0.58	1.15	0.58		0.58		1.15
11.Area of Facilities (m2)	1,389	1,389	2,779	1,261		1,257		2,518
12.Dewatering Facilities								
(1) Number of Beltpress Filter (Unit)	0.6	0.6	1.3	1		1		2
(Filter: Cap=150kg/m/h/Unit, OH=6h/d)								
(2) Effective Width per Filter (m)	1.0	1.0	1.0	1.0		1.0		
(3) Water Content (%)	76	76	76	76		76		
(4) Dopant Ratio of Polymer Coagulant (%)	0.8	0.8	0.8	0.8		0.8		
13. Administrative Buiding: Area (m2)	480.0		480.0	480.0				480.0
13.1 Operation/Blower/Power Receiving Room	10x15							
13.2 Office & Laboratory	7x15							
13.3 Chemical Mixing Room	5x15							
13.4 Dewatering Room	10x15							
13.5 Size of Area (m)								
Width	15.00		15.00	15.00				15.00
Length	32.00		32.00	32.00				32.00
14.Dewatered Sludge (m3/d)	2.4	2.4	4.8	2.4		2.4		4.8
15.Required Area (m2)	4,000	3,000	7,000	4,000		3,000		7,000

Source: JICA Survey Team

(2) Communal Combined-Type Septic Tank (Cast-in-Place Reinforced Concrete)

Table III.4.8: Communal Combined-Type Septic Tank (Cast-in-Place Reinforced Concrete)

SUMMARY ON PROPOSED FACILITIES OF Domestic WASTEWATER TREATMENT Tank
(Septic Tank)

Item	Genral Plan for Septic Tank of Stage 1			Construction Plan for Septic Tank of Stage 1		
	Phase I	Phase II	Total	Septic Tank No.1	Septic Tank No.2	Total
Area (ha)	2.5	2.5	5.0	2.5	2.5	5.0
Future Population (Resident)	3,000	3,000	6,000	3,000	3,000	6,000
Future Population Dencity (person /ha)	1,197.6	1,197.6	1,197.6			
Daily Ave. Wastewater Flow: DAWF (m3/d)	360	360	720	360	360	720
Daily Max. Wastewater Flow: DMWF (m3/d)	475	475	950	475	475	950
Hourly Max. Wastewater Flow: HMWF (m3/d)	618	618	1,236	618	618	1,236
Unit Pollutant Load						
- Domestic (g/c/d)	40	40	40	40	40	
- Commercial (mg/l of BOD)	100	100	100	100	100	
- Industrial (mg/l of BOD)	200	200	200	200	200	
Domestic Future Pollutant Load (kg/d)	120	120	240	120	120	
Specific Yield (m3/d/ha)	47.90	47.90	47.90			
Specific Load (kg/d/ha)	47.90	47.90	47.90			
Raw Wastewater Quality (BOD:mg/l)	333	333	333	333	333	
(SS:mg/l)	417	417	417	417	417	
Proposed Removal	85	85	85	85	85	
Efficiency of BOD (%)	80	80	80	80	80	
Treated Wastewater Quality (BOD:mg/l)	20	20	20	20	20	
1.Grit Chamber						
1.1 Number (Unit)	1	1	2	2	2	4
1.2 Surface Area (m2)	0.26	0.26	0.53	0.60	0.60	1.20
1.3 Size (m) Effective Depth	0.30	0.30	0.30	0.30	0.30	
Width	0.02	0.02	0.04	0.30	0.30	
Length	14.40	14.40	14.40	1.00	1.00	
2. Regulating Tank (Unit)	1	1	2	1	1	2
Required Volume (m3)	79.20	79.20	158.40	80.64	80.64	161
Effective Depth (m)	0.60	0.60	0.60	0.60	0.60	
Length (m)	15.71	15.71	31.43	16.00	16.00	
Width (m)	8.40	8.40	8.40	8.40	8.40	
Produced Sludge (m3)	0.006	0.006	0.012	0.006	0.006	0.012
3.Aeration Tank						
3.1 Required Number (Unit)	1.98	1.98	3.96	2	2	4
3.2 Size (m)						
Effective Depth	2.50	2.50	2.50	2.50	2.50	
Width	4.00	4.00	4.00	4.10	4.10	
Length	16.00	16.00	16.00	16.00	16.00	
4.Settling Tank						
Necessary Volume (m3)	50	50	99	77	77	155
Necessary surface area (m2)	19	19	38	34	34	67
4.1 Number (Unit)	1.2	1.2	2.5	2	2	4
4.2 Size (m)						
Effective Depth	2.30	2.30	2.30	2.30	2.30	
Width	3.90	3.90	3.90	4.10	4.10	
Length	3.90	3.90	3.90	4.10	4.10	
5. Designed Sludge (m3/d)	23	23	45	23	23	45
6. Chlorination Tank						
Necessary Volume	5	5	10	8	8	16
6.1 Number (Unit)	0.2	0.2	0.4	1	1	2
6.2 Size (m)						
Effective Depth	2.4	2.4	2.4	1.5	1.5	
Width	2.0	2.0	2.0	0.7	0.7	
Length	5.0	5.0	5.0	7.5	7.5	
7.Thickener						
Necessary Volume	120	120	240	129	129	259
Necessary surface area	7	7	14	56.3	56.3	113
7.1 Number (Unit)	0.8	0.8	1.6	1	1	2
7.2 Size (m)						
Effective Depth	2.30	2.30	2.30	2.30	2.30	
Width	8.00	8.00	8.00	7.50	7.50	
Length	8.00	8.00	8.00	7.50	7.50	
8.Thickened Sludge (m3/d)	6	6	13	6	6	13
10. Excess Sludge (m3/d)	1.9	1.9	3.8	1.9	1.9	3.8
Solid Volume of 95% (ton/d)	0.10	0.10	0.19	0.10	0.10	0.19
11.Area of Facilities (m2)	332	332	664	361	361	721
13.1 Operation/Blower/Power Receiving Room	100.0		100.0	100.0		100
Width (m)	10.00		10.00	10.00		10.00
Length (m)	10.00		10.00	10.00		10.00
14.Required Area (m2)	900	700	1,600	1,000	800	1,700

Source: JICA Survey Team

APPENDIX III.5 INTERESTS OF JAPANESE ENTERPRISES IN VIP

In order to preliminarily identify Japanese enterprises interested in VIP, the JICA Survey Team conducted an interview survey during the period of February to March 2010. The survey results are shown in Table III.5.1 and summarized as follows:

1) Ten out of 43 interviewed enterprises expressed interest in VIP as location for their factory. Considering that the VIP project is at the feasibility study stage, such rate of interest in VIP is relatively high. If the project develops in the direction of realization, more enterprises are expected to express interest in building factories in VIP.

2) Relatively high levels of interest in VIP were shown by the metal working and non-ferrous metal enterprises. On the other hand, there are no apparel enterprises interested in VIP, such industry is currently the largest manufacturing industry in the Lao PDR.

3) The timing of investment varies from one enterprise to another. It seems to depend on each business strategy, market environment of each products, employment situation and labor cost levels around the existing factories of each enterprise, situation in the neighboring countries, and so forth. If the completion of VIP project is too delayed for an enterprise, it will be obliged to choose other locations for its factory. In addition, an enterprise may call off or suspend the investment project in response to the changing situations. Therefore, the management body of VIP needs to maintain communication with the potential investors, and do the best it can to meet the investors' demands.

Table III.5.1: Results of Survey to Determine Levels of Interests in VIP

	No. of Enterprises
1. Number of interviewed Japanese enterprises	43
2. Number of enterprises interested in VIP	10
Metal working and non-ferrous metal	*(4)*
Electric parts	*(2)*
Textile	*(2)*
Food processing	*(1)*
Information and Communications Technology (ICT)	*(1)*

Source: JICA Survey Team

APPENDIX III.6 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS ON VIZ

1 Environmental and Social Consideration for VIZ Development

The draft environmental and social impact assessment (ESIA) report and the preliminary resettlement action plan (RAP) for VIP (Stage1) with an area of 140 ha and the target year 2015, were prepared in this Survey. ESIA reports and RAPs for VIP Stage 2 and Stage 3 shall be prepared in parallel with the future feasibility studies. The ESIA and RAP as well as the infrastructure development plan prepared in this survey shall be referred to in ESIA reports and RAPs, to be prepared during Stage 2 and Stage 3.

The major conceivable impacts by the VIP development Stage 2 and Stage 3 are as follows:

(1) Involuntary resettlement

According to interviews from district offices and village authorities, the VIZ area belongs to 13 villages and its present population is presented in Table III.6.1. Although it could be judged that the location of VIZ is selected so as to avoid and mitigate involuntary resettlement as much as possible, relocation of 30 households and 119 persons assumed to be residing at present will be inevitable. Therefore, RAP must be prepared subject to strict compliance with relevant legislations.

Table III.6.1: Present Population in VIZ and Affected Villages

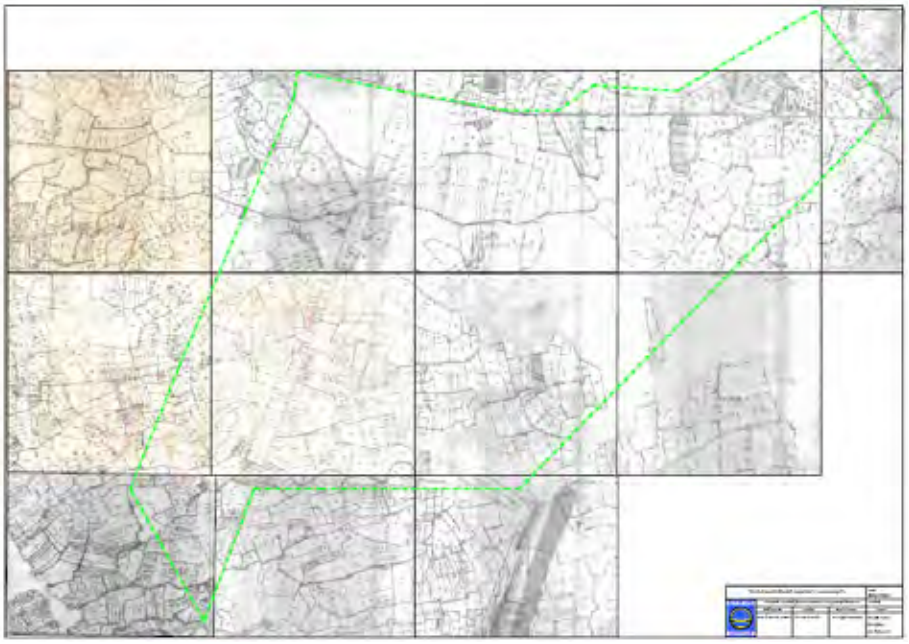
District	Village	Within VIZ Area		Total				
		Population	Household	Population	Household	Family	Male	Female
Saythany	Saphakhanong	0	0	77	80	403	193	210
	Khoksa-ad	0	0	236	237	1,228	612	616
	Huaxieng	0	0	447	441	2,161	1,120	1,041
	Sanghuabor	0	0	459	139	781	367	414
	Sangkhone	0	0	65	67	352	173	179
Saysetha	Xokyei	8	2	329	305	1,425	711	714
	Xoknoi	64	18	431	395	1,903	971	932
	Phongthong	36	8	176	137	850	438	412
	Nabien	11	2	133	130	591	306	285
	Dungyei	0	0	101	99	527	261	266
	Dungkang	0	0	125	134	658	314	344
	Nahei	0	0	147	138	637	318	319
	Nano	0	0	218	223	1,072	517	555
Total		119	30	2,944	2,525	12,588	6,301	6,287

Source: Interviewing from district offices and village authorities conducted by JICA Survey Team in Nov. 2009.

(2) Land acquisition and compensation

The land register map in VIZ was prepared by Public Works and Transportation Institute (PTI) as shown in Figure III.6.1. The number of land pieces as well as their size distribution was preliminarily

analyzed as shown in Figure III.6.2 and Table III.6.2, though the land register map prepared by PTI. It covers only about 1,945 ha of VIZ.

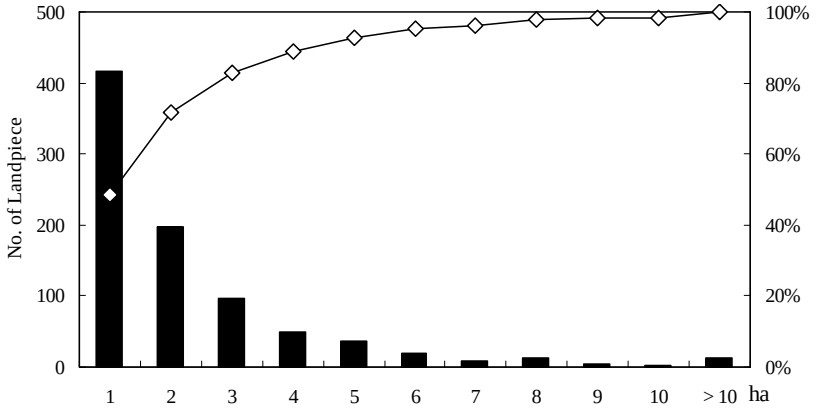


Source: Public Works and Transportation Institute (2009)

Figure III.6.1: Land Register Map in VIZ

There are 859 land pieces identified in VIZ area (1,945 ha) and most of these were subdivided. The average size of land pieces was 2.27 ha and the median size was 1.05 ha as shown in Table III.6.2. More than 400 of the land pieces are smaller than 1 ha as shown in Figure III.6.2.

Therefore, it is assumed that there are a lot of land owners in VIZ. The land acquisition and compensation procedures for VIP development Stage 2 and Stage 3 must be implemented subject to intensive consultations with land owners as well as fair and appropriate compensation amount.



Source: JICA Survey Team

Figure III.6.2: Size Distribution of Land Pieces in VIZ

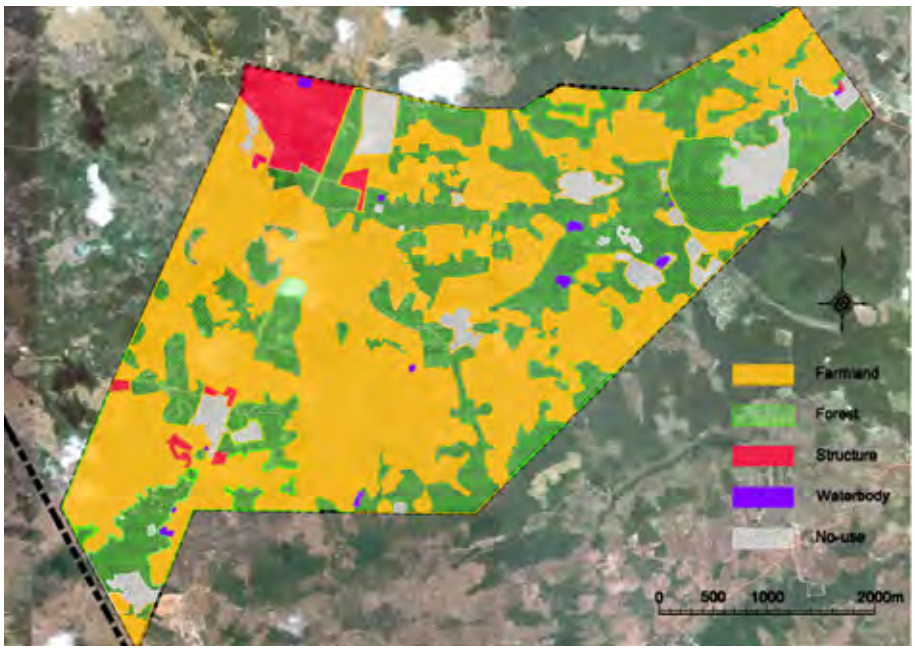
Table III.6.2: Characteristics of Land Ownership in VIZ

Number of Land Piece (-)	859
Average Size (ha)	2.27
Median Side (ha)	1.05
Maximum Size (ha)	229.50
Minimum Size (ha)	0.1

Source: JICA Survey Team

(3) Flora, fauna and biodiversity

The present vegetation in VIZ was prepared by analyzing aerial photographs as presented in Figure III.6.2 and its composition is shown in Table A.III.6.3. The 815 ha forest area and the 1065 ha paddy field would disappear and would be converted to an industrial area. Although the forest area in VIZ is assumed to be degraded forest, scrub and/or bush in general, flora and fauna condition in VIZ area should be studied in detail. Then, mitigation and compensation measures such as creating greenery areas in VIZ should be considered.



Source: JICA Survey Team

Figure III.6.2: Present Vegetation in VIZ

Table III.6.3: Composition of Vegetation in the Project Area Before and After the Project

Composition	Area (ha)	Proportion (%)
Forest	815	39.2
Paddy Field	1,065	51.2
Non-productive area	113	5.4
Structures (Residential/Industrial area)	81	3.9
Water Body (Pond)	6	0.3
Total	2,080	100.0

Source: JICA Survey Team

2 Environmental and Social Considerations for Vientiane Capital Master Plan

The VIP development will cause extensive impact on national and local economies as well as environmental condition in its surrounding area. Although required urban functions such as residential, commercial and amenity areas are initially integrated in VIP, there is a possibility that urban sprawl will occur in the surrounding area with the development of VIP as well as other infrastructure development such as the construction of 450 Year Road, expansion of District Road No.108, etc. Besides, expected increase of transportation in the area might affect the surrounding environment such as causing air and noise pollution.

These current situations of rapid development in the suburban area of Vientiane Capital must be well managed and controlled by the Vientiane Capital Master Plan which will be revised in 2010 with technical assistance by JICA. The land use zoning plan, including protection area management plan, should be examined and necessary regulatory measures should be set up.

APPENDIX III.7 ENVIRONMENTAL CHECKLISTS BY FORMER JBIC GUIDELINES FOR CONFIRMATION OF ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
1 Permits and Explanation	(1) EIA and Environmental Permits	① Have EIA reports been officially completed? ② Have EIA reports been approved by authorities of the host country's government? ③ Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? ④ In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	① Draft EIA report was prepared in the JICA Survey. ② MOIC will finalize the Draft EIA report and will make an application to WREA. ③ EIA report is not applied to WREA at this stage. ④ Preliminary RAP was prepared in the JICA Survey. MOIC will finalize the Preliminary RAP and will make an application to WREA.
	(2) Explanation to the Public	① Are contents of the project and the potential impacts adequately explained to the public based on appropriate procedures, including information disclosure? Is understanding obtained from the public? ② Are proper responses made to comments from the public and regulatory authorities?	① 3 stakeholder meetings were held in the course of the JICA Study. Besides, villages consultations for 4 affected villages were held. ② The comments raised in above mentioned meetings and consultations were adequately reflected into EIA/RAP.
2 Mitigation Measures	(1) Air Quality	① Do air pollutants, (such as sulfur oxides (SOx), nitrogen oxides (NOx), and soot and dust) emitted from the proposed infrastructure facilities and ancillary facilities comply with the country's emission standards and ambient air quality standards?	① Environmental impact forecast on air pollution caused by vehicle transportation in operation phase was conducted and it was judged that ambient air quality in the surrounding area will satisfy the related environmental quality standards. Besides, air pollution caused by tenant industries will be well controlled and managed according to the "Internal Regulation on Environmental Management for VIP."
	(2) Water Quality	① Do effluents or leachates from various facilities, such as infrastructure facilities and the ancillary facilities comply with the country's effluent standards and ambient water quality standards?	① Wastewater from residential area will be treated by Johkaso and will be discharged with the water quality satisfying the related effluent standards. Wastewater from tenant industries will be well controlled and managed according to the "Internal Regulation on Environmental Management for VIP."
	(3) Wastes	① Are wastes from the infrastructure facilities and ancillary facilities properly treated and disposed of in accordance with the country's standards?	① Solid waste discharged from VIP will be adequately treated and disposed according to the solid waste management plan for VIP.

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
2 Mitigation Measures (continued)	(4) Soil Contamination	① Are adequate measures taken to prevent contamination of soil and groundwater by the effluents or leachates from the infrastructure facilities and the ancillary facilities?	① Wastewater and solid waste discharged from VIP will be adequately treated and disposed according to the wastewater treatment plan and solid waste management plan for VIP. Therefore, soil and/or groundwater contamination by the project will not occur.
	(5) Noise and Vibration	① Do noise and vibrations comply with the country's standards?	① Environmental impact forecast on noise caused by vehicle transportation in operation phase was conducted and it was judged that noise level in the surrounding area will satisfy the related environmental standards. Besides, noise caused by tenant industries will be well controlled and managed according to the "Internal Regulation Environmental Management for VIP."
	(6) Subsidence	① In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	① The project will not extract groundwater.
	(7) Odor	① Are there any odor sources? Are adequate odor control measures taken?	① Odor caused by tenant industries will be well controlled and managed according to the "Internal Regulation on Environmental Management for VIP."
3 Natural Environment	(1) Protected Areas	① Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	① There is no protected area in the project area. No significant impact on surrounding protected areas was assumed.
3 Natural Environment	(2) Ecosystem	① Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? ② Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? ③ If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? ④ Is there a possibility that the amount of water (e.g., surface water, groundwater) used by the project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?	① The project site does not encompass primeval forests, tropical rain forests, ecologically valuable habitats. ② Some important species that fall into IUCN Red List and National Red List in the Lao PDR were identified in the project area. Detailed survey and further mitigation measures will be examined in detailed environmental management plan which will be prepared in D/D stage. Besides, the identified important species were widely observed in the surrounding area. Therefore, it was judged that no significant impact on habitats of important species was assumed. ③ No significant impact on ecosystem was assumed. Landscape and greenery plan for VIP was designed so as to secure greenery as much as possible. ④ No water source development was planned by the project and piped water will be supplied to VIP by existing water supply company. Wastewater discharged from VIP will be adequately treated and will not cause significant impact on aquatic environments.
	(3) Hydrology	① Is there a possibility that hydrologic changes due to the project will adversely affect surface water and groundwater flows?	① Flow regime of rivers will not be changed by the project. No significant impact on storm water was assumed as the retention pond in VIP was designed so as to equip the capacity to cope with 10-years flood return period

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
3 Natural Environment (continued)	(4) Topography and Geology	① Is there a possibility the project will cause large-scale alteration of the topographic features and geologic structures in the project site and surrounding areas?	① Though 140 ha of the land will be altered by the project, no important topographic and geologic features was identified in the project area. Besides, land use plan for VIP was designed so as to preserve the existing topography and geology as much as possible.
4 Social Environment	(1) Resettlement	① Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? ② Is adequate explanation on relocation and compensation given to affected persons prior to resettlement? ③ Is the resettlement plan, including proper compensation, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? ④ Does the resettlement plan pay particular attention to vulnerable groups or persons, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? ⑤ Are agreements with the affected persons obtained prior to resettlement? ⑥ Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? ⑦ Is a plan developed to monitor the impacts of resettlement?	① Although the involuntary resettlement caused by the project was firstly tried to avoid as much as possible, there identified 10 households in the project area. (As of October 25th, 2009) ② The procedures for public participation and information disclosure will be guaranteed according to the Preliminary RAP. ③ Fair and appropriate resettlement, compensation and restoration measures was developed in Preliminary RAP. MOIC need to finalize RAP according to Preliminary RAP. ④ The existence of squatters, tenant farmers and vulnerable groups was confirmed and the income restoration measures was developed in the Preliminary RAP as necessary. ⑤ There was no objection to the project in the stakeholder meetings and village consultation held in the course of the JICA Survey. ⑥ Institutional arrangement for finalization and implementation of RAP as well as required budget was examined in the Preliminary RAP. ⑦ Monitoring plan on income restoration for PAPs was examined in the Preliminary RAP.
	(2) Living and Livelihood	① Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?	① The resettlement, compensation and rehabilitation measures for PAPs was examined in the Preliminary RAP so as to minimize the adverse impact on livelihoods of PAPs.
	(3) Heritage	① Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage sites? Are adequate measures considered to protect these sites in accordance with the country's laws?	① No impact on cultural heritage by the project was assumed.
	(4) Landscape	① Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	① No significant impact on landscape was assumed. Landscape plan for VIP was designed so as to create fine urban landscape.
	(5) Ethnic Minorities and Indigenous Peoples	① Does the project comply with the country's laws for rights of ethnic minorities and indigenous peoples? ② Are considerations given to reduce the impacts on culture and lifestyle of ethnic minorities and indigenous peoples?	① The project comply with the country's laws for rights of ethnic minorities and indigenous peoples. ② No impact on culture and lifestyle of ethnic minorities and indigenous peoples was assumed by the project.

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
5 Others	(1) Impacts during Construction	① Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? ② If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? ③ If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? ④ If necessary, is health and safety education (e.g., traffic safety, public health) provided for project personnel, including workers?	① Environmental pollution in construction work will be well controlled and managed by contractor according to the "Terms of Reference for VIP Infrastructure Development." MOIC will supervise the construction work and conduct environmental monitoring in construction phase. ② Alternation of the vegetation in the project area will occur in construction phase. Greenery will be secured in VIP as much as possible. ③ The livelihood of residents and land owners in the project area will be adversely affected. Resettlement, compensation and restoration measures will be implemented according to the Preliminary RAP. ④ Contractor will provide health and safety education for workers according to the "Terms of Reference for VIP Infrastructure Development."
	(2) Monitoring	① Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? ② Are the items, methods and frequencies included in the monitoring program judged to be appropriate? ③ Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? ④ Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	① The proponent (MOIC) will implement the environmental and social monitoring according to the environmental and social management plan prepared in EIA. ② The items, methods and frequencies included in the monitoring program were judged to be appropriate. ③ The proponent establish an adequate monitoring framework according to the environmental and social management plan prepared in EIA. ④ Regulatory requirements pertaining to the monitoring report system were identified.
6 Note	Reference to Checklist of Other Sectors	① Where necessary, pertinent items described in the Roads and Railways checklist should also be checked (e.g., projects including access roads to the infrastructure facilities). ② For projects, such as installation of telecommunication cables, power line towers, and submarine cables, where necessary, pertinent items described in the Electric Power Transmission and Distribution Lines, and Oil and Gas Pipelines checklists should also be checked.	Not applicable.
	Note on Using Environmental Checklist	① If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	① GHG emission by the vehicle transportation in operation phase was estimated in the course of EIA. VIP was planned so as to minimize the GHG emission as much as possible.