THE MINISTRY OF LIVESTOCK, FISHERIES AND
RURAL DEVELOPMENT
THE REPUBLIC OF THE UNION OF MYANMAR

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR IMPROVEMENT OF FOOT AND MOUTH DISEASE CONTROL
IN
THE REPUBLIC OF THE UNION OF MYANMAR

MARCH 2016

JAPAN INTERNATIONAL COOPERATION AGENCY

YAMASHITA SEKKEI INC.
CM PLUS CORPORATION
INTEM CONSULTING, INC.

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to the consortium of Yamashita Sekkei Inc., CM Plus Corporation, INTEM Consulting, Inc.

The survey team held a series of discussions with the officials concerned of the Government of the Republic of the Union of Myanmar, and conducted a field investigations. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of the Union of Myanmar for their close cooperation extended to the survey team.

March, 2016

Mr. Makoto Kitanaka
Director General,
Rural Development Department
Japan International Cooperation Agency

SUMMARY

1. Outline of the Recipient Country

The Republic of the Union of Myanmar (hereinafter referred to as “Myanmar”) is located between North Latitude (NL) 10 degrees and NL 28 degrees along the western side of the Indochina Peninsula. It has a coastline some 2,000 km long facing onto the Andaman Sea and the Bay of Bengal and is bordered by the People’s Republic of China to the north east, by Laos to the east, Thailand to the southeast, Bangladesh to the west and India to the northwest. The land area is approximately 680,000 square kilometers (about 1.8 times the size of Japan) and the population is about 63.67 million (as of 2012, IMF estimate).

The Administrative divisions of Myanmar comprise seven states and seven regions. The site of this project is in Yangon, the biggest city in the country which lays in the middle south of the country, approximately 380 km south from the capital city Nay Pyi Taw.

Most of the land of Myanmar is in the tropical or subtropical zone, but as the land extends in a narrow strip north to south with highland areas, there are typically large differences in climate depending on the location. The year is divided into the dry season from late October to March, the hot season from April to May, and the rainy season from June to mid-October.

According to IMF statistics, Myanmar’s nominal GDP for FY2012/13 was US$55.3 billion and the nominal per capita GDP was US$868. The economic growth rate is steady, at 5.9% and 6.4% in 2011/12 and 2012/13, respectively. Since the transition to civilian government in 2011 in particular, the Myanmar boom has brought demand on development, with the start, natural gas exports to Thailand, the construction of those pipeline to China, followed by foreign and domestic investment in light industries such as garment manufacture, as well as the development of special economic zones and large-scale real estate development. It is brisk market.

The break down of Myanmar’s GDP by industry sector in FY 2010/11 was primary industries 34.7%, secondary industries 27.6% and tertiary industries 37.7%. Even though, year on year, the proportion occuied by primary industries is shrinking, it is still occupying the largest ratio, and the growth rate of livestock industry is in average, 12.5% (2006-2010), and is one of the expecting industries.

2. Basic Concept of the Project

The Republic of the Union of Myanmar is an agricultural country with some 60% of the working population engaged in farming including stock raising, forestry, and fisheries. The share of agriculture including stock raising, forestry, and fisheries in GDP is higher in Myanmar than in any other ASEAN countries. Myanmar also holds the largest number of cattle including water buffaloes in the ASEAN region with around 18 million head. Not only are these animals used to plow fields and transport goods, their manure is also used to fertilize fields and their meat and dairy products are

sold in the market. In Myanmar, livestock is an important resource that contributes to a rise in the earnings of farmers as well as food security. Moreover, the industrialization of the livestock sector can serve as a driving force for economic development because the growth rate of the sector is high.

Myanmar frequently suffers from outbreaks of Foot-and-Mouth Disease (hereinafter referred to as "FMD"), an acute febrile viral disease of cloven-hoofed animals. As it is characterized by its extremely high communicability, the import of cattle products from countries affected with FMD is severely restricted. A ban on the import of livestock products can cause great economic losses. FMD not only has a severe negative impact on livestock industry and productivity but also is a serious threat to neighboring countries because the cross-border smuggling of livestock can spread the disease to other countries.

FMD cannot be properly controlled in Myanmar due to its constant financial difficulties and deterioration of facilities and equipment needed to diagnose FMD and to produce vaccines. As a result, the disease continues to break out every several years, causing serious damage to the country's livestock sector. Moreover, it is internationally regarded as one of the most dangerous infectious diseases of livestock. Under these circumstances, urgent measures are required to prevent the disease from spreading to neighboring countries including Japan.

To aime for such improvement in FMD control, the Government of Japan received request of development of vaccine production and diagnostic facilities and provision of equipment, from the government of Myanmar under Japanese Grant Aid.

3. Outline of the Survey Results and Description of the Project

(1) Facility Plan

In November 2013, when JICA conducted a basic information collection survey, it was assumed that the Japanese side would renovate and equip the FMD Vaccine Production Laboratory (FVPL), an existing building that had been built but not used by the Myanmar side. However, as a result of the site survey conducted by preparatory survey team of the Project from April to May 2014 the survey team concluded that the existing building could not be used for FMD diagnosis or vaccine production plant, and the Myanmar side agreed on it. The Japanese side requested the Myanmar side to prepare an alternative building, and a building used as a veterinary medical plant in the premises of the LBVD in Insein Township, Yangon was proposed. The structural assessment of the building indicated that the ground floor could be used as a FMD diagnostic laboratory after its renovation is completed. The building, however, cannot be used for vaccine production because of its structural limitation. Therefore, the Japanese and Myanmar sides agreed that a new vaccine production plant would be newly constructed in the vicinity of the veterinary medical plant with Japan's Grant Aid.

Renovation work for FMD diagnostic laboratory is also to be covered by Japan's Grant Aid.

(2) Equipment plan

1) Equipment for Vaccine Production

It has been requested to select or design the essential equipment for stable production and quality control of vaccines considering sustainability in Myanmar, as well as to procure the vaccine production equipment for roller bottle culture method in Japan.

In order to achieve requested annual production capacity of one million doses, production plan with 10 times of batch which consisted of 100,000 doses respectively a year was agreed. Also, the plan refers to production index in Pak Chong FMD lab in Thailand considering current level of FMD Laboratory in Yangon in the manufacturing technology of roller bottle culture method, since there is no data in the Yangon Laboratory.

2) FMD diagnostic equipment

According to requested equipment list of data collection survey, equipment related to disease diagnosis was only PCR machine, ELISA reader and computer for analysis. In the preparatory survey, necessity of other ancillary equipment for testing and equipment for storage were confirmed and these equipments were added to the requested equipment list considering current situation of the FMD diagnosis facilities in Japan, in Pak Chong in Thailand and existing National FMD Laboratory in Yangon.

(3) Soft Component (Management Guidance) Plan

Since there are a few staff in current National FMD Laboratory who have had technical education and training on vaccine production equipment for virus mass culture, the technical support to operate, maintain and manage the project facilities and equipments properly is indispensable for its sustainability. As the soft component, the initial support on the operation and maintenance method of the project facilities, utility systems, production system and equipment, as well as essential items needed for making vaccine production plan will be given.

As a result of the above review, it was concluded that this Grant Aid Project would include the following components as shown in TableTable Ⅰ

Table I：Outline of the Project

<table>
<tr><th></th><th>Outline of the Project</th></tr>
<tr><td>Facilities</td><td>
(1) Facilities：
<table>
<tr><th>Building</th><th>Construction type</th><th>Floor area</th><th>Main construction structure, number of floors, etc.</th></tr>
<tr><td>Vaccine production plant</td><td>New construction</td><td>1,070 m^2</td><td>A two-story building of reinforced concrete construction, including ancillary facilities (a guardhouse, a machine building, etc.)</td></tr>
<tr><td>FMD diagnostic laboratory</td><td>Renovation</td><td>803 m^2</td><td>A two-story building of brick masonry construction with a steel roof structure</td></tr>
<tr><td colspan="2">Total</td><td>1,873 m^2</td><td></td></tr>
</table>
(2)Ancillary facilities：
・Electrical Work：Power supply system (including power receiving, transformer and distribution sstems), emergency generator system, lighting and receptacle, communication system, public address system, fire alarm and lightning protection system.
・Mechanical work：Air-conditioning and Ventilation system.
・Plumbing and sanitation work：Sanitary equipment, water supply system, drainage/ sewage system, fire extinguishing equipment and deep well.
・Special Facility for Vaccine production.
</td></tr>
<tr><td>Equipments</td><td>
(1) Vaccine production plant：
Cell roller, Roller bottle, Roller cap, Inverted microscope with digital camera , Ultra-centrifuge etc.

(2) FMD diagnostic laboratory：
PC, Printer, Real-time PCR, Reader for microplate, CO2 incubator, Safety cabinet, Clean bench, DNA sequencer etc.
</td></tr>
<tr><td>Soft Component</td><td>
Following primary support will be delivered.
(1) Acquisition of operation, management and maintenance method for the FMD vaccine production facility and infrastructural utility systems.
(2) Acquisition of operation, management and maintenance method for the FMD vaccine production systems.
(3) Acquisition of operation, management and maintenance method for the processing equipment for FMD vaccine dosage products.
(4) Understanding of mass production process in FMD vaccine production facility.
</td></tr>
</table>

4. Construction Period and Construction Estimation of the project

Taking into account the scale of the facilities, local construction conditions,the budgeting systems of the government of both countries, preparation of the project site, etc., the construction period needed for the implementation of this project is expected to be approximately 24 months (detailed design and tenders, 6.5 month; construction of the facilities 13 months; installation and inspection of quipment 1 month; soft conponent 5 months). The project cost by the Government of Myanmar (GOM) is estimated to be 10 million Japanese yen.

5. Evaluation of the Project

(1) Relevance

It is deemed to be highly necessary for the Government of Japan to implement this Grant Aid Project with the following reason:

1) Target Group of the Project

Impacts on Southeast Asia

Outbreaks of FMD have been widely reported in Southeast Asia, except for the Philippines, Indonesia, and the Malay Archipelago. Support for FMD control may have a larger impact in Myanmar than in other Southeast Asian countries and contribute to the stability and development of the livestock industry in the region because of the following three reasons. First, having been governed by the military regime, Myanmar has been lagged behind in FMD control. Secondly, Myanmar has a much greater number of livestock than its neighboring countries. Thirdly, livestock is brought from a country where it is sold cheaper, such as Myanmar, to a country where it is sold at higher prices in accordance with economic theories.

Impacts of the Project on Myanmar

In Myanmar, the agricultural population accounts for a quite large proportion of the total population and for a majority of the poor. FMD control can stabilize agricultural production and contribute to poverty alleviation in the following ways:

- An increase in production of milk and meat
- A rise in income from livestock sales
- Expansion of export of healthy livestock
- Continued use of livestock as a sound labour.

2) Contribution to achieving the Medium- and Long-term Development Plans of Myanmar

Based on the workshop held in May 2011, the Central Committee for Rural Development and Poverty Alleviation under the Government of Myanmar formulated Action Plan for

Rural Development and Poverty Alleviation, which has focused on eight development issues, including the development of the livestock and fisheries sectors, in order to develop rural areas and reduce poverty effectively and efficiently. Moreover, Livestock and Fishery Sector Short-term Plans (2011-2015) were adopted in 2011 as a result of the same workshop, identifying animal disease control as one of the priority policies. Thus, the Project is consistent with the development strategies and priorities of the Government of Myanmar.

3) Consistency with Japan's Assistance Policies

The Project can contribute to the improvement of people's livelihoods, one of the priority areas identified in Japan's new economic cooperation policy for Myanmar revised in April 2012. Under this cooperation policy, JICA's support in the agricultural sector has focused on four fields/areas: (i) intensive agriculture mainly in the Delta Zone; (ii) diversified agriculture mainly in the Central Dry Zone; (iii) rural development and income generation mainly in Northern Shan State; and (iv) policy making and human resource development in Nay Pyi Taw / Yezin. Constituting part of the (i) assistance to intensive agriculture, this Project is expected to improve livestock disease control and thus contribute to developing the livestock industry and raising agricultural production.

(2) Effectiveness

This Project is deemed to be effective with the following outputs.

Table II：Quantitative indicators

Indicator	Benchmark value (Actual results in 2013)	Target value (in 2020) 3 years after the completion of the Project
Amount of FMD vaccine produced	250,000 doses per year	1,000,000 doses per year
Number of specimen tested for FMD	1,775 specimens per year	4,000 specimens per year
Improvement in FMD diagnostic performance (Number of test methods available)	0 item	7 items

Table III：Qualitative outputs

- Vaccine can be produced more efficiently by following the proper vaccine production procedures.
- The efficacy of vaccines can be guaranteed through appropriate quality control testing.
- The safety of the vaccine production plant can be guaranteed.
- The FMD diagnostic test accuracy will be improved by following the proper diagnostic procedures.

Contents

Preface
Summary
Contents
Location Map/ Perspective
List of Figures & Tables
Abbreviations

Chapter 1 Background of the Project 1-1

1-1 Background of the Project 1-1

1-2 Environmental Conditions 1-1

1-3 Social and Environmental Considerations 1-3

Chapter 2 Contents of the Project 2-1

2-1 Basic Concept of the Project 2-1

2-2 Outline Design of the Japanese Assistance 2-2

2-2-1 Design Policy 2-2

2-2-1-1 Basic Policy 2-2
2-2-1-2 Policy for Natural Conditions 2-8
2-2-1-3 Policy on Protection against Socioeconomic Risks 2-8
2-2-1-4 Policy on Construction and Procurement Conditions 2-8
2-2-1-5 Policy on Use of Local Contractors 2-9
2-2-1-6 Policy on Operation and Maintenance 2-9
2-2-1-7 Policy on Grade Setting for Facilities and Equipment 2-10
2-2-1-8 Policy on Construction Schedule 2-10

2-2-2 Basic Plan (Construction Plan / Equipment Plan) 2-12

2-2-2-1 Examination of Request 2-12
2-2-2-2 Construction Plan 2-14
2-2-2-3 Equipment Plan 2-30

2-2-3 Outline Design Drawing 2-36

2-2-4 Implementation Plan 2-47

2-2-4-1 Implementation Policy 2-47
2-2-4-2 Implementation Conditions 2-49
2-2-4-3 Scope of Works 2-50
2-2-4-4 Consultant Supervision 2-51
2-2-4-5 Quality Control Plan 2-52
2-2-4-6 Procurement Plan 2-54

2-2-4-7 Operational Guidance Plan 2-57
2-2-4-8 Soft Component (Management Guidance) Plan 2-57
2-2-4-9 Implementation Schedule 2-57
2-3 Obligations of Recipient Country 2-59
2-4 Project Operation Plan 2-60
2-4-1 Operation and Maintenance System 2-60
2-4-2 Maintenance Plan 2-61
2-5 Project Cost Estimation 2-63
2-5-1 Initial Cost Estimation 2-63
2-5-2 Operation and Maintenance Cost 2-64
Chapter 3 Project Evaluation 3-1
3-1 Preconditions 3-1
3-2 Necessary Inputs by Recipient Country 3-1
3-3 Important Assumptions 3-1
3-4 Project Evaluation 3-2
3-4-1 Relevance 3-2
3-4-2 Effectiveness 3-3

[Appendices]

1. Member List of the Study Team
2. Study Schedule
3. List of Parties Concerned in the Recipient Country
4. Minutes of Discussions
5. Soft Component Plan
6. References
7. Other Relevant Data

Location Map

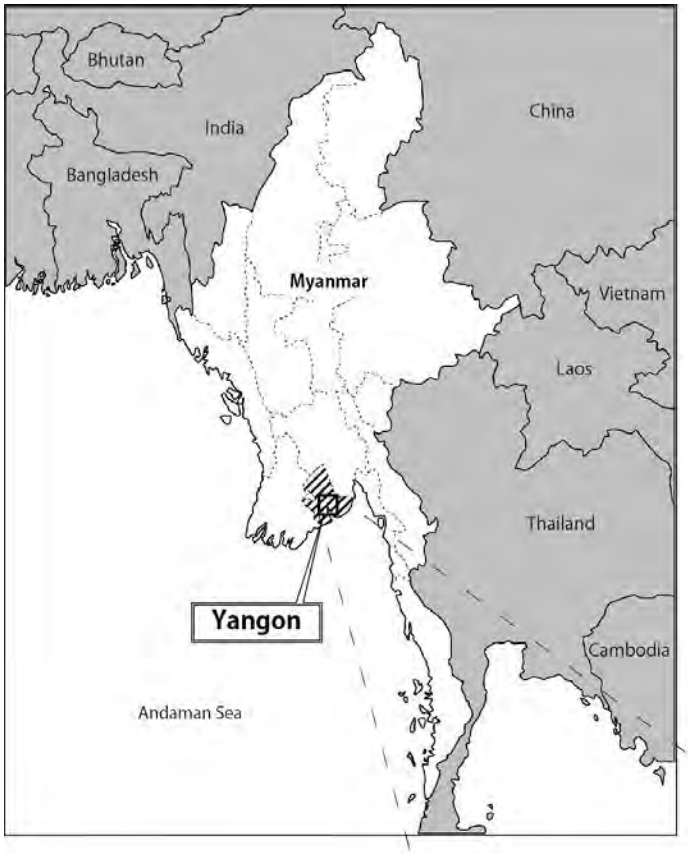


Figure Ⅰ : Map of the Republic of the Union of Myanmar

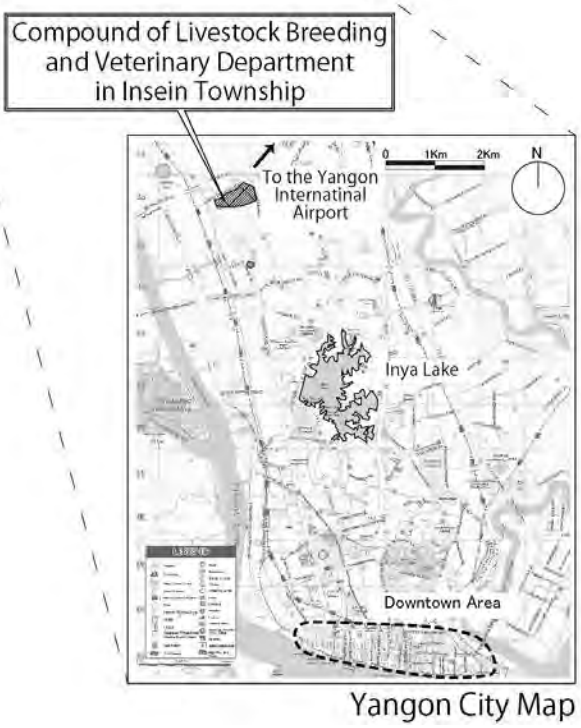


Figure Ⅱ : The Project Site

Perspective

Figure II：Bird’s Eye View of the Project Building

Figure III：Image of Entrance

List of Figures & Tables

Table I : Outline of the Project
Table II : Quantitative indicators
Table III : Qualitative outputs
Table 1-1 Geological features at the Project site
Table 1-2 Results of the water-quality survey
Table 1-3 Monthly precipitation in Yangon
Table 1-4 Monthly average maximum temperature in Yangon
Table 1-5 Monthly average minimum temperature in Yangon
Table 1-6 Monthly average wind directions in Yangon in 2013
Table 2-1 Strategies in the roadmap of SEAFMD and amount of vaccines required in Myanmar
Table 2-2 Number of Townships
Table 2-3 Comparison of FMD vaccine production methods
Table 2-4 Components of the Project
Table 2-5 Main rooms of the vaccine production building
Table 2-6 Main rooms of the FMD diagnostic laboratory building
Table 2-7 Exterior finishing materials to be used for the vaccine production building
Table 2-8 Exterior finishing materials to be used for the FMD diagnostic laboratory building
Table 2-9 Interior finishing materials to be used for the vaccine production building
Table 2-10 Interior finishing materials to be used for the FMD diagnostic laboratory building
Table 2-11 Main materials to be used
Table 2-12 Air-conditioning equipment
Table 2-13 Estimated amount of water needed
Table 2-14 Wastewater quality standards
Table 2-15 Treatment capacity
Table 2-16 Major Equipment
Table 2-17 Equipment List
Table 2-18 Major undertakings to be taken by each government
Table 2-19 Quality control plan
Table 2-20 Procurement plan of major construction materials
Table 2-21 Procurement plan of equipment
Table 2-22 Project implementation schedule
Table 2-23 Future organizational structure and personnel plan of the National FMD Laboratory
Table 2-24 Regular inspection for facilities
Table 2-25 Lifespan of building equipment
Table 2-26 Estimated cost to be borne by the Myanmar side
Table 2-27 Estimated operation and maintenance costs
Table 2-28 Hours of operation (assumption)
Table 2-29 Personnel expenses for the Project

Table 2-30 Electricity consumption for the Project
Table 2-31 Water consumption for the Project
Table 2-32：Cost for FMD diagnosis
Table 2-33 Recent trends in LBVD budgets
Table 2-34 Proportion of FMD vaccine expenditures in total vaccine expenditures
Table 3-1 Quantitative indicators
Table 3-2 Test methods for FMD

Figure I：Map of the Republic of the Union of Myanmar
Figure II：The Project Site
Figure III：Bird’s Eye View of the Project Building
Figure Ⅳ：Image of Entrance
Figure 2-1 Layout plan of buildings
Figure 2-2 Functional diagram of the vaccine production building
Figure 2-3 Functional diagram of the FMD diagnostic laboratory building
Figure 2-4 Sectional diagram of diagnostic laboratory
Figure 2-5 Earthquake zone map of Myanmar
Figure 2-6 Electrical wiring diagram
Figure 2-7 Air-conditioning system diagram
Figure 2-8 Plumbing system diagram

Abbreviations

AC	Autoclave
ASEAN	Association of South-East Asian Nations
ASTM	American Society for Testing and Materials
BOD	Biochemical Oxygen Demand
BS	British Standards
BSL	Bio-safety Level
CIP	Cleaning in Place
DNA	Deoxyribo Nucleic Acid
ELISA	Enzyme-Linked Immunosorbent Assay
E/N	Exchange of Notes
FAO	Food and Agriculture Organization
FMD	Foot and Mouth Disease
G/A	Grant Agreement
GDP	Gross Domestic Product
GMP	Good Manufacturing Practice
HEPA	High Efficiency Particulate Air Filter
IFC	International Finance Corporation
IMF	International Monetary Fund
JETRO	Japan External Trade Organization
JIS	Japanese Industrial Standards
KOICA	Korea International Cooperative Agency
LAN	Local Area Network
LBVD	Livestock Breeding and Veterinary Department
LED	Light Emitting Diode
MLFRD	Ministry of Livestock, Fisheries and Rural Development
MMK	Myanmar Kyat
OIE	International Epizootic Office
PCR	Polymerase Chain Reaction
PP	Polypropylene
PR	Pass-room
PQ	Prequalification
RNA	Ribonucleic Acid
SEACFMD	South-East Asia and China Foot and Mouth Disease
SIP	Sterilizing in Place
SS	Suspended Solids
STANDZ	Stop Transboundary Animal Diseases and Zoonoses
SUS	Stainless Steel
UPS	Uninterrupted Power Supply
WHO	World Health Organization

Chapter 1 Background of the Project

1-1 Background of the Project

In the Republic of the Union of Myanmar, the Livestock Breeding and Veterinary Department (LBVD) of the Ministry of Livestock, Fisheries and Rural Development (MOLFRD) is responsible for livestock and poultry disease control; however, problems such as constant financial difficulties and deterioration of facilities and equipment to diagnose livestock diseases and produce vaccines have prevented the LBVD from fulfilling its role properly. In particular, the facilities and equipment of the National Foot-and-Mouth Disease Laboratory, the only foot-and-mouth disease (FMD) vaccine producer in Myanmar, have seriously deteriorated, which has made it difficult for the Laboratory to meet the domestic demand for vaccines or assess the quality of vaccines it produces. As a result, FMD continues to break out in Myanmar every year.

In this context, the MOLFRD requested the Government of Japan for the Grant Aid to upgrade the facilities and equipment of the National Foot-and-Mouth Disease Laboratory (the Project for Improvement of Foot-and-Mouth Disease Control; hereinafter referred to as "the Project").

Requested items

Facility	FMD vaccine production plant / FMD diagnostic laboratory
Equipment	Equipment necessary for the above-mentioned facilities

1-2 Environmental Conditions

(1) Topographical and Geographical Features

The Project site is located in Yangon, which is approximately 24km long from east to west and approximately 32km wide from north to south and surrounded by the Hlaing River in the west, the Yangon River in the south, and the Bago River in the east. It is situated in the eastern Ayeyarwady Delta, and its center is located some 34km upstream from the mouth of the Yangon River. It is a flat city, cut into eastern and western flat area of the city are devided by hilly area in the central part.

(2) Geological Features

A geological survey was conducted at the Project site by drilling four boreholes to a depth of 20 meters from late April to early May 2014. The results indicated that the bearing capacity of the soil is approximately 5t/m^2 at a depth of about 2m below the ground level and that the ground water level is 4 to 7m underneath the surface. The details of the survey results are shown in Table 1-1 below.

Table 1-1 Geological features at the Project site

Borehole number	Layer at 2m deep	N-value (bearing capacity estimation)	Ground water level
BH-1	Fat clay layer	11	7.0m
BH-2	Silt-sand layer	7	7.0m
BH-3	Silt-sand layer	5	6.5m
BH-4	Clayey sand layer	14	4.0m

(3) Water Quality

As the water sources of the Project site, the public water sources in Gyo Gone Ward and the existing well in the Project site were surveyed. The results are shown in Table 1-2 below. These sources of water met the World Health Organization's drinking-water standards, and therefore they are deemed to be safe to use for the Project.

Table 1-2 Results of the water-quality survey

Survey item	WHO drinking-water standards (1993)	Public water sources in Gyo Gone Ward	Existing well
pH	6.5-8.5	7.35	7.35
Turbidity (NTU)	5-25	6	6
Total hardness (mg/L)	500	72	218
Arsenic (mg/L)	0.01	2.9x10-6	6.07x10-6
Iron (mg/L)	0.3	0.0001	0.0002
Magnesium (mg/L)	―	5.9x10-7	1.3x10-6
Lead (mg/L)	0.01	Not detected	Not detected
Chlorine and Chloride (mg/L)	250	47.87	10.64
Fluorine and Fluoride (mg/L)	1.5mg/L	0.3	0.5
Nitrate (mg/L)	50mg/L	0.7	1.5
Sulfate (mg/L)	200	89.34	33.14
Cyanide (mg/L)	0.07mg/L	Not detected	Not detected
Total dissolved solids (mg/L)	1,000	188.16	384.64

(4) Climate

Myanmar is located in the tropical monsoon climate zone. As shown in Table 1-3 below, rainfall concentrates in rainy season from May to October. Yangon's highest monthly average precipitation is four to five times higher than that of Tokyo. In Yangon, air temperature peaks in April, just before the rainy season. The average maximum temperature in April 2013 was 38.6°C. Yangon's monthly average maximum and minimum temperatures are shown in Tables Table 1-4 Monthly average maximum temperature in Yangon

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	32.3	34.8	33.7	36.5	33.0	31.7	31.2	30.5	31.2	33.0	34.2	33.3
2012	33.5	36.0	36.9	37.9	34.8	31.7	31.1	30.2	32.1	33.8	33.9	32.6
2013	32.7	36.6	37.1	38.6	35.5	31.4	30.4	30.9	31.2	32.1	34.1	30.9

Source: Yangon Kabar Aye Weather Station, Department of Meteorology and Hydrology

and Table 1-5 below.

Table 1-3 Monthly precipitation in Yangon

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total

2011	48	0	127	5	412	567	574	615	538	178	0	0	3,064
2012	0	0	0	8	167	450	717	864	379	59	115	0	2,759
2013	6	0	0	0	125	556	630	464	612	371	13	3	2,780

Source: Yangon Kabar Aye Weather Station, Department of Meteorology and Hydrology

Table 1-4 Monthly average maximum temperature in Yangon

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	32.3	34.8	33.7	36.5	33.0	31.7	31.2	30.5	31.2	33.0	34.2	33.3
2012	33.5	36.0	36.9	37.9	34.8	31.7	31.1	30.2	32.1	33.8	33.9	32.6
2013	32.7	36.6	37.1	38.6	35.5	31.4	30.4	30.9	31.2	32.1	34.1	30.9

Source: Yangon Kabar Aye Weather Station, Department of Meteorology and Hydrology

Table 1-5 Monthly average minimum temperature in Yangon

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	18.2	19.5	21.6	24.4	24.7	24.7	24.0	23.7	23.6	23.5	21.4	19.7
2012	17.1	18,8	21.9	24.4	24.5	23.6	22.8	22.4	22.6	22.7	22.1	17.3
2013	15.8	19.2	20.0	21.9	22.4	22.1	24.0	24.2	23.9	23.7	22.9	17.6

Source: Yangon Kabar Aye Weather Station, Department of Meteorology and Hydrology

(5) Wind Directions

Prevailing winds are southerly, except from November to January, when northerly and westerly winds are dominant. The wind velocity is relatively low throughout the year, at around 2-8 meters per second.

Table 1-6 Monthly average wind directions in Yangon in 2013

Measuring time	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
9:30 am	NE	SE	SE	SW	SE	SW	SW	SW	SW	SW	NE	NE
6:30 pm	W	SW	SW	SW	SW	SW	SW	SW	SW	SW	NW	NE

Source: Yangon Kabar Aye Weather Station, Department of Meteorology and Hydrology

(6) Earthquakes

According to the seismic hazard map of Myanmar, the Project site is situated in Earthquake Zone II, Moderate Zone, where the possible peak ground acceleration is estimated at 110-200 Gal equivalent to a seismic intensity of 8 on the Mercalli scale.

(7) Cyclones

Myanmar has been hit by six cyclones coming from the Indian Ocean since 2001. Three of them reached a strength of Category 4.

1-3 Social and Environmental Considerations

This preparatory survey did not find any risk factors that would lead to significant adverse impacts on the environment or society around the Project site. It was concluded that the Project would have little or no negative social or environmental impacts. Therefore, the Project was classified as Category C in accordance with JICA Guidelines for Environmental and Social Considerations.

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

(1) Overall Goal and Project Objectives

The Republic of the Union of Myanmar is an agricultural country with some 60% of the working population engaged in farming including stock raising, forestry, and fisheries. The share of agriculture including stock raising, forestry, and fisheries in GDP is higher in Myanmar, at 34.7% in FY 2011-2012, than in any other ASEAN countries. Myanmar also holds the largest number of cattle including water buffaloes in the ASEAN region with around 18 million head. Not only are these animals used to plow fields and transport goods, their manure is also used to fertilize fields and their meat and dairy products are sold in the market. In Myanmar, livestock is an important resource that contributes to a rise in the earnings of farmers as well as food security. Moreover, the industrialization of the livestock sector can serve as a driving force for economic development because the growth rate of the sector is high, with an average of 12.5% from 2006 to 2010.

Myanmar frequently suffers from outbreaks of Foot-and-Mouth Disease (FMD), an acute febrile viral disease of cloven-hoofed animals. As it is characterized by its extremely high communicability, the import of cattle products from countries affected with FMD is severely restricted. A ban on the import of livestock products can cause great economic losses. FMD not only has a severe negative impact on livestock industry and productivity but also is a serious threat to neighboring countries because the cross-border smuggling of livestock can spread the disease to other countries. According to the statistics of the Food and Agriculture Organization (FAO) from 2008 to 2011, Myanmar annually exports approximately 50-70 thousand head of cloven-hoofed livestock to Thailand.

FMD cannot be properly controlled in Myanmar due to its constant financial difficulties and deterioration of facilities and equipment needed to diagnose FMD and to produce vaccines. As a result, the disease continues to break out every several years, causing serious damage to the country’s livestock sector. Moreover, it is internationally regarded as one of the most dangerous infectious diseases of livestock. Under these circumstances, urgent measures are required to prevent the disease from spreading to neighboring countries including Japan.

The Central Committee for Rural Development and Poverty Alleviation under the Government of Myanmar formulated the Action Plan for Rural Development and Poverty Alleviation. In order to develop rural areas and reduce poverty, the plan has focused on eight development issues, including the development of the livestock and fisheries sectors. Additionally, Livestock and Fishery Sector Short-term Plans (2011-2015) were adopted, identifying animal disease control as one of the priority policies. In this context, the Project aims to prevent the spread of FMD by strengthening the capacity of the National Foot-and-Mouth Disease Laboratory.

(2) Outline of the Project

The Project aims to strengthen the FMD control capacity of the National Foot-and-Mouth Disease Laboratory under the Livestock Breeding and Veterinary Department (LBVD) of the Ministry of Livestock, Fisheries and Rural Development (MOLFRD) through the development of its FMD diagnostic and vaccine production facilities and provision of equipment, thereby contributing to stabilizing livestock production in Myanmar.

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Basic Policy

(1) Scope of the Project

Aiming to strengthen the capacity of the National Foot-and-Mouth Disease Laboratory, the Project will newly construct a vaccine production plant with roller bottle culture method with an annual production capacity of one million doses of FMD vaccine and renovate the existing building as a FMD diagnostic laboratory as well as procure necessary equipment.

1) FMD Vaccine Production

(i) Production capacity: one million doses per year

- Necessary measures for FMD control in Myanmar

Necessary measures for FMD control in Myanmar is to implement basic strategies in “a roadmap to prevent, control and eradicate foot and mouth disease in South-East Asia and China.”Table 2-1 below shows outline of the strategies and amount of vaccine required annually for respective strategy.

Table 2-1 Strategies in the roadmap of SEACFMD and amount of vaccines required in Myanmar

Strategy		Amount of vaccines required annually
1	Vaccinate in active hotspots	It is necessary to prepare for vaccination for 10 hot spots annually. It is considered that approximately 100 thousand doses of vaccines are required for each hotspot. 100,000 doses x 10 hot spots = 1,000,000 doses
2	Vaccinate in high risk zone	Vaccination in suspected hotspots 400,000 doses Vaccination in critical control point 150,000 doses Zoning programs for Vaccination 200,000 doses Total 750,000 doses

Strategy		Amount of vaccines required annually
3	Maintain FMD free zone[1]	It is necessary to vaccinate all livestocks in FMD free zone with vaccine matched with epidemic antigenicity[2] twice a year 17,000,000 x twice a year[3]x80%[4]=27,200,000 doses

Among the strategies, it is deemed that strategy 3 would be mid or long-term goal to achieve considering technical and budgetary constraint in Myanmar. Therefore, the Project focuses on the strategy 1, and covers some part of the strategy 2 if possible.

- Assumed result if only the strategy 1 and 2 are implemented

Vaccination in active hotspots and suspected hotspots cannot prevent infection totally, but can restrain symptom of the disease of the infected animals. It can slow the spread of the disease with restraint on the virus emission.[5]

- Vaccine production capacity of the Project

Among the above vaccination activities, the strategy 1, vaccination in active hotspots should be given the highest priority. If FMD in the hotspots is successfully controlled, the surplus doses of vaccines can be distributed in suspected hotspots and other necessary areas, which may accelerate the control of the disease. If the production capacity of FMD vaccine is less than one million doses, it cannot contain the outbreaks in active hotspots, which may cause pandemic and undermine the effects of immunization campaigns in suspected hotspots and other areas.

Therefore, the Project will construct vaccine manufacturing facilities with an annual production capacity of one million doses in order to meet the minimum demand. The amount of vaccines required for other vaccination activities for FMD can be imported or provided by other international donors.

- Calculation of amount of vaccine required for respective measure

（Vaccinate in active hotspots）

・Number of active hotspots

Table 2-2 below shows number of townships where FMD outbreaks were confirmed. It is

1To maintain the FMD free zone, not only regular vaccination but also ring vaccination, distruction of an infected animal and animal movement control are necessary in case of outbreak.

[2]FMD virus is categorized into 7 serotype and its antigenicity veries. It is necessary to match antigenicity with epidemic virus in the field.

[3]Since FMD vaccine is inactivated, normally its efficacy is for 6 months. In order to maintain the efficacy, it is ecessary to vaccinate twice a year.

[4]It is epidemiologically confirmed that spread of infection is not observed with vaccination of more than 80% of a herd.

[5]As a result of vaccination in Xiengkhuang, one of the hotspots in Laos with 100,000 doses donated by Japan, outreak has not been observed in the area since 2012. This 100,000 doses are equivalent to 80 % of total number of cow and water buffalo in the area.

fluctuating from 33 townships in 2006 to 3 townships in 2012. In Bago in 2004, and in Rakine, Aeyawady and Bago in 2006 many outbreaks were observed. Average number of outbreaks in past 10 years is 14 townships. In 5 years out of 10 past years more than 10 outbreaks were annually observed. On the other hand, it is reported that no outbreak has spread to more than 10 townships since 2010 in Sagaing, Magwe, and Mandalay Regions in the Central Dry Zone. Considering recent decrease in past 5 years, it is deemed that vaccine for 10 hotspots is annually needed.

If early detection of outbreak and vaccination efficiently works, serious pandemic expanded throughout the region like the cases in 2004 and 2006 can be controlled.

Table 2-2 Number of Townships where FMD outbreaks were confirmed in recent 10 years

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Sagain	2	1	5	4	1	2	4			6
Magway	3	2	1	1		4	2	3	2	1
Mandalay	1		3	1				1	1	
Nay Pyi Taw						1				1
Bago	12	1	6	1		5		2		
Yangon	6		3	4	3	1				
Aeyawady	2		5	2	3	2				
Shan					1	1				
Kayah		2				1				
Mon					1					
Thanitharyi			2				2			
Chin		1	2				1			
Rakine		2	6	1		1	1	1		
Total	26	9	33	14	9	18	10	7	3	8

・Amount of vaccines required in respective hotspot

Numbers of cows in Central Dry Zone where FMD outbreaks consecutively reported are 30,000 in Sagain, 70,000 in Mandalay and 70,000 in Magway within a circle of 20km radius, and 70,000 in Sagain, 160,000 in Mandalay and 160,000 in Magway within a circle of 30km radius. If ratio of vaccination is 70 ~ 80 % of total number of cows in the area, it is considered that approximately 100 thousand doses of vaccines are required for each hotspot to contain the disease.

（Vaccinate in suspected hotspots）

If vaccination in active hotspots is implemented efficiently, it is deemed that number of outbreaks can decrease except for unexpected pandemic. In this case, surplus vaccines including donation can be provided to suspected hotspots selected through epidemiologic analysis such as review of outbreak record in the past and serosurveillance. Currently, most of donated vaccines annually procured approximately 400,000 doses are used in the suspected hotspots in Sagain and Mandalay. It is necessary to maintain vaccination campaign with a similar scale in the suspected hotspots.

（Vaccinate in critical control points）

It is essential to vaccinate livestock in hubs such as check points and livestock markets in order to control the disease more efficiently. Among the approximately 250,000 head of cattle traded in official markets, 40% are slaughtered, and the remaining 150,000 head of cattle need to be immunized.

（Zoning programs for vaccination）

The Myanmar-Thailand-Malaysia (MTM) peninsular zone and the Upper Mekong zone including eastern Shan State are set as international FMD buffer zones by the SEAC-FMD. In MTM zone, currently monitoring is only implementing since any outbreak has not been observed since 2011 and number of livestock is relatively low in the region. In Upper Mekong zone, it is difficult to vaccinate geographically, racially and politically. Number of the livestock is approximately 50,000 in the region.

In addition to these two zones, Rakhine State and Sagaing Region are targeted for immunization as proposed buffer (control) zones.

As a measure for next stage from risk based control such as vaccination in hotspots in Progressive Control Pathway established by OIE, each of the four zones requires 50,000 doses of FMD vaccine every year; therefore, a total of 200,000 doses are needed.

(ii) Vaccine production method: roller bottle cell culture system

A vaccine is not an industrial product but a medical product produced with biological method where cell lines are cultured. Therefore, the productivity of vaccine is fluctuated significantly depending on the production technology and quality control in the manufacturing process. Table 2- below shows typical FMD vaccine production methods.

Table 2-3 Comparison of FMD vaccine production methods

Cell culture method	Optimal production volume	Advantages	Disadvantages	Assessment
Flat-bottom flask culture (Monolayer culture) (Applied at present)	0.05-0.2 Mil	- Vaccine production can be started with minimum capital investment. - The production process only requires basic experimental skills. - Failures in the production process are unlikely to lead to serious incidents.	- Low productivity	△

Cell culture method		Optimal production volume	Advantages	Disadvantages	Assessment
Roller bottle culture	Glass bottle	0.5-2 Mil	- Bottles are reusable, which can cut the running costs. - Vaccine production can be started with minimum automation. - Germ contamination is unlikely to have a significant effect on productivity because the problem can be solved by disposing of the contaminated bottles.	- It takes time to clean and sterilize glass bottles for reuse. - Glass bottles should be handled carefully because they are fragile.	◎
Roller bottle culture	Improved bottle (multilayer culture vessel)	2-30 Mil	- Production capacity can be scaled up by changing type of bottle keeping utilizing the basic facilities and equipment for roller bottle. - Number of personnel can be reduced because there is no need to sterilize bottles.	- Running cost is high because disposable bottles are used. - Full-scale automation is required to expand production capacity. - If bottles with a large production capacity are used, bottle contamination may affect productivity significantly. - The supply of disposable bottles has not been established.	○
Tank culture		More than 20 Mil	- This production system has high productivity and scalability. - Number of personnel can be reduced with automation.	- The production process requires high technical skills. - The production process relies on a stable supply of utilities. - Large capital investments are needed. - Maintenance cost is high. - Errors in operation may significantly decrease production volumes.	×

Considering the operation and maintenance capacity and vaccine production skills of the

personnel in National FMD Laboratory as well as the necessary production volume, amounting to one million doses per year, the roller bottle culture method using glass culture vessels would be the most practical and efficient method. Although the tank culture system enables mass production, it is deemed inappropriate for the Project because of the following reasons. First, a stable supply of electricity is needed in the entire production process to maintain aseptic conditions, however blackout happens frequently in Yangon. Secondly, the system may require high maintenance costs. Moreover, the optimal production scale of the system is more than 20 million doses, which is too large for the Project.

In the future when the Myanmar side develops their vaccine production skills and becomes ready for mass production, the roller bottle-based production system can be scaled up by using the facilities constructed and equipped through the Project with the substitution of improved bottles or multilayer culture vessels that have a larger production capacity for the glass bottles.

The Project will introduce quality control for quantitative evaluation of the efficacy of the vaccine produced as well as consider the possibility that the vaccine production unit may undertake the process of working virus seeds production, which is an essential step for sustainability in the mass production.

2) FMD Diagnosis

For effective immunization, it is essential not only to identify FMD outbreaks quickly and correctly but also to produce efficacious vaccines matching antigenicity with epidemic virus in the field. In order to ensure this entire process goes smoothly, the Project will assist the vaccine production plant and the FMD diagnostic laboratory in fulfilling their duties.

(2) Selection of the Project Site

For reliable vaccine production, it is essential to select a location with easy access to suppliers of raw materials and consumables. It is also important to select a location close to the agencies that can promptly solve any unpredictable equipment malfunction. Therefore, the Project site should be situated in the LBVD's property in Insein Township in the northern area of Yangon, where the National FMD Laboratory is currently located.

The vaccine production plant to be constructed in the Project will be the only one in Myanmar to manufacture FMD vaccine for the time being. On the other hand, FMD diagnosis will be undertaken by two laboratories: the one to be renovated through this Project and the one established in the suburb of Nay Pyi Taw in 2014 in cooperation with KOICA. They are expected to collaborate to detect FMD cases across the country.

2-2-1-2 Policy for Natural Conditions

(1) Consideration for High Temperature and Solar Radiation

Yangon is hot all the year round with an annual average temperature of 27.5°C. March and April, at the end of the dry season, are the hottest months of the year in the city. In the Project, thermal insulation will be installed in the roofs and walls to mitigate the impact of the outdoor environment on the indoor conditions.

(2) Consideration for Rainfall

Myanmar has a typical tropical monsoon climate, which is characterized by short-time torrential rains. The city's annual average precipitation is over 2,700mm. Although the Project site is not susceptible to flooding since it is located in a relatively elevated area, it should be important to promptly discharge rainwater into nearby drainage ditches. The ground level is to be raised around the buildings.

(3) Consideration for Strong Winds

In the past, Yangon was hardly affected by cyclones; however, recently, a large cyclone has hit the city every several years. In particular, Cyclone Nargis in April 2008 caused huge destruction in Yangon when it ripped through the city. Therefore, the Project facilities should be designed to be fully wind-resistant.

2-2-1-3 Policy on Protection against Socioeconomic Risks

FMD is a highly communicable disease affecting cloven-hoofed animals although the virus is not a threat to human health. The site of the Project, whose vaccine production process will include a step to culture viruses, should be carefully selected because virus leakage may cause a significant economic loss if the Project is situated in a stock-raising area. From this viewpoint, the candidate project site is considered appropriate for FMD vaccine production since it is located in Insein Township, which is a residential area with no stock-raising facilities in the vicinity.

2-2-1-4 Policy on Construction and Procurement Conditions

(1) Building Permissions and Regulations

1) Building Regulations

In Yangon, there is a need to apply to the Yangon Urban Development Committee for building permission prior to the construction. It generally takes about two months for the committee to examine an application.

2) Fire Regulations

In case of building exceeding two stories, the design should be approved by the Yangon Fire

Services Department prior to the construction. The Project's facilities are not subject to the approval requirement since they are two-story buildings.

(2) Quality of Locally Procured Materials and Difficulties in Local Procurement

In principle, the Project's construction materials are to be purchased locally since most of them including products imported from other ASEAN countries and China are available at local markets. Airtight doors and other special system and equipment of vaccine production are to be procured in Japan.

(3) Condition for Construction Labor

There are no regulations concerning working hours in the Myanmar construction industry. In general, construction workers work from 9 am to 5 pm in the country, but many also work at night to reduce the construction period. In this Project, construction hours should be limited to 9 am to 5 pm to minimize night-time noise and light pollution from the construction site, which is situated near a LBVD staff housing area. The construction period is to be scheduled under this assumption.

Although the recent construction boom has created competition in hiring skilled workers in Myanmar, because highly-skilled workers are concentrated in Yangon, recruitment of construction workers seems easier in Yangon than in other cities.

2-2-1-5 Policy on Use of Local Contractors

Before privatization reforms, most of construction projects were undertaken by state-owned construction companies; however, they have been privatized during the last decade, resulting in a growing number of private construction firms. Previously, there were only three kinds of projects in Myanmar's construction market: small-scale construction in Yangon; public works, mostly in Nay Pyi Taw; and construction in Mandalay, funded by Chinese investors. Now there are many foreign-invested large-scale construction works, mainly in Yangon. In most of these cases, buildings are of reinforced concrete or steel construction. Many local construction firms have experienced these construction methods. These methods should be preferentially adopted in the Project.

2-2-1-6 Policy on Operation and Maintenance

(1) Project Design to Minimize Operation and Maintenance Costs

The Project should be designed to make maintenance easier and minimize running costs so that the Myanmar side can maintain the targeted vaccine production capacity of one million doses per year.

Therefore, in principle, the production process where vaccine is produced manually is to be introduced. Only a minimum number of automated machines will be provided in the Project.

(2) Management Guidance (Soft Component)

Technical support is to be delivered to ensure the Project will generate the expected outcomes. This indirect support will include the transfer of knowledge and technology required for proper operation and maintenance of the facilities and equipment to be provided by the Japanese side as well as basic technical assistance for mass production of FMD vaccine.

2-2-1-7 Policy on Grade Setting for Facilities and Equipment

(1) Good Manufacturing Practices (GMPs)

In Myanmar, FMD vaccine is treated not as a pharmaceutical product but as a biological material, and thus it falls outside the medical laws. Therefore, Good Manufacturing Practices (GMPs) will not be taken into account in the Project though the door will be left open for their establishment in the future.

(2) Biosafety Level

The FMD virus is highly contagious and spreads rapidly within a group of cloven-hoofed animals. It becomes the most active in a pH range of 7.0-9.0 at low temperatures. It is unlikely to survive for more than several hours in a high-temperature and high-humidity environment, like Yangon. Thus, it is highly unlikely to be transmitted from one animal to another in the city. Moreover, the virus is not acid resistant. It can be easily inactivated by acid (e.g., acetic and citric acid). Therefore, even if a virus leaks out of a damaged glass bottle and spreads in a room, proper inactivation treatment can prevent the accident from causing an outbreak of FMD in residential areas such as Insein Township.

As containment measures, the Project's facilities are to be designed to meet Bio Safety Level (BSL) 2 in principle. Additionally, the Project will prevent virus leakage by ensuring continued proper operation and maintenance.

(3) Equipment Grade

The Project's equipment is designed to produce one million doses of vaccine per year by roller bottle culture method and ensure quality control of the products. The Project will also provide equipment to enable the FMD diagnostic laboratory to use a wider range of test methods since it tested an average of 2,000 specimens for FMD each year during the last four years. With this equipment, the laboratory can use molecular biological techniques, such as PCR, in addition to antibody-testing techniques, which they have used thus far. Additionally, technical levels of users, frequency of use, durability, availability of maintenance services in Myanmar or its neighboring countries, maintenance costs, and competitiveness in bidding have been taken into consideration to set equipment grades.

2-2-1-8 Policy on Construction Schedule

All construction will stop for some 10 days in mid-April because of New Year's holidays in

Myanmar. If foundation and outdoor works are performed in the intense rainy season from June to August, the entire process may be delayed due to frequent rains. These risk factors should be considered in scheduling construction works.

2-2-2 Basic Plan (Construction Plan / Equipment Plan)

2-2-2-1 Examination of Request

(1) Facility Plan

In November 2013, when JICA conducted a basic information collection survey, it was assumed that the Japanese side would renovate and equip the FMD Vaccine Production Laboratory (FVPL), an existing building that had been built but not used by the Myanmar side. However, as a result of the site survey conducted by preparatory survey team of the Project from April to May 2014 the survey team concluded that the existing building could not be used for FMD diagnosis or vaccine production plant, and the Myanmar side agreed on it. The Japanese side requested the Myanmar side to prepare an alternative building, and a building used as a veterinary medical plant in the premises of the LBVD in Insein Township, Yangon was proposed. The structural assessment of the building indicated that the ground floor could be used as a FMD diagnostic laboratory after its renovation is completed. The building, however, cannot be used for vaccine production because of its structural limitation. Therefore, the Japanese and Myanmar sides agreed that a new vaccine production plant would be newly constructed in the vicinity of the veterinary medical plant with Japan's Grant Aid.

Renovation work for FMD diagnostic laboratory is also to be covered by Japan's Grant Aid.

(2) Equipment plan

1) Equipment for Vaccine Production

It has been requested to select or design the essential equipment for stable production and quality control of vaccines considering sustainability in Myanmar, as well as to procure the vaccine production equipment for roller bottle culture method in Japan.

In order to achieve requested annual production capacity of one million doses, production plan with 10 times of batch which consisted of 100,000 doses respectively a year was agreed. Also, the plan refers to production index in Pak Chong FMD lab in Thailand considering current level of FMD Laboratory in Yangon in the manufacturing technology of roller bottle culture method, since there is no data in the Yangon Laboratory.

The emulsion tank for production of oil emulsion adjuvant in the initial requested equipment list is excluded from the Project, since aluminum sulfate gel adjuvant which is currently applied in the Yangon Laboratory could be applied in the Project.

2) FMD diagnostic equipment

According to requested equipment list of data collection survey, equipment related to disease diagnosis was only PCR machine, ELISA reader and computer for analysis. In the preparatory survey, necessity of other ancillary equipment for testing and equipment for storage were confirmed

and these equipments were added to the requested equipment list considering current situation of the FMD diagnosis facilities in Japan, in Pak Chong in Thailand and existing National FMD Laboratory in Yangon.

The centrifuge, Ultra-centrifuge and ice machine in the initial requested equipment list are excluded from the Project since the first and the second are not essential for basic diagnosis work and there are many alternative methods for cooling without ice machine.

Final requested equipment list was developed after confirming their needs, quantity and duplication with the existing equipment with respective stakeholder.

The basis of the qualification of the requested equipment are as follows;

【Basis of qualification】

1) Consistency with plan of vaccine production and control of FMD in Myanmar
2) Consistency with the skill of the local staff
3) Not affected by technology obsolescence and having long market value
4) Expensive consumables not to be needed frequently
5) Feasibility of maintenance by local technician

【Basis of exclusion】

I) Equipment which should be included in the component of construction
II) Equipment currently available as the existing or duplication with the equipment procured by other donor
III) In case of inadequate maintenance cost and technique
IV) low cost-effectiveness because of frequency of use
V) In case of duplication with other requested equipment observed, alternation with other equipment confirmed
VI) In case of large scale renovation work to be needed for the installation or due to budget constraint

【Priority of the equipment】

A The equipment which is confirmed as necessary and relevant for the Project.
B The equipment which is desirable to be included in the Project, but needs further analysis in Japan
C The equipment not included in the project or In case that alternatives are available

Requested equipment is examined with above evaluation basis. Details are described in appendices "Final Requested Equipment List after Evaluation”.

As a result of the above review, it was concluded that this Grant Aid Project would include the following components as shown in Table 2-.

Table 2-4 Components of the Project

■ Facilities

Building	Construction type	Floor area	Main construction structure, number of floors, etc.
Vaccine production plant	New construction	1,070 m^2	A two-story building of reinforced concrete construction, including ancillary facilities (a guardhouse, a machine building, etc.)
FMD diagnostic laboratory	Renovation	803 m^2	A two-story building of brick masonry construction with a steel roof structure

■Equipments

Section	Policy and major equipments
Vaccine production plant	Essential equipment is designed or selected considering long-term use in Myanmar. Manufacturing equipments for roller bottle culture method are procured from Japan. Specification and quantity of equipments are consistent with facility planning and vaccine production scale. Major equipment for vaccine production plant are as follows; Cell roller, Roller bottle, Roller cap, Inverted microscope with digital camera , Ultra-centrifuge etc.
FMD diagnostic laboratory	Equipments for genetic testing method with PCR and antibody testing method by ELISA which are commonly used in FMD diagnosis are planned. Also, equipments currently used in the existing laboratory are planned to be updated. Moreover, missing equipments for the activity of the existing laboratory are planned. Quantity of equipment is consist with facility plan and satisfies number of sample which is around 500/month. Major equipments for FMD diagnostic laboratory are as follows; PC, Printer, Real-time PCR, Reader for microplate, CO2 incubator, Safety cabinet, Clean bench, DNA sequencer etc.

2-2-2-2 Construction Plan

(1) Layout Plan

A new vaccine production plant and a new machine building for supply of utilities such as water and electricity are to be constructed in the north of the FMD diagnostic laboratory renovated with existing building. An inner court is to be created as a buffer between the diagnostic laboratory and vaccine production plant. These two buildings are planned to be connected with a roofed corridor as protection from rain and solar radiation in the tropical climate.

In the Project site, a main entrance is to be placed at the northwest corner of the premises from

which a path leads to a public road called the Insein Butaryon Road. The existing entrance in the south of the diagnostic laboratory is to be renovated into a sub entrance. The vaccine production plant and diagnostic laboratory will have individual entrances and drop-off respectively.

At present, there are two paths at the north of the Project site: one to the east leading to the staff housing area and one to the north. These paths will be detoured out of the project site.

Figure 2-1 below shows where the buildings will be extended by the Government of Myanmar in the future. For future expansion, the building located on the west side of the premises but not used at the time of the preparatory survey in May 2014 will need to be demolished.

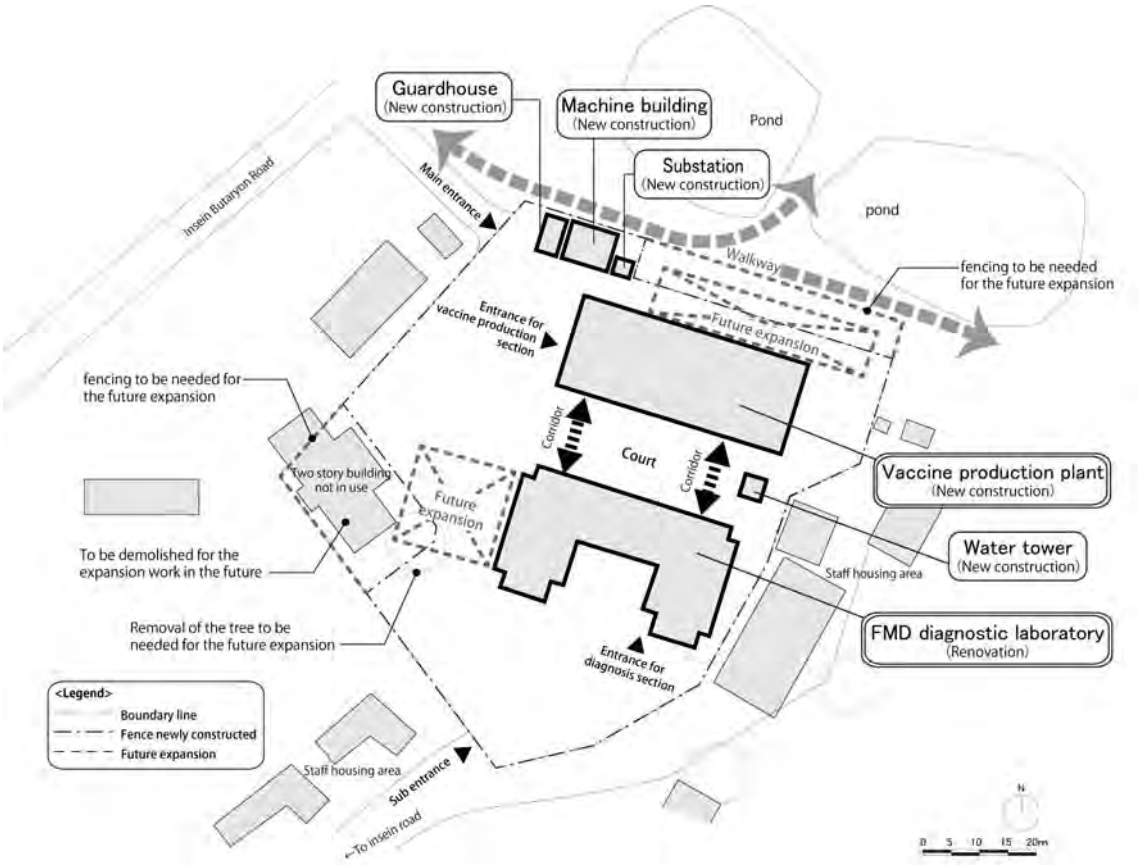


Figure 2-1 Layout plan of buildings

(2) Floor Plan

1) Vaccine Production Building

The Project is planning to build a vaccine production plant with roller bottle culture method having an annual production capacity of one million doses of FMD vaccine. In order to prevent germ contamination and virus leakage in the production process, the cell culture and vaccine production units are designed to be accessible only through the air lock or pass room. Additionally, a quality control unit is to be built with an exclusive entrance separate from the entrance to the vaccine

production section in order to prevent virus contamination.

The filling of inactivated vaccines into vials at the packaging step and the filling of cell suspension into culture bottles at an early step in the vaccine production process are not simultaneous; therefore, these two steps are to be performed in the same room to save floor area.

In order to ensure pest control and to save air-conditioning energy in the main parts of the building, the vaccine production plant is designed to have no direct entrance from the outside of the building and to be accessible only through the indoor corridors. In the case of virus leakage, these corridors can be used as buffer spaces to prevent the virus from spreading to the outside of the building.

Figure 2-2 below shows the functional diagram of the vaccine production building.

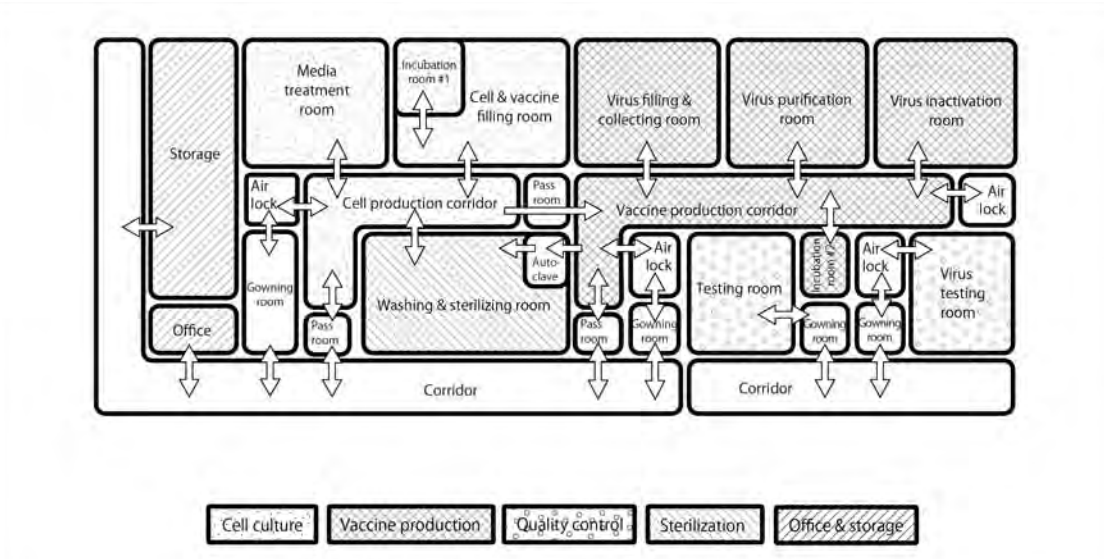


Figure 2-2 Functional diagram of the vaccine production building

2) FMD Diagnostic Laboratory Building

The veterinary medical plant building proposed by the Myanmar side is to be renovated as a FMD diagnostic laboratory on the ground floor.

The laboratory will consist of virus, cell, and PCR experimental rooms. The cell experimental room is adjacent to a gowning room, and the virus experimental room is adjacent to a gowning room and an air lock.

In principle, the first floor will be used as offices. However, the room whose slab was found to have been cracked and sunk at the structural survey should not be used. It is also recommended that the other rooms should not be used as a document archive or storage to store heavy materials. These restrictions have to be recognized by FMD laboratory staff properly.

Figure 2-3 below shows the functional diagram of the FMD diagnostic laboratory.

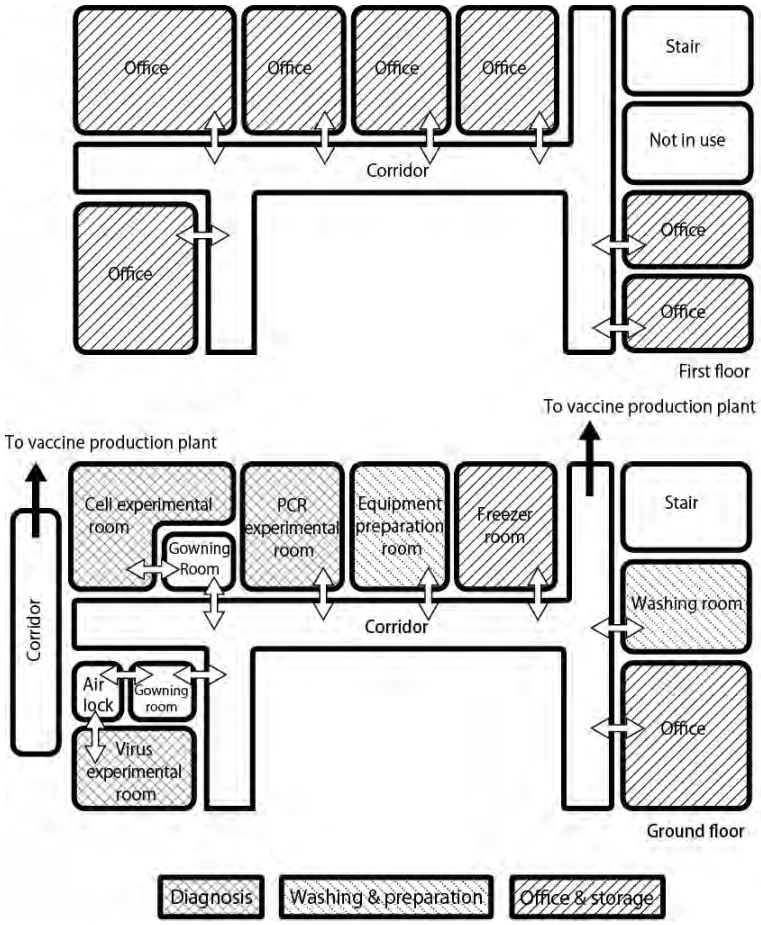


Figure 2-3 Functional diagram of the FMD diagnostic laboratory building

Table 2-5 and 2-6 below show the floor area and description of each room of the vaccine production plant and FMD diagnostic laboratory, respectively.

Table 2-5 Main rooms of the vaccine production building

Unit	Room	Floor area	Description
Cell Culture	Media treatment room	31m^2	To formulate culture media and additives, produce working seeds, and prepare cell suspension. Equipped with worktables, clean benches, etc.
	Cell & vaccine filling room	42m^2	To fill cell suspension into roller bottles. Also used to package concentrated solution of inactivated vaccine with additives. Sized to accommodate a 3.5m-by-2.5m laminar flow booth in order to prevent contamination of suspended particles and keep cleanliness with sufficient work space around it.
	Incubation room #1	14m^2	To cultivate BHK-21 cells in roller bottles. Sized to accommodate two cell roller machines. Connected to the backup generator in order to keep cultured cells alive in a blackout.
Vaccine Production	Virus filling & collection room	24m^2	To take out media for cell culture from roller bottle. To inoculate virus into cultured cell and fill maintenance media in the roller bottle. To collect cultured virus fluid into tank. Sized to accommodate a 3.0m-by-2.0m laminar flow booth in order to prevent contamination of suspended particles and keep cleanliness with sufficient work space around it.
	Incubation room #2	14m^2	To cultivate the infected cells inoculated with virus fluid in maintenance media in roller bottles. Sized to accommodate two cell roller machines. Connected to the backup generator in order to keep cultured cells alive in a blackout.
	Virus purification room	40m^2	To purify virus by removing impurities from the virus suspension collected into a tank. Also used to mix virus seeds into fluid to prepare virus fluid for inoculation.
	Virus inactivation room	40m^2	For chloroform treatment of purified virus suspension, which is then transferred into another tank and inactivated by BEI treatment.
Sterilization	Washing & sterilization room	50m^2	To wash and sterilize equipment for vaccine production. Equipped with a large autoclave to sterilize virus-contaminated equipment.
Quality Control	Testing room	28m^2	For vaccine quality control tests not associated with viruses (e.g., sterility, culture medium performance, and vaccine potency tests).
	Virus testing room	30m^2	For vaccine quality control tests associated with viruses (e.g., viral potency test and working virus seed production).
Office & Storage	Storage	51m^2	To temporarily store equipment, materials, chemicals needed for vaccine production as well as products. Equipped with refrigerators and deep freezers to enable storage at room, refrigeration, and freezing temperatures.
	Office	12m^2	For paperwork for vaccine production, such as keeping production records and printing data.
Storage, corridor, gowning room etc		694m^2	Including machine room with 242 m^2 on the first floor, waste water treatment room with 52 m^2 on the basement floor, machine room building with 50 m^2 , water tower with 25 m^2 , guard hut with 15 m^2
Total		1,070m^2	

Table 2-6 Main rooms of the FMD diagnostic laboratory building

Unit	Room	Floor	Floor area	Description
Diagnosis	Cell experimental room	1	48m^2	For sample testing. Equipped with a 2.0m-by-3.0m gowning room.
	Virus experimental room	1	39m^2	For viral identification testing. Equipped with a gowning room and a air lock.
	PCR experimental room	1	27m^2	For PCR testing.
	Equipment preparation room	1	27m^2	To store test devices and reagents.
	Washing room	1	28m^2	To wash test devices.
	Freezer room	1	32m^2	Freezer/refrigerated room to store reagents.
Management	Office #1 (Management)	1	49m^2	Office of the management unit of the National FMD Laboratory. Sized to accommodate four people (5-10m2 per person).
	Office #2 (Diagnosis)	2	80m^2	Office of veterinary officers of the diagnosis section. Sized to accommodate eight people (5-10m2 per person).
	Office #3 (Vaccine Production I)	2	65m^2	Office of veterinary officers of the vaccine production section. Sized to accommodate 14 people (5-10m2 per person).
	Office #4 (Vaccine Production II)	2	32m^2	
	Office #5 (Quality Control)	2	32m^2	Used as the office of veterinary technical officers of the quality control unit. Sized to accommodate four people (5-10m2 per person).
	Meeting room	2	49m^2	Composed of a 33m2 meeting room and a 16m2 storage. Sized to seat 13 people (1.5-2.5 m2 per person) so as to hold general meetings attended by Director and three representatives from each unit.
	Director's office	2	33m^2	Reasonably sized for a director's office at 30-45 m2.
Common Use	Staff room	2	32m^2	Lounge for staff except for veterinary officers.
	WC	1	33m^2	Based on the assumption of equal sex ratio, it is calculated that 54/2=27. The female restroom is sized to fit water closets and two washbasins. The male restroom is sized to fit two water closets, a urinal, and two washbasins.
Corridor etc			197m^2	
Total			803m^2	

(3) Cross-sectional Plan

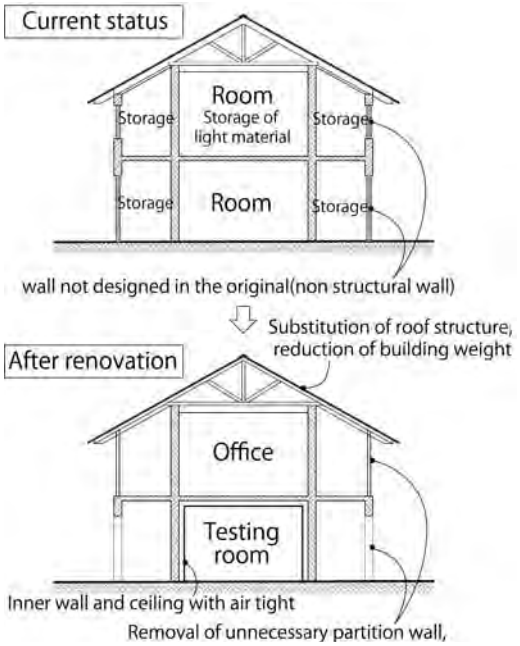


Figure 2-4 Sectional diagram of diagnostic laboratory

1) Vaccine Production Building

In order to contain viruses, the vaccine production plant is, in principle, designed to have an airtight structure with reinforced concrete roof slab and concrete block walls. The ducts and pipes should be reasonably arranged by placing the outside unit for air-conditioning and other systems either directly above or as much close to the rooms as possible.

2) FMD Diagnostic Laboratory Building

As shown in Figure 2-4 to indicate how the laboratory building is used at present (before renovation), the areas originally designed as verandas have been walled in to be used mainly as storages. However, most of them are not used with inappropriate room shape. Moreover, their walls are not structural walls and therefore not earthquake-resistant; rather, they may have adverse effects by imposing additional loads on the structure in case of earthquake.

In the Project, these unnecessary walls on the verandas are to be removed. This weight reduction can make the building more resistant and safer in an earthquake.

Furthermore, the roof is to be lightened and strengthened by replacing the damaged wooden frame by a steel structure. Inner walls are to be installed in the experimental rooms on the ground floor to ensure airtightness. The first floor will be used as office as much as possible in order to reduce the area of new construction.

(4) Interior and Exterior Finishing

1) Basic Policy

a) Use as many materials available in local market as possible to reduce the construction cost and period.

b) Select materials that are suitable for the local climate and environment, weather-resistant, and easy to maintain to save the maintenance cost.

c) Use chemical-resistant and durable materials considering function of the facilities such as vaccine production plant and laboratory buildings.

2) Construction Materials

a) Structural Materials

The reinforced concrete pillars, beams, and floor slabs which are generally used in Myanmar will be used. In principle, the walls are to be constructed with concrete blocks.

b) Exterior Finishing Materials

Major exterior finishing materials are shown below.

(i) Vaccine Production Building

The building will be newly constructed with the finishing materials listed in Table 2- below.

Table 2-7 Exterior finishing materials to be used for the vaccine production building

Part	Finishing materials	Notes
Roof	Dry thermal insulation layer on the water-resistant layer	Designed for higher thermal insulation
Exterior walls	Covered with thermal insulated metal panels and trowelled mortar	Designed for higher thermal insulation
Doors & windows	Steel and wooden doors and aluminum sashes	Designed for higher airtightness and durability
Exterior pavement	Interlocking block pavement and concrete pavement	Common in Myanmar

(ii) FMD Diagnostic Laboratory Building

The building will be renovated with the finishing materials listed in Table 2- below.

Table 2-8 Exterior finishing materials to be used for the FMD diagnostic laboratory building

Part	Finishing materials	Notes
Roof	Insulated and covered with metal sheet	Replacing the existing tiles to enhance thermal insulation and lighten the roof
Exterior wall	Repairing the existing brick walls.	Restoring the walls to their original appearance
Doors & windows	Steel and wooden doors and aluminum sashes	Replacing the existing wooden sashes to enhance durability
Exterior pavement	Interlocking block pavement and concrete pavement	Common in Myanmar

c) Interior Finishing Materials

The interior finishing materials to be used for main rooms are shown below.

(i) Vaccine Production Building

The building will be newly constructed with the finishing materials listed in Table 2- below.

Table 2-9 Interior finishing materials to be used for the vaccine production building

Room/unit	Floor	Wall	Ceiling	Notes
Vaccine production unit	Paint	Decorative calcium silicate board	Decorative calcium silicate board	For higher chemical resistance, durability, and cleanliness
Cell culture, sterilization, and quality control unit	Paint	Paint	Paint	For cleanliness
Corridor	Tile	Paint	Paint	For higher durability
Storage	Tile	Paint	Paint	For higher durability
Office	Tile	Paint	Mineral fiber acoustic board	For higher durability

(ii) FMD Diagnostic Laboratory Building

The building will be renovated with the finishing materials listed in Table 2- below.

Table 2-10 Interior finishing materials to be used for the FMD diagnostic laboratory building

Room	Floor	Wall	Ceiling	Notes
Experimental and washing rooms	Paint	Paint	Paint	For cleanliness
Freezer room	Tile	Paint	Painted (direct ceiling)	For higher durability
Corridor (on the ground floor)	Tile	Paint	Painted	For higher durability
Corridor (on the first floor)	Paint	Paint	Hardwood	Considering dead loads
Office (on the ground floor)	Tile	Paint	Painted (direct ceiling)	For higher durability
Office (on the first floor)	Paint	Paint	Mineral fiber acoustic board	Considering dead loads
WC	Tile	Tile	Paint	For higher durability

(5) Structural Design

1) Foundation Structure Design

A geological survey of the proposed construction site found that the soil has a bearing capacity of approximately 5t/m^2 at a depth of 2m below the present ground. The Project's building is to be supported on direct foundations placed 2m below the current ground surface.

2) Superstructure Design

In principle, the Project's building is to be of rigid-frame reinforced-concrete frame with anti-seismic walls considering its low-rise. The non-anti-seismic wall are to be constructed of concrete blocks, which are common in Myanmar.

3) Load

In this Project, the external forces and loads are assumed as follows, considering the local climate and geographical conditions as well as the building functions.

a) Dead Load

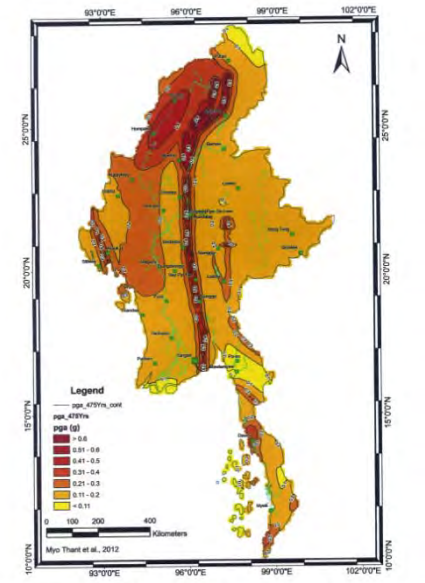
The dead load will be calculated by adding up the weight of all structural and finishing materials to be used for each building.

b) Wind Load

The wind load will be calculated in accordance with the Building Standards Act of Japan.

c) Live Load

The live load will be calculated in accordance with the current situation of Myanmar and the Building Standards Act of Japan.



Probabilistic Seismic Hazard Map of Myanmar for 10% probability of exceedance in 50 years (475 years recurrent interval), the seismic hazard is described in term of peak ground acceleration (PGA) in g (firm rock).

Figure 2-5 Earthquake zone map of Myanmar

d) Seismic Load

The seismic load will be evaluated in accordance with the earthquake zone map (Figure 2-5). According to the map, the Project site is located in Earthquake Zone II (Moderate Zone), where the possible peak ground acceleration is estimated at 110-200 Gal.

e) Structural Material

Table 2-1 below shows main materials to be used.

Table 2-1 Main materials to be used

Materials	Specifications
Concrete	Design strength: Fc=24N/mm^2
Reinforcing iron bar	Yield strength: 345 N/mm^2, 295 N/mm^2

(6) Electrical System Design

1) Service Drop and Transformers

In the western part of the LBVD's premises in Insein Township, electricity is supplied from the Insein Road through an underground high-voltage cable of 6.6kV and distributed to individual buildings through a transformer installed about 100m south of the Project site.

There are, however, problems such as difficulties in maintenance because the drawings of the existing electrical system have been lost. Moreover, the capacity of the existing transformer is too small to run the Project's facilities. Therefore, in this Project, an 11kV high-voltage cable is to be newly installed to bring electricity from the Insein Butaryon Road to the Project's facilities. The electricity is to be supplied to the vaccine production plant and FMD diagnostic laboratory through a new transformer rated 250 kVA. The cost to install the primary line to the new transformer is borne by the Myanmar side..

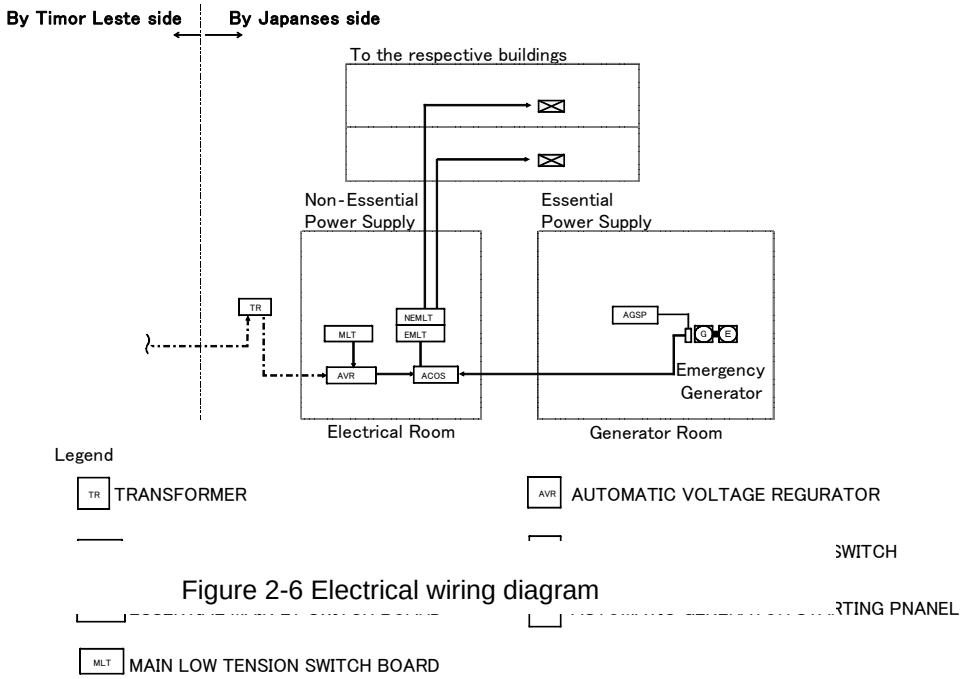


Figure 2-6 Electrical wiring diagram

2) Power Supply Facilities

a) Primary Power Facilities

Electricity is supplied to the buildings from the main distribution board to the switchboards/control panels of the respective buildings through underground cables.

b) Backup Power Generator

A backup generator with a capacity of 70kVA is to be installed to ensure the minimum necessary supply of electricity for the Project's facilities in the case of a blackout. It will supply

power only to the incubation rooms of the cell culture and vaccine production units; refrigerators and freezers to store reagents, viruses, and specimens; and the interlocking doors of the major airlocks for zoning.

3) Lighting and Socket Outlets

A lighting switchboard is to be installed on each floor. The circuit configuration, as well as the secondary piping and wiring from the switchboards to lighting equipment and electrical outlets, will be planned appropriately

a) Lighting Equipment

General lighting equipment: Power-saving equipment such as LED lights is to be selected.

Emergency lighting equipment: Battery-operated LED wall lights are to be installed in rooms and corridors for emergency purposes.

b) Socket Outlets

All general electrical outlets are to be earthed. The number of sockets will be carefully determined to meet minimum needs.

4) Telephones

Telephone lines are to be wired from the Office 1 (Management) at the FMD diagnostic laboratory. The rooms equipped with telephone lines will be selected to meet minimum needs.

5) LAN System

LAN cables are to be installed from the Office 1 (Management) at the FMD diagnostic laboratory. The rooms equipped with LAN outlets will be selected to meet minimum needs.

6) Fire Alarm System

According to the local laws and regulations, a fire alarm is not necessary for the Project's buildings because of its size and purpose. Nevertheless, a fire alarm system is to be installed so that everyone inside the building can be immediately informed of emergency.

7) Lightning Protection

A lightning conductor or rod is to be installed on the roof to protect the building from lightning strikes.

(7) Air Conditioning / Ventilation Design

1) Air-conditioning System

Room temperatures are to be set appropriately for vaccine production and FMD diagnostic processes, respectively. Because of the building size and local infrastructure, an air-conditioning system powered by electricity has been selected. A decentralized system that allows individual

control of air conditioning in each room or management zone has been selected not only because it would fit the building size but also because it would be easy to repair and save the running costs. In principle, packaged air-conditioning units and direct-expansion-coil-type outdoor units are to be procured.

In the Project, only cleanable rough filters are planned to be purchased; however, filter boxes for HEPA filters are to be installed at the inlet ports of the air conditioners at the vaccine production plant and at the outlet ports of those at the laboratory so that they can be upgraded in the future.

Table 2-2 below shows the air-conditioning equipment to be installed in each zone.

Table 2-2 Air-conditioning equipment

Building	Room	Air-conditioning equipment
Vaccine production building	Cell culture area Quality control area	Direct-expansion coil air conditioners + Air-cooled packaged air conditioners
	Vaccine production area	Direct-expansion coil air conditioners + Air-cooled packaged air conditioners
	Offices and storages	Air-cooled packaged air conditioners
FMD diagnostic laboratory building	Experimental rooms, etc.	Direct-expansion coil air conditioners + Air-cooled packaged air conditioners
	Offices	Air-cooled packaged air conditioners

Figure 2-7 below shows the design of the air-conditioning system.

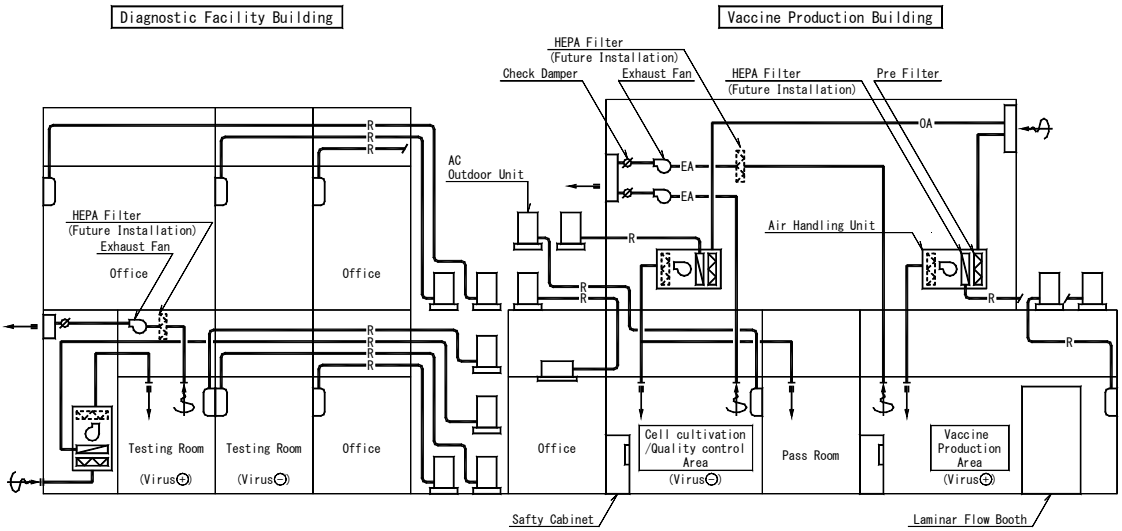


Figure 2-7 Air-conditioning system diagram

2) Ventilation Equipment

Each room is to be equipped with a mechanical ventilation system to supply fresh air. The WCs,

machine rooms are to be equipped with exhaust fans to remove smell, heat, and dust.

(8) Plumbing System Design

1) Sanitary Equipment

Low-tank toilets with hand showers, a flush-valve urinal, washbasins and other sanitary equipment are to be installed.

2) Water Supply Facilities

The existing buildings are supplied with water not only from the city's waterworks system but also from community water tanks fed from nearby wells. However, there are still water shortages, especially in the dry season (from February to May). Although there is a tube well in the premises, because the underwater pump as well as the casing of the well itself has been deteriorated over time, a new tube well will be built to ensure a reliable supply of water.

This water is to be reserved in a raw water tank, filtered to remove sand and iron, and pumped from the reservoir to an elevated water tank, and then supplied by gravity to where it is needed.

Table 2-3 below shows the estimated amount of water needed for each unit.

Table 2-3 Estimated amount of water needed

Target	Estimated number of staff (persons)	Unit amount of water needed (litter per person/day)	Daily amount of water needed
Staff at the vaccine production plant	34	(100L/person×0.6)	2,040 L
Staff at the FMD diagnostic laboratory	14	(100L/person×0.6)	840 L
Administration staff	5	(100L/person×0.6)	300 L
Subtotal	53		3,180 L →4 m^3
Vaccine production	-	15Lit×6 times/hr×8hrs×5	3.6 m^3 →4 m^3
Total			→8 m^3

Note: The unit amount of water is calculated by taking 60% of the average amount of water consumed in Japan.

The necessary capacity of equipment is estimated as follows.

Reservoir	8m^3 (the daily amount of water needed)
Elevated water tank	8m^3 (the daily amount of water needed)
Water pump	100L/min (to pump the daily required amount of water in 1.35 hours)

3) Drainage Facilities

The public sewerage system has not been developed around the Project site; therefore, a unit-type combined septic system will be built through the Project. The infectious wastewater is to be treated by the septic system after it is chemically inactivated and neutralized to an appropriate pH.

The treatment capacity of the septic system will be designed to meet the wastewater quality standards suggested by the International Financial Cooperation (IFC), in which Myanmar has gained membership, because such standards have not been developed in the country (See エラー! ブックマークが自己参照を行っています。 below). The treated wastewater is to be discharged to the regulating reservoir in the north of the Project site.

Table 2-4 Wastewater quality standards

Item	Wastewater quality standards set by the IFC	Quality of water (planned)	
		Quality of inflow water	
BOD	30ppm	200ppm	BOD
SS	50ppm	200ppm	SS
pH	6-9	-	pH

Table 2-5 below shows the treatment capacity of the septic system.

Table 2-5 Treatment capacity

Tank		Treatment capacity
Sterilization/neutralization tank	infectious wastewater (pretreatment)	$2m^3$/day x 1 tank
Combined treatment tank	Inactivated infectious wastewater and other wastewater	$8m^3$/day x1 tank

The septic system should be inspected every two months for sludge accumulation and any other damage and cleaned, if necessary, to remove sludge formation.

4) Firefighting System

According to the local laws and regulations, necessary firefighting system is not specified for the project buildings since its scale is small enough. Nevertheless, a fire hydrant system is to be installed referring to Japanese standard.

Figure 2-8 below shows the design of the plumbing system.

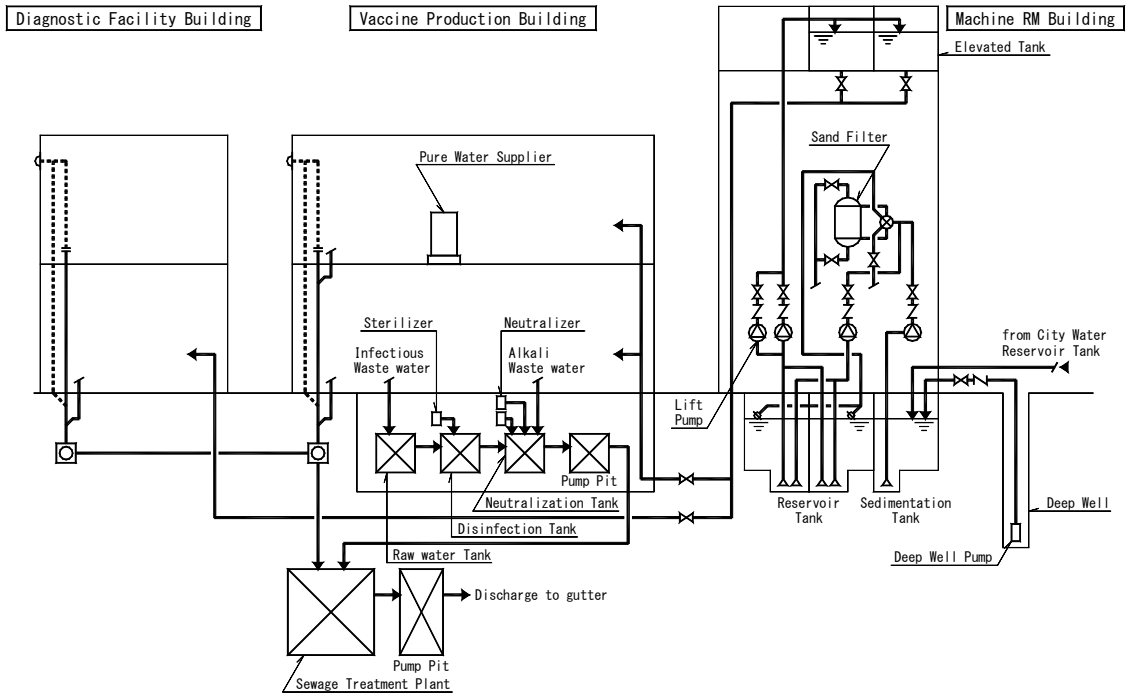


Figure 2-8 Plumbing system diagram

(9) Special System and Equipment for Vaccine Production

Large-scale installation and piping works will be required for special system and equipment for FMD vaccine production, such as water purification/supply system, a pure steam generator, a water-for-injection generator/supplier, autoclaves, a CIP unit, waste disinfectant unit, laminar flow booths. These installation and piping works should be frequently coordinated with building construction works. Moreover, they should be carefully planned to minimize the time taken for installation. Therefore, works for special system and equipment for vaccine production are to be integrated into the building construction works.

2-2-2-3 Equipment Plan

(1) Vaccine production control equipment

PC, printer, fixtures and fittings are planned to make manufacturing records, standard operation procedure (SOP) and quality control record and for its output.

(2) Equipment for sterilization

To assure aseptic condition, all the equipments and materials must be sterilized when they are supplied. Equipments in contact with the virus or waste materials generated during manufacturing process also need to be sterilized. Therefore, equipments for sterilization are included in the plan.

(3) Equipment for cultivation process of cell and virus

Equipments for cultivation of BHK21 cell in roller bottles, equipments to inoculate virus in the cultivated cells and equipment to amplify the virus are included in the plan.

(4) Equipment for virus purification and vaccine production process.

Equipments to purify and inactivate the harvested virus after amplification are included in the plan. For the production process with handling of the virus and aseptic condition, bio-safety cabinet and clean bench are included in the plan.

(5) Equipment for vaccine filling and storage

Tanks in order to store vaccine stock solution temporally which is assumed to have the volume of from 300L to 500L. are included in the plan. Also, equipments for filling the vaccine into the bottles (number of bottles is from 3,000 to 5,000 in a batch), for capping with rubber and aluminum cap are included in the Project. This filling and capping process would share the aseptic working area with cell cultivation process.

(6) Other equipment required for vaccine production

Equipment for preparation of medium, adjustment of instruments and cleaning are required are included in the plan.

(7) Equipment for diagnosis

Equipments for nucleotide analysis with PCR, antigen detection and antibody detection with ELISA are included in the plan. Additionally, essential equipments currently used in the existing laboratory are planned to be updated. Moreover, missing equipments for the activity of the existing laboratory are also planned.

As a result of abovementioned investigation, the final equipment list is shown in Table 2-17.

While initial equipment list was sorted into section and unit, the final equipment list is sorted into name of the equipment. Major equipment is shown in Table 2-16 bellow.

Table 2-16 : Major Equipment

Seri-al No.	Request No.	Equipment Name	Main Specifications	Q'ty	Purpose of Use
9	UT-15	Washing Machine	Max Capacity: 20kg/time or more Rotating rate(Spinning): 707rpm or more	2	For washing clothes for laboratory
11	PT-10	Inverted Microscope with Camera	Composition: Main Unit x 1, Digital Camera x 1 Main Unit Type: Trinocular tube microscope for routine observation Illumination: Halogen 30W Eyepieces: 10x or more Magnification: 40x ~ 1000x Digital Camera Function: Take photograph of microscope	3	For observation cells inside roller bottle
12	PT-11	Roller Apparatus	Load capacity of bottle: 150 or more Turn speed: 0.25~6.0rpm or wider Battery run time: 6hrs or more	2	For cells and virus cultivation with rolling roller bottles
16	PT-15	Clean Bench A	Width of inside: Approx. 1870mm Height of inside: Approx. 720mm Cleanliness factor: Class 100 or better Air flow: Approx. 26m3/min HEPA filter: Provided Pre filter: Provided	2	For work for virus treatment without contamination
19	PT-21-1	CO2 Incubator A	Composition: Main Unit x 1, Turn unit for roller bottle x 1 Main Unit Type: CO2 Incubator for roller bottle culture Capacity: 165L or more Turn speed: 0~2rpm or wider Operating temperature range: Room. Temp. +5 degree to 50 degree or wider Turn Unit for roller bottle Number of roller bottle: 12	2	For cultivating cells with rolling bottles
20	PT-21-2	CO2 Incubator B	Composition: Main Unit x 1, Turn unit for roller bottle x 1 Main Unit Type: CO2 Incubator for roller bottle culture Capacity: 165L or more Turn speed: 0~2rpm or wider Operating temperature range: Room. Temp. +5 degree to 50 degree or wider Turn Unit for roller bottle Number of roller bottle: 6	2	For cultivating cells with rolling bottles
21	PT-25	Ultra Centrifuge	Composition: Main Unit x 1, Rotor x 1 Main Unit Max. Speed: 22,000rpm or more Operation temperature range: -9degree to 35degree or wider Timer: 0 ~ 99 mins 59 seconds. or longer Refrigeration: Equipped Rotor Capacity: 1000ml x 4~6 units	2	For using process of vaccine production

Seri-al No.	Request No.	Equipment Name	Main Specifications	Q'ty	Purpose of Use
22	PT-27	Refrigerated Centrifuge	Composition: Main Unit x 1, Rotor x 1 Main Unit Max. Speed: 4,700rpm or more Operating temperature range: -10degree to 40 degree or wider Timer: 1~99min. 59 seconds or longer	3	For centrifuging with refrigeration
26	PT-31	Bio-safety Cabinet	Type: Floor type Bio-safety level Class AII Dust collection efficiency: 99.99% or more (0.3μm PAO particle) Filter: HEPA filter Dimension of work space: W1,870～1,950×D623～700mm	6	For working without contamination
34	ST-03	Deep Freezer	Inside capacity; 309L or more Inside material: Stainless steel Safety: Alarm for power failure, temperature, sensor, etc. Inside temp.:-80degree to -60degree or wider	3	For storing freezing materials
36	MS-01	Glass Ware Set for Vaccine Production	Composition: Beaker, flask, cylinder, micropipette, etc.	1	For using many processes in vaccine production
37	MS-02	Tool Set for Vaccine Production	Composition: Bucket, power scoop, safety glasses, stirrer, etc.	1	For using many processes in vaccine production
53	DS-01	Real-Time PCR System	Block formats: 96well plate Sample volume: 10~50μl or less Temperature range: 30~110degree or wider Interface: USB or Ethernet	2	For amplifying RNA virus
56	DS-10	Microplate Reader	Plate type: 96 well plates Wavelength range: 340~750nm or wider Accuracy: ±1%(0.3~3Abs)	2	For reading result of ELISA
60	DS-17	Ultra--Low Temperature Freezer	Min. temperature: -85degree or lower Capacity: Approx. 540L	2	For storing freezing blood
72	DS-36	Bio-safety Cabinet B	Width of inside: Approx. 1870mm Height of inside; Approx. 720mm Cleanliness factor: Class 100 or better Air flow: Approx. 26m3/min HPEA filter: Provided Pre filter: Provided	1	For working without contamination
78	DS-45-1	Laboratory Table B	Dimension(WDH): 4200mm × 1500mm × 800mm Electrical outlet: Equipped Sink: Equipped Table top material: Heat-resistant, tolerability, waterproof	1	For FMD diagnosis
90	DS-48	Reagent Set	Composition; Reagents which is necessary for Vaccine manufacturing and diagnosis.	1	For FMD diagnosis, vaccine production
91	MS-11	Media Filtration Unit	Composition: Medium filtration unit x 2, filter x 1set Filter Size: 30 inch (920m/m) Main unit material: SUS304 Caster: Equipped	1	For filtration of medium for cell culture

Seri-al No.	Request No.	Equipment Name	Main Specifications	Q'ty	Purpose of Use
92	MS-12	Capping System	Composition: Capping Machine x 4, Aluminum Capping unit x 4 Size of bottle: 100cc PP bottle Driving type: Semi-Automatic air driving type	1	For capping bottles of vaccine
94	DS-49	DNA Sequencer	Composition: DNA Sequencer x1 , materials x 1 DNA Sequencer No. of capillary: 8 Sample capacity: 96 well plate Materials Composition: Polymer, Buffer, DNA sequencing kit, etc.	1	For analyzing nucleotide type of virus

Table 2-17 : Equipment List

Seria-l No.	RequestNo.	Equipment Name	Q'ty	Unit	Demarcation	
					Vaccine Production	
1	PM-01	Personal Computer	16	Sets		1
2	PM-02	Color Laser Printer	2	Sets		2
3	PM-03	Laser Printer	6	Sets		3
4	PM-04	PC Desk	12	Sets		4
5	PM-05	Projector	1	Set		5
6	PM-06	Screen	1	Set		6
7	UT-17	Autoclave (Floor Standing)	6	Sets	4	7
8	UT-12	Hot Air Sterilizer	4	Sets	2	8
9	UT-15	Washing Machine	2	Sets		9
10	UT-16	Tumble Dryer	2	Sets		10
11	PT-10	Inverted Microscope with Camera	3	Sets	3	11
12	PT-11	Roller Apparatus	2	Sets	2	12
13	PT-12	Roller Bottle	300	Sets	300	13
14	PT-13	Roller Bottle Cap	500	Sets	500	14
15	PT-14	Centrifuge for Cell Production	2	Sets	2	15
16	PT-15	Clean Bench A	2	Sets	2	16
17	PT-16	Waste Suction Unit	7	Sets	7	17
18	PT-20	Gas Torch	8	Sets	6	18
19	PT-21-1	CO2 Incubator A	2	Sets	2	19
20	PT-21-2	CO2 Incubator B	2	Sets	2	20
21	PT-25	Ultra Centrifuge	2	Sets	2	21
22	PT-27	Refrigerated Centrifuge	3	Sets	3	22
23	PT-28	Bottles for Centrifuge	150	Sets	150	23
24	PT-29	Tubing Pump	4	Sets	4	24
25	PT-30	Silicone Tube for Tubing Pump	12	Sets	12	25
26	PT-31	Bio-safety Cabinet	6	Sets	5	26
27	PT-33-1	Electric Balance A	1	Set	1	27
28	PT-33-2	Electric Balance B	5	Sets	3	28

Seria-l No.	RequestNo.	Equipment Name	Q'ty	Unit	Demarcation	
					Vaccine Production	
29	PT-34	EC meter	3	Sets	3	29
30	PT-35	pH meter	5	Sets	3	30
31	PT-36-1	Constant Temperature Water Bath A	1	Set	1	31
32	PT-36-2	Constant Temperature Water Bath B	2	Sets	2	32
33	ST-02	Freezer (Portrait Type)	3	Sets	3	33
34	ST-03	Deep Freezer	3	Sets	3	34
35	ST-04	2 Doors Refrigerator	10	Sets	5	35
36	MS-01	Glass Ware Set for Vaccine Production	1	Set	1	36
37	MS-02	Tool Set for Vaccine Production	1	Set	1	37
38	MS-03	Hemacytometer	20	Sets		38
39	MS-04-1	SUS Worktable A	2	Sets	2	39
40	MS-04-2	SUS Worktable B with chair	3	Sets	3	40
41	MS-04-3	SUS Worktable C	5	Sets	5	41
42	MS-04-4	SUS Worktable D	2	Sets	2	42
43	MS-04-5	SUS Worktable E	1	Set	1	43
44	MS-04-6	SUS Worktable F	1	Set	1	44
45	MS-04-7	Laboratory Center Table	2	Sets	2	45
46	MS-04-8	Laboratory Table A	1	Set	1	46
47	MS-05	Silicon Hose Set	5	Sets	5	47
48	MS-06	Temperature Data Logger	8	Sets	8	48
49	MS-07	Surface Thermometer	2	Sets	2	49
50	MS-08	Trolley	10	Sets	10	50
51	MS-09	PP Container	3	Sets	3	51
52	MS-10	Tool Set	1	Set	1	52
53	DS-01	Real-Time PCR System	2	Sets		53
54	DS-07	Microplate Shaker	2	Sets		54
55	DS-09	Microplate Washer	2	Sets		55
56	DS-10	Microplate Reader	2	Sets		56
57	DS-13	Low-Speed Centrifuge	2	Sets		57
58	DS-14	Micro Centrifuge	3	Sets		58
59	DS-16	Magnetic Stirrer	2	Sets		59
60	DS-17	Ultra--Low Temperature Freezer	2	Sets		60
61	DS-18	Freezer (Chest Type)	2	Sets		61
62	DS-20	Liquid Nitrogen Tank	2	Sets		62
63	DS-21	CO2 Incubator C	2	Sets		63
64	DS-22	Single Channel Micropipette Set	4	Sets		64
65	DS-23	Multi Channel Micropipette Set	4	Sets		65

Seria-l No.	RequestNo.	Equipment Name	Q'ty	Unit	Demarcation	
					Vaccine Production	
66	DS-25	Constant Temperature Water Bath C	2	Sets		66
67	DS-26	Water Distilizer	1	Set		67
68	DS-27	Inverted Microscope	2	Sets		68
69	DS-29	Analytical Balance	2	Sets		69
70	DS-33	Dry Oven	2	Sets		70
71	DS-34	Spectrophotometer	2	Sets		71
72	DS-36	Bio-safety Cabinet B	1	Set		72
73	DS-39	Touch mixer	5	Sets		73
74	DS-41	Aspirator	2	Sets		74
75	DS-42	Viral Titration Kit	1	Set		75
76	DS-43	Glass Ware Set for Diagnosis	1	Set		76
77	DS-44	Tool Set for Diagnosis	1	Set		77
78	DS-45-1	Laboratory Table B	1	Set		78
79	DS-45-2	Laboratory Table C	1	Set		79
80	DS-47	Stool	17	Sets		80
81	DS-46-1	Steel Shelf A	3	Sets	3	81
82	DS-46-2	Steel Shelf B	2	Sets	2	82
83	DS-46-3	Steel Shelf C	1	Set	1	83
84	DS-46-4	Steel Shelf D	2	Sets	2	84
85	DS-46-5	Steel Cabinet A	3	Sets	3	85
86	DS-46-6	Steel Cabinet B	3	Sets	3	86
87	DS-46-7	Heavy Load Steel Shelf	11	Sets	1	87
88	DS-46-8	Steel Storage Cabinet	1	Set	1	88
89	DS-46-9	Steel Cabinet C	21	Sets	9	89
90	DS-48	Reagent Set	1	Set	1	90
91	MS-11	Media Filtration Unit	1	Set	1	91
92	MS-12	Capping System	1	Set	1	92
93	MS-13	Filling Nozzle	1	Set	1	93
94	DS-49	DNA Sequencer	1	Set		94

2-2-3 Outline Design Drawing

Site plan

Vaccine production building　Ground floor plan

Vaccine production building　First floor plan

Vaccine production building　Elevations

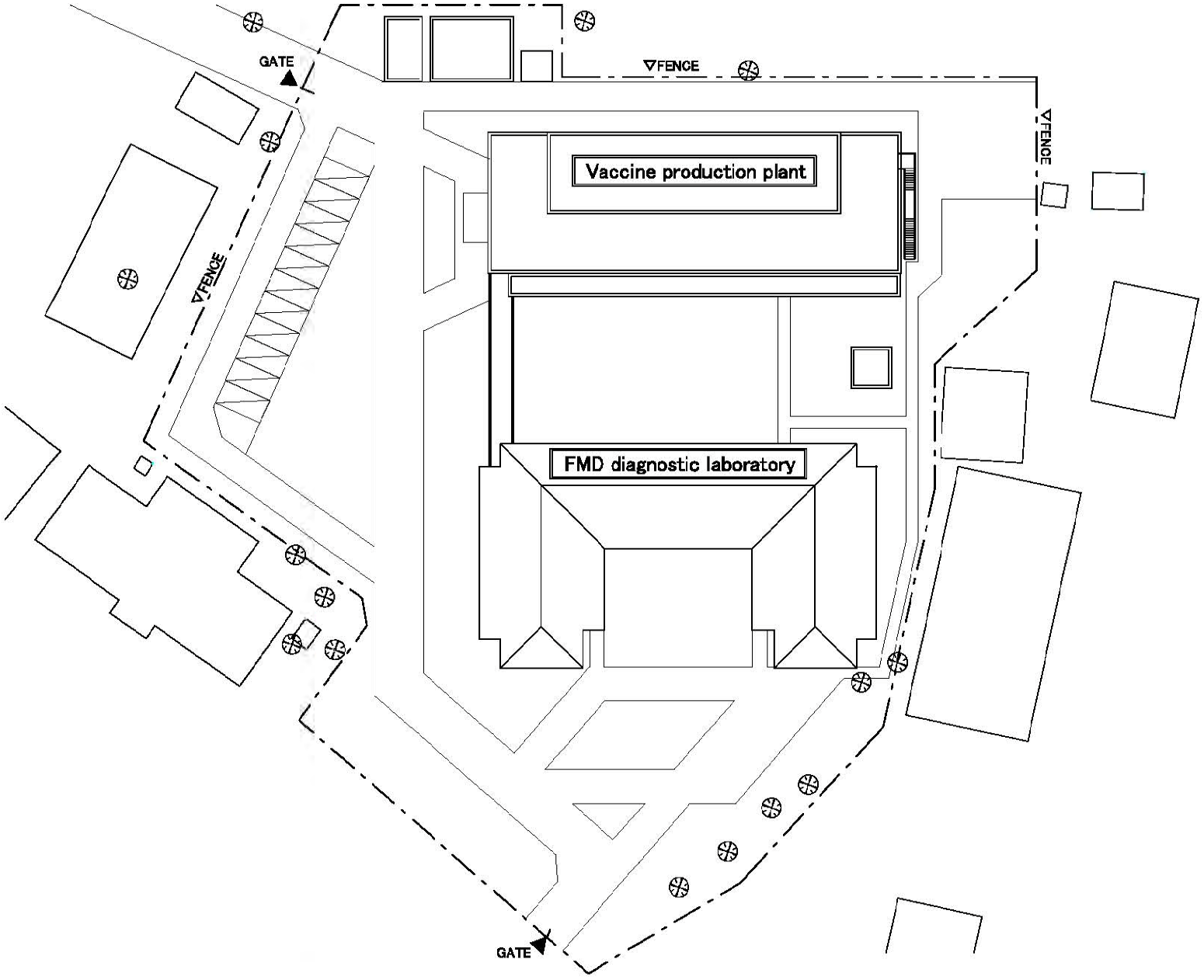
Vaccine production building　Sections

Diagnosis building　Ground floor plan

Diagnosis building　First floor plan

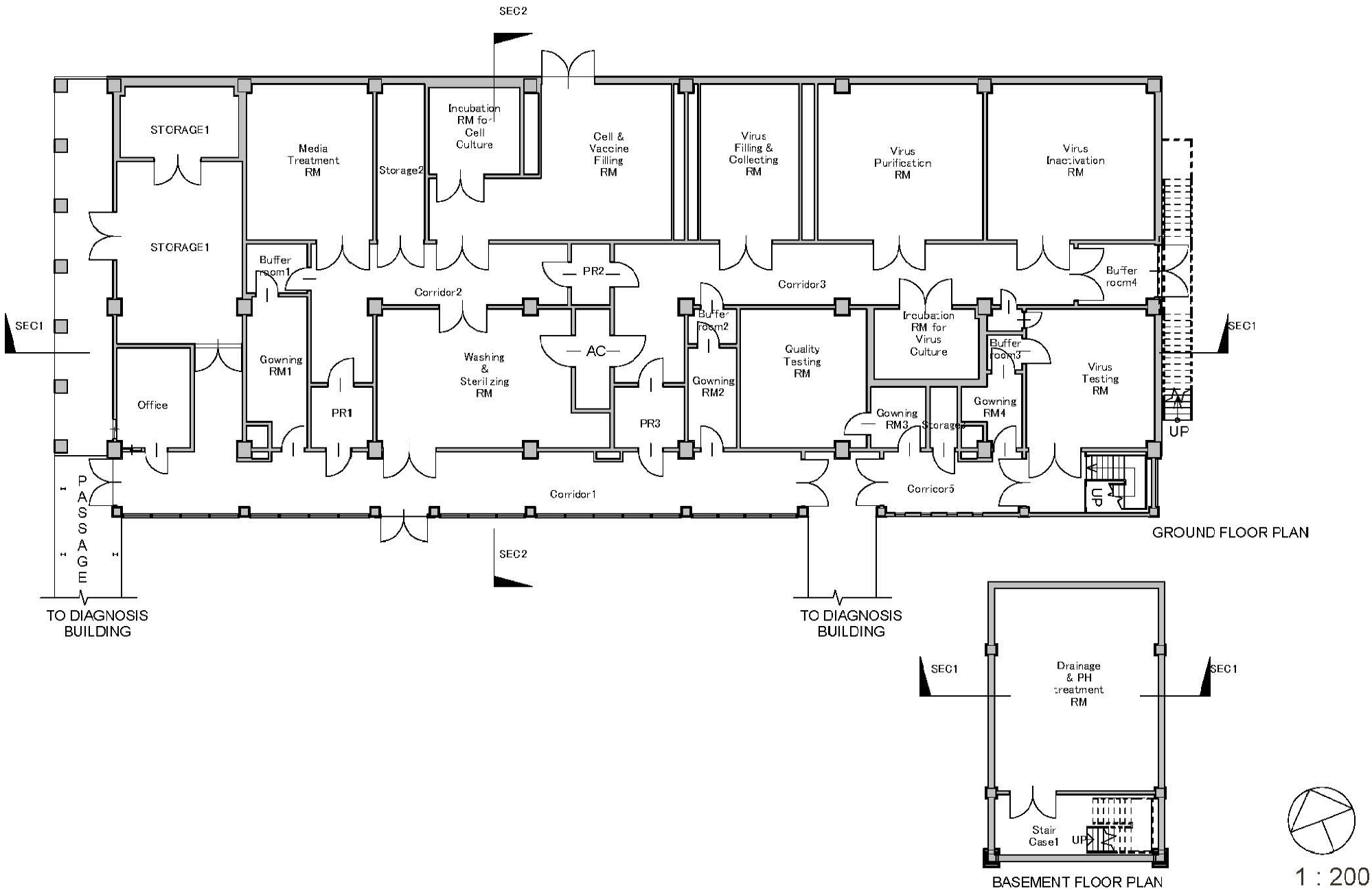
Diagnosis building　Elevations

Diagnosis building　Sections

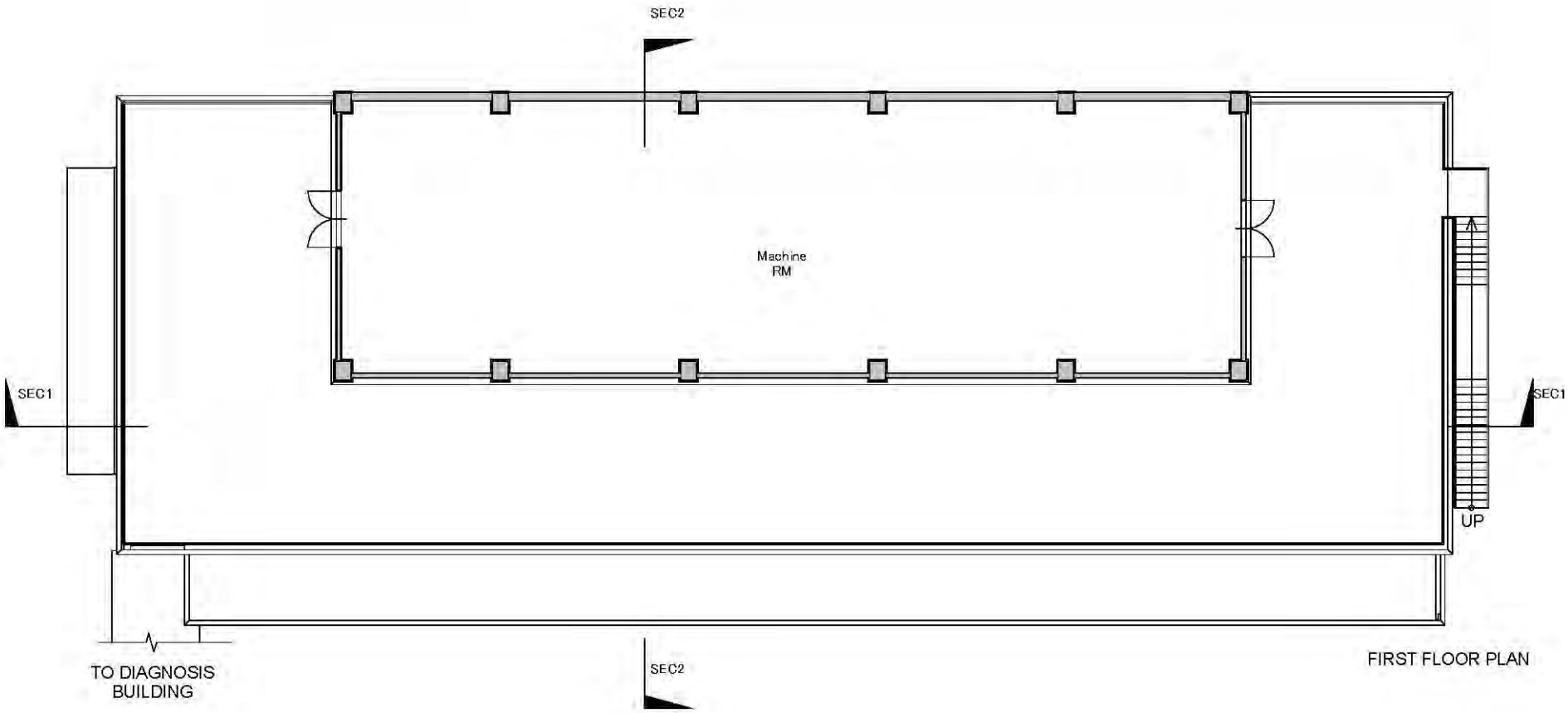


1 : 600

Project for Improvement of Foot-and-Mouth Disease Control | Vaccine production plant | Site plan



Project for Improvement of Foot-and-Mouth Disease Control | Vaccine production plant | Ground floor and basement floor plan

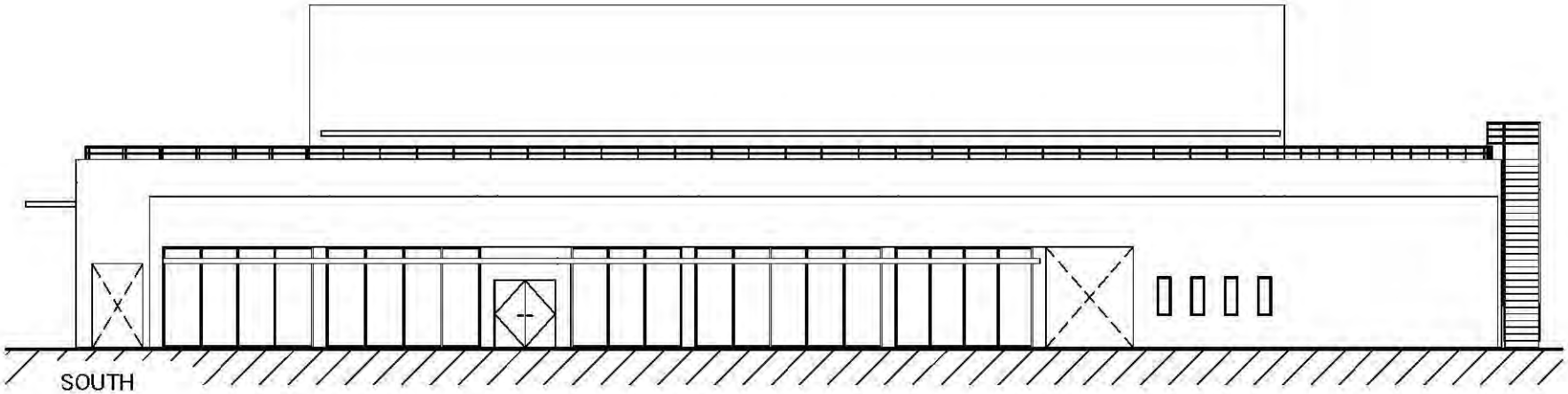


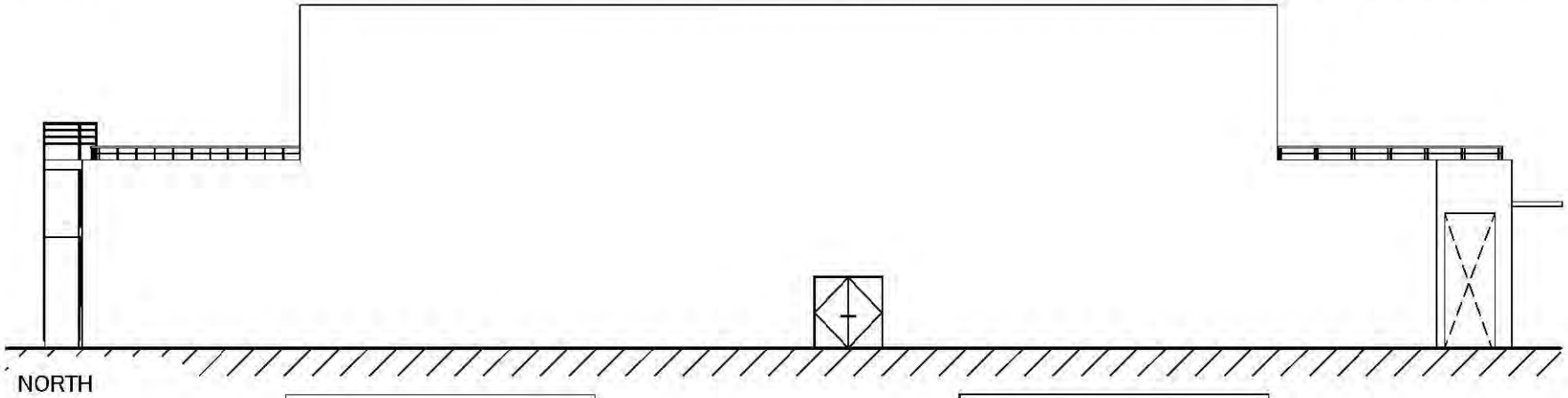
FIRST FLOOR PLAN

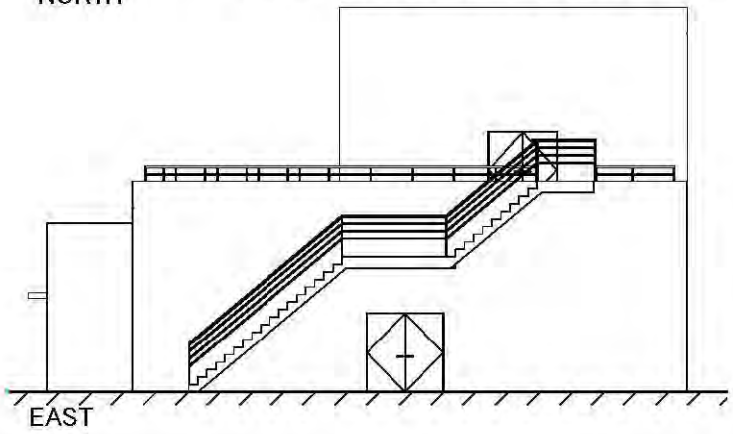
1 : 200

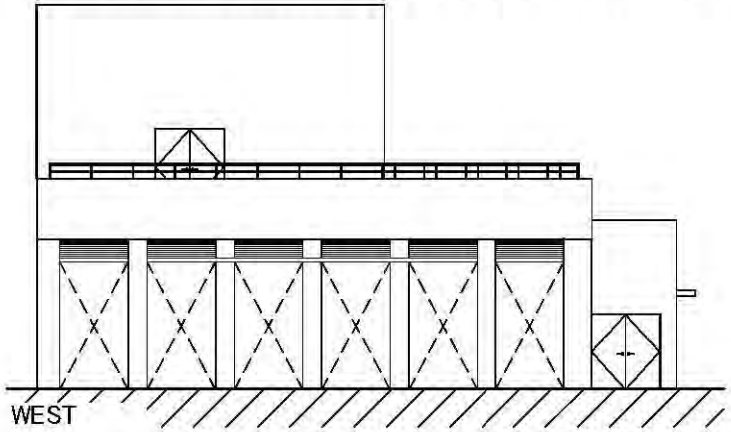
2-39

Project for Improvement of Foot-and-Mouth Disease Control | Vaccine production plant | First floor plan









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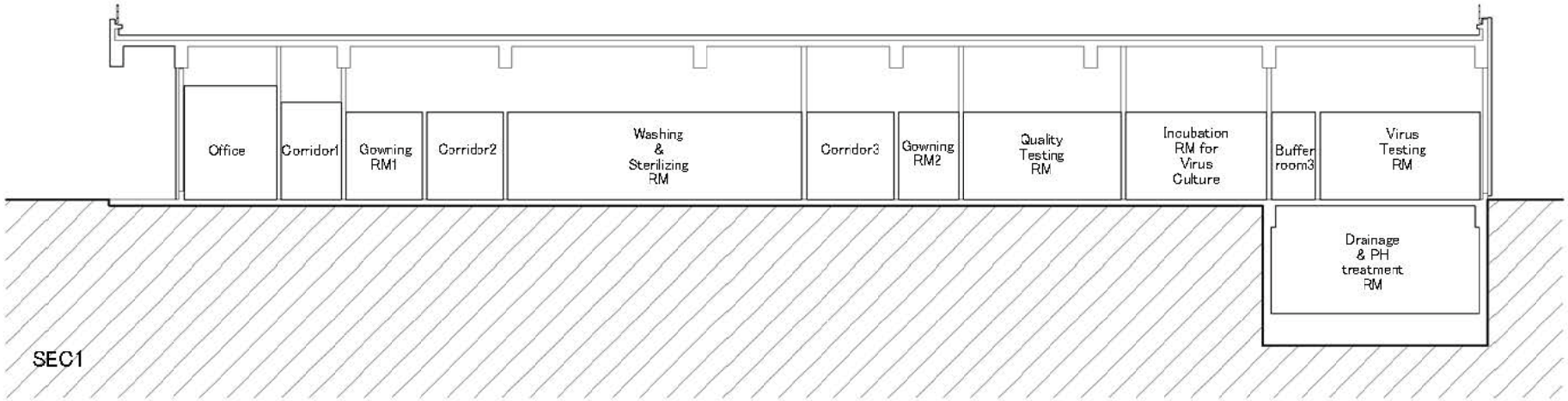
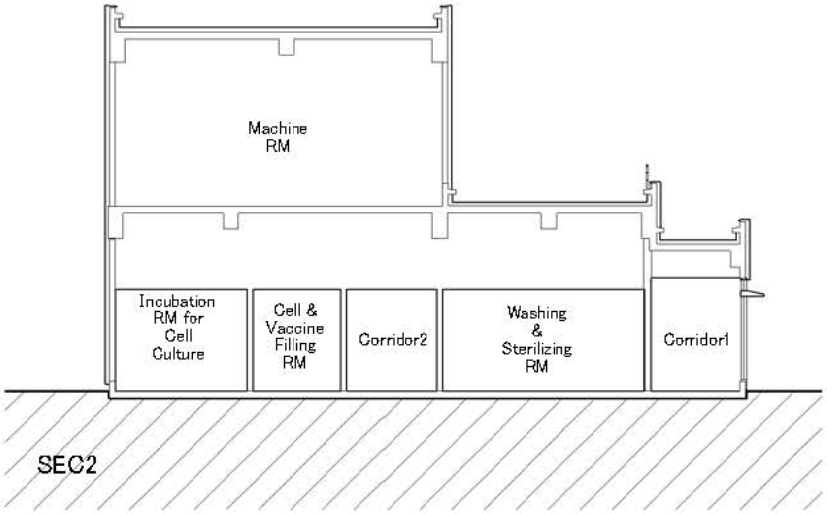
2-40

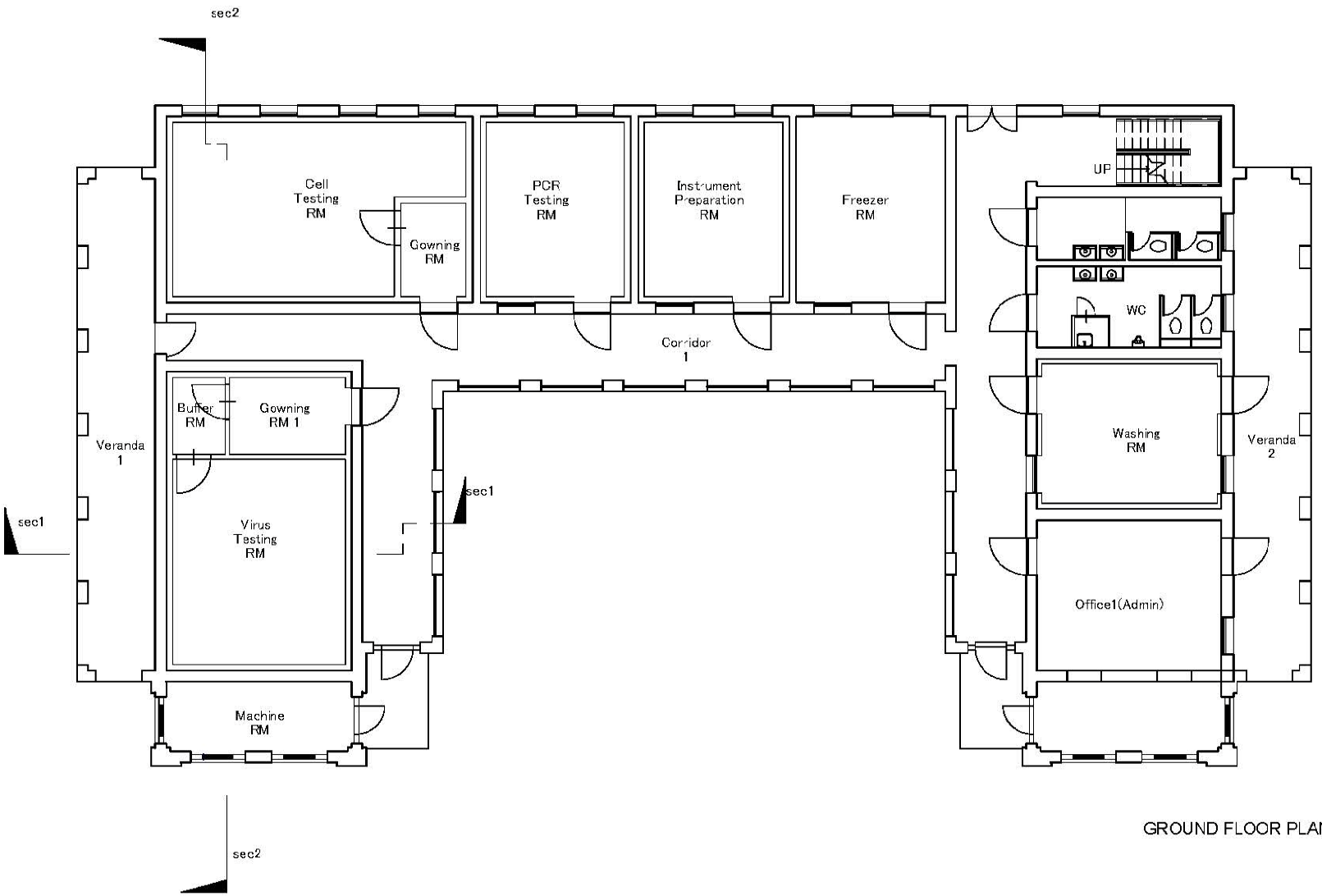
Project for Improvement of Foot-and-Mouth Disease Control | Vaccine production plant | Elevations





1 : 200

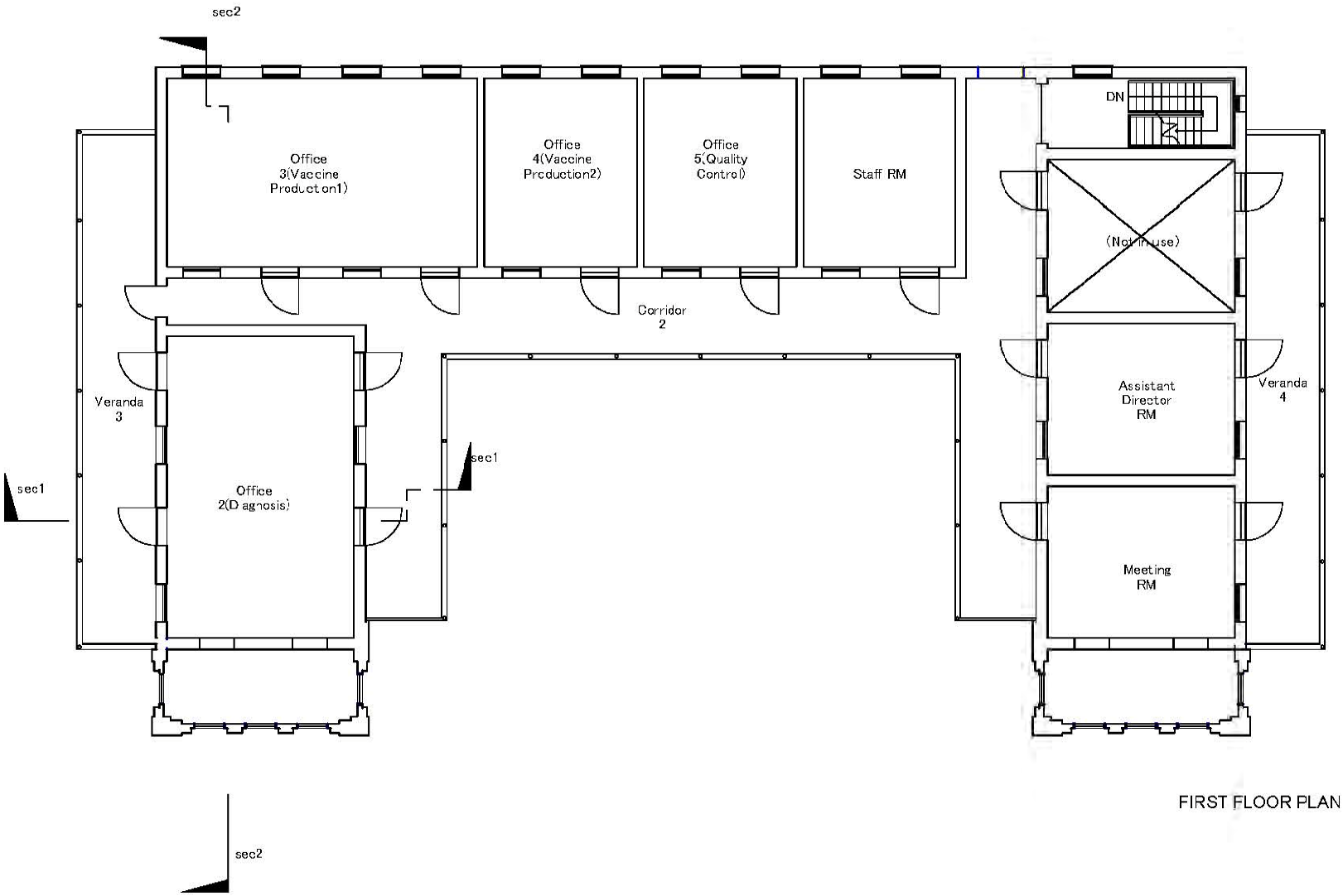
Project for Improvement of Foot-and-Mouth Disease Control | Vaccine production plant | Sections



GROUND FLOOR PLAN

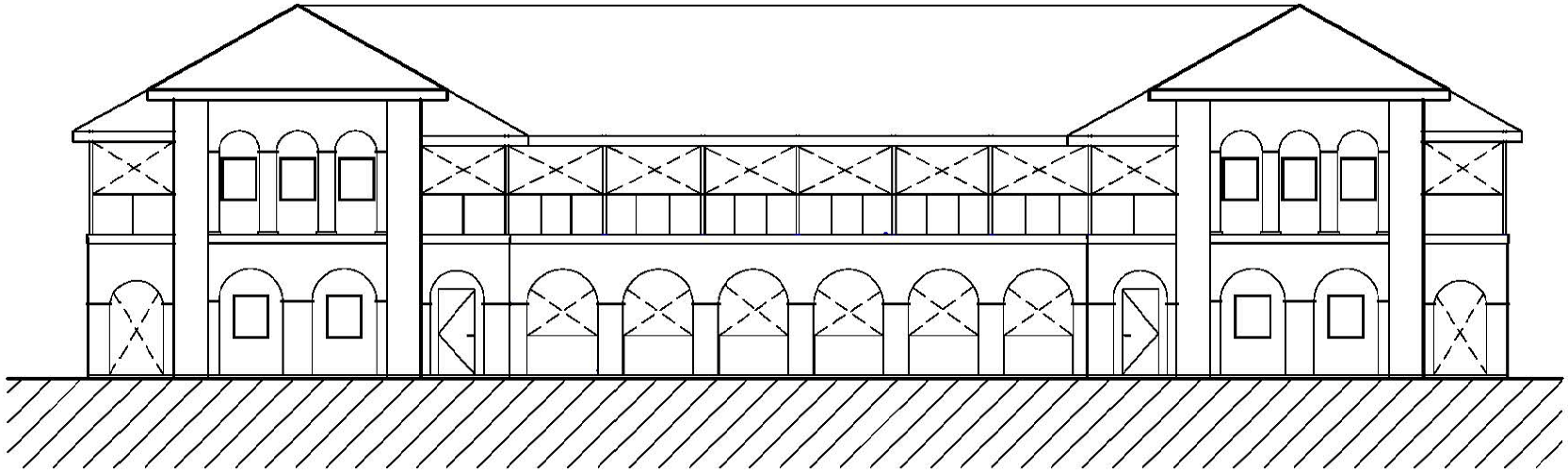
1 : 200

Project for Improvement of Foot-and-Mouth Disease Control | Diagnostic Facility Building | Ground floor plan

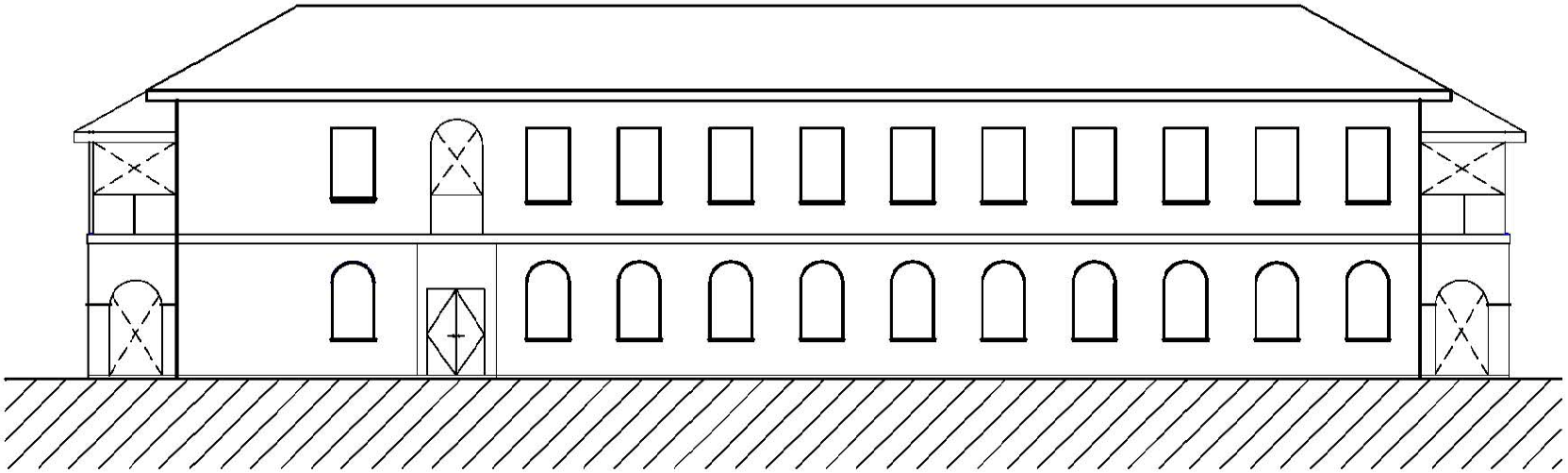


FIRST FLOOR PLAN

1 : 200



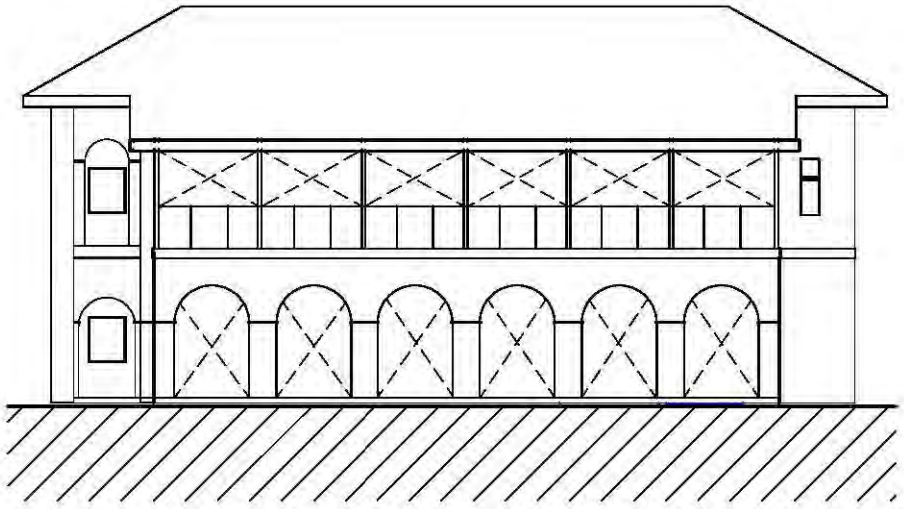
SOUTH

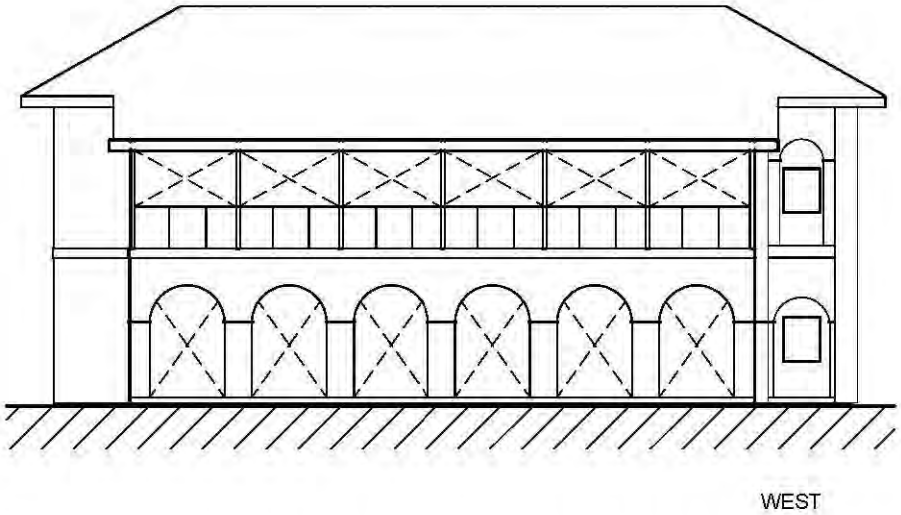


NORTH

1 : 200

Project for Improvement of Foot-and-Mouth Disease Control | Diagnostic Facility Building | Elevation1





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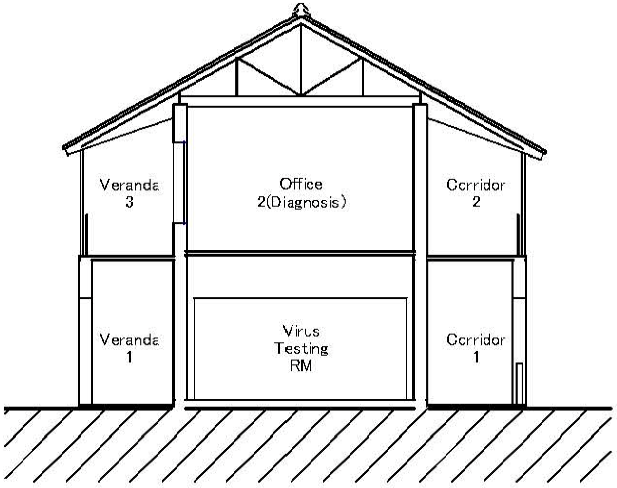
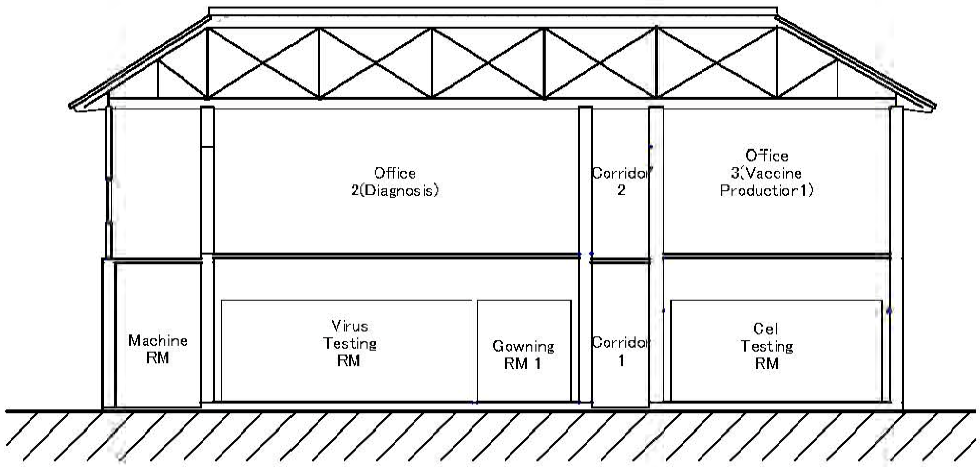


SEC1



SEC2

1 : 200

Project for Improvement of Foot-and-Mouth Disease Control | Diagnostic Facility Building | Section

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

This Project is to be implemented in accordance with Japan's Grant Aid Scheme. After the Project is approved by the Japanese Cabinet, the Governments of Japan and Myanmar will sign an Exchange of Notes (E/N), which is followed by the conclusion of a Grant Agreement (G/A) between JICA and the Government of Myanmar. Subsequently, the Government of Myanmar will enter into a consulting services agreement for the Project with a Japanese consulting firm, which will conduct a detailed design for the Project's facilities and equipment. Then, detailed design drawings and tender documents will be prepared for the tender. The Japanese contractor and equipment supplier awarded the contracts will construct facilities and procure and install equipment for the Project.

Once the construction starts, a supervision structure will be formed consisting of the implementing agency of Myanmar as well as the Japanese consultants, contractor, and equipment supplier.

(1) Project Implementation Structure

The line agency of the Government of Myanmar for the Project is the MOLFRD, and the executing agency is Livestock Breeding and Veterinary Department. As a representative of the executing agency, the director of the MOLFRD-LBVD will be a signatory of relevant agreements and contracts. LBVD staff and the director of the National Foot-and-Mouth Disease Laboratory will serve as coordinators to manage operations during the implementation of the Project.

(2) Consultants

After the E/N and G/A are signed as mentioned above, the MOLFRD will conclude a consulting services agreement for the detailed design and supervision of the Project with a Japanese consulting firm and obtain verification from JICA in accordance with the Grant Aid Scheme. After the agreement is verified, the consultants will prepare detailed design drawings and tender documents based on this preparatory survey report and discussions with the MOLFRD. Eventually, these documents will be explained to the MOLFRD to gain its consent.

During the tender and execution of the construction contract, the consultants are to assist in the tendering process and supervise the construction works based on the detailed design drawings and tender documents. For equipment procurement and installation, they are also to assist in the tendering process and supervise the installation, trial run, and commissioning of the equipment. The detailed tasks and responsibilities of the consultants are described as follows.

1) Detailed Design

Based on this preparatory survey report, the consultants are to create a detailed plan, review the equipment plan, and prepare tender documents consisting of relevant drawings, specifications, instructions to tenderers, drafts of contracts for construction works and equipment procurement. The

consultants are also to estimate the costs of the construction and equipment procurement.

2) Assistance in Tendering

The consultants are to assist the executing agency of Myanmar in tendering to select a contractor and an equipment supplier and in preparing paperwork for the respective contracts. The consultants are also to report the results of the tenders to the Government of Japan.

3) Construction Supervision

The responsibilities of the consultants are to confirm whether the contractor and equipment supplier are performing their respective works as specified in their contracts; to give them advice and guidance as well as coordinate all parties concerned from an impartial position to facilitate the smooth implementation of the Project; and to report the progress of the Project, the process of payment, the commissioning of completed facilities and equipment, and other relevant matters to the Project's executing agency and JICA.

The major tasks of the consultants are described below:

- Examine and confirm the construction plans, working drawings, equipment specifications, and other relevant documents submitted by the contractor and equipment supplier;
- Conduct pre-shipment inspection to examine and confirm the quality and performance of the construction materials, furniture, and equipment delivered;
- Ensure that building installations and equipment are delivered and installed and that operating instructions are given and demonstrated;
- Monitor and report the progress of the construction works; and
- Witness the commissioning of the completed facilities and equipment.

4) Equipment Procurement Supervision

When equipment is shipped, the consultants may have third-party inspectors to conduct pre-shipment inspection at the port of shipment. The consultants are to confirm the written inspection certificates submitted by the third-party inspectors. After acceptance inspection, the consultants are to promptly send inspection reports to the executing agency of Myanmar.

When equipment is installed, the consultants are to confirm the delivery of equipment, inspect installation works and initial operation training. After being installed, each of equipment is to be inspected on the spot for compliance with the contracts and checked for its product model, place of origin, manufacturer name, appearance, and the presence of ODA stickers on it. The commissioning of equipment should be witnessed by not only by the equipment supplier and consultants but also by representatives of the LBVD and the National FMD Laboratory.

5) Management Guidance as Soft Component

After the Project's facilities and equipment are set up, technical assistance will be provided to

ensure their proper operations and maintenance. Japanese experts and consultants will be dispatched on a regular basis to provide practical training and education for Myanmar staff by using the Project's equipment.

(3) Constructor and Equipment Supplier

A contractor and an equipment supplier are to be selected by open tender in which only qualified Japanese corporations are eligible to participate. In principle, the lowest tenderers are to be awarded the contracts with the MOLFRD for facility construction and equipment procurement, respectively. In accordance with their respective contracts, the contractor is to construct facilities, and the equipment supplier is to procure, deliver, and install equipment as well as provide the Myanmar side with operation and maintenance training for the equipment. Additionally, the equipment supplier is to prepare a list of contact information of the relevant manufacturers and local agencies so that the Project's target organization can purchase spare parts and consumable supplies and receive paid technical training after the equipment is handed over to them.

(4) Local Consultants and Constructors

A resident supervisor appointed from the Japanese consultants can hire local consultants as supervision assistants. The Japanese constructor can also subcontract part of its construction works to local constructors.

2-2-4-2 Implementation Conditions

(1) Points to Be Considered for Construction Works

In Yangon, there are many contractors who have substantial technical capabilities to work on the Project as subcontractors. Most of them have experienced in reinforced concrete frame and concrete block construction, which is the construction method adopted for the Project. Moreover, most construction materials are available in local markets as they are regularly imported from neighboring countries, such as Thailand and China. Skilled construction workers are also available in Yangon. Meanwhile, attention should be paid to the following pointes.

1) Work for Special System and Equipment

Some special facilities and equipment for vaccine production plant will need to be carefully designed. Not only should their detailed design drawings be reviewed before manufacturing, but also they should be temporarily assembled for inspection and operational testing in the workshop before delivery. Moreover, it is also important to plan delivery routes in the constructed building for some system. They should be installed by skilled workers to ensure that they work properly after their commissioning.

2) Schedule Management

In Myanmar, the rainy season from May to September poses great challenges in scheduling construction works. There will be a need to assure temporary areas/roads that would not be submerged in the construction site when it floods. Additionally, proper drainage measures should be taken during the rainy season to enable underground construction works such as foundation and exterior construction. The Japanese contractor should quickly complete these preparatory works as well as make a practical construction schedule by taking the above-mentioned challenges into account. The progress of construction is to be monitored at regular meetings with the implementing agency of Myanmar, the consultants, and the construction contractor.

3) Safety Management

The construction site should be temporarily fenced to minimize the number of entrances to it during the construction works. The contractor should control circulation of construction vehicles and workers for the safety of the neighborhood and for traffic. The existing walkways running through the construction site are to be detoured at the north of the site by the Myanmar side.

(2) Points to Be Considered for Equipment Procurement

Training of local staff about the operation and maintenance of the Project's equipment will be essential to ensure that it continues working property as well as to make full use of it for vaccine production and laboratory diagnosis. Therefore, the equipment supplier should carefully prepare tender documents, not only to hire skilled engineers with extensive knowledge and experience but also to enable them to devote proper period to such training.

2-2-4-3 Scope of Works

Table 2-6 below shows the demarcation of responsibilities between the Governments of Japan and Myanmar in the construction and equipment installation phases.

Table 2-6 Major undertakings to be taken by each government

Demarcation		Construction	Equipment procurement and installation
To be covered by the Japanese side		- Construction of a new vaccine production plant (including other relevant buildings) - Renovation work for the FMD diagnostic laboratory - Landscape work within the Project site	- Procurement, installation, trial run, and tune-up of equipment for vaccine production and FMD diagnosis - Explanation and training of operation and maintenance of the procured equipment
To be covered by the Myanmar side	To be completed before the Japanese side starts construction works	- Demolition and clearance of existing facilities, trees, etc. in the Project site - Ground leveling - Relocation of the existing infrastructure running through the site - Construction of walkway to detour traffic around the construction site	To be covered by the Myanmar side
	To be completed before the Japanese side finishes construction works	- Installation of a service drop (electricity)	

2-2-4-4 Consultant Supervision

(1) Consultant Supervision Policy

The construction works of this Project are to be supervised based on the following principles:

- Keep in close contact with the responsible officials of the relevant agencies of Myanmar and Japan to ensure that the construction of facilities and the installation of equipment are completed without delay.
- Give prompt and appropriate instructions and advice to the contractor and equipment supplier and their related members from an impartial position.
- Provide proper instructions and advice on the operation and maintenance of the facilities and equipment after their installation and commissioning; confirm the completion of the facility construction and equipment installation in accordance with their respective contracts; and then complete the contracts by witnessing the commissioning of the facilities and equipment to confirm their acceptance by the MOLFRD.

(2) Consultant Supervision Plan

A supervisor is to be stationed in the Project site throughout the construction period. Additionally, engineers in the following fields are to be dispatched to Myanmar in accordance with the construction progress.

- Project manager: Overall coordination and supervision of process and quality control
- Architect: Explanation of design intent and examination of materials
- Structural engineer: Analysis of bearing capacity of soil and examination of materials
- Mechanical engineer: Explanation of design intent and midterm and final inspection of plumping and air-conditioning works
- Electrical engineer: Explanation of design intent and midterm and final inspection of electrical works
- Vaccine plant specialist: Examination of manufacture drawings, inspection of trial assembly, installation and trial run

(3) Contractor

The Japanese contractor should have a construction manager stationed in the Project site in order to complete the construction as specified in the contract documents by the end of the scheduled period.

(4) Equipment Supplier

The Japanese equipment supplier should have a procurement manager stationed in the Project site throughout the period of time from the installation of equipment until its trial run, initial operation training, and final inspection and hand over.

2-2-4-5 Quality Control Plan

Ready-mixed concrete is available in Yangon. Since the city's monthly maximum temperature never drops below 25°C all the year round, Admixtures will be needed for concrete when the ready-mixed concrete is delivered to the construction site. Specified acceptance inspection on the delivered flesh concrete is to be carried out, such as slump testing and temperature testing.

The ground water level is 3-4m below the surface in the dry season. In the wet season, however, water may spring out of the supporting soil of the foundation. In this case, foundation works will be carried out while unwatering. These measures should be included in the construction plan.

Table 2-19 below shows quality control plans for major construction works.

Table 2-7 Quality control plan

Work type	Control parameter	Control value	Inspection method	Quality standards	Inspection frequency	Analysis of results
Earth work	Bearing capacity of soil	5ton/m^2 or more	Plate bearing test	BS, ASTM	Multi-locations	Report
	Slope angle	Within planned range	Gauge, visual inspection	JIS	As needed	Photos, inspection documents
	Leveling tolerance	Within +0～-5cm	Level, visual inspection			
	Thickness of replaced soil	+5cm～0				
Reinforcement work	Reinforcement cover thickness	Places not in contact with soil: 30mm	Visual inspection, measurement	Spec.	As needed	Photos, inspection documents
		Places in contact with soil: 60mm				
		Others: 40mm				
	Shape tolerance	Stirrup/hoop: ±5mm				
		Others: ±10mm				
	Tensile test	Standard strength or more	Sampling at the work site or at the time of shipment	BS, ASTM	At the time of material selection and delivery (every 200t of steel bars of each diameter); 3 test pieces at each test	Report
Concrete work	Compression strength	Designed strength: 24N/m^2 or more	Attendance at the work site	BS, ASTM	3 or more test pieces per 50m^3	Report
	Slump value	15cm±2.5cm				Photos, inspection documents
	Chloride content	0.3kg/m^3 or less				
	Air content	45% ±1.5%				
	Concrete temperature (at the time of delivery)	35 Celsius degrees or less				
	Shape tolerance	10mm per 1m or less	Measurement	JIS	At the time of form removal	
Masonry work (concrete block)	Compression strength	According to each plant's management value	Attendance at compression test	Myanmar standards, BS	Once before shipment from the factory	Report
Plastering, painting, roofing, door and window works	Materials, storage methods, work methods, mixing, coating thickness, curing, tolerance	According to particular specifications	Same as left	Same as left	As needed	Photos, inspection documents
Plumping work	Water supply pipes	Leakage	Water pressure test (1.75Mpa for 60 min)	BS	Inspect each system at the completion of pipe laying work	Report
	Drainage pipes		Water filling test			
Electrical work	Cables	Within planned range	Insulation test	BS	Inspect each system at the completion of wiring	Report
			Conductivity test			

2-2-4-6 Procurement Plan

(1) Construction Materials

1) Procurement Policy

Most construction materials are available in Myanmar. In principle, they are to be procured locally.

2) Procurement Plan

- Structural work

  Structural materials, such as reinforcing bars, concrete and formwork materials, concrete blocks for partition walls, are to be procured locally.

- Finishing work

  In principle, interior and exterior construction materials, such as aluminum sashes, tiles, colored metal sheet, paint, and glass, are to be procured from local markets, regardless of whether they are domestically produced or imported. Airtight doors are to be purchased in Japan.

- Air-conditioning and plumbing work

  Air conditioners, exhaust fans, ceiling fans, pumps, tanks, and sanitary ware are to be procured from local markets, regardless of whether they are domestically produced or imported.

- Electrical work

  Electrical materials such as lighting fixtures, power panels, cables/wires, and conduits, are to be procured from local markets, regardless of whether they are domestically produced or imported.

- Work for special system and equipment

  Special system and equipment for vaccine production are to be procured in Japan.

Table 2- below shows the procurement plan of major construction materials to be used in this Project.

Table 2-20 Procurement plan of major construction materials

Item	Procurement location			Notes
	Myanmar	Japan	Third country	
Portland cement	○			
Aggregate	○			
Deformed bar	○			
Concrete formwork plywood	○			
Concrete block	○			
Glass block	○			
Waterproofing material	○			
Light gauge steel	○			
Colored metal sheet	○			
Aluminum panel	○			
Steel door/window	○			
Aluminum door/window	○			
Wooden door/window	○			
Airtight door		○		
Glass	○			
Tile	○			
Gypsum board	○			
Decorative calcium silicate board	○			
Mineral fiber acoustic board	○			
Paint	○			
Air conditioner	○			
Ceiling fan	○			
Pump	○			
Conduit materials and fittings	○			
Sanitary ware	○			
Distribution panel	○			
Conduit and wire	○			
Lighting fixtures	○			
Lightning arrester	○			
Fire hydrant	○			
Special system/equipment		○		

(2) Equipment

The planned equipment shall be products of Japan, Myanmar or the third countries. The general equipment such as a computer, gas fittings and furniture will be procured in Myanmar. The other equipment which requires high standard will be procured from Japan. In this case, manufacturers which could dispatch a technician within Myanmar or from neighboring countries shall be selected in order to assure the after-sales service.

Several sets of the consumables spare parts for the equipment with high frequency and continual

use will be procured in the Project while in principal procurement of consumables and spare parts shall be borne by the Myanmar side.

Procurement plan of equipment is shown in Table2-21 below.

Table 2-8 : Procurement plan of equipment

Equipment	Procurement location			Notes
	Local	Japan	Third countries	
Vaccine production control equipment (PC, Printer, Rack, etc.)	○			
Equipment for sterilization (Autoclave, Hot Air Sterilizer, Tumble Dryer, etc.)	○	○	○	Sweden
Equipment for cultivation process of cell & virus (Inverted Microscope with Camera, Roller Apparatus, Roller Bottle, Gas Torch, Clean Bench, etc.)	○	○	○	USA
Equipment for virus purification and vaccine production process (Media Filtration Unit, Ultra Centrifuge, Bio-safety Cabinet, etc.)		○	○	USA, Singapore
Equipment for vaccine filling and storage (Capping System, Deep Freezer, etc.)	○	○		
Other equipment required for vaccine production (Glass Ware, SUS Worktable, Laboratory Center Table, etc.)		○		
Equipment for diagnosis (Real-Time PCR, DNA Sequencer, Constant Temperature Water Bath, Clean Bench, Regent Set, etc.)	○	○	○	USA, France, Singapore

(3) Transportation Plan

In principle, the equipment and materials transported from Japan are to be sent by container ships and unloaded at the Port of Yangon in Myanmar. After customs clearance at the bonded house in Yangon Port, they are to be transported to the construction site by trailers.

Sea transportation		Land transportation		
Main ports in Japan	→	Yangon Port in Myanmar	→	Project site in Yangon

It should take approximately 45 days to ship equipment from Japan and clear customs in Myanmar. The materials and equipment transported from third countries are also, in principle, to be sent by container ships and unloaded at the Port of Yangon.

2-2-4-7 Operational Guidance Plan

After equipment is delivered, professional engineers dispatched by the equipment supplier are to provide training for operation (e.g., overview of specifications, operation procedures, and function-check) and maintenance (e.g., daily check-up, cleaning and tune-up, and trouble shooting). Operation and maintenance manuals, a list of contact information of the relevant manufacturers and agencies, and other necessary documents should be handed over to the Myanmar side in order to establish a mechanism for sustainable maintenance.

2-2-4-8 Soft Component (Management Guidance) Plan

Since there are a few staff in current National FMD Laboratory who have had technical education and training on vaccine production equipment for virus mass culture, the technical support to operate, maintain and manage the project facilities and equipments properly is indispensable for its sustainability. As the soft component, the initial support on the operation and maintenance method of the project facilities, utility systems, production system and equipment, as well as essential items needed for making vaccine production plan will be given.

The detail of the plan is shown in “Soft Component Plan” in the Annex of the report

2-2-4-9 Implementation Schedule

(1) Tender

After the detailed design phase, the MOLFRD / Livestock Breeding and Veterinary Department, will put a contract for the construction works out to tender, and Japanese consultants will assist in the process. At first, the MOLFRD will announce the prequalification (P/Q) of the tender in Japan. Then, the Japanese construction companies that meet the prequalification criteria will be invited to the tender. Bids for equipment procurement will be invited separately from those for the construction works

(2) Construction Works and Equipment Procurement

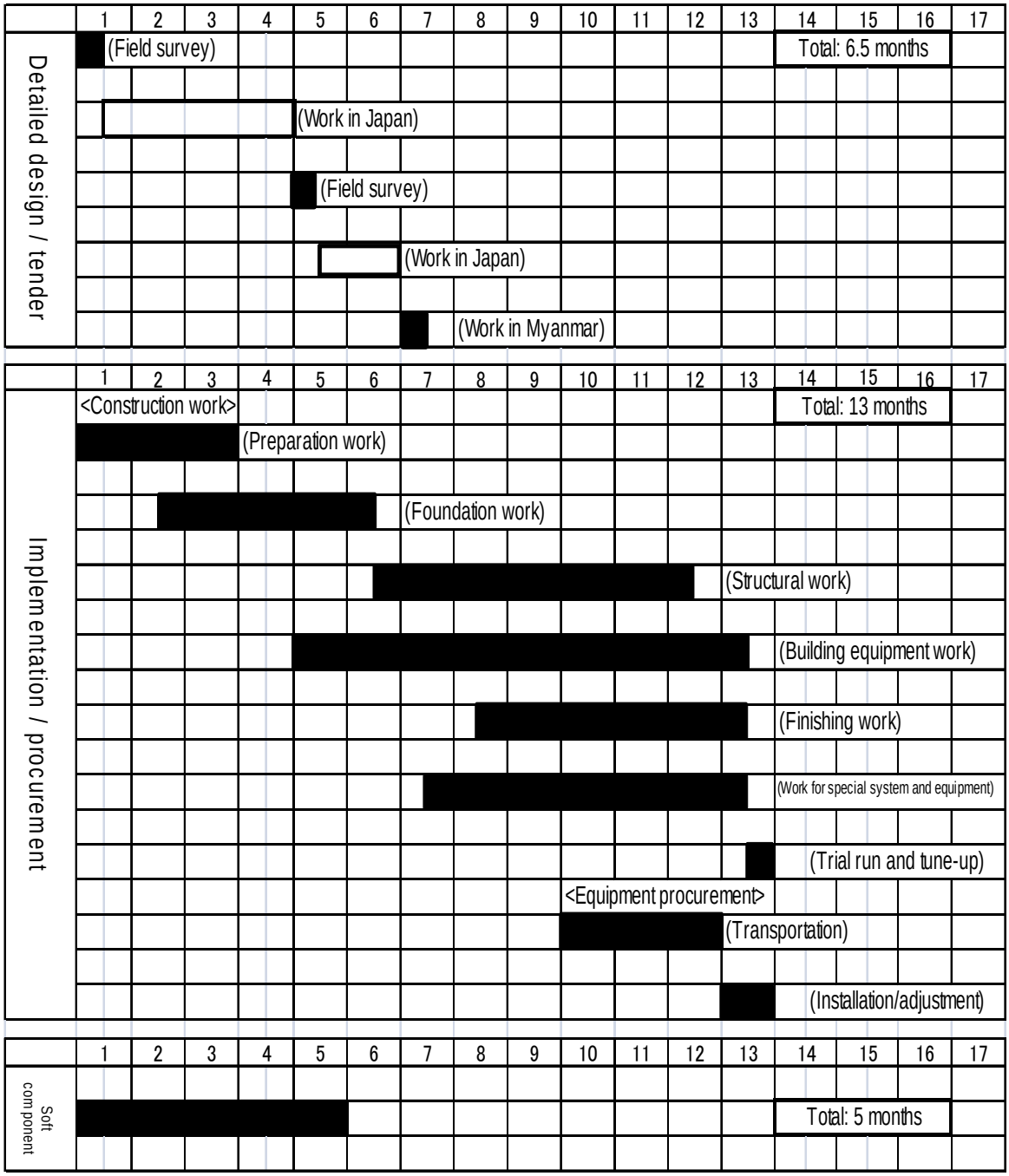
Although Myanmar has a rainy season from May to September, the Project site is unlikely to be flooded as it is located in an elevated area. It is possible to continue construction works during the rainy season if drainage systems are installed. Judging from the scale and specifications of this Project, it is estimated that Construction period would be approximately 13 months. Equipment can be installed in parallel with the construction works, taking one month to be completed.

(3) Management Guidance (Soft Component)

AAfter the completion of construction, technical support will be provided as soft component for approximately five months in total. This will require the Myanmar side to complete their undertakings, such as relocating staff and equipment from existing buildings and establishing an implementation structure.

Table 2-22 below shows an assumed schedule for the Project.

Table 2-9 Project implementation schedule



2-3 Obligations of Recipient Country

This Project will be implemented under the Grant Aid Scheme of the Government of Japan, and the Government of Myanmar will be responsible for the following tasks.

(1) Preconstruction Preparation

- Secure the lot of land necessary for the Project
- Vacate existing VETERINARY MEDICAL PLANT
- Investigation of underground buried object
- Demolish existing building, etc., level the ground, and relocate existing infrastructure
- Prepare walkway to detour traffic
- Install an electrical service drop (from the Insein Butaryon Road to the Project site)

(2) Maintenance

- Procure general furniture and equipment other than those provided by the Japanese side
- Procure consumables and spare parts required to maintain the Project's facilities and equipment
- Establish an implementation structure with an adequate number of staff to ensure proper and effective use and maintenance of the Project's facilities and equipment.

(3) Administrative Procedures

- Bear commissions for the Banking Arrangement (B/A), payment to contractors, and notification of Authorizations to Pay (A/P) and amended A/P
- Acquire building permission (examined and approved by the Yangon City Development Committee)
- Obtain permissions, licenses, and other authorizations necessary for the Project
- Ensure prompt unloading, customs clearance, and tax exemption of the construction material and equipment imported for the Project
- Exempt the Japanese nationals and corporate entities engaged in the Project from customs duties, taxes, and any other levies and charges in Myanmar
- Make necessary arrangements for the above-mentioned Japanese nationals to enter into and stay in Myanmar to engage themselves in the Project.
- Bear all expenses, other than those covered by Japan's Grant Aid, necessary for the completion of the Project
- Request and secure the budget appropriation of both Japanese Grant budget and the budget for fulfilling the obligation on Myanmar side

2-4 Project Operation Plan

2-4-1 Operation and Maintenance System

(1) Operation System

Table 2-10 below shows the number of staff members required for each unit to properly operate the vaccine production plant with roller bottle culture method an annual production capacity of one million doses of FMD vaccine and the FMD diagnostic laboratory constructed and equipped through this Project. It is essential to establish an implementation structure for initial equipment operation training and soft component by adequately staffing the plant and laboratory before they are completed and equipped..

Table 2-10 Future organizational structure and personnel plan of the National FMD Laboratory

Section	Unit	No. of veterinary technical officers	No. of other staff members
Vaccine production	Cell culture	6	5
	Vaccine production	8	8
	Quality control	4	3
Diagnosis	Serology and virus taxonomy	4	3
	PCR	4	3
Administration		2	3
	Total	28	25

(2) Maintenance System

Although the existing National FMD Laboratory has no section devoted to maintenance, it has some technicians to repair minor damage. When they cannot solve problems, they request the LBVD to repair the damage or bear the repair costs. Many of these requests, however, are not accepted by the LBVD due to financial and personnel difficulties. As a result, a number of damaged facilities and equipment are left unrepaired.

After the completion of the Project, the administration section of National FMD Laboratory will take charge of maintenance. When equipment needs repair by the manufacturer or agency, they will still need to request budget from the LBVD. Therefore, it is essential for the LBVD to quickly accept repair requests.

Daily maintenance is crucial to ensure that facilities and equipment continue working properly. As soft component of the Project, technical assistance will be provided for maintenance planning, detailed maintenance methods, and operational management.

2-4-2 Maintenance Plan

(1) Facilities

The maintenance of facilities is categorized into two types: (i) daily cleaning and (ii) repair of wearing parts, damage, and deterioration.

The repair of facilities mainly consists of the renovation and restoration of the interior and exterior finish on the structure. Facilities should be refurbished every decade to retain their functions.

Items for regular inspection and repair which affect the lifespan of facilities will be presented in the Maintenance Manuals submitted by the contractor at the commissioning of the facilities. Detailed inspection and cleaning methods will be also explained.

Regular inspection points are summarized in Table 2-11 below.

Table 2-11 Regular inspection for facilities

Part	Inspection and maintenance points	Frequency
Exterior	- Restore and repaint exterior walls	Repaint every 5 years; restore every 3 years
	- Inspect and restore roofs	Inspect every 3 years; restore every 10 years
	- Inspect and repair exterior door and window seals	Every year
	- Inspect and clean drainage gutters and ditches, manholes, etc.	Every year
Interior	- Renovate the interior	As necessary
	- Restore and repaint partition walls	As necessary
	- Replace ceiling materials	As necessary
	- Adjust doors and windows to fit the openings	Every year
	- Replace door handles, hinges, etc.	As necessary

(2) Building Equipment

What is important to maintain building equipment is daily *preventive* maintenance before there arises a need to repair defects and replace parts. Its lifespan can be extended by normal operation and daily inspection, lubrication, tune-up, cleaning, and repair. Daily maintenance can prevent defects and accidents as well as mitigate their impacts.

Electricity-powered equipment such as power generators and water pumps needs periodical inspection and maintenance. It is desirable for these kinds of equipment to have annual inspection by outside professionals. The general lifespan of major building equipment is shown below in Table 2-12.

Table 2-12 Lifespan of building equipment

	Equipment	Lifespan
Electrical installations	- Distribution panel - LED lamp - Generator	20-30 years 20,000-40,000 hours 15 years
Plumbing installations	- Pump, pipe, and valve - Tank - Sanitary ware - Ventilator (for aeration)	15 years 20 years 25-30 years 15 years
Air-conditioning installations	- Air conditioner - Exhaust fan	10 years 20 years

(3) Special Facilities and Equipment for Vaccine Production

Maintenance of special system and equipment for vaccine production mainly consists of daily inspection, adjustment of measuring instruments, replenishment of reagents and consumables, and repair of wearing parts, damage, and deterioration. In particular, daily inspection of equipment and replenishment of reagents and consumables are essential to prevent breakdown and ensure stable operation and reliable production. It is recommended to have the manufacturers' technicians inspect automation equipment (e.g., ice making equipment, pure steam generators, water-for-injection generators, and autoclaves) on a regular basis. High-pressure equipment, such as autoclaves and pure steam generators, is subject to legal inspection according to local laws and regulations.

It is recommended to have outside professionals inspect facilities and equipment (e.g., such as CIP/SIP units, inactivation system, and water treatment system) on a regular basis.

(4) Equipment

Before installation of the equipment, the structure, detail plan and formalities for maintenance should be established. The outline of assumed maintenance formalities is as follows;

* Organizing the structure for maintenance before installation of the equipment.

* More than one user including a person in charge will take the initial guidance for the equipment.

* Implementing regular maintenance according to the manuals.

* Making an equipment inventory and a maintenance record, managing consumables and spare parts.

* When malfunction is observed, taking measures appropriately as follows;

1) examining the degree of failure

2) repairing a minor failure by technician in the national FMD laboratory

3) making a contact to an agency or manufacturer for requesting a relevant technician

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

(1) Estimated Cost to Be Borne by the Myanmar Side: approx. 82 million Kyat (approx. 9 million yen)

Table 2-13 Estimated cost to be borne by the Myanmar side

Item	Estimated cost (Thousand MMK)	Estimated cost (Thousand yen)	Timing
(1) Construction works			
1) Investigation of underground buried object	1,541	168	Before notice of the tender document
2) Demolition and clearance of existing buildings	49,319	5,376	Before notice of the tender document
3) Relocation of existing electric wires and poles	2,480	270	Before notice of the tender document
4) Cutting and removal of existing trees	335	37	Before notice of the tender document
5) Ground leveling within the Project site	1,209	132	Before notice of the tender document
6) Construction of walkway to detour traffic	738	80	Before notice of the tender document
7) Installation of a service drop (electricity)	2,437	266	2 month before completion of the construction
(2) Equipment procurement			
1) Procurement of furniture and equipment	11,376	1,240	1 month after completion of the construction
(3) Administrative procedures			
Bank commissions, etc.	12,970	1,414	At the time of contract and payment
Total	82,405	8,983	

(2) Conditions for Estimation

- Estimating time: May 2014
- Exchange rate: 1USD=103.33JPY, 1MMK=0.109JPY
- Construction and procurement period: See the project implementation schedule for the detailed plan and construction/installation work periods.
- Other: The cost shall be estimated in accordance with Japan's Grant Aid Scheme.

2-5-2 Operation and Maintenance Cost

Table 2-14 below shows the yearly operation and maintenance costs of the vaccine production plant and FMD diagnostic laboratory constructed and equipped through this Project.

Table 2-14 Estimated operation and maintenance costs

Item		Estimated cost (Thousand MMK)
1. Personnel cost		78,226
2. Utilities cost	- Electricity	23,691
	- Communications	1,049
	- Water	186
	- Fuel oil	23,410
3. Vaccine production cost (materials, consumables, etc.)		50,600
4. FMD diagnosis cost (reagents, consumables, etc.)		67,263
5. Maintenance cost	- Facilities	27,660
	- Equipment	1,623
	Total	273,708

(1) Basis of Calculation

The operation and maintenance cost is estimated based on the following assumptions.

- The annual price escalation rate for the period between May 2014, when a cost survey was conducted, and January 2018, when the Project's facilities and equipment are planned to be completed and first used, is estimated at 23.3%.
- Hours of operation: The number of annual operating days for each section is assumed as follows in Table 2-15.

Table 2-15 Hours of operation (assumption)

Section	Hours of operation	Number of annual operating days	Remark
Vaccine production	7.5 hours/day	Vaccine production: 20days/month X 10months – 6days = 194days/year Other: 20days/month X 12months – 6days = 234days/year	An assumption is made that the vaccine production plant has 10 production runs each year, with 100,000 doses per run. Each run requires 1 month. In a year, 2 months are for maintenance. Six days of New Year's holidays are not considered business days. Assumed working time is from 8:00 am to 4:30 pm with a one-hour lunch break.
FMD diagnosis	7.5 hours/day	20days/month X 12months – 6days = 234days/year	Six days of New Year's holidays are not considered business days. An assumption is made that the working time is from 8:00 am to 4:30 pm with a one-hour lunch break.
Administration	7.5 hours/day	20days/month X 12months – 6days = 234days/year	Six days of New Year's holidays are not considered business days. An assumption is made that the working time is from 8:00 am to 4:30 pm with a one-hour lunch break.

- Personnel Expenses

The laboratory developed through this Project is to be staffed with a total of 53 people. Their positions and salaries are assumed as follows in Table 2-16.

Table 2-16 Personnel expenses for the Project

Category	Position	No. of people	Annual salary (thousand MMK)	Total (thousand MMK)
Veterinary technical officer	Director	1	1,980	1,980
	Research officer	7	1,740	12,180
	Researcher	7	1,500	10,500
	Technician	13	1,248	16,224
Others	Worker	24	900	21,600
	Security guard	1	960	960
			Total	63,444

Considering price escalation, the cost is calculated as follows:

63,444 thousand MMK x 1.233= 78,226 thousand MMK

- Utilities Cost

  - Electricity

Based on the transformer capacity and operating rate, the annual power consumption is calculated as follows in Table 2-17.

Table 2-17 Electricity consumption for the Project

Function		Annual hours of operation	Hourly electricity consumption (KW)	Annual electricity consumption (KWh)
Vaccine production plant	Vaccine production	4,656	52	242,112
	Other	1,755	38	66,690
FMD diagnostic laboratory		1,755	43	75,465
			Total	384,267

The annual electricity cost is calculated as follows:

(384,267Wh x 50 MMK/KWh + 500MMK) x 1.233 = 23,691 thousand MMK

where,
electricity unit price: 50MMK/KWh; basic usage charges: 500MMK; price escalation rate: 23.3%

  - Communications

Telephone: An assumption is made that only one phone line is used. Based on this assumption and the actual usage of phone services at the existing buildings as well as the price escalation rate, the cost is calculated as follows:

350 thousand MMK x 1.233 = 432 thousand MMK (a)

Internet: An assumption is made that the most common Internet plan is used. Based on this assumption and the price escalation rate, the cost is calculated as follows:

500 thousand MMK x 1.233 = 617 thousand MMK (b)

Total communications cost: (a)+(b) 1,049 thousand MMK

  - Water

Based on the daily water consumption and operating rate, the annual water volume is calculated as follows in Table 2-18.

Table 2-18 Water consumption for the Project

Facility function	No of annual operating days	Daily water consumption (m^3)	Annual water consumption (m^3)
Vaccine production	194	4	776
Other	234	4	936
		Total	1,712

The annual water cost is calculated as follows:

(1,712 m^3 x 88 MMK/m^3 + 100MMK) x 1.233 = 186 thousand MMK

where,
water unit price: 88MMK/m^3; basic usage charge: 100MMK; price escalation rate: 23.3%

- Fuel oil

Boiler: Fuel oil is used for the boiler to produce pure water for vaccine production. It is estimated that 250t of steam is annually required to produce vaccine as planned. Based on the capacity and fuel consumption efficiency of the boiler, the annual fuel oil cost is calculated as follows:

250,000kg÷750kg/h x 52L/h x 991MMK/L x 1.233=21,180 thousand MMK (c)

where,
boiler capacity: 750kg/h; boiler fuel consumption: 52L/h; fuel oil unit price: 991MMK/L; price escalation rate: 23.3%

Back-up power generator: An assumption is made that the back-up power generator works half an hour per day on average. Based on this assumption, the annual cost is calculated as follows:

0.5h x 10L/h x 365 days x 991MMK/L x 1.233=2,230 thousand MMK (d)

where,
generator fuel consumption: 10L/h; number of operating days (vaccine production): 365 days; fuel oil unit price: 991MMK/L; price escalation rate: 23.3%

Fuel oil cost: (c)+(d) 23,410 thousand MMK

- Vaccine Production Cost (supplies expenses, etc.)

The annual raw material cost to produce a dose of vaccine is estimated at 50.6 MMK. The annual

cost to produce one million doses of vaccine is calculated as follows. The price escalation rate is not taken into account because the international prices of raw materials for vaccine production are likely to remain unchanged.

50.6MMK x 1,000,000 = 50,600 thousand MMK

- Cost for FMD diagnosis (Consumables and Spare parts)

The annual cost of consumables and spare parts for diagnosis is estimated about 67,263,000 MMK. The price escalation rate is not taken into account because price escalation of those imported items is considered small enough. The detail is as bellow

Table 2-19：Cost for FMD diagnosis

Serial No.	Request No.	Equipment Name	Consumables and Spare Parts	Unit Price (MMK)	Q'ty for total	Unit	Total (MMK)
2	PM-02	Laser Printer	Toners	276,000	20	Sets	5,520,000
3	PM-03	PC Desk	Cartridge	92,000	40	Units	3,680,000
11	PT-10	Inverted Microscope with Camera	Halogen Lamp	19,000	3	Units	57,000
12	PT-11	Roller Apparatus	Pulley	28,000	50	Units	1,400,000
			Magnetic Pulley	33,000	2	Units	66,000
			Drive Belt	19,000	10	Units	190,000
			Horizontal Belt	10,000	20	Units	200,000
13	PT-12	Roller Bottle	Roller Bottle	92,000	10	Units	920,000
14	PT-13	Roller Bottle Cap	Packing	3,000	100	Units	300,000
16	PT-15	Clean Bench A	HEPA Filter	367,000	1	Set	367,000
17	PT-16	Waste Suction Unit	Filter	111,000	7	Sets	777,000
			Cube	19,000	7	Sets	133,000
			Fitting	14,000	7	Sets	98,000
18	PT-20	Gas Torch	Gas Cylinder	1,000	48	Units	48,000
19	PT-21-1	CO2 Incubator A	CO2 Gas 40L	23,000	12	Sets	276,000
20	PT-21-2	CO2 Incubator B	CO2 Gas 40L	23,000	12	Sets	276,000
23	PT-28	Bottles for Centrifuge	Bottles	28,000	20	Units	560,000
25	PT-30	Silicone Tube for Tubing Pump	Silicone Tube	652,000	1	Set	652,000
26	PT-31	Biosafety Cabinet	HEPA Filter	367,000	1	Set	367,000
29	PT-34	EC meter	Electrode	505,000	3	Units	1,515,000
			Reference Solution	37,000	3	Sets	111,000
30	PT-35	pH meter	Electrode	505,000	5	Units	2,525,000
			Reference Solution	37,000	5	Sets	185,000
37	MS-02	Tool Set for Vaccine Production	Consumables for Vaccine Production	2,753,000	1	Set	2,753,000
47	MS-05	Silicon Hose Set	Tube	459,000	2	Sets	918,000

48	MS-06	Temperature Data Logger	Sensors	46,000	3	Sets	138,000
53	DS-01	Real-Time PCR System	Adhesive Sealing Film	42,000	100	Units	4,200,000
			Plate and Strip	753,000	1	Set	753,000
56	DS-10	Microplate Reader	Halogen Lamp	597,000	2	Sets	1,194,000
62	DS-20	Liquid Nitrogen Tank	Liquid Nitrogen	10,000	400	kg	4,000,000
63	DS-21	CO2 Incubator C	CO2 Gas 40L	23,000	12	Sets	276,000
64	DS-22	Single Channel Micropipette Set	Micro Chips	459,000	1	Set	459,000
65	DS-23	Multi Channel Micropipette Set	Micro Chips	459,000	1	Set	459,000
71	DS-34	Spectrophotometer	Quartz Cell	166,000	1	Unit	166,000
			Pasteur Pipette	92,000	1	Set	92,000
			Rubber Bulb	92,000	1	Set	92,000
72	DS-36	Biosafety Cabinet B	HEPA Filter	367,000	1	Set	367,000
75	DS-42	Viral Titration Kit	Multiple Dish	4,587,000	1	Set	4,587,000
77	DS-44	Tool Set for Diagnosis	96wells Micro Plate	459,000	1	Set	459,000
90	DS-48	Reagent Set	Reagent	9,174,000	1	Set	9,174,000
91	MS-11	Media Filtration Unit	Filtration	9,174,000	1	Set	9,174,000
94	DS-49	DNA Sequencer	Sequencing Kit	3,000	240	Runs	720,000
			Polymers	6,000	240	Runs	1,440,000
			Capillary Array	12,000	240	Runs	2,880,000
			Buffers	7,000	240	Runs	1,680,000
			96wells Micro Plate	1,000	240	Runs	240,000
			Septa	1,000	240	Runs	240,000
			Air Filter	120,000	1	Set	120,000
			Reagent	459,000	1	Set	459,000
				Total Amount			**67,263,000**

- Maintenance Cost

  - Facility maintenance cost

Architectural repair cost: Although the architectural repair cost varies each years, the annual average cost for the first 10 years from the completion of the facilities is assumed to be equal to 0.1% of the construction cost of the parts that need to be repaired (e.g., finishing materials). Considering price escalation, the cost is calculated as follows:

963 thousand MMK x 1.233 = 1,187 thousand MMK (e)

Building equipment repair cost: Although the cost is rarely incurred for the first five years from

the completion of the facilities, the frequency of replacement of spare and defective parts can increase after that. The annual average building equipment repair cost for the first 10 years is assumed to be equal to 0.2% of the building equipment that need to be replaced. Considering price escalation, the cost is calculated as follows:

2,144 thousand MMK x 1.233 = 2,644 thousand MMK (f)

Repair cost of special system and equipment for vaccine production: In principle, the vaccine production system and equipment designed to prevent self-destruction by monitoring are to be procured. There are, however, possibilities that these system and equipment may be broken down due to the lack of daily inspection or wrong operations. Therefore, maintenance cost, such as expenses for periodic inspection and replacement of consumables, is assumed to be incurred, equal to approximately 1% of the initial costs annually. The price escalation rate is not taken into account because price escalation of these special system imported from developed country is considered small enough.

23,829 thousand MMK (g)

Maintenance cost of facilities in total: (e)+(f)+(g) 27,660 thousand MMK

- Equipment maintenance cost

Equipment repair and replacement cost: Although equipment does not need to be repaired or replaced regularly, the lifespan of the Project's equipment is assumed to be seven years, and the annual average cost for repair and maintenance is estimated to be equal to approximately 0.1% of the equipment costs. The price escalation rate is not taken into account because price escalation of those imported equipment is considered small enough.

1,623 thousand MMK

(2) Budget of the Implementing Agency

Tables Table 2-21 and Table 2-21 show the recent trends in the LBVD's budgets and the proportion of FMD vaccine expenditures in the LBVD's total vaccine expenditures, respectively.

Table 2-20 Recent trends in LBVD budgets

Fiscal year	Ordinary budget (thousand MMK)	Capital budget (thousand MMK)	Total (thousand MMK)
2010-11	238,737	1,363,062	1,601,799
2011-12	1,578,906	183,324	1,762,230
2012-13	1,577,715	418,545	1,996,260
2013-14	3,123,364	6,272,618	9,395,982
2014-15	9,339,124	199,000	9,538,124

Table 2-21 Proportion of FMD vaccine expenditures in total vaccine expenditures

	2010-11	2011-12	2012-13	2013-14
Amount of vaccine produced (dose)	221,260	250,200	145,100	134,100
Expenditure of FMD vaccine production (A) (MMK)	78,191,238	129,709,920	82,574,732	72,781,983
Total expenditure of vaccine production (B) (MMK)	194,291,116	330,287,587	195,146,669	235,002,576
(A) / (B) (%)	40	39	42	31

The LBVD's revenue has expanded steadily. In particular it soared 4.7 times from FY 2012-2013 to FY 2013-2014. The average growth rate, excluding the sudden rise from FY 2013 to 2014, is 8.2%.

Meanwhile, the LBVD has recently allocated a large share of its vaccine production budget to FMD vaccine production, which accounted for up to 42% of the total vaccine expenditures. It is also confirmed that the total budget for vaccine production reached some 578,613 thousand MMK in FY 2014-2015, doubling from the previous fiscal year.

Assuming that the LBVD's revenue and total budget for vaccine production will continue to grow at the same rate as recent increases, it is estimated that they will reach approximately 12,082,165 thousand MMK and 732,942 thousand MMK, respectively, in FY 2017-2018, when the maintenance cost of this Project will be incurred. If 38% of the budget is allocated to FMD vaccine production as usual, it is estimated at around 278,517 thousand MMK. Meanwhile, the maintenance cost of the Project is estimated at 273,708 thousand MMK, which will account for approximately 2.3% of the estimated revenue of the LBVD in the same year. Therefore, the maintenance cost is likely to be fully covered.

Chapter 3 Project Evaluation

3-1 Preconditions

The Government of Myanmar shall carry out the following items in order to implement the Project:

(1) Complete the preparation work before beginning of construction;

- Demolish and clear existing buildings, relocate existing electric wires and poles, and cut down and remove existing trees
- Level the ground within the Project site
- Prepare walkway to detour traffic
- Acquire building permission

(2) Ensure prompt unloading, customs clearance, and tax exemption of the equipment imported for the Project;

(3) Install a service drop by the end of construction; and

(4) Undertake the following work during and after the construction works of the Japanese side.

- Procure furniture and equipment used at the Project's facilities

3-2 Necessary Inputs by Recipient Country

The Government of Myanmar shall carry out the following items in order to enhance and sustain the effects of the Project:

(1) Establish an adequately staffed implementation structure as specified in 2-4-1 Operation and Maintenance System; and

(2) Secure necessary operation and maintenance costs after the completion of the Project.

3-3 Important Assumptions

In order to maintain the effectiveness and sustainability of the Project, the following external conditions shall be satisfied:

- The drafted National Foot-and-Mouth Disease Control Plan is officially enforced and its control measures work as planned.
- The vaccination system works properly.
- Power supply at the Project site is maintained.

3-4 Project Evaluation

3-4-1 Relevance

It is deemed to be highly necessary for the Government of Japan to implement this Grant Aid Project with the following reason:

(1) Target Group of the Project

1) Impacts on Southeast Asia

Outbreaks of FMD have been widely reported in Southeast Asia, except for the Philippines, Indonesia, and the Malay Archipelago. Support for FMD control may have a larger impact in Myanmar than in other Southeast Asian countries and contribute to the stability and development of the livestock industry in the region because of the following three reasons. First, having been governed by the military regime, Myanmar has been lagged behind in FMD control. Secondly, Myanmar has a much greater number of livestock than its neighboring countries. Thirdly, livestock is brought from a country where it is sold cheaper, such as Myanmar, to a country where it is sold at higher prices in accordance with economic theories.

2) Impacts of the Project on Myanmar

In Myanmar, the agricultural population accounts for a quite large proportion of the total population and for a majority of the poor. FMD control can stabilize agricultural production and contribute to poverty alleviation in the following ways:

- An increase in production of milk and meat
- A rise in income from livestock sales
- Expansion of export of healthy livestock
- Continued use of livestock as a sound labour

(2) Contribution to achieving the Medium- and Long-term Development Plans of Myanmar

Based on the workshop held in May 2011, the Central Committee for Rural Development and Poverty Alleviation under the Government of Myanmar formulated Action Plan for Rural Development and Poverty Alleviation, which has focused on eight development issues, including the development of the livestock and fisheries sectors, in order to develop rural areas and reduce poverty effectively and efficiently. Moreover, Livestock and Fishery Sector Short-term Plans (2011-2015) were adopted in 2011 as a result of the same workshop, identifying animal disease control as one of the priority policies. Thus, the Project is consistent with the development strategies and priorities of the Government of Myanmar.

(3) Consistency with Japan's Assistance Policies

The Project can contribute to the improvement of people's livelihoods, one of the priority areas

identified in Japan's new economic cooperation policy for Myanmar revised in April 2012. Under this cooperation policy, JICA's support in the agricultural sector has focused on four fields/areas: (i) intensive agriculture mainly in the Delta Zone; (ii) diversified agriculture mainly in the Central Dry Zone; (iii) rural development and income generation mainly in Northern Shan State; and (iv) policy making and human resource development in Nay Pyi Taw / Yezin. Constituting part of the (i) assistance to intensive agriculture, this Project is expected to improve livestock disease control and thus contribute to developing the livestock industry and raising agricultural production.

3-4-2 Effectiveness

This Project is deemed to be effective with the following outputs.

(1) Quantitative outputs

The development of a FMD vaccine production plant and a FMD diagnostic laboratory may lead to the following effects.

Table 3-1 Quantitative indicators

Indicator	Benchmark value (Actual results in 2013)	Target value (in 2020) 3 years after the completion of the Project
Amount of FMD vaccine produced	250,000 doses per year	1,000,000 doses per year
Number of specimen tested for FMD	1,775 specimens per year	4,000 specimens per year
Improvement in FMD diagnostic performance (Number of test methods available)	0 item	7 items

Calculation of indicators

1) Number of specimens tested for FMD

A) Number of diagnostic tests at outbreaks of FMD (in hotspot areas)

3 x 10 = 30 specimens per year

where,

3 specimens per outbreak (the actual results of the existing FMD laboratories); 10 outbreaks per year (the average number of outbreaks in Myanmar for the last five years)

B) Number of diagnostic tests in suspected hotspot areas

30 x 2 = 60 specimens per year

Based on the assumption that the number of specimens annually tested is twice larger than A

C) Number of diagnostic tests at critical control points

250,000 x 0.03 =7,500 specimens per year

Based on the assumption that approximately 3% of the livestock traded in official markets (250,000 head) are tested each year

A+B+C=7,590 specimens per year

Based on the assumption that the number of tests is equally divided between the two laboratories, one in Nay Pyi Taw and the other in Yangon, the number of specimens tested in Yangon is estimated at:

7,590/2=3,795≒4,000 specimens per year

2) Number of test methods available in the laboratory

The following table shows the test methods that were available in 2013 and that are expected to be available in 2020.

Table 3-2 Test methods for FMD

As of 2013	By 2020 (planned)
Sandwich and liquid-phase competitive ELISA test	Indirect sandwich ELISA test Virus isolation test PCR test Sandwich and liquid-phase competitive ELISA test Neutralization test Antibody identification based on the nonstructural protein Genetic analysis

(2) Qualitative outputs

- Vaccine can be produced more efficiently by following the proper vaccine production procedures.
- The efficacy of vaccines can be guaranteed through appropriate quality control testing.
- The safety of the vaccine production plant can be guaranteed.
- The FMD diagnostic test accuracy will be improved by following the proper diagnostic procedures.
- The safety of livestock products produced in the areas vaccinated against FMD will be enhanced.

Appendices

1. **Member List of the Study Team**
2. **Study Schedule**
3. **List of Parties Concerned in the Recipient Country**
4. **Minutes of Disscussions**
5. **Soft Component Plan**
6. **References**
7. **Other Relevant Data**

1. Member List of the Study Team

1. **Member List of the Study Team**

Field Survey Ⅰ (April.21st～May.30th)

Name	Position	Period of Stay	Organization
Mr. Shiro NABEYA	Leader	May.11th～17th	Japan International Cooperation Agency
Dr. Kenichi SAKAMOTO	Animal Disease Diagnosis/equipment	May.11th～17th	Director of Exotic Disease Research Division, National Institute of Animal Health (NIAH), National Agriculture and Food Research Organization (NARO)
Mr. Makoto YAMANE	Planning/ Analysis	May.11th～17th	Japan International Cooperation Agency
Mr. Takaaki KIMURA	Chief Consultant /Architectural Design	May.11th～20th	Yamashita Sekkei Inc.
Mr. Shingo KURODA	Deputy Chief Consultant / Structural diagnosis	Apr.21st～26th May.11th～30th	Yamashita Sekkei Inc.
Mr. Tsunehiro TOGASHI	Equipment Planning I-1 Vaccine production	May.11th～20th	CM Plus Corporation
Mr. Atsushi YASUMOTO	Equipment Planning I-2 Vaccine production	May.11th～25th	CM Plus Corporation
Mr. Tomohiro TAMAKI	Equipment Planning II Diagnosis of Livestock Diseases	May.11th～30th	INTEM Consulting, Inc.
Ms. Misato OOHARA	Equipment Management Cost	May.17th～30th	INTEM Consulting, Inc.
Mr. Eisuke YAMAMOTO	Mechanical Design I	May.11th～20th	Yamashita Sekkei Inc.
Mr. Win Min OO	Mechanical Design II	Apr.22nd～25th May.19th～30th	Yamashita Sekkei Inc.
Mr. Mochizuki Hiroyuki	Construction Planning/ Cost Estimate I	Apr.21st～26th	Yamashita Sekkei Inc.
Ms. Yuka KOBAYASHI	Construction Planning/ Cost Estimate II	May.11th～30th	Yamashita Sekkei Inc.

Field Survey Ⅱ (December.13th～19th)

Name	Position	Period of Stay	Organization
Dr. Masaharu KANAMEDA	Leader	December..13th～19th	Japan International Cooperation Agency
Mr. Hiroaki IMAI	Planning/ Analysis	December..13th～19th	Japan International Cooperation Agency
Mr. Shingo KURODA	Deputy Chief Consultant / Structural diagnosis	December..13th～19th	Yamashita Sekkei Inc.
Mr. Atsushi YASUMOTO	Equipment Planning I-2 Vaccine production	December..13th～19th	CM Plus Corporation

2. **Study Schedule**

2. **Study Schedule**

Field Survey Ⅰ (April.21st～May.30th)

Field Survey Ⅰ

			Official Members	Chief Consultant /Architectural Design	Deputy Chief Consultant / Structural	Equipment Planning Ⅰ-1 Vaccine	Equipment Planning Ⅰ-2 Vaccine	Equipment Planning Ⅱ Diagnosis of	Equipment Cost Planner	Mechanical Design Ⅰ	Mechanical Design Ⅱ	Construction Planning/ Cost Estimate Ⅰ,Ⅱ
			Shiro NABEYA Kenichi SAKAMOTO Makoto YAMANE	Takaaki KIMURA	Shingo KURODA	Tsunehiro TOGASHI	Atsushi YASUMOTO	Tomohiro TAMAKI	Misato OOHARA	Eisuke YAMAMOTO	Win Min Oo	Mochizuki Hiroyuki Yuka KOBAYASHI
				①	②	③	④	⑤	⑥	⑦	⑧	⑨⑩
Days			7	10	26	10	15	20	14	10	14	24
1	4/21	Mon			Flight (from NRT to RGN)							Same as ②
2	4/22	Tue			Courtesy call to JICA Office Courtesy call to						Survey on FMD Lab, Infrastructure	Same as ②
3	4/23	Wed			Survey on FMD Lab						Survey on FMD Lab, Infrastructure	Same as ②
4	4/24	Thu			Commencement of Geological and Topographical survey						Survey on FMD Lab, Infrastructure	Constuction planning and construction condition survey
5	4/25	Fri			Survey on FMD Lab Flight (from RGN						Survey on FMD Lab, Infrastructure	Constuction planning, Flight (from RGN
6	4/26	Sat			to NRT)							to NRT)
21	5/11	Sun	Flight (from HND to RGN) (Mr. Nabeya：ADD→BKK)			Flight (from SIN to BNKK)	Flight (from HND to BKK)			Flight (from HND to BKK)		
22	5/12	Mon	Visit Pak Chong FMD Lab		Same as ① Flight (from BKK to RGN)					Same as ①		
23	5/13	Tue	Flight (from BKK to RGN) Same as ②		Courtesy call to FMD Lab					Same as ①		Flight (from NRT to RGN)
24	5/14	Wed	Courtesy call on the Embassy, Same as ③			Flight (from RGN to Nay Pyi Taw), Courtesy call and a meeting at the Veterinary Department, (Explanation on the inception report)	Same as ③, Flight (from Nay Pyi Taw to RGN)	Same as ③		Survey on FMD Lab、Plan on Vaccine plant		Survey on FMD Lab, Suvey on Construction Market
25	5/15	Thu	Discussion on the draft minutes Visit FMD Lab in Nay Pyi Taw		Same as ①, Flight (from Nay Pyi Taw to RGN)	Same as ①	Survey on FMD Lab、Plan on Vaccine plant	Same as ①		Survey on FMD Lab、Plan on Vaccine plant		Survey on FMD Lab, Suvey on Construction Market
26	5/16	Fri	Same as ① Flight (from RGN	Signing of the minutes →Flight (from Nay Pyi Daw to RGN), Survey on FMD Lab	Survey on FMD Lab	Same as ①	Survey on FMD Lab、Plan on Vaccine plant	Same as ①		Survey on FMD Lab、Plan on Vaccine plant		Survey on FMD Lab, Suvey on Construction Market
27	5/17	Sat	to HND) (Mr. Nabeya：to NRT)	Plan FMD lab 、work on a draft of the technical note. Team meeting					Flight(from NRT to RGN) Team meeting	Survey on FMD Lab、Plan on Vaccine plant		Request on cost estimate, Suvey on Construction Market
28	5/18	Sun		Plan FMD lab 、work on a draft of the technical note. Team meeting					Filing documents Team meeting	Filing documents Team meeting		Filing documents Team meeting
29	5/19	Mon		Survey on FMD Lab, Report to JICA, Planning, Flight (from RGN	Survey on FMD Lab	Survey on vacccine producing facility, (Leave RGN→ BANKOK→	Survey on FMD Lab, Planning	Discussion on equipments of diagnosis	Survey on FMD Lab and the agents	Survey on FMD Lab、Plan on Vaccine plant	Survey on FMD Lab, Infrastructure	Request on cost estimate, Suvey on Construction Market
30	5/20	Tue		to NRT)	Survey on FMD Lab	to NRT)	Survey on FMD Lab, Planning	Discussion on equipments of diagnosis	Survey on FMD Lab and the agents	to NRT)	Survey on FMD Lab, Infrastructure	Request on cost estimate, Planning
31	5/21	Wed			Survey on FMD Lab, Planning		Survey on FMD Lab, Planning	Discussion on equipments of diagnosis	Survey on FMD Lab and the agents		Survey on FMD Lab, Infrastructure	Request on cost estimate, Planning
32	5/22	Thu			Survey on FMD Lab, work on the technical note		Work on the technical note	Discussion on equipments of diagnosis	Survey on FMD Lab and the agents		Survey on FMD Lab, Infrastructure	Planning, Work on the technical note
33	5/23	Fri			Survey on FMD Lab, work on the technical note		Work on the technical note	Discussion on equipments of diagnosis	Survey on FMD Lab and the agents		Survey on FMD Lab, Infrastructure	Planning, Work on the technical note
34	5/24	Sat			planing the lab、work on the technical note		Work on the technical note, Flight (from RGN	Work on the technical note	Survey on FMD Lab and the agents			Planning, Work on the technical note
35	5/25	Sun			work on the technical note,Team meeting		to NRT)	Same as ②	Filing documents Team meeting			Same as ②
36	5/26	Mon			Work on the technical note, Survey on FMD Lab			Work on the technical note	Survey on FMD Lab and the agents		Survey on FMD Lab, Infrastructure	Same as ②
37	5/27	Tue			Flight (from RGN to Nay Pyi Taw), discussion on the technical note.			Work on the technical note	Survey on FMD Lab and the agents		Same as ②	Same as ②
38	5/28	Wed			Signing the technical note, Flight (from Nay Pyi Taw to RGN)			Same as ②	Survey on FMD Lab and the agents		Survey on FMD Lab, Infrastructure	Same as ②
39	5/29	Thu			Arrangement of survey on natural conditions, Survey on FMD Lab, Flight (from RGN			Market survey, Flight (from RGN	Survey on FMD Lab and the agents, Flight (from RGN		Survey on FMD Lab, Infrastructure	Same as ②, Flight (from RGN
40	5/30	Fri			to NRT)			to NRT)	to NRT)		Survey on FMD Lab, Infrastructure	to NRT)

Field Survey Ⅱ (December.13th～December.19th)

Field Survey Ⅱ

			Official Members	Chief Consultant /Architectural Design	Equipment Planning I-2 Vaccine production
			Masaharu KANAMEDA Akihiro IMAI	Shingo KURODA	Atsushi YASUMOTO
Days			7	7	7
1	12/13	Sun	Flight(from NRT to RGN)		
2	12/14	Mon	Visit FMD Lab, Flight (from RGN to Nay Pyi Taw)		
3	12/15	Tue	Meeting with the Veterinary Department,		
4	12/16	Wed	Discussion on the draft minutes		
5	12/17	Thu	Discussion and signing on the draft minutes		
6	12/18	Fri	Flight (from Nay Pyi Taw to RGN), Report to the Embassy and JICA, Flight (from RGN		
7	12/19	Sat	to NRT)		

3. List of Parties Concerned in the Recipient Country

3. List of Parties Concerned in the Recipient Country

Organizaion	Position	Name
Ministry of Livestock, Fisheries and Rural Development		
Livestock Breeding and Veterinary Department	Director General	Dr. Myint Than
	Deputy Director General	Dr. Yee Tun Win
	Deputy Director General	Dr. Aung Zan Htue
Research and Disease Control Division	Director	Dr. Kyaw Naing Oo
	Deputy Director	Dr.Zin Mar Aung
	Deputy Director	Dr. Min Thein Maw
	AssistantDirector	Dr. Sein Lwin
National FMD Laboratory – Serology unit	Research Officer	Dan Mu Mu Myint
National FMD Laboratory – Cell Production unit	Research Officer	Dr. Myint Han
National FMD Laboratory – Vaccine Production Unit	Research Officer	Dr. Kyu Kyu Wai
Diagnosis Disease Control	Director	Dr. Myint Win
Assay Lab	AssistantDirector	Ms. Aye Sandar Cho
Epidemiology Unit	Research Officer	Ms. Tu Tu Zaw Win
Administration Division		
Planning	Deputy Director	Dr Khin Ohmar Lwin
Livestock, Feedstuff and Milk Products Enterprise		
Veterinary Medecine Plant	Manager	Dr. Nant Yin Yin Myint
Directorate of Livestock and Fisheries	Deputy Director General	Dr. Khin Zaw

Myanmar Veterinary Association	Executive committee member	Dr. Khin Maung Latt

National Institute of Animal Health （Thailand）		
Bureau of Veterinary Biologics	Director	Mr. Niteth Lertlimchalalai
Biologics Production	Chief	Mr. Kamontmip Thunpimon
Quality Control Department	Chief	Mr. Nopporn Patanaprasith
FMD Department	Chief	Mr. Chaiya Sangapranhon
	Engineer	Mr. Suphanet Hansuri
Virus Production Department		Mr. Aree Katsumon
		Mr. Anurak Trakara Uwa See
Waste water treatment and Environment Department		Mr. Varunyu Chomfuang Raew
Veterinary Officer		Mr. Somkiat Sripisuth
Regional Reference Laboratory for FMD	Director	Dr. Somajai Kamolsiripichaifoan
	Veterinary Senior	Dr. Rompheuke
	Veterinary Senior	Dr. Panithan Thongtha

Embassy of Japan in Myanmar	Counselor	Mr. Hideaki Matsuo
	Second Secretary	Mr. Watabe Shouichi
	Second Secretary	Mr. Hideki WADA

JICA Myanmar Ofiice	Deputy director	Mr. Kyosuke Inada
	Representative	Mr. Kouhei ISA
	Representative	Mr. Yasuyuki SATO

4. **Minutes of Disscussions**

(1) Field Survey I

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY
ON
THE PROJECT FOR IMPROVEMENT OF FOOT-AND-MOUTH DISEASE CONTROL
IN
THE REPUBLIC OF THE UNION OF MYANMAR

DATE: May 16, 2014
PLACE: Nay Pyi Taw, Myanmar

In response to a request from the Government of the Republic of the Union of Myanmar (hereinafter referred to as "GOM"), the Government of Japan (hereinafter referred to as "GOJ") decided to conduct a Preparatory Survey on the Project for Improvement of Foot and Mouth Disease Control in Myanmar (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to the Republic of the Union of Myanmar (hereinafter referred to as "Myanmar") the Preparatory Survey Team (hereinafter referred to as "the Team"), which is headed by Mr. Shiro Nabeya, and is scheduled to stay in the country from April 21 to May 29, 2014.

The Team held discussions with the officials concerned of the GOM and conducted a field survey.

As a result of discussions and field survey, both sides confirmed the main points described in the attached sheets. The Team will proceed to further works and prepare the Preparatory Survey Report.

Mr. Shiro Nabeya
Leader
Preparatory Survey Team
Japan International Cooperation Agency

Dr. Myint Than
Director General
Livestock Breeding and Veterinary Department
Ministry of Livestock, Fisheries and Rural Development
The Republic of the Union of Myanmar

ATTACHMENT

1. Objective of the Project

The objective of the Project is to reduce the incidence of Foot-and-Mouth Disease (FMD) through the improvement of National Foot-and-Mouth Disease Laboratory in Yangon, hereby contributing to economic development and poverty reduction in Myanmar.

2. Title of the Project

Both sides agreed that the Project title would be "the Project for Improvement of Foot-and-Mouth Disease Control". After consultation with GOJ, the Project title shall be finalized.

3. Inception Report

The Team explained the Preparatory Survey to be conducted in accordance with the Inception Report. After a series of discussions, the Team and GOM (hereinafter referred to as "the both sides") agreed on the contents of the Inception Report in principle.

4. Project Site

The prospected site of the Project is located in Insein Township, Yangon as shown in Annex-1.

5. Responsible and Implementing Agency

5.1 The Responsible Agency is Ministry of Livestock, Fisheries and Rural Development, the Republic of the Union of Myanmar.

5.2 The Implementing Agency is Livestock Breeding and Veterinary Department, Ministry of Livestock, Fisheries and Rural Development, the Republic of the Union of Myanmar.

6. Requested Components

6.1 The Team confirmed that the components in Annex-3 are the final request by the Myanmar side. After assessing the appropriateness of the request, JICA will recommend to GOJ for approval.

6.2 Items for FMD vaccine production in Annex-3 are used by roller bottle culture method with capacity of 1 (one) million doses production which is current demand per year in Myanmar.

6.3 Soft component for operation and maintenance for the procured equipment by the Project was requested by the Myanmar side.

7. Japan's Grant Aid Scheme

7.1 The Myanmar side understood Japan's Grant Aid Scheme as described in Annex-4.

7.2 The Myanmar side will take necessary measures, as described in Annex-5, for smooth implementation of the Project, as a condition for the Japanese Grant Aid to be implemented.

8. Schedule of the Study

8.1 The Team will proceed to further studies in Myanmar until May 29, 2014.

8.2 JICA will prepare the draft final report of the Preparatory Survey in English and dispatch the mission to Myanmar in order to explain it in October, 2014.

8.3 In case the contents of the draft final report is accepted in principle by the Myanmar side, JICA will complete the final report and send it to GOM by January, 2015.

9. Other Relevant Issues

9.1 Improvement of Facilities

- Both sides agreed that improvement of facilities of existing F.M.D. VACCINE PRODUCTION LABORATORY (FVPL) built in 2011 should be excluded out of the component of the Project due to the condition of FVPL.
- The Team requested Myanmar side to prepare appropriate alternative building/facility, instead of FVPL, to install the equipment provided by the Project. As well as proposing VETERINARY MEDICAL PLANT (VMP), Pharmaceutical Industry Building, as alternative one, Myanmar side requested the Team to construct new laboratory building as the component of the Project, in case if VMP is unsuitable for the Project. The Team will examine the VMP as well as conveying the request to GOJ. The result will be informed to GOM by the next mission or beforehand.
- The Myanmar side mentioned that FVPL would be renovated and utilized by the responsibility of GOM if necessary.
- Both sides agreed that the Project's facilities would be required to fulfill the standard of Bio Safety Level (BSL) 2 in principle. Optional facilities exceeding BSL2 will be carefully examined by the Team through the perspective of necessity, maintenance cost and sustainable operation.

9.2 Technical Cooperation

- The Myanmar side requested the Team to provide technical support for one year following establishment of the Production Plant including suitable cell lines, reagents and training.
- The Myanmar side requested the Team not only to provide facility and equipment but also to dispatch two year's technical expert for efficient and sustainable

operationalization of production plant.

-The Team replied that above requests for technical cooperation are difficult to be implemented within the framework of the Japan's Grant Aid Scheme, and those requests are required to go through the appraisal and approval by GOJ as another project through the future needs survey. However, the support for the initial operation of the equipment and facilities for the smooth launch of the Project would be examined as soft components written in 4-2-(6) of the Inception Report through the preparatory survey.

-The Team explained that above requests would be conveyed to GOJ.

9.3 Selection Criteria of Equipment

-Both sides agreed that requested equipment and materials will be examined carefully by the Team from the point of view of maintenance cost, operation skill, and the relevance to the objective of the Project with the following priority.

- Priority A: High priority
- Priority B: Necessary but further examination is required.
- Priority C: Low priority

9.4 Operation and Maintenance of Equipment and Facilities

-The Myanmar side shall allocate necessary budget and human resources for operation and maintenance of the equipment and facilities procured/constructed in the Project.

-The necessary operation and maintenance cost and number of staff will be calculated and reported by the Team. The Myanmar side will take necessary actions to secure the budget before and during implementation of the Project.

9.5 Standard of FMD Vaccine Production Facility

-Both sides agreed that international GMP is not applicable to design of vaccine production facility of the Project.

9.6 Approval of the Project

-Both sides confirmed that the approval of the Project would be depended on the decision by GOJ.

Annex-1 Map of the Project Site

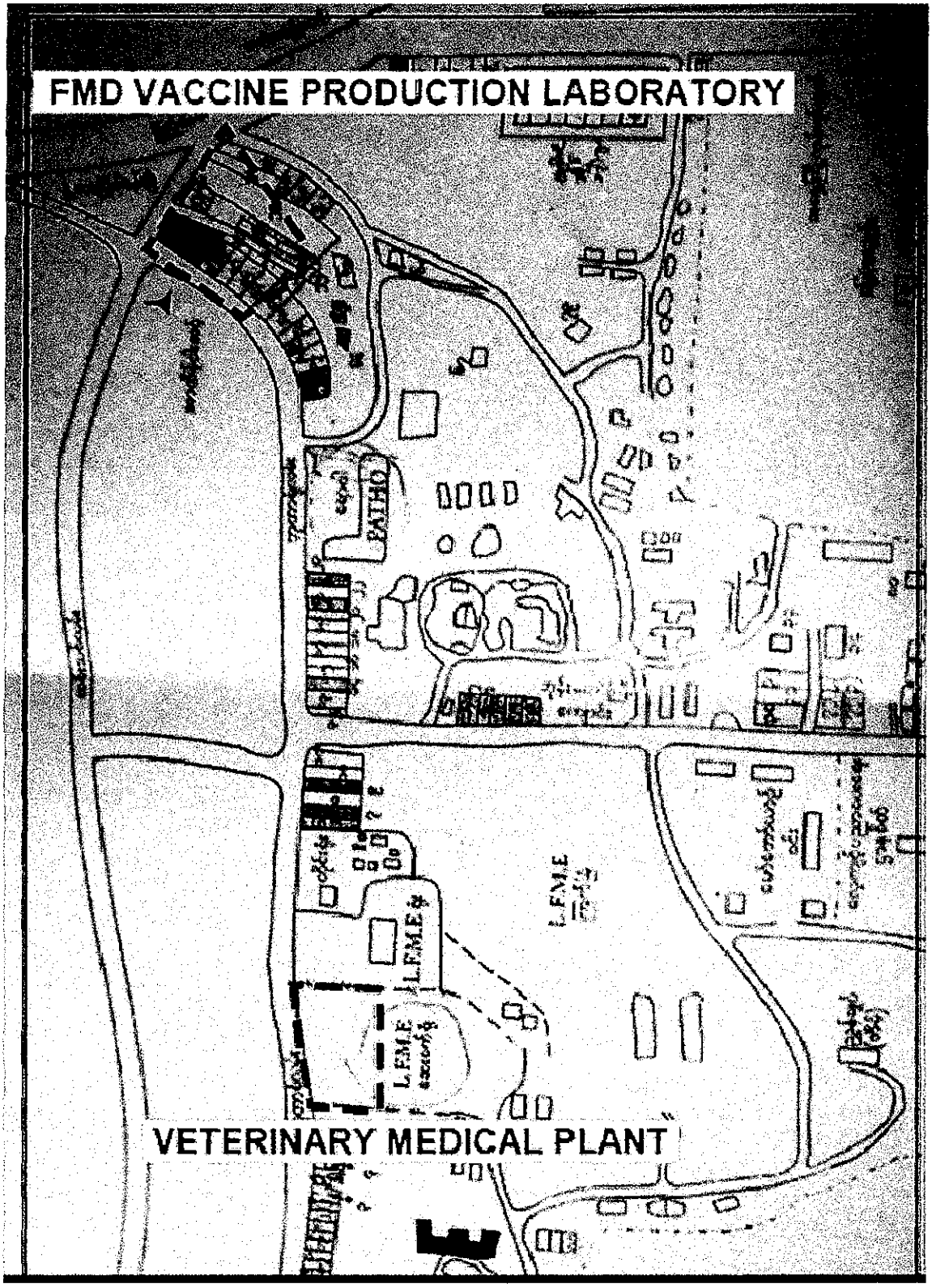
Annex-2 Organization Chart of the Responsible and Implementing Agency

Annex-3 Revised contents requested by GOM

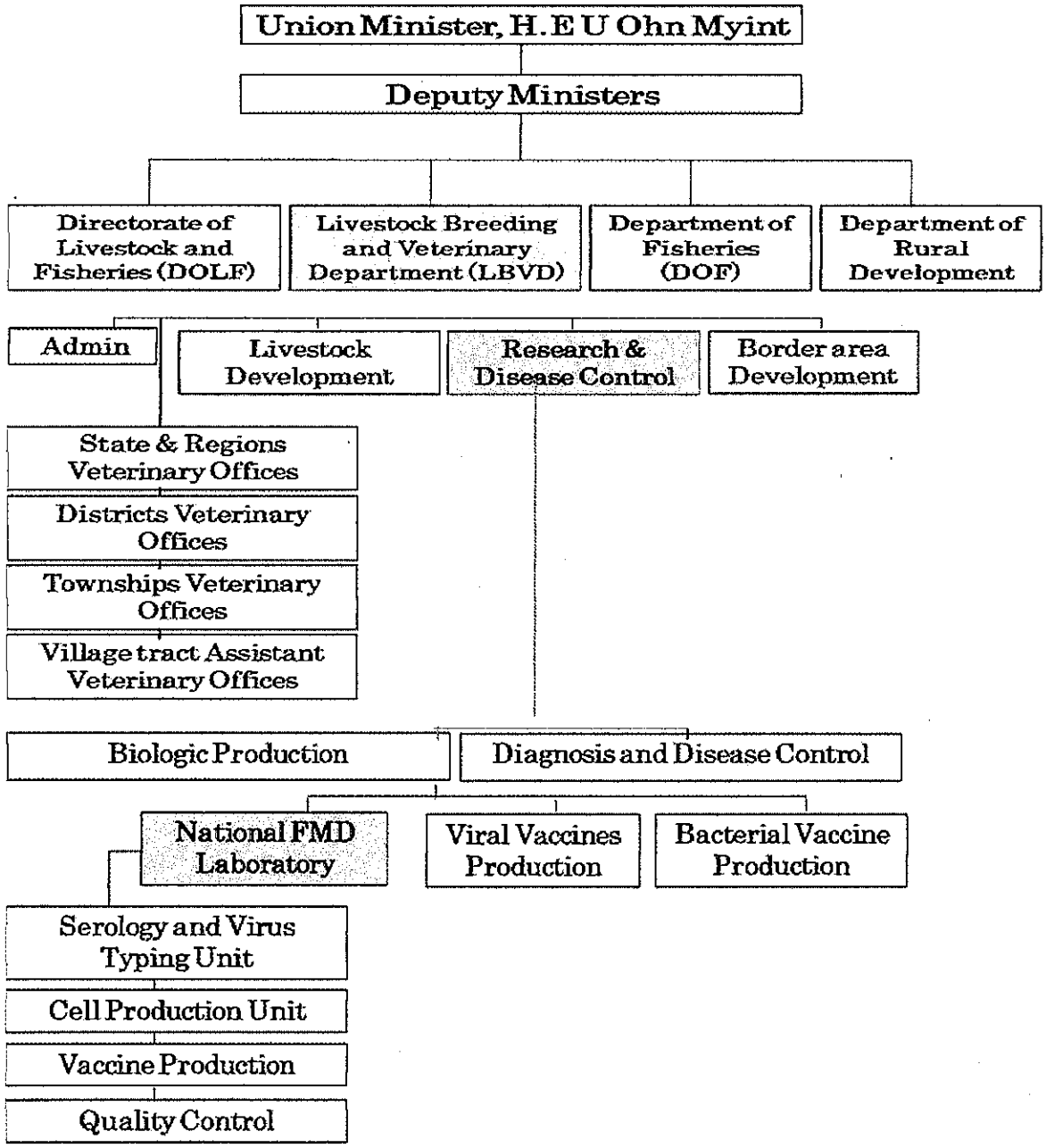
Annex-4 Japan's Grant Aid Scheme

Annex-5 Major Undertakings to be taken by Each Government

Annex-1 Map of the Project Site



Annex-2 Organization Chart of the Responsible and Implementing Agency



Annex-3 List of the requested Items

1. Functions of Facility

FMD vaccine production
Diagnosis of FMD virus

2. Equipment

Category	No.	Code No.	Description
production Management	1	PM-01	Computer for Batch Record control
	2	PM-02	Color Laser printer for printing Batch Record
	3	PM-03	Printing for in process control record
	4	PM-04	PC Desk
	5	PM-05	Printer Rack
	6	PM-06	Spare Toner
Utility	7	UT-01	Boiler
	8	UT-02	Process Chilling Unit
	9	UT-03	LPG Gas system
	10	UT-04	Purified water System Unit
	11	UT-05	Distilled water production/Supply unit for vaccine production
	12	UT-06	Oil free screw compressor unit
	13	UT-07	CIP Unit for Tank washing
	14	UT-08	SIP Unit for Tank Sterilization
	15	UT-09	Waste water inactivation system
	16	UT-10	Waste water treatment system
Sterilization	17	UT-11	Sterilizer
	18	UT-12	Hot air oven
	19	UT-13	Generator
	20	UT-14	Transformer (300KV)
Production	21	PT-01	Media Preparation Tank
	22	PT-02	Media filtration unit
	23	PT-03	Aluminum hydroxide Gel Tank
	24	PT-04	Chloroform Treatment Tank

	25	PT-05	Inactivation Tank
	26	PT-06	Oil type vaccine production tank
	27	PT-07	Mixing Tank
	28	PT-08	Reservoir Tank
	29	PT-09	Storage Tank
	30	PT-10	Microscope (Inverted Bi-ocular) for roller and roux
	31	PT-11	Roller Machine
	32	PT-12	Roller bottles
	33	PT-13	Roller bottle cap
	34	PT-14	Centrifugal unit for Cell production
	35	PT-15	Clean bench for Cell production
	36	PT-16	Vacuum pump
	37	PT-17	Waste Tank
	38	PT-18	Lamina Air Flow booth for cell culture
	39	PT-19	Gas Burner
	40	PT-20	Gas Torch
	41	PT-21	Incubator
	42	PT-22	Incubation Room
	43	PT-23	Filling and capping system
	44	PT-24	Filter for virus fluid filtration
	45	PT-25	Ultra Centrifuge for virus purification
	46	PT-26	Rotor for Ultra Centrifuge
	47	PT-27	Refrigerated Centrifuge
	48	PT-28	PP bottles
Purification	49	PT-29	Tubing Pump
	50	PT-30	Pump tube for tubing pump
	51	PT-31	Bio-safety cabinet (BSL-2)
	52	PT-33	Electric Balance
	53	PT-34	EC meter
	54	PT-35	pH meter
Storage	55	ST-01	Cold Room (+2 - +8C)

	56	ST-02	Deep Freezer (-20C)
	57	ST-03	Deep Freezer (-80C)
	58	ST-04	2 door Refrigerator
	59	ST-05	shelf
Miscellaneous	60	MS-01	Glass ware kit
	61	MS-02	Tool for production kit
	62	MS-03	Counting Chamber
	63	MS-04	Furniture for vaccine production
	64	MS-05	Silicon pipe
	65	MS-06	Thermo Logger
	66	MS-07	Thermo tester
	67	MS-08	Trolley
Diagnosis	68	DS-01	Thermal cycler with software
	69	DS-02	Sequencer
	70	DS-03	Electrocataphoresis apparatus
	71	DS-04	Ultraviolet irradiation apparatus for electrocataphoresis
	72	DS-05	Camera for record
	73	DS-06	Computer for PCR
	74	DS-07	Shaker for micro plate
	75	DS-08	Incubator for micro plate
	76	DS-09	Washer for micro plate
	77	DS-10	Micro plate reader with software
	78	DS-11	Computer for fluorochrome detection
	79	DS-12	High-speed centrifuge
	80	DS-13	Low-speed centrifuge
	81	DS-14	Micro-centrifuge
	82	DS-15	Ultracentrifuge
	83	DS-16	Magnetic stirrer
	84	DS-17	Ultra freezer
	85	DS-18	Freezer
	86	DS-19	Refrigerator

87	DS-20	Container of liquid nitrogen
88	DS-21	CO2 incubator
89	DS-22	Single channel micropipette set
90	DS-23	12 channel micropipette set
91	DS-24	Bunsen burner
92	DS-25	Thermostat bath
93	DS-26	Water demineralizer
94	DS-27	Inverted microscope
95	DS-28	Electronic balance
96	DS-29	Precision balance
97	DS-30	Autoclave
98	DS-31	Dry heart sterilizer
99	DS-32	Sterilization container
100	DS-33	Dry oven
101	DS-34	Biosafety cabinet
102	DS-35	Spectrophotometer
103	DS-36	Lamina air-flow
104	DS-37	Ice making machine
105	DS-38	pH meter
106	DS-39	Touch mixer
107	DS-40	Counting chamber
108	DS-41	Aspirator
109	DS-42	Virus titration kit
110	DS-43	Glass ware set
111	DS-44	Tool set for diagnosis
112	DS-45	Laboratory table
113	DS-46	Stool
114	DS-47	Shelf
115	DS-48	Reagent set

Annex-4

JAPAN'S GRANT AID

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as a part of this realignment, a new JICA law was entered into effect on October 1, 2008. Based on this law and the decision of the GOJ, JICA has become the executing agency of the Grant Aid for General Projects, for Fisheries and for Cultural Cooperation, etc.

The Grant Aid is non-reimbursable fund provided to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

The Japanese Grant Aid is supplied through following procedures :

- Preparatory Survey
  - The Survey conducted by JICA
- Appraisal &Approval
  - -Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet
- Authority for Determining Implementation
  - -The Notes exchanged between the GOJ and a recipient country
- Grant Agreement (hereinafter referred to as "the G/A")
  - -Agreement concluded between JICA and a recipient country
- Implementation
  - -Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the preparatory Survey is to provide a basic document necessary for the appraisal of the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of a outline design of the Project.

- Estimation of costs of the Project.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Outline Design of the Project is confirmed based on the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization of the recipient country which actually implements the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA employs (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the Report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the appropriateness of the Project.

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes(hereinafter referred to as "the E/N") will be singed between the GOJ and the Government of the recipient country to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the recipient country to continue to work on the Project's implementation after the E/N and G/A.

(3) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals".

(4) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to fulfill accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Annex.

(6) "Proper Use"

The Government of the recipient country is required to maintain and use properly and effectively the facilities constructed and the equipment purchased under the Grant Aid, to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Grant Aid.

(7) "Export and Re-export"

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account under the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). JICA will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

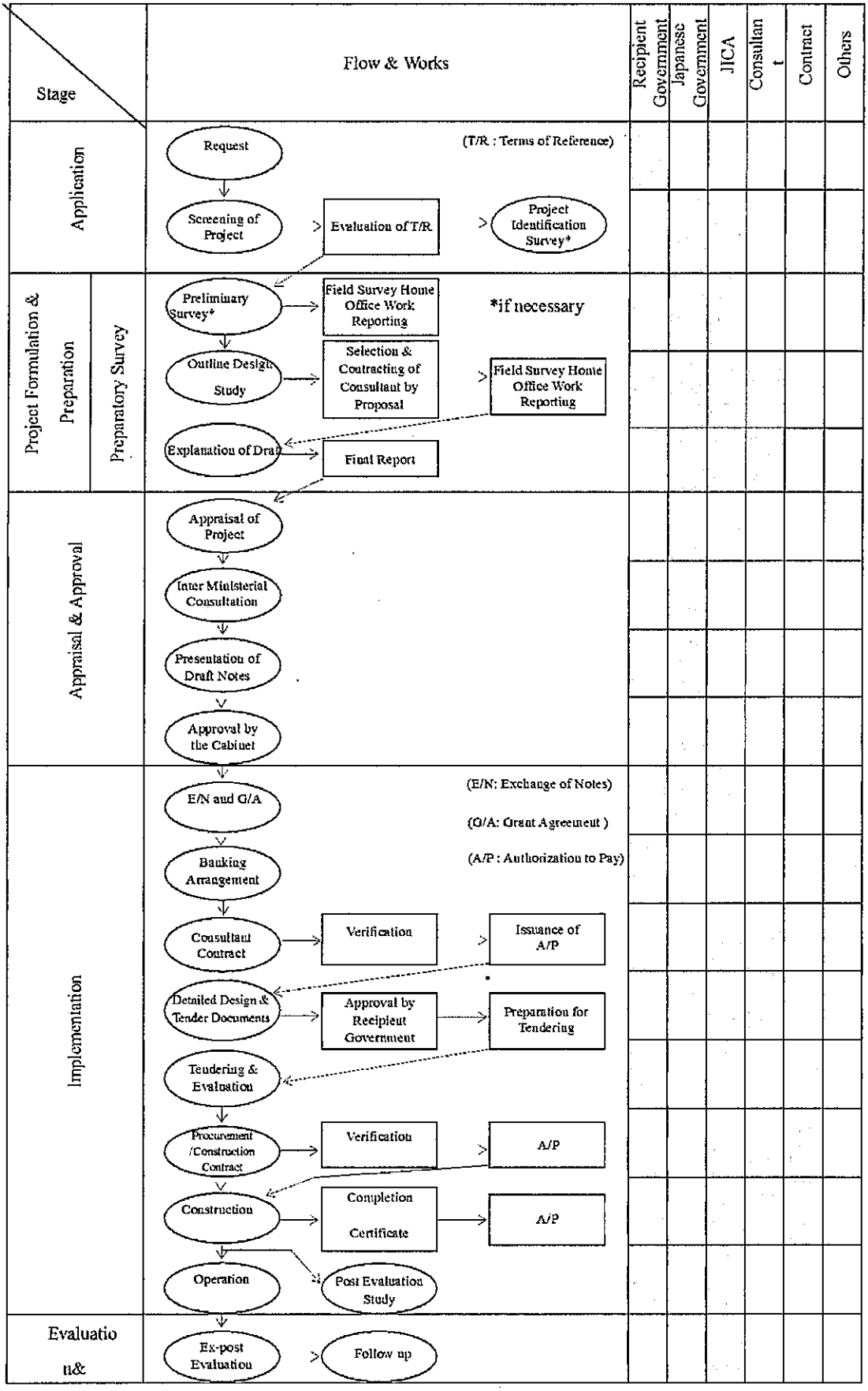
(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions paid to the Bank.

(10) Social and Environmental Considerations

A recipient country must carefully consider social and environmental impacts by the Project and must comply with the environmental regulations of the recipient country and JICA socio-environmental guidelines.

FLOW CHART OF JAPAN's GRANT AID PROCEDURES



Annex-5

Major Undertakings to be taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	to secure [a lot] /[lots] of land necessary for the implementation of the Project and to clear the [site]/[sites];		●
2	To construct the following facilities		
	1) The building	●	
	2) The gates and fences in and around the site		●
	3) The parking lot	●	
	4) The road within the site	●	
	5) The road outside the site		●
3	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the [site]/[sites]		
	1) Electricity		
	a. The distributing power line to the site		●
	b. The drop wiring and internal wiring within the site	●	
	c. The main circuit breaker and transformer	●	
	2) Water Supply		
	a. The city water distribution main to the site		●
	b. The supply system within the site (receiving and elevated tanks)	●	
	3) Drainage		
	a. The city drainage main (for storm sewer and others to the site)		●
	b. The drainage system (for toilet sewer, common waste, storm drainage and others) within the site	●	
	4) Gas Supply		
	a. The city gas main to the site		●
	b. The gas supply system within the site	●	
	5) Telephone System		
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		●
	b. The MDF and the extension after the frame/panel	●	
	6) Furniture and Equipment		
	a. General furniture		●
	b. Project equipment	●	
4	To ensure prompt unloading and customs clearance of the products at ports of disembarkation in the recipient country and to assist internal transportation of the products		
	1) Marine (Air) transportation of the Products from Japan to the recipient country	●	
	2) Internal transportation from the port of disembarkation to the project site	(●)	(●)
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services be exempted		●
6	To accord Japanese physical persons and / or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
7	To ensure that [the Facilities and the products]/[the Facilities]/ [the products] be maintained and used properly and effectively for the implementation of the Project		●
8	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		●
9	To bear the following commissions paid to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
10	To give due environmental and social consideration in the implementation of the Project.		●

(B/A : Banking Arrangement, A/P : Authorization to pay)

(2) Field Survey Ⅱ

Minutes of Discussions
on the Preparatory Survey for the Project for
Improvement of Foot-and-Mouth Disease Control
in the Republic of the Union of Myanmar
(Explanation on Draft Preparatory Survey Report)

On the basis of the discussions and field survey in the Republic of the Union of Myanmar (hereinafter referred to as "Myanmar") in May 2014, and the subsequent technical examination of the results in Japan, the Japan International Cooperation Agency (hereinafter referred to as "JICA") prepared a draft Preparatory Survey Report on the Project for the Project for Improvement of Foot-and-Mouth Disease Control in Myanmar (hereinafter referred to as "the Draft Report").

In order to explain the Draft Report and to consult with the concerned officials of the Government of Myanmar on its contents, JICA sent to Myanmar the Preparatory Survey Team for the explanation of the Draft Report (hereinafter referred to as "the Team"), headed by Dr. Masaharu Kanameda, Senior Advisor, JICA, and is scheduled to stay in the country from 13 to 18 December, 2015.

As a result of the discussions, both sides confirmed the main items described in the attached sheets.

Nay Pyi Taw, 17 December, 2015

Dr. Masaharu Kanameda	Dr. Kyaw Naing Oo
Leader	Director,
Preparatory Survey Team	Research and Disease Control Division
	Livestock Breeding and Veterinary Department
Japan International Cooperation Agency	Ministry of Livestock Fisheries and Rural Development
Japan	The Republic of the Union of Myanmar

ATTACHEMENT

1. Objective of the Project

The objective of the Project is to improve the Foot-and-Mouth Disease (hereinafter referred to as "FMD") control ability of the National Foot-and-Mouth Disease Laboratory in Yangon by construction of facilities and provision of equipment for FMD vaccine production and FMD diagnosis conducted by the laboratory, thereby contributing to the improved stability of agriculture and livestock production in Myanmar.

2. Title of the Preparatory Survey

Both sides confirmed the title of the Project as "the Project for Improvement of Foot-and-Mouth Disease Control".

3. Project Site

Both sides confirmed that the site of the Project is in Insein Township, Yangon which is shown in Annex-1.

4. Line Agency and Executing Agency

Both sides confirmed the line agency and executing agency as follows:

4-1. The line agency is Ministry of Livestock, Fisheries and Rural Development, the Republic of the Union of Myanmar, which would be the agency to conduct the Grant Agreement.

4-2. The executing agency is Livestock Breeding and Veterinary Department, Ministry of Livestock, Fisheries and Rural Development. The executing agency shall coordinate with all the relevant agencies to ensure smooth implementation of the project and ensure that the Undertakings are taken by relevant agencies properly and on time. The organization charts are shown in Annex-2.

5. Contents of the Draft Report

5-1. After the explanation of the contents of the Draft Report by the Team, the Myanmar side agreed in principle to its contents.

5-2. The Myanmar side explained that they consulted with the relevant stakeholders who will play central role in the new government to be established in March, 2016 on the Project. The Myanmar side assures that the Project is to be given high priority by the new government.

6. Cost Estimation

Both sides confirmed that the Project cost estimation described in the Draft Report was provisional and would be examined further by the Government of Japan for its final approval.

7. Confidentiality of the Cost Estimation and Specifications

Both sides confirmed that the Project cost estimation and technical specifications in the Draft

Report should never be duplicated or disclosed to any third parties until all the contracts of the Project are concluded.

8. Japan's Grant Aid Scheme

The Myanmar side understands the Japan's Grant Aid Scheme and its procedures as described in Annex 5 through Annex 7, and necessary measures to be taken by the Government of Myanmar.

9. Project Implementation Schedule

The Team explained to the Myanmar side that the expected implementation schedule is as attached in Annex 8.

10. Expected outcomes and Indicators

Both sides agreed that key indicators for expected outcomes are as follows. The Myanmar side has responsibility to monitor the progress of the indicators and achieve the target in year 2021.

(a) Quantitative Effect

Indicators	Base (Actual value in 2013)	Target (2021) (3 years after the completion of the Project)
FMD vaccine production (dose per a year)	250,000	1,000,000
Number of FMD diagnosis (sample per a year)	1,775	4,000
Improvement of the precision of FMD diagnosis (the number of virus types distinguishable)	0	7

(b) Qualitative Effect

- To improve the stability of agriculture and livestock production in Myanmar
- To produce FMD vaccine effectively through the appropriate operation procedure.
- To ensure performance of FMD vaccine by through suitable quality-control testing.
- To ensure safety of the facility for FMD vaccine production.

11. Technical assistance ("Soft Component" of the Project)

Considering the sustainable operation and maintenance of the provided facility, following technical assistance is planned to be provided under the Project. The Myanmar side confirmed that it will assign necessary number of competent and appropriate C/Ps as described in the draft final report.

12. Undertakings Taken by Both Sides

12-1. Both sides confirmed to undertakings described in Annex 9. The Myanmar side assured to take the necessary measures and coordination including allocation of the necessary budget which are preconditions of implementation of the Project. It is further agreed that the costs are indicative, i.e. at Outline Design level. More accurate costs will be calculated at the Detailed Design stage. Contents of Annex 9 will be updated as the Detailed Design progresses, and will finally be the Attachment to the Grant Agreement.

12-2. Myanmar side explains that the Project expenditure can only be done after the national congress authorizes the budget for Project. As an earliest assumption, the budget is foreseen to be authorized around October 2016 as a supplementary budget. Myanmar side will take necessary measures to procure the consultant before the budget authorization. Also, the executing agency will allocate their own budget to fulfill their responsibility such as payment for Banking Arrangement and Land Preparation even before the budget authorization.

12-3. Myanmar side explains the Tax exemption will be done through the method that tax is exempted without payment. Myanmar side explained detailed procedures for the tax exemption as attached in the Annex 12. Myanmar side confirmed to bear or reimburse the taxes without using the Grant if these are not exempted.

12-4. The executing agency will request budgetary authorization of the Project Expenditure including Japanese Grant Aid portion every year based on the updated forecast of the next fiscal year's disbursement. Especially, the executing agency will secure budget for fulfilling its undertakings as per Annex 9.

13. Monitoring during the Implementation

The Project will be monitored every 6 months by the executing agency and using the Project Monitoring Report (PMR) as shown in the Annex 10.

14. Ex-Post Evaluation

JICA will conduct ex-post evaluation three (3) years after the project completion with respect to five evaluation criteria (Appropriateness, Impact, Effectiveness, Efficiency, Sustainability) of the project. Result of the evaluation will be publicized. The Myanmar side is required to provide necessary support for them.

15. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items and send it to the Myanmar side around January, 2015.

16. Other Relevant Issues

16-1. Location and Improvement of Facilities

- Both sides agreed that the project site is the National Foot-and-Mouth Disease Laboratory in Yangon.

- Both side confirmed that F.M.D. VACCINE PRODUCTION LABORATORY (FVPL) was excluded out of the component of the Project due to the condition of FVPL.
- Both side agreed that improvement of facility of existing VETERINARY MEDICAL PLANT (VMP), Pharmaceutical Industry Building for utilization as the facility of FMD diagnosis, instead of FVPL.
- Both sides agreed that the new building for FMD vaccine production at the Project site will be constructed as the component of the Project.

16-2. Selection Criteria of Equipment

Both sides agreed that requested equipment and materials will be examined carefully by the Team from the point of view of maintenance cost, operation skill, and the relevance to the objective of the Project with the following priority.

Priority A: High priority
Priority B: Necessary but further examination is required.
Priority C: Low priority

16-3. Operation and Maintenance of the Facilities

The team explained about the importance of operation and maintenance of the facilities considering the fact that proper asset management impacts greatly on maintenance cost and lifespan of the facilities. The Myanmar side shall secure enough staff and budgets necessary for appropriate operation and maintenance of the facilities constructed by the Project. The annual operation and maintenance costs are estimated and shown in Annex 11

16-4. Technical Cooperation

- The Myanmar side requested the Team not only to provide facility and equipment but also to dispatch technical experts for efficient and sustainable operation of production plant.
- The team suggested that the government of Myanmar issues an official request for technical cooperation after E/N conclusion.

16-5. Disclosure of Information

Both sides confirmed that the study results excluding the Project cost will be disclosed to the public after completion of the Preparatory Survey. All the study results including the project cost will be disclosed to the public after all the contracts for the Project are concluded.

16-6. Liability against defects on FMD Diagnostic Laboratory

- Both sides confirmed that Japanese entities are not responsible for the defects of the foundation and superstructure except roof of the FMD Diagnostic Laboratory during and after the Project because the Project will only reconstruct the roof structure and refurbish interior and exterior of the building, and not change foundation and superstructure except roof, unless such defects arise from gross negligence or willful misconduct of the Japanese entities during the project

implementation.

- In case defects on the foundation or superstructure except roof arise during or after the project implementation, Myanmar side takes responsibility to repair such defects.
- In case defects on roof structure, interior, exterior, and other portion reconstructed by Japanese entities arise during construction or warranty period, Japanese entities take responsibility to repair such defects.

Annex-1 Map of the Project Site
Annex-2 Organization Chart of the Responsible and Implementing Agency
Annex 3 Draft Report
Annex 4 Project Cost Estimation
Annex 5 Japan's Grant Aid Scheme
Annex 6 Flow Chart of Japan's Grant Aid Procedures
Annex 7 Financial Flow of Japan's Grant Aid
Annex 8 Project Implementation Schedule and Annual C/P Fund Requirement
Annex 9 Major Undertakings to be taken by Each Government
Annex 10 Project Monitoring Report
Annex 11 Annual Operation and Maintenance Costs
Annex 12 Tax Exemption Procedure

END

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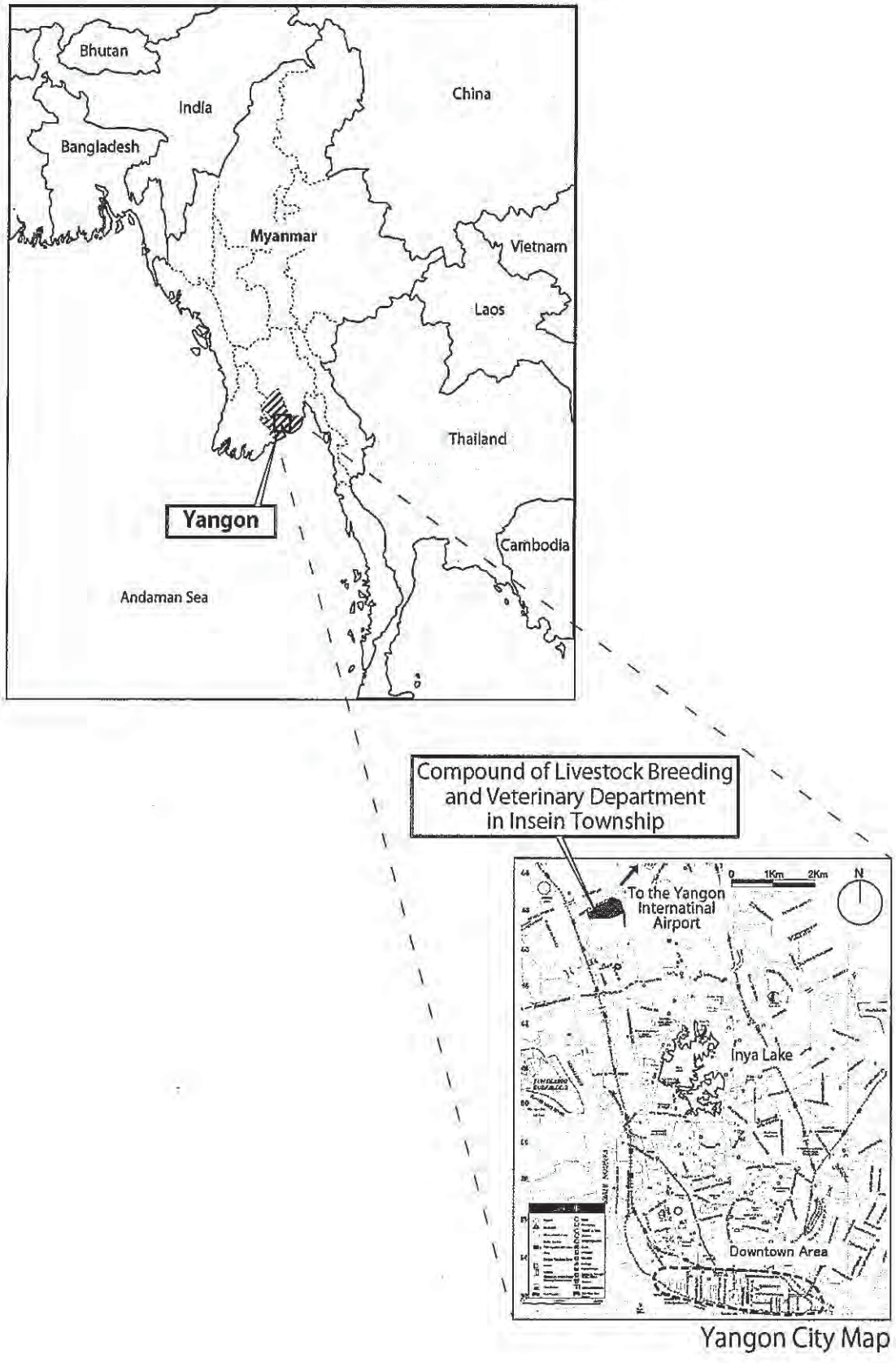
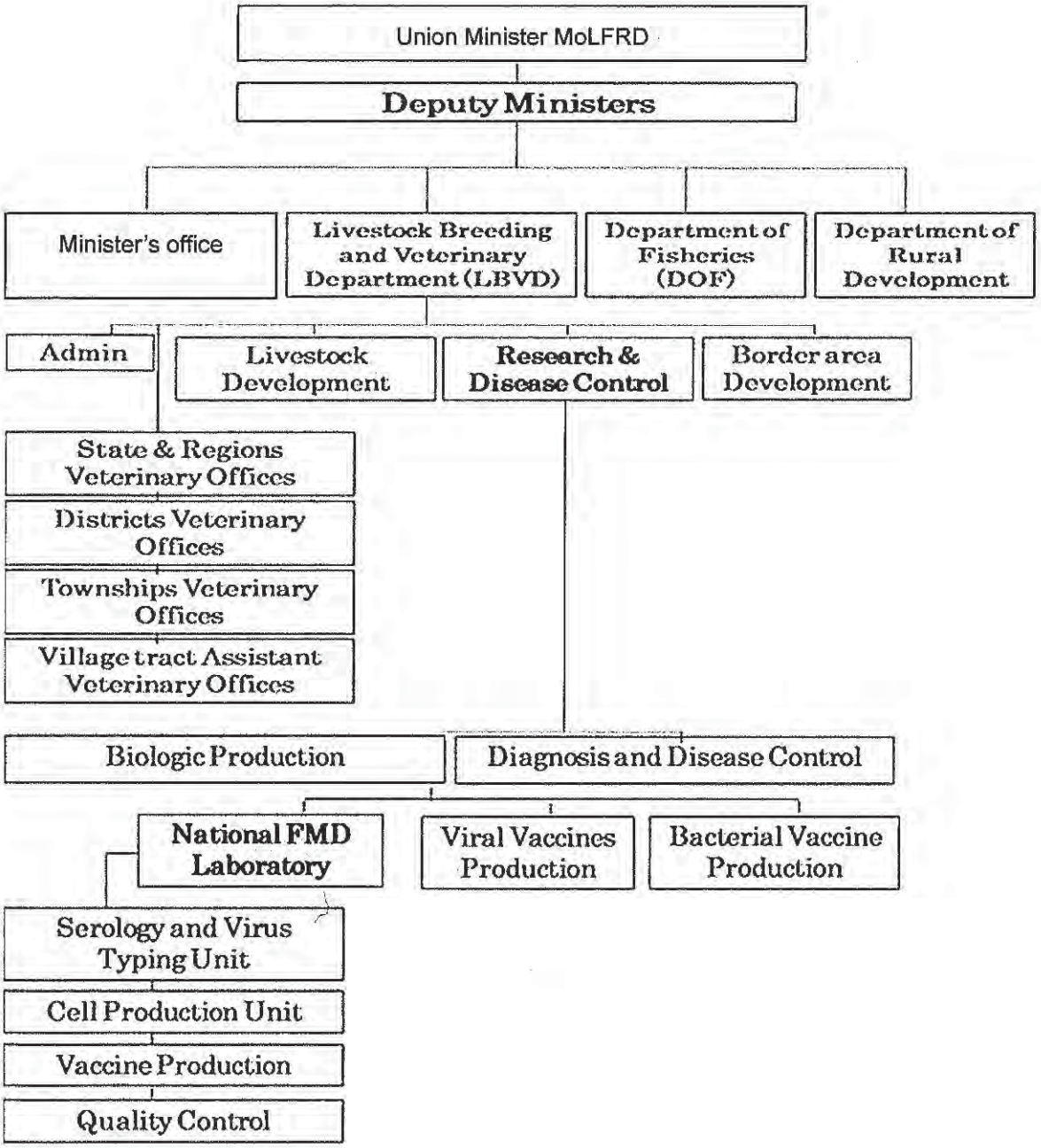


Yangon City Map

Annex-2 Organization Chart of the Responsible and Implementing Agency



Annex-4

(1)Project Cost to be borne by Japan's Grant Aid

Category	Cost (Million Japanese Yen)
Construction cost	This Page is closed due to the confidentiality .
Equipment procurement cost	
Soft component	
Design supervision cost	
Contingency	
Total	

Note:

(1) The cost estimates in the above table are provisional and will be further examined by the government of Japan for the approval of the Grant.

(2) Estimation Conditions

a) Date of estimation :May 2014

b) Foreign exchange rate :US$ 1=103.33 yen

Annex-5

JAPAN'S GRANT AID

Based on a JICA law which was entered into effect on October 1, 2008 and the decision of the GOJ, JICA has become the executing agency of the Grant Aid for Projects for construction of facilities, purchase of equipment, etc.

The Grant Aid is non-reimbursable fund provided to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

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(4) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals, in principle. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to fulfill accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Annex. The Japanese Government requests the Government of the recipient country to exempt all customs duties, internal taxes and other fiscal levies such as VAT, commercial tax, income tax, corporate tax, resident tax, fuel tax, but not limited, which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract, since the Grant Aid fund comes from the Japanese taxpayers.

(6) "Proper Use"

The Government of the recipient country is required to maintain and use properly and effectively the facilities constructed and the equipment purchased under the Grant Aid, to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Grant Aid.

(7) "Export and Re-export"

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account under the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"), in principle. JICA will execute the Grant Aid by making payments in Japanese yen, in principle, to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions paid to the Bank.

(10) Social and Environmental Considerations

The Government of the recipient country must carefully consider social and environmental impacts by the Project and must comply with the environmental regulations of the recipient country and JICA socio-environmental guidelines.

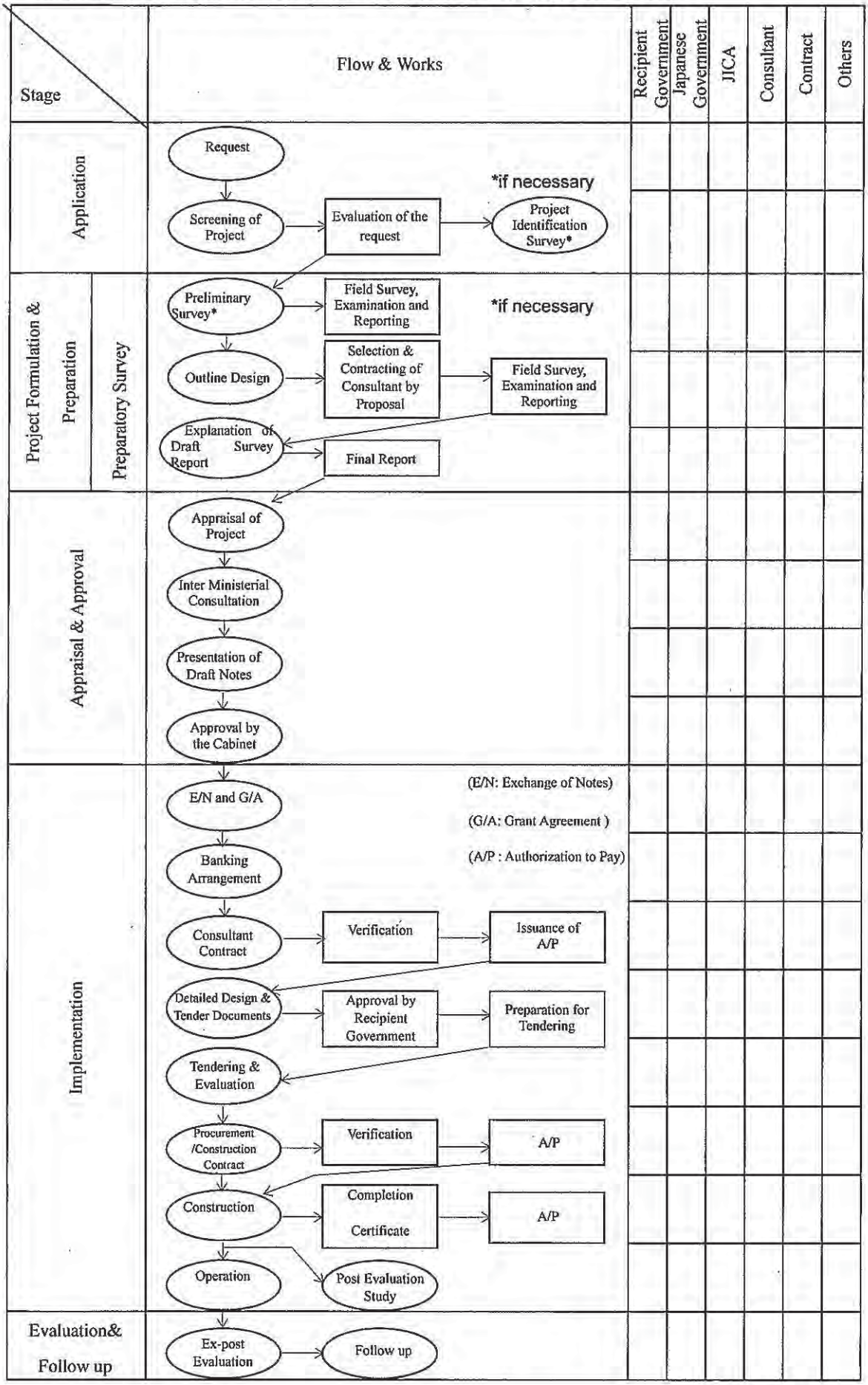
(11) Monitoring

The Government of the recipient country must take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and must regularly report to JICA about its status by using the Project Monitoring Report (PMR).

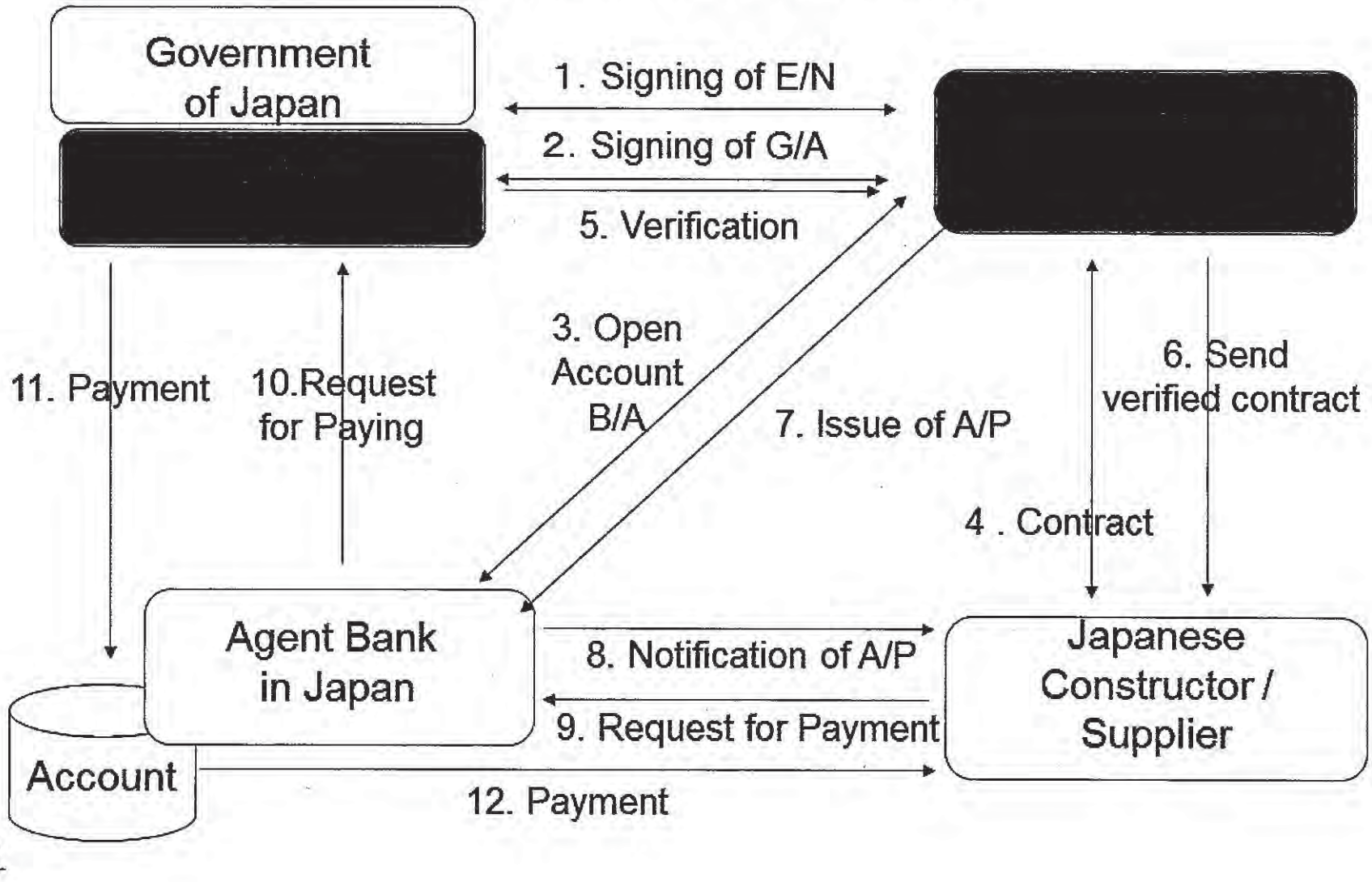
(12) Safety Measures

The Government of the recipient country must ensure that the safety is highly observed during the implementation of the Project.

Annex-6 FLOW CHART OF JAPAN's GRANT AID PROCEDURES



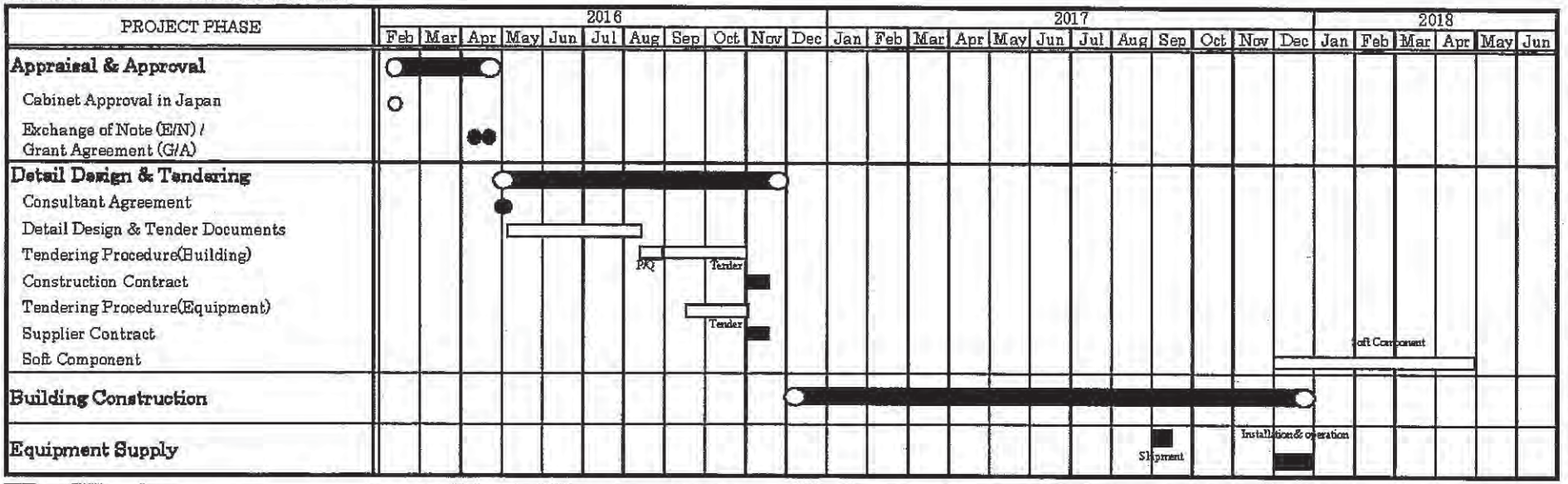
Financial Flow of Grant Aid



ANNEX-8 Project Implementation Schedule

PROJECT IMPLEMENTATION SCHEDULE

PROJECT IMPLEMENTATION SCHEDULE



Works by Government of Myanmar	FY2015	FY2016 60,672,000 MMK	FY2017 9,117,000MMK	FY2018 12,616,000MMK
1) Investigation of underground buried object		■		
2) Demolition and clearance of existing buildings		■		
3) Relocation of existing electric wrires and poles		■		
4) Cutting and removal of existing trees		■		
5) Ground leveling within the Project site		■		
6) Construction of walkway to detour traffic		■		
7) Installation of a service drop (electricity)			■	
8) Procurement of furniture and equipment				■
9) Commissions for A/P		▼ ▼		
10) Commissions for payment		▼ ▼	▼ ▼ ▼	▼
11) Building permit		■		

※ schedule may be subject to change.

Annex 9 Major Undertakings to be taken by Each Government

1. Major obligations to be taken by the Myanmar Government

(1) Specific obligations of the Recipient

The Recipient shall undertake the specific obligations for the Project as listed in the table below. JICA and the Recipient may agree from time to time separately in writing on the items, deadlines and other matters described in the tables below and the specific obligations of the Recipient.

1) Before the Tender

NO	Items	Deadline	In charge	Cost	Ref.
1	To open Bank Account (Banking Arrangement (B/A))	within 1 month after G/A	MOF		
2	To secure the following lands and building 1) project sites for new construction and renewal of an existing building in Insein Township, Yangon 2) diversion route 3) temporary construction yard and stock yard near the Project area 4) secure pit and disposal site near the Project area 5) vacate existing VETERINARY MEDICAL PLANT (within 1 month after G/A) 6) Investigate of underground buried object	before notice of the tender document	MoLFRD	2,279,000 MMK	
3	To obtain the planning, zoning, building permit	before notice of the tender document	MoLFRD		
4	To clear, level and reclaim the following sites 1) remove existing one 2-story building, 2 1-story building3 and 2 car sheds 2) remove existing concrete pavement, flag pole and abandoned plumbing 3) remove existing lighting pole and distribution board at existing VETERINARY MEDICAL PLANT and relocate power line. 4) Cutting and removal of existing trees 5) Ground leveling within the Project site	before notice of the tender document	MoLFRD	53,343,000 MMK	

2) During the Project Implementation

NO	Items	Deadline	In charge	Cost	Ref.
1	To bear the following commissions to a bank of Japan for the banking services based upon the B/A				
	1) Requesting budget for the Project	at the initial occasion to request a budget for the Project	MoLFRD		
	2) Advising commission of A/P	within 1 month after the budget of the Project gets authorized by the national congress	MoLFRD	150,000 MMK	
	3) Payment commission for A/P	every payment	MOF	12,820,000 MMK	
2	To ensure prompt unloading, customs clearance and internal transportation in the country of the Recipient of the products				
	1) Tax exemption and customs clearance of the products at the port of disembarkation	during the Project	MoLFRD		
	2) Internal transportation from the port of disembarkation to the project site	during the Project	MoLFRD		

3	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work	during the Project	MoLFRD		
4	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the Products and/or the Services be exempted; Such customs duties, internal taxes and other fiscal levies mentioned above include VAT, commercial tax, income tax and corporate tax of Japanese nationals, resident tax, fuel tax, but not limited, which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract	during the Project	MoLFRD MOF		
5	To bear all the expenses, other than those to be borne by the Japanese Grant, necessary for construction of the facilities as well as for the transportation and installation of the equipment	during the Project	MoLFRD		
6	To provide facilities for distribution of electricity, water supply, drainage and other incidental facilities necessary for the implementation of the Project outside the site(s)				
	1) Electricity The distributing power and telephone line including internet connection to the site	2 months before completion of the construction	MoLFRD	2,437,000 MMK	
	2) Water Supply Arrangement of the city water distribution main to the site	2 months before completion of the construction	MoLFRD		
	3) Drainage The city drainage main (for storm, sewer and others) to the site		MoLFRD		
	4) Furniture and Equipment General furniture	1 month after completion of the construction	MoLFRD	11,376,000 MMK	

3) After the Project

NO	Items	Deadline	In charge	Cost	Ref.
1	To maintain and use properly and effectively the facilities constructed and equipment provided under the Japanese Grant 1) Allocation of maintenance cost 2) Operation and maintenance structure 3) Routine check/Periodic inspection	After completion of the construction	MoLFRD	As per Annex	

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

2. Major obligations to be taken under the Japanese Grant

No	Items	Deadline	Amount (Million Japanese Yen)*
1	To construct and renew facilities (or To procure equipment)		This Page is closed due to the confidentiality
	- Facilities		
	- Equipment		
1)	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country		
	a) Marine(Air) transportation of the products from Japan to the recipient country		
	b) Internal transportation from the port of disembarkation to the project site		
2)	To construct access roads		
	a) Within the site		
3)	To construct the temporary building		
4)	To provide facilities for the distribution of electricity, water supply, drainage and other incidental facilities		
	a) Electricity		
	- The drop wiring and internal wiring within the site		
	- The main circuit breaker and transformer		
	b) Water Supply		
	- The supply system within the site (receiving and/or elevated tanks)		
	c) Drainage		
	- The drainage system (for toilet sewer, ordinary waste, storm drainage and others) within the site		
	d) Furniture and Equipment		
	- Project equipment		
2	To implement detailed design, tender support, construction supervision and soft component (Consultant)		
3	Contingency		
	Total		

(Note) Progress of the specific obligations of the Recipient may be confirmed and updated from time to time with written agreement between JICA and the Recipient in the form other than the amendment of the G/A.

Project Monitoring Report
on
Project Name
Grant Agreement No. XXXXXXX

20XX, Month

Organization Information

Authority (Signer of the G/A)	**Dr. Ye Tun Win** Person in Charge: Director General Livestock Breeding and Veterinary Development Ministry of Livestock, Fisheries and Rural Development Contacts: Address: Office No. 36, Nay Pyi Taw, Myanmar Phone/FAX: +95 67 408056 / +95 959 502 9759 Email: ytwvet84@gmail.com, lbvd@mptmail.ne.mm
Executing Agency	**Dr. Ye Tun Win** Person in Charge: Director General Livestock Breeding and Veterinary Development Ministry of Livestock, Fisheries and Rural Development Contacts: Address: Office No. 36, Nay Pyi Taw, Myanmar Phone/FAX: +95 67 408056 / +95 959 502 9759 Email: ytwvet84@gmail.com, lbvd@mptmail.ne.mm
Line Agency	**Dr. Khin Zaw** Person in Charge: Permanent Secretary Minister's Office, Ministry of Livestock, Fisheries and Rural Development Contacts: Address: Office No. 36, Nay Pyi Taw, Myanmar Phone/FAX: Email:

Outline of Grant Agreement:

Source of Finance	This part is closed due to the confidentiality Government of Myanmar: 82 million Kyat
Project Title	THE PROJECT FOR IMPROVEMENT OF FOOT AND MOUTH DISEASE CONTROL
E/N	Signed date: Duration:
G/A	Signed date: Duration:

1: Project Description

1-1 Project Objective

The Project aims to strengthen the FMD control capacity of the National Foot-and-Mouth Disease Laboratory under the Livestock Breeding and Veterinary Department (LBVD) of the Ministry of Livestock, Fisheries and Rural Development (MOLFRD) through the development of its FMD diagnostic and vaccine production facilities and provision of equipment, thereby contributing to stabilizing livestock production in Myanmar.

1-2 Necessity and Priority of the Project

- Consistency with development policy, sector plan, national/regional development plans and demand of target group and the recipient country.

The Republic of the Union of Myanmar is an agricultural country with some 60% of the working population engaged in farming including stock raising, forestry, and fisheries. The share of agriculture including stock raising, forestry, and fisheries in GDP is higher in Myanmar, at 34.7% in FY 2011-2012, than in any other ASEAN countries. Myanmar also holds the largest number of cattle including water buffaloes in the ASEAN region with around 18 million head. Not only are these animals used to plow fields and transport goods, their manure is also used to fertilize fields and their meat and dairy products are sold in the market. In Myanmar, livestock is an important resource that contributes to a rise in the earnings of farmers as well as food security. Moreover, the industrialization of the livestock sector can serve as a driving force for economic development because the growth rate of the sector is high, with an average of 12.5% from 2006 to 2010.

Myanmar frequently suffers from outbreaks of Foot-and-Mouth Disease (FMD), an acute febrile viral disease of cloven-hoofed animals. As it is characterized by its extremely high communicability, the import of cattle products from countries affected with FMD is severely restricted. A ban on the import of livestock products can cause great economic losses. FMD not only has a severe negative impact on livestock industry and productivity but also is a serious threat to neighboring countries because the cross-border smuggling of livestock can spread the disease to other countries. According to the statistics of the Food and Agriculture Organization (FAO) from 2008 to 2011, Myanmar annually exports approximately 50-70 thousand head of cloven-hoofed livestock to Thailand.

FMD cannot be properly controlled in Myanmar due to its constant financial difficulties and deterioration of facilities and equipment needed to diagnose FMD and to produce vaccines. As a result, the disease continues to break out every several years, causing serious damage to the country's livestock sector. Moreover, it is internationally regarded as one of the most dangerous infectious diseases of livestock. Under these circumstances, urgent measures are required to prevent the disease from spreading to neighboring countries including Japan.

The Central Committee for Rural Development and Poverty Alleviation under the Government of Myanmar formulated the Action Plan for Rural Development and Poverty Alleviation. In order to develop rural areas and reduce poverty, the plan has focused on eight development issues, including the development of the livestock and fisheries sectors. Additionally, Livestock and Fishery Sector Short-term Plans (2011-2015) were adopted, identifying animal disease control as one of the priority policies. In this context, the Project aims to prevent the spread of FMD by strengthening the capacity of the National Foot-and-Mouth Disease Laboratory.

1-3 Effectiveness and the indicators

- Effectiveness by the project

Quantitative Effect (Operation and Effect indicators)		
Indicators	Original (Yr 2013)	Target (Yr 2021)
FMD vaccine production (dose per a year)	250,000	1,000,000
Number of FMD diagnosis (sample per a year)	1,775	4,000
Improvement of the precision of FMD diagnosis (the number of virus types distinguishable)	0	7
Qualitative Effect		
1. To improve the stability of agriculture and livestock production in Myanmar 2. To produce FMD vaccine effectively through the appropriate operation procedure. 3. To ensure performance of FMD vaccine by through suitable quality-control testing. 4. To ensure safety of the facility for FMD vaccine production.		

2: Project Implementation

2-1 Project Scope

Table 2-1-1a: Comparison of Original and Actual Location

Location	**Original:** *(M/D)* the LBVD's property in Insein Township in the northern area of Yangon, where the National FMD Laboratory is currently located. **Attachment(s):Map**	**Actual:** *(PMR)* **Attachment(s):Map**

Table 2-1-1b: Comparison of Original and Actual Scope

Items	Original	Actual
1. New construction of a vaccine production plant with roller bottle culture method with an annual production capacity of one million doses of FMD vaccine	1. Floor Area 1,070 m2. A two-story building of reinforced concrete construction, including ancillary facilities (a guardhouse, a machine building, etc.)	*(PMR)*
2. Renovation of the existing building as a FMD diagnostic laboratory	2. Floor Area 803 m2 A two-story building of brick masonry construction with a steel roof structure	
3. Procurement of necessary equipment	3. For Vaccine production plant: Cell roller, Roller bottle, Roller cap, Inverted microscope with digital camera , Ultra-centrifuge etc. For FMD diagnostic laboratory: PC, Printer, Real-time PCR, Reader for microplate, CO2 incubator, Safety cabinet, Clean bench, DNA sequencer etc.	Please state not only the most updated schedule but also other past revisions chronologically. All change of design shall be recorded regardless of its degree.
4. Soft Component	4. The initial support on the operation and maintenance method of the project facilities, utility systems, production system and equipment, as well as essential items needed for making vaccine production plan will be given	

2-1-2 Reason(s) for the modification if there have been any.

(PMR)

2-2 Implementation Schedule

2-2-1 Implementation Schedule

Table 2-2-1: Comparison of Original and Actual Schedule

Items	Original		Actual
	DOD	G/A	
Cabinet Approval	3/2016	-	-
E/N	4/2016		
G/A	4/2016		
Mobilization of consultant	5/2016		
Detailed Design	5/2016-8/2016		
Budget Request for FY2017	8/2016		
Supplementary Budget Request for FY2016	8/2016		
Tender Process of contractor and supplier	8/2016-10/2016		
Approval of contractor and supplier contract	11/2016		
Supplementary Budget Appropriation for FY 2016 and Issuance of A/P	11/2016		
Construction Period	12/2016-12/2017		
Shipment	9/2017		
Custom Clearance	10/2017-11/2017		
Installation and acceptance Check	12/2017		
Soft component	12/2017-4/2018		
Project Completion Date	4/2018		
Defect Liability Period	4/2019		

*Project Completion was defined as Completion of Soft component at the time of G/A.

2-2-2 Reasons for any changes of the schedule, and their effects on the project.

2-3 Undertakings by each Government

2-3-1 Major Undertakings

See Attachment 2.

2-3-2 Activities

See Attachment 3.

2-3-3 Report on RD

See Attachment 4.

2-4 Project Cost
2-4-1 Project Cost

Table 2-4-1a Comparison of Original and Actual Cost by the Government of Japan
(Confidential until the Tender)

Items			Cost (Million Yen)	
	Original	Actual	Original	Actual
Construction of Facilities	1. New construction of a vaccine production plant with roller bottle culture method with an annual production capacity of one million doses of FMD vaccine 2. Renovation of the existing building as a FMD diagnostic laboratory		This Page is closed due to the confidentiality	Please state not only the most updated schedule but also other past revisions chronologically.
Equipment	For Vaccine production plant and FMD diagnostic laboratory			
Soft Component				
Consulting Services	- Detailed design -Procurement Management -Construction Supervision			
Contingency				
Total				

Note: 1) Date of estimation: May 2014
2) Exchange rate: 1 US Dollar =103.33 Yen

Table 2-4-1b Comparison of Original and Actual Cost by the Government of Myanmar

Items			Cost (Thousand MMK)	
	Original	Actual	Original	Actual
Construction works	1) Investigation of underground buried object		1,541	Please state not only the most updated schedule but also other past revisions chronologically.
	2) Demolition and clearance of existing buildings		49,319	
	3) Relocation of existing electric wires and poles		2,480	
	4) Cutting and removal of existing trees		335	
	5) Ground leveling within the Project site		1,209	
	6) Construction of walkway to detour traffic		738	
	7) Installation of a service drop (electricity)		2,437	
Equipment procurement	Procurement of furniture and equipment		11,376	
Administrative procedures	Bank commissions, etc.		12,970	
Total			82,405	

Note: 1) Date of estimation: May 2014
2) Exchange rate: 1 US Dollar =947.98 MMK(local currency)

2-4-2 Reason(s) for the wide gap between the original and actual, if there have been any, the remedies you have taken, and their results.

(PMR)

2-5 **Organizations for Implementation**

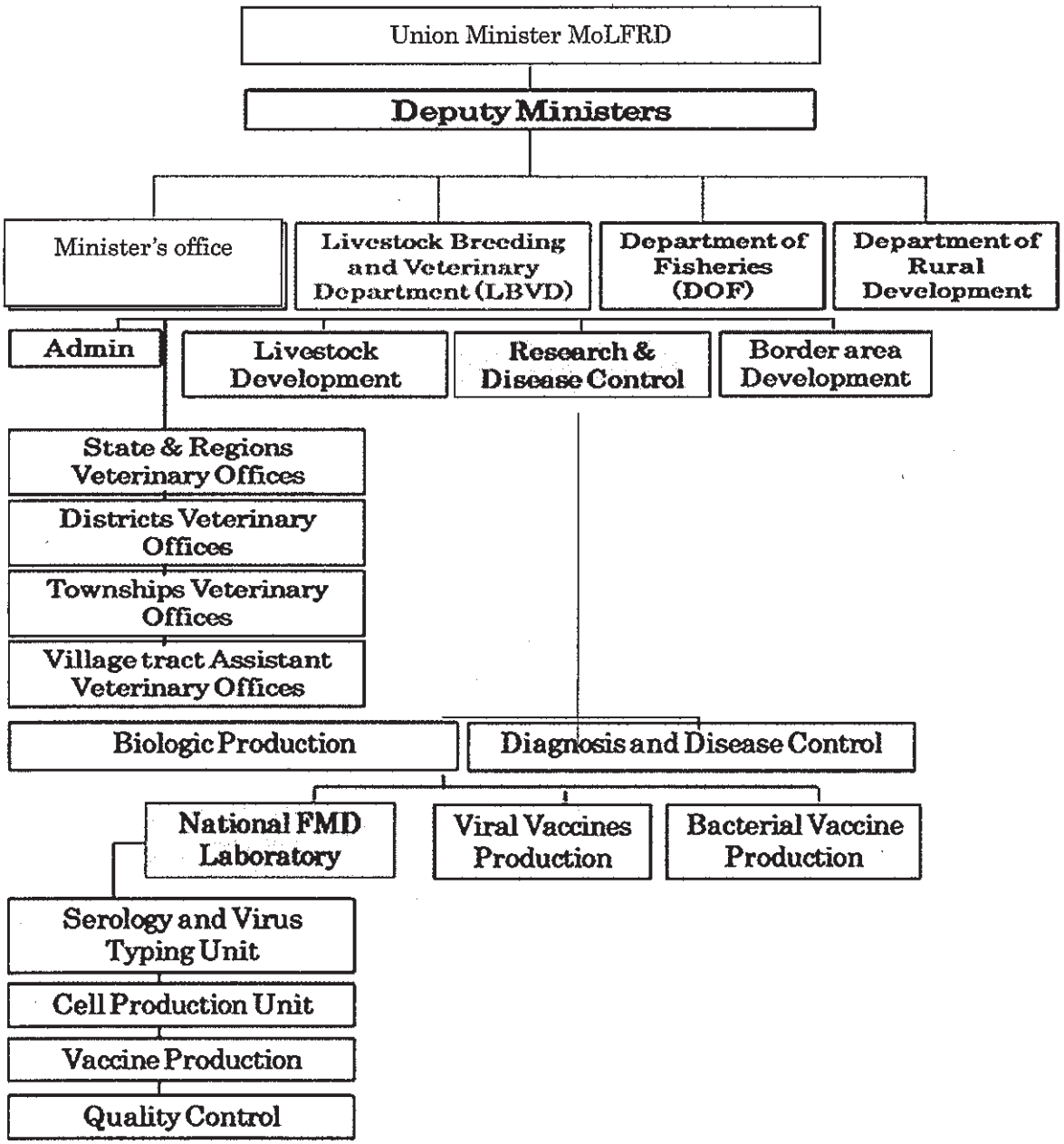
2-5-1 **Executing Agency:**

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original: *(M/D)*

The line agency is Ministry of Livestock, Fisheries and Rural Development, the Republic of the Union of Myanmar, which would be the agency to supervise the executing agency.

The executing agency is Livestock Breeding and Veterinary Department, Ministry of Livestock, Fisheries and Rural Development. The executing agency shall coordinate with all the relevant agencies to ensure smooth implementation of the project and ensure that the Undertakings are taken by relevant agencies properly and on time. The organization charts are shown below.



Actual, if changed: *(PMR)*

2-6 Environmental and Social Impacts

- The environmental monitoring is not required in the Project as this project was categorized as category C in accordance with the GUIDELINES FOR ENVIRONMENTAL AND SOCIAL CONSIDERATIONS of JICA as of April 2010.

3: Operation and Maintenance (O&M)

3-1 O&M and Management

- Organization chart of O&M
- Operational and maintenance system (structure and the number ,qualification and skill of staff or other conditions necessary to maintain the outputs and benefits of the project soundly, such as manuals, facilities and equipment for maintenance, and spare part stocks etc)

Original: *(M/D)*

(1) Operation System

Table 3-1 below shows the number of staff members required for each unit to properly operate the vaccine production plant with roller bottle culture method an annual production capacity of one million doses of FMD vaccine and the FMD diagnostic laboratory constructed and equipped through this Project. It is essential to establish an implementation structure for initial equipment operation training and soft component by adequately staffing the plant and laboratory before they are completed and equipped.

Table 3-1-1 Future organizational structure and personnel plan of the National FMD Laboratory

Section	Unit	No. of veterinary technical officers	No. of other staff members
Vaccine production	Cell culture	6	5
	Vaccine production	8	8
	Quality control	4	3
Diagnosis	Serology and virus taxonomy	4	3
	PCR	4	3
Administration		2	3
	Total	28	25

(2) Maintenance System

After the completion of the Project, the administration section of National FMD Laboratory will take charge of maintenance. When equipment needs repair by the manufacturer or agency, they will still need to request budget from the LBVD. Therefore, it is essential for the LBVD to quickly accept repair requests.

Daily maintenance is crucial to ensure that facilities and equipment continue working properly. As soft component of the Project, technical assistance will be provided for maintenance planning, detailed maintenance methods, and operational management.

(3) Facilities maintenance plan

The maintenance of facilities is categorized into two types: (i) daily cleaning and (ii) repair of wearing parts, damage, and deterioration. The repair of facilities mainly consists of the renovation and restoration of the interior and exterior finish on the structure. Facilities should be refurbished every decade to retain their functions.

Items for regular inspection and repair which affect the lifespan of facilities will be presented in the Maintenance Manuals submitted by the contractor at the commissioning of the facilities. Detailed inspection and cleaning methods will be also explained.

Regular inspection points are summarized in Table 3-2 below.

Table 3-1-2 Regular inspection for facilities

Part	Inspection and maintenance points	Frequency
Exterior	Restore and repaint exterior walls	Repaint every 5 years; restore every 3 years
	Inspect and restore roofs	Inspect every 3 years; restore every 10 years
	Inspect and repair exterior door and window seals	Every year
	Inspect and clean drainage gutters and ditches, manholes, etc.	Every year
Interior	Renovate the interior	As necessary
	Restore and repaint partition walls	As necessary
	Replace ceiling materials	As necessary
	Adjust doors and windows to fit the openings	Every year
	Replace door handles, hinges, etc.	As necessary

(4) Building Equipment maintenance plan

What is important to maintain building equipment is daily *preventive* maintenance before there arises a need to repair defects and replace parts. Its lifespan can be extended by normal operation and daily inspection, lubrication, tune-up, cleaning, and repair. Daily maintenance can prevent defects and accidents as well as mitigate their impacts.

Electricity-powered equipment such as power generators and water pumps needs periodical inspection and maintenance. It is desirable for these kinds of equipment to have annual inspection by outside professionals. The general lifespan of major building equipment is shown below in Table 3-1-1.

Table 3-1-1 Lifespan of building equipment

	Equipment	Lifespan
Electrical installations	Distribution panel	20-30 years
	LED lamp	20,000-40,000 hours
	Generator	15 years
Plumbing installations	Pump, pipe, and valve	15 years
	Tank	20 years
	Sanitary ware	25-30 years
	Ventilator (for aeration)	15 years
Air-conditioning installations	Air conditioner	10 years
	Exhaust fan	20 years

(5) Special System and Equipment for Vaccine Production maintenance plan

Maintenance of special system and equipment for vaccine production mainly consists of daily inspection, adjustment of measuring instruments, replenishment of reagents and consumables, and repair of wearing parts, damage, and deterioration. In particular, daily inspection of equipment and replenishment of reagents and consumables are essential to prevent breakdown and ensure stable operation and reliable production. It is recommended to have the manufacturers' technicians inspect automation equipment (e.g., ice making equipment, pure steam generators, water-for-injection generators, and autoclaves) on a regular basis. High-pressure equipment, such as autoclaves and pure steam generators, is subject to legal inspection according to local laws and regulations.

It is recommended to have outside professionals inspect facilities and equipment (e.g., such as CIP/SIP units, inactivation system, and water treatment system) on a regular basis.

(6) Equipment maintenance plan

Before installation of the equipment, the structure, detail plan and formalities for maintenance should be established. The outline of assumed maintenance formalities is as follows;

* Organizing the structure for maintenance before installation of the equipment.
* More than one user including a person in charge will take the initial guidance for the equipment.
* Implementing regular maintenance according to the manuals.
* Making an equipment inventory and a maintenance record, managing consumables and spare parts.
* When malfunction is observed, taking measures appropriately as follows;
  1) examining the degree of failure
  2) repairing a minor failure by technician in the national FMD laboratory
  3) making a contact to an agency or manufacturer for requesting a relevant technician

Actual: *(PMR)*

3-2 O&M Cost and Budget

- The actual annual O&M cost for the duration of the project up to today, as well as the annual O&M budget.

Original: *(M/D)*

Table 3-2-1 below shows the prospected yearly operation and maintenance costs as of FY 2017 of the vaccine production plant and FMD diagnostic laboratory constructed and equipped through this Project.

Table 3-2-1 Estimated yearly operation and maintenance costs

Item		Estimated cost (Thousand MMK)
1. Personnel cost		78,226
2. Utilities cost	- Electricity	23,691
	- Communications	1,049
	- Water	186
	- Fuel oil	23,410
3. Vaccine production cost (materials, consumables, etc.)		50,600
4. FMD diagnosis cost (reagents, consumables, etc.)		67,263
5. Maintenance cost	- Facilities	27,660
	- Equipment	1,623
	Total	273,708

Actual: *(PMR)*

4: Precautions (Risk Management)

- Risks and issues, if any, which may affect the project implementation, outcome, sustainability and planned countermeasures to be adapted are below.

Original Issues and Countermeasure(s): *(M/D)*	
Potential Project Risks	Assessment
1. Delay of budget appropriation	Probability: H/M/L
(Description of Risk) Grant Aid budget should be appropriated by Myanmar parliament before execution. In the past, some Grant Aid project's construction progress delayed and entered into fiscal year 2015 which was not planned in the initial schedule. As the executing agency did not fully foreseen the delay, they missed to apply for year 2015's budget so the payment under the Grant Aid project was stopped until that year's budget was appropriated through supplementary budget.	Impact: H/M/L Analysis of Probability and Impact: The probability of the delay of the construction work is moderate. So the probability of this risk is also moderate. The impact is very high because it can potentially cause lawsuit related to the non-payment. Mitigation Measures: Yearly disbursement plan is made and attached to this PMR for budget request. Action during the Implementation: The disbursement forecast of the next fiscal year should be updated by the consultant before the MoLFRD's budget request internal procedure starts. The executing agency should supervise that the consultant provides the information on time. Contingency Plan (if applicable):
2.	Probability: H/M/L
(Description of Risk)	Impact: H/M/L Analysis of Probability and Impact: Mitigation Measures: Action during the Implementation: Contingency Plan (if applicable):
3.	Probability: H/M/L
(Description of Risk)	Impact: H/M/L Analysis of Probability and Impact: Mitigation Measures: Action during the Implementation: Contingency Plan (if applicable):
Actual issues and Countermeasure(s)	
(PMR)	

5: Evaluation at Project Completion and Monitoring Plan

5-1 Overall evaluation

Please describe your overall evaluation on the project.

5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

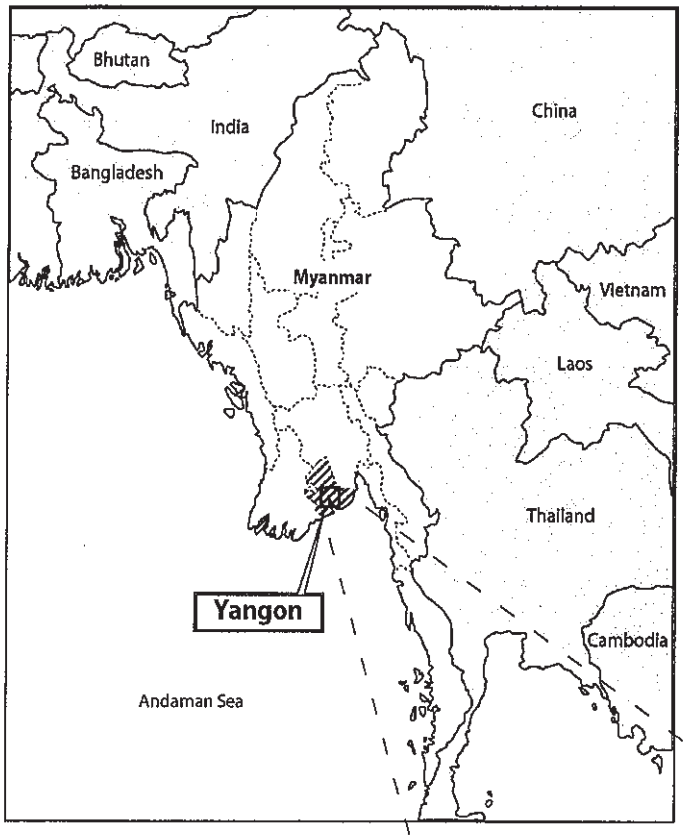
5-3 Monitoring Plan for the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

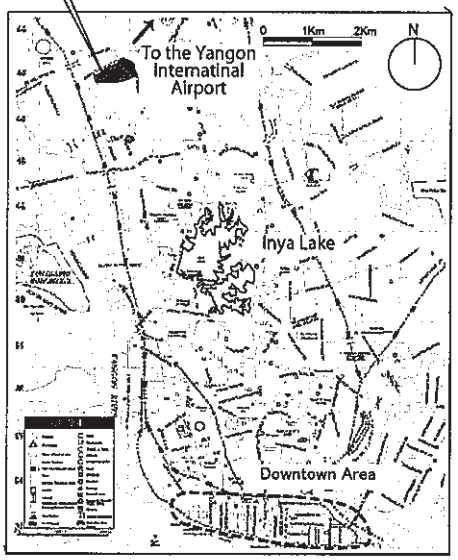
Attachment

1. Project Location Map
2. Undertakings to be taken by each Government
3. Monthly Report
4. Report on RD
5. Yearly disbursement plan
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (Final Report Only)

Attachment 1 Project Location Map



Compound of Livestock Breeding and Veterinary Department in Insein Township



Yangon City Map

Attachment 2 Undertakings to be taken by each Government

1. Major obligations to be taken by the Myanmar Government

(1) Specific obligations of the Recipient

The Recipient shall undertake the specific obligations for the Project as listed in the table below. JICA and the Recipient may agree from time to time separately in writing on the items, deadlines and other matters described in the tables below and the specific obligations of the Recipient.

1) Before the Tender

NO	Items	Deadline	In charge	Cost	Ref.
1	To open Bank Account (Banking Arrangement (B/A))	within 1 month after G/A	MOF		
2	To secure the following lands and building 1) project sites for new construction and renewal of an existing building in Insein Township, Yangon 2) diversion route 3) temporary construction yard and stock yard near the Project area 4) secure pit and disposal site near the Project area 5) vacate existing VETERINARY MEDICAL PLANT (within 1 month after G/A) 6) Investigate of underground buried object	before notice of the tender document	MoLFRD	2,279,000 MMK	
3	To obtain the planning, zoning, building permit	before notice of the tender document	MoLFRD		
4	To clear, level and reclaim the following sites 1) remove existing one 2-story building, 2 1-story building3 and 2 car sheds 2) remove existing concrete pavement, flag pole and abandoned plumbing 3) remove existing lighting pole and distribution board at existing VETERINARY MEDICAL PLANT and relocate power line. 4) Cutting and removal of existing trees 5) Ground leveling within the Project site	before notice of the tender document	MoLFRD	53,343,000 MMK	

2) During the Project Implementation

NO	Items	Deadline	In charge	Cost	Ref.
1	To bear the following commissions to a bank of Japan for the banking services based upon the B/A				
	1) Requesting budget for the Project	at the initial occasion to request a budget for the Project	MoLFRD		
	2) Advising commission of A/P	within 1 month after the budget of the Project gets authorized by the national congress	MoLFRD	150,000 MMK	
	3) Payment commission for A/P	every payment	MOF	12,820,000 MMK	
2	To ensure prompt unloading, customs clearance and internal transportation in the country of the Recipient of the products				
	1) Tax exemption and customs clearance of the products at the port of disembarkation	during the Project	MoLFRD		
	2) Internal transportation from the port of disembarkation to the project site	during the Project	MoLFRD		

3	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work	during the Project	MoLFRD		
4	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the Products and/or the Services be exempted; Such customs duties, internal taxes and other fiscal levies mentioned above include VAT, commercial tax, income tax and corporate tax of Japanese nationals, resident tax, fuel tax, but not limited, which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract	during the Project	MoLFRD MOF	356,264,000 MMK	
5	To bear all the expenses, other than those to be borne by the Japanese Grant, necessary for construction of the facilities as well as for the transportation and installation of the equipment	during the Project	MoLFRD		
6	To provide facilities for distribution of electricity, water supply, drainage and other incidental facilities necessary for the implementation of the Project outside the site(s)				
	1) Electricity The distributing power and telephone line including internet connection to the site	2 months before completion of the construction	MoLFRD	2,437,000 MMK	
	2) Water Supply Arrangement of the city water distribution main to the site	2 months before completion of the construction	MoLFRD		
	3) Drainage The city drainage main (for storm, sewer and others) to the site		MoLFRD		
	4) Furniture and Equipment General furniture	1 month after completion of the construction	MoLFRD	11,376,000 MMK	

3) After the Project

NO	Items	Deadline	In charge	Cost	Ref.
1	To maintain and use properly and effectively the facilities constructed and equipment provided under the Japanese Grant 1) Allocation of maintenance cost 2) Operation and maintenance structure 3) Routine check/Periodic inspection	After completion of the construction	MoLFRD	As per Annex	

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

2. Major obligations to be taken under the Japanese Grant

No	Items	Deadline	Amount (Million Japanese Yen)*
1	To construct and renew facilities (or To procure equipment)		This Page is closed due to the confidentiality
	- Facilities		
	- Equipment		
1)	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country		
	a) Marine(Air) transportation of the products from Japan to the recipient country		
	b) Internal transportation from the port of disembarkation to the project site		
2)	To construct access roads		
	a) Within the site		
3)	To construct the temporary building		
4)	To provide facilities for the distribution of electricity, water supply, drainage and other incidental facilities		
	a) Electricity		
	- The drop wiring and internal wiring within the site		
	- The main circuit breaker and transformer		
	b) Water Supply		
	- The supply system within the site (receiving and/or elevated tanks)		
	c) Drainage		
	- The drainage system (for toilet sewer, ordinary waste, storm drainage and others) within the site		
	d) Furniture and Equipment		
	- Project equipment		
2	To implement detailed design, tender support, construction supervision and soft component (Consultant)		
3	Contingency		
	Total		

(Note) Progress of the specific obligations of the Recipient may be confirmed and updated from time to time with written agreement between JICA and the Recipient in the form other than the amendment of the G/A.

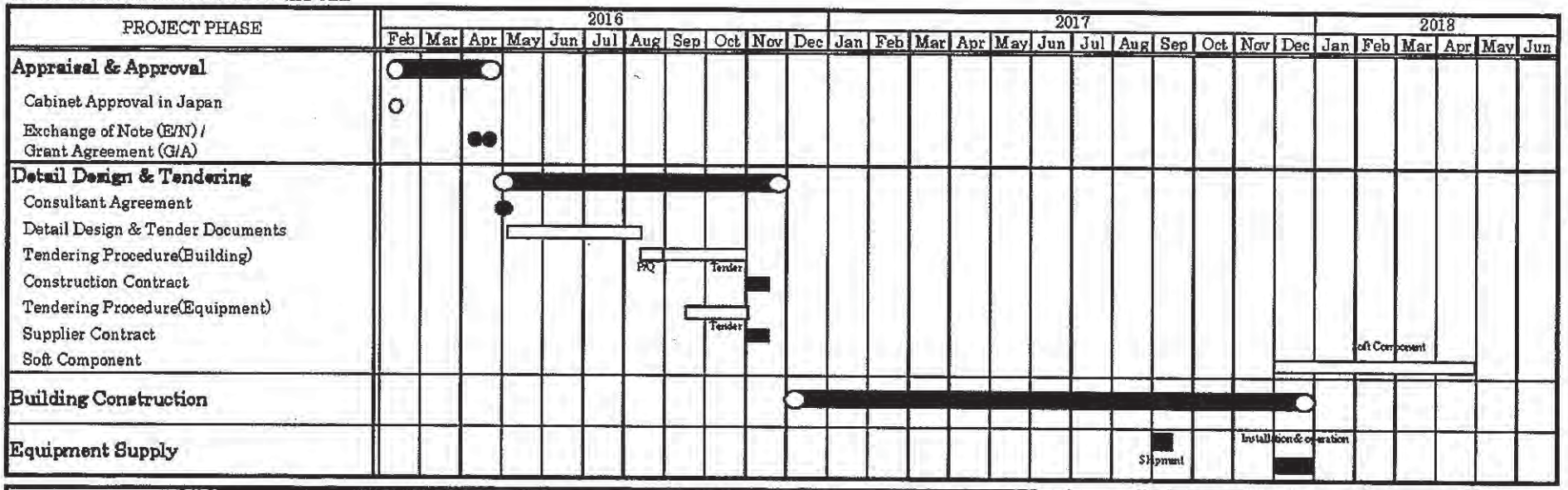
3. Monthly Report

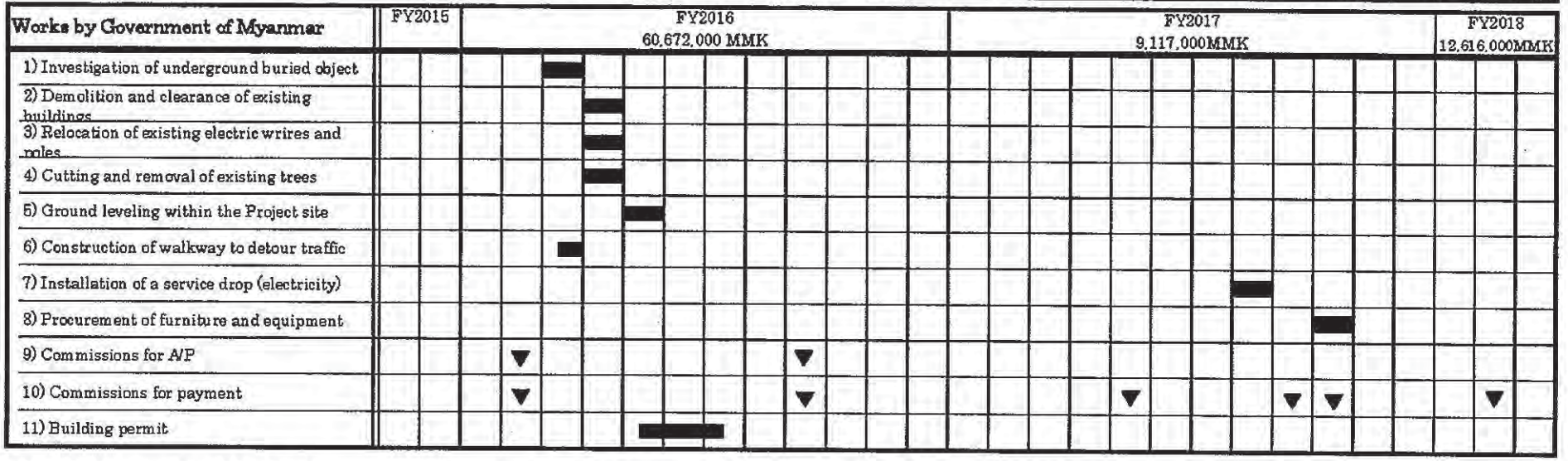
4. Report on RD

Attachment 5. Yearly disbursement plan

PROJECT IMPLEMENTATION SCHEDULE

PROJECT IMPLEMENTATION SCHEDULE





※ schedule may be subject to change.

Attachment 6 Monitoring sheet on price of specified materials

1. Initial Conditions (Confirmed)

	Items of Specified Materials	Initial Volume A	Initial Unit Price (¥) B	Initial total Price C=A×B	1% of Contract Price D	Condition of payment	
						Price (Decreased) E=C−D	Price (Increased) F=C+D
1	Item 1	●●t	●	●	●	●	●
2	Item 2	●●t	●	●	●		
3	Item 3						
4	Item 4						
5	Item 5						

2. Monitoring of the Unit Price of Specified Materials

(1) Method of Monitoring : ●●

(2) Result of the Monitoring Survey on Unit Price for each specified materials

	Items of Specified Materials	1st ●month, 2015	2nd ●month, 2015	3rd ●month, 2015	4th	5th	6th
1	Item 1						
2	Item 2						
3	Item 3						
4	Item 4						
5	Item 5						

(3) Summary of Discussion with Contractor (if necessary)

-

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Attachment 7 Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)
(Actual Expenditure by Construction and Equipment each)

	Domestic Procurement (Recipient Country) A	Foreign Procurement (Japan) B	Foreign Procurement (Third Countries) C	Total D
Construction Cost	(A/D%)	(B/D%)	(C/D%)	
Direct Construction Cost	(A/D%)	(B/D%)	(C/D%)	
others	(A/D%)	(B/D%)	(C/D%)	
Equipment Cost	(A/D%)	(B/D%)	(C/D%)	
Design and Supervision Cost	(A/D%)	(B/D%)	(C/D%)	
Total	(A/D%)	(B/D%)	(C/D%)	

Annex 11 Annual Operation and Maintenance Costs

Table Estimated yearly operation and maintenance costs

Item		Estimated cost (Thousand MMK)
1. Personnel cost		78,226
2. Utilities cost	- Electricity	23,691
	- Communications	1,049
	- Water	186
	- Fuel oil	23,410
3. Vaccine production cost (materials, consumables, etc.)		50,600
4. FMD diagnosis cost (reagents, consumables, etc.)		67,263
5. Maintenance cost	- Facilities	27,660
	- Equipment	1,623
	Total	273,708

Annex 12 Tax Exemption Procedure

To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the Products and/or the Services be exempted; Such customs duties, internal taxes and other fiscal levies mentioned above include VAT, commercial tax, income tax and corporate tax of Japanese nationals, resident tax, fuel tax, but not limited, which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract

Livestock Breeding and Veterinary Development explained and proposed the following procedures. JICA took note of it.

1. Customs duties and Commercial Tax on import goods

(1) The executing agency prepares and submits documents for tax exemption to MOF 1 months prior to arrival of goods on a port. The documents consists of i) Package list, ii) Donation letter, and iii) Shipment document. Donation letter should be issued by JICA one time and the executing agency uses the letter for each importation.

(2) The executing agency prepares budget and pays "import permit fee" to MOF.

(3) MOF issues customs exemption letter to the executing agency.

(4) The executing agency submit the customs exemption letter to MOC.

(5) MOC does tax exemption procedures on import goods.

2. Commercial Tax and Withholding tax on domestic goods

(1) Whenever Japanese contractor/supplier purchase goods in domestic market, the contractor/supplier organize tender with a condition that this contract should not include taxes such as commercial tax and withholding tax.

Note: This process is applied to a government procurement. Under the government procurement, the government of Myanmar does not pay tax on the procured goods through the above mentioned scheme.

5. Soft Component Plan

Soft Component (Management Guidance) Plan

Table of contents

1. Background of Soft Component 1
2. Objectives of Soft Component 2
3. Outputs of Soft Component 3
4. Verification of outputs 4
5. Activities of Soft Component (resource input planning) 5
6. Procurement of implementation resources 10
7. Implementation Schedule 11
8. Deliverables of Soft Component 11
9. Responsibility of recipient country 12

1. Background of Soft Component

The Project for Improvement of Foot-and-Mouth Disease Control in the Republic of the Union of Myanmar, (hereinafter referred to as "the Project") consists of procurement and installation of the equipment necessary for Foot-and-Mouth Disease (hereinafter referred to as "FMD") vaccine production and diagnosis at the National FMD Laboratory in Insein Township in Yangon (hereinafter referred to as "FMD Lab"), as well as construction and renovation work for facilities in which the equipment procured in the project will be installed.

Currently, the FMD Lab is manufacturing annual 200,000 to 250,000 doses of FMD vaccine through the flat-bottom flask culture with 2 veterinaries and 8 staff out of 5 veterinaries and 20 staff in total in FMD Lab. Although there are a few experienced personnel with essential technique needed for roller bottle culture method introduced in the Project, the number of personnel is not sufficient to achieve the targeted production volume of one million doses. Hence, Myanmar side is planning to increase the number of personnel in FMD lab as shown in Table-1 below. Therefore, it would be desirable to delivery basic technical support for proper operation, management and maintenance of the facility and equipment with the introduction of the mass production techniques with roller bottle culture method at the beginning of the management stage. Thus, Soft Component program was requested by Myanmar side within the Project.

Consequently, the Project will implement the Soft Component as the training for the necessary knowledge and techniques for proper operation, management and maintenance method of the facility and equipment as well as the basic requirements for the mass production process of FMD vaccines.

In this Soft Component program, Japanese consultants specialized in FMD vaccine production facility and infrastructural utility system, such as the purified water production system, pure steam generator, distilled water production and supply system and waste water treatment system etc, and vaccine production system and equipment will be sent to Myanmar to implement the technical support activities associated with the principles and features of the facility and those infrastructure utility systems, production systems and equipment, and their operation, management and maintenance method, as well as essential information needed for planning of vaccine production with the Project facility and equipment such as expertise of the configuration of the production equipment and specification at the design stage. The program will be conducted in the vaccine production plant established by the Project. The trainees will be the personnel in the FMD Lab in accordance with the new organizational structure and the staffing plan developed by Myanmar side, and other concerned personnel as shown in Table-1 below.

Table-1. staffing plan in FMD Lab developed by Myanmar Side

Division	Unit	Veterinary	Other staff
Vaccine production	Cell culture	6	5
	Vaccine production	8	8
	Quality control	4	3
Diagnosis	Serology and virus taxonomy	4	3
	PCR	4	3
Administration		2	3
	Total	28	25

2. Objectives of Soft Component

The Soft Component program will be delivered with the following objectives.

I. Acquisition of operation, management and maintenance method for the FMD vaccine production facility and infrastructural utility systems

The FMD vaccine production facility to be established in the Project is a facility that supports microbiological containment at Biological Safety Level (hereinafter referred to as "BSL") 2. Therefore, the operational practice such as gowning procedure, entry and exit control for clean rooms and hygiene management in the production rooms in accordance with BSL-2 standard will be regulated. In addition, since the Project introduces the purified water, pure steam, distilled water, water for injection and waste water treatment as infrastructural utility systems, daily management and maintenance method for the systems will be also essential. Acquisition of the expertise as such will contribute to establish proper operation, management and maintenance system of vaccine production facility and infrastructural utility systems.

II Acquisition of operation, management and maintenance method for the FMD vaccine production systems

The Project requires the installations of large tanks used in the production processes for the vaccine mass production. Because it is difficult to manually clean and sterilize this kind of large tanks, the cleaning and sterilizing system such as CIP (Cleaning in place), SIP (Sterilization in place), as well as the large sized high-pressure steam sterilizer are necessary. In order to operate those system properly, the basic concepts and management and maintenance method will be presented. Acquisition of expertise as such will contribute to establish management and maintenance system of the FMD vaccine production systems.

III. Acquisition of operation, management and maintenance method for the processing equipment for FMD vaccine dosage products

It is necessary for mass production of FMD vaccine to provide the large-scale cultivation equipment such as incubators, the roller apparatus referred to as cell-rollers, the formulation equipment of the culture solution and virus solution, the carrying tanks, the dispensing, bottle-filling and capping machines for the final dosage products. The basic concepts and management and maintenance method will be presented. Acquisition of expertise as such will contribute to establish the management system that enables to sustain stable vaccine production.

IV. Understanding of mass production process in FMD vaccine production facility

Since the concept of the facility and equipment was concluded with the production volume and basic specifications developed in the design stage, at the beginning of the Soft Component program such design specification should be shared with FMD Lab staff and other concerned personnel after the new staffing plan of FMD Lab is implemented. Proper understanding of the technical information on the facility and the equipment for the personnel who are actually involved in the vaccine production will contribute to ensure the smooth start-up of the production.

3. Outputs of Soft Component

The outputs at the time of completion of the Soft Component will be as below;

I. Acquisition of operation, management and maintenance method for the FMD vaccine production facility and infrastructural utility systems

I-1 Acquisition of the operational practice for the facility in accordance with BSL-2

I-2 Acquisition of the operation, management and maintenance method for the purified water production system, pure steam generator, distilled water production/supply system and waste water treatment system

II. Acquisition of operation, management and maintenance method for the FMD vaccine production systems

II-1 Acquisition of the basic concepts and operation, management and maintenance method for the CIP and SIP systems

II-2 Acquisition of the basic concepts and operation, management and maintenance method for the large-scale sterilization system

III. Acquisition of operation, management and maintenance method for the processing equipment for FMD vaccine dosage products

III-1 Acquisition of the basic concepts and operation, management and maintenance method for large-sized cell culture and formulation of virus solution

III-2 Acquisition of the basic concepts and operation, management and maintenance method for the vaccine dosage product processing equipment such as filling machine, aluminum capping machine etc

IV. Understanding of mass production process in FMD vaccine production facility

IV-1 Understanding of the technical information on the design specifications of FMD vaccine production facility and equipment provided in the Project

IV-2 Acquisition of knowledge with respect to the matters that require attention and efficient production.

4. Verification of outputs

The outputs of the Soft Component and its confirmation methods are as below;

Outputs		Methodology
Ⅰ Acquisition of operation, management and maintenance method for the FMD vaccine production facility and infrastructural utility systems	I-1 Acquisition of the operational practice for the facility in accordance with BSL-2 I-2 Acquisition of the operation, management and maintenance method for the purified water production system, pure steam generator, distilled water production/supply system and waste water treatment system	I-1 & I-2 Confirmation of standard documents, documents of protocols and procedures Confirmation of On-the-job-training (OJT) record Confirmation of the test result for technique acquisition
Ⅱ Acquisition of operation, management and maintenance method for the FMD vaccine production systems	II-1 Acquisition of the basic concepts and operation, management and maintenance method for the CIP and SIP systems II-2 Acquisition of the basic concepts and operation, management and maintenance method for the large-scale sterilization system	II -1 & II -2 Confirmation of documents of protocols and procedures Confirmation of OJT record Confirmation of the test result for technique acquisition
Ⅲ Acquisition of operation, management and maintenance method for the processing equipment for FMD vaccine dosage products	III-1 Acquisition of the basic concepts and operation, management and maintenance method for large-sized cell culture and formulation of virus solution III-2 Acquisition of the basic concepts and operation, management and maintenance method for the vaccine dosage product processing equipment such as filling machine, aluminum capping machine etc	III -1 & III -2 Confirmation of the descriptions of user manuals of equipment Confirmation of OJT record Confirmation of the test result for technique acquisition
Ⅳ Understanding of mass production process in FMD vaccine production facility	IV-1 Understanding of the technical information on the design specifications of FMD vaccine production facility and equipment provided in the Project IV-2 Acquisition of knowledge with respect to the matters that require attention and efficient production	IV -1 & IV -2 Confirmation of OJT records Confirmation of draft plan of vaccine mass production Confirmation of the test result for technique acquisition

5. Activities of Soft Component (resource input planning)

Japanese side will send the consultants to Myanmar in accordance with the progress of the Project to delivery the Soft Components program, co-organized by Myanmar Side implementing educational trainings for responsible persons and staff in each unit, using the actual facility and equipment for its proper use.

(1) Action plan

Outcomes		Activities	
		Consultant	Descriptions
Ⅰ Acquisition of operation, management and maintenance method for the FMD vaccine production facility and infrastructural utility systems	I-1 Acquisition of the operational practice for the facility in accordance with BSL-2	Consultant of FMD vaccine facility and infra-structural utility system	・Support of document development and implementation of OJT training; -Clean room entry/exit protocol/record -Hygiene management procedure, protocol, record -Routine maintenance procedures/record ・Recording educational training ・ Conducting test to examine technique acquisition
	I-2 Acquisition of the operation, management and maintenance method for the purified water production system, pure steam generator, distilled water production/supply system and waste water treatment system		・Support of document development and implementation of OJT training; -SOPs (Standard Operation Procedures) and record -Routine maintenance procedures/record ・Recording educational training ・ Conducting test to examine technique acquisition
Ⅱ Acquisition of operation, management and maintenance method for the FMD vaccine production system	II-1 Acquisition of the basic concepts and operation, management and maintenance method for the CIP and SIP systems	Consultant of FMD vaccine production system and equipment	・Lecture on basic concepts and construction of CIP/SIP equipment ・Support of document development and implementation of OJT training; - CIP/SIP's SOPs and record -CIP/SIP maintenance procedures/record ・Recording educational training ・ Conducting test to examine technique acquisition
	II-2 Acquisition of the basic concepts and operation, management and maintenance method for the large-scale sterilization system		・Lecture on safety measurements for operation of 1st class pressure vessel ・Support of document development and implementation of OJT training; - SOPs and record of large-sized sterilizer - Routine maintenance procedures/record large-scale sterilizer ・Recording educational training ・ Conducting test to examine technique acquisition

Ⅲ Acquisition of operation, management and maintenance method for the processing equipment for FMD vaccine dosage products	III-1 Acquisition of the basic concepts and operation, management and maintenance method for large-sized cell culture and formulation of virus solution III-2 Acquisition of the basic concepts and operation, management and maintenance method for the vaccine dosage product processing equipment such as filling machine, aluminum capping machine etc		・Confirmation of the descriptions of user manuals of equipment and confirmation of OJT records ・Recording educational training ・ Conducting test to examine technique acquisition
Ⅳ Understanding of mass production process in FMD vaccine production facility	IV-1 Understanding of the technical information on the design specifications of FMD vaccine production facility and equipment provided in the Project	Consultant of FMD vaccine processing	・ Lecture and workshop on design specification ・ Conducting test to examine technique acquisition
	IV-2 Acquisition of knowledge with respect to the matters that require attention and efficient production		・lecture on mass production planning ・Support of drafting production plan ・Recording educational training ・ Conducting test to examine technique acquisition

The relevancy and maters that require attention for each output are as follows;

I. Acquisition of operation, management and maintenance method for the FMD vaccine production facility and infrastructural utility systems

It is essential to acquire BSL operation and management method for BSL controlled virus mass culture facility.

Since the vaccine production plant in the Project is BSL-2 facility, appropriate operation, management and maintenance method will be recorded with instruction on the basic concept of BSL-2 facility and documentation of Standard Operational Procedures (SOPs) supported by the consultant.

For the infrastructural utility systems, in order to understand concept and function of the respective utility systems and practical operation, management and maintenance method, instruction on mass production process will be conducted prior to the program for infrastructural utility systems.

II Acquisition of operation, management and maintenance method for the FMD vaccine production systems

Management of the large scale systems in mass vaccine production requires specialized skill for operation and appropriate knowledge of cleaning and sterilizing specification. Moreover, expertise for the large scale sterilizer is also essential, for instance its wastewater is infectious

and has to be sterilized. Inappropriate operation may cause serious accidents with those systems such as virus leakage and injury in operation.

In order to acquire operation, management and maintenance method, practical program such as instruction on documentation of SOPs, as well as the exercise with actual equipment procured in the project will be presented.

III. Acquisition of operation, management and maintenance method for the processing equipment for FMD vaccine dosage products

The equipment for FMD vaccine dosage product procured in the project are more complicated and specialized than those in the existing FMD Lab. For example, semi-automatic equipment such as filling machine and capping machine, etc. will be required to efficiently dispense the bulk vaccine into thousands of containers. In order to acquire practical operation, management and maintenance method for the equipment, instruction on handling method of respective equipment and documentation of SOPs are effective.

IV. Understanding of mass production process in FMD vaccine production facility

The design specification of the vaccine production process in the Project is based on the actual production record at the Pak Chong FMD Laboratory in Thailand and the vaccine processing technology transferred from Italy in Yangon FMD Lab considering current related situation in Myanmar such as logistics, power supply etc. Its productivity may be affected if the settings such as expansion conditions and manufacturing parameters of the cell culture do not match with the actual specification of the production equipment due to lack of clear understanding of these design specification. Thus it is important that the personnel in FMD lab should understand overall picture of mass production process by making an original production plan with discussion with the consultant. This process could facilitate smooth start-up of the vaccine production system.

(2) Resource Input

1) Consultant of vaccine production facility and infrastructural utility system：1 Japanese (0.50MM in Japan, 1.43MM in Myanmar)

2) Consultant of vaccine production system and equipment： 1 Japanese (0.50MM in Japan, 1.67MM in Myanmar)

3) Consultant of vaccine production process：1 Japanese (0.50MM in Japan, 1.20MM in Myanmar)

(3) Activity

1) Preparation work

Prior to implementing the Soft Component program, each consultant will develop the curriculum, coordinate with the implementing agency and prepare the lecture material in Japan for 7 days respectively.

2) Activities on site

Ⅰ. Consultant of FMD vaccine production facility and infrastructural utility system

The Consultant will be dispatched to the site immediately after the completion of construction work to perform the instruction. The detail activities are as follows

;

Days	Weeks	Activities	Styles
Work in Myanmar			
43	1～2	• Travel to Yangon from Japan • Pre-meeting with recipient agency • Inspection of the installation of infrastructural utility systems • Examination on operating conditions and tune-up of the systems • Discussion with staff on training matters and curriculum review	 • Discussion • Discussion
	3～5	• Lecture on maintenance method • OJT on routine maintenance for infrastructural utility systems • Lecture on BSL-2 control, entry and exit gowning procedure • Instruction on documentation of protocol and record • OJT on infrastructure utility systems • Instruction on review of routine maintenance record and report • Confirmation of operation performance • Trouble shooting and workshop	• Lecture • Exercise • Lecture • Lecture • Exercise • Exercise • Exercise • Exercise
	6	• Technology acquisition test (operation check, interview, etc.), and re-training depending on the result of the test • Q&A session on operation, operation performance check • Interim report to LBVD • Move from Yangon to Japan	• Exercise • Exercise/Lecture

Ⅱ. Consultant of FMD vaccine production system and equipment

The consultant is responsible for the vaccine production system and equipment. Since the trainees are assumed to be the same as those of FMD vaccine production facility and infrastructural utility systems, this instruction will be presented after those of the facility and infrastructural utility system complete.

The detail activities are as follows;

Days	Weeks	Activities	Styles
Work in Myanmar			
50	1～3	• Travel to Yangon from Japan • Pre-meeting with recipient agency to discuss the lecture contents • Update the lecture material • Training on basic concept and structure of vaccine production systems and equipment • Training on basic concept/management method of CIP • Training on basic concept/management method of SIP • Pre-setting of CIP and output evaluation • Pre-setting to SIP and output evaluation • routine maintenance/management for CIP/SIP • SOP/record development instruction, check and review for CIP/SIP systems	• Discussion • Lecture • Exercise • Exercise • Exercise • Exercise • Exercise • Lecture
	4～6	• Training on basic concept/management method of high-pressure steam sterilizer • Safety education on high-pressure containers • Sterilizing cycle pattern study using the high-pressure steam sterilizer • Inspection and instruction of operation of high-pressure steam sterilizer • Inspection and instruction of simulated operation using test liquid and trouble shooting • OJT on routine operation and maintenance	• Lecture/Exercise • Exercise • Exercise • Exercise • Exercise • Exercise
	7	• OJT on routine operation and maintenance of instruments • Technology acquisition test (operation check, interview, paper test) • Re-training depending on the result of the test • Final report to LBVD • Move from Yangon to Japan	• Exercise • Lecture/Exercise • Lecture/Exercise

Ⅲ. Consultant of FMD vaccine processing

The consultant will be dispatched approximately one month prior to the completion of the Project to perform the instruction on roller bottle process of FMD vaccine which is fundamental information of the vaccine production facility, so that the other consultants start their program immediately after the completion of this program.

The detail activities are as follows;

Days	Weeks	Activities	Styles
Work in Myanmar			
36	1	• Travel to Yangon from Japan • Briefing to LBVD • Pre-meeting with recipient agency to discuss the lecture contents • Update the lecture material • Training schedule coordination • Training venue preparation. Lecture material preparation	• Discussion • Discussion
	2～5	• Training on design specification • Training on expansion condition of cell culture and process parameters • Training on considerations to mass-production and its efficiency • Discussion and planning of the tasks for mass-production • Discussion and support to develop the original production plan • Technology acquisition test (paper test, etc.), and re-training depending on the result of the test • Move from Yangon to Japan	• Lecture • Lecture • Lecture • Lecture • Lecture • Lecture

3) Summarizing in Japan

After completion of the training, consultants will make reports in Japan. The duration will be 3 days for each consultant.

6. Procurement of implementation resources

The Japanese consultants have to be in charge of the training program. The consultant has to have the relevant knowledge related to start-up of the vaccine production facility, management of mass vaccine production, as well as operation, management and maintenance of the equipment procured from Japan.

7. Implementation Schedule

The implementation schedule of Soft Component is as follows;

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Implementation Schedule	Facility Construction																	
	Equipment Procurement																	
	Soft Components																	
Detailed schedule of Soft Components																		
Consultant of vaccine production facility and infrastructural utility system																		
Consultant of vaccine production system and equipment																		
Consultant of vaccine production process																		
Deliverables																		

□ : Work in Japan ■ : Work in Myanmar

The programs will be conducted in the FMD vaccine production plant constructed in the Project by using the actual equipment.

8. Deliverables of Soft Component

The final report of the Soft Component Program will be submitted to the Myanmar side and Japanese side. The deliverables will be as follows;

(1) Lecture materials

(2) Documents of SOPs, protocols and records

(3) Reports

9. Responsibility of recipient country

The Livestock Breeding and Veterinary Department, Ministry of Livestock, Fisheries and Rural Development (hereinafter referred as "LBVD") have to select trainees for the Soft Component programs, as well as provide venue and coordinate the schedule for the programs. Also, LBVD have to implement necessary activities such as the continuous personnel trainings, budget allocation etc, based on the technology that would be obtained as the output of the Soft Component.

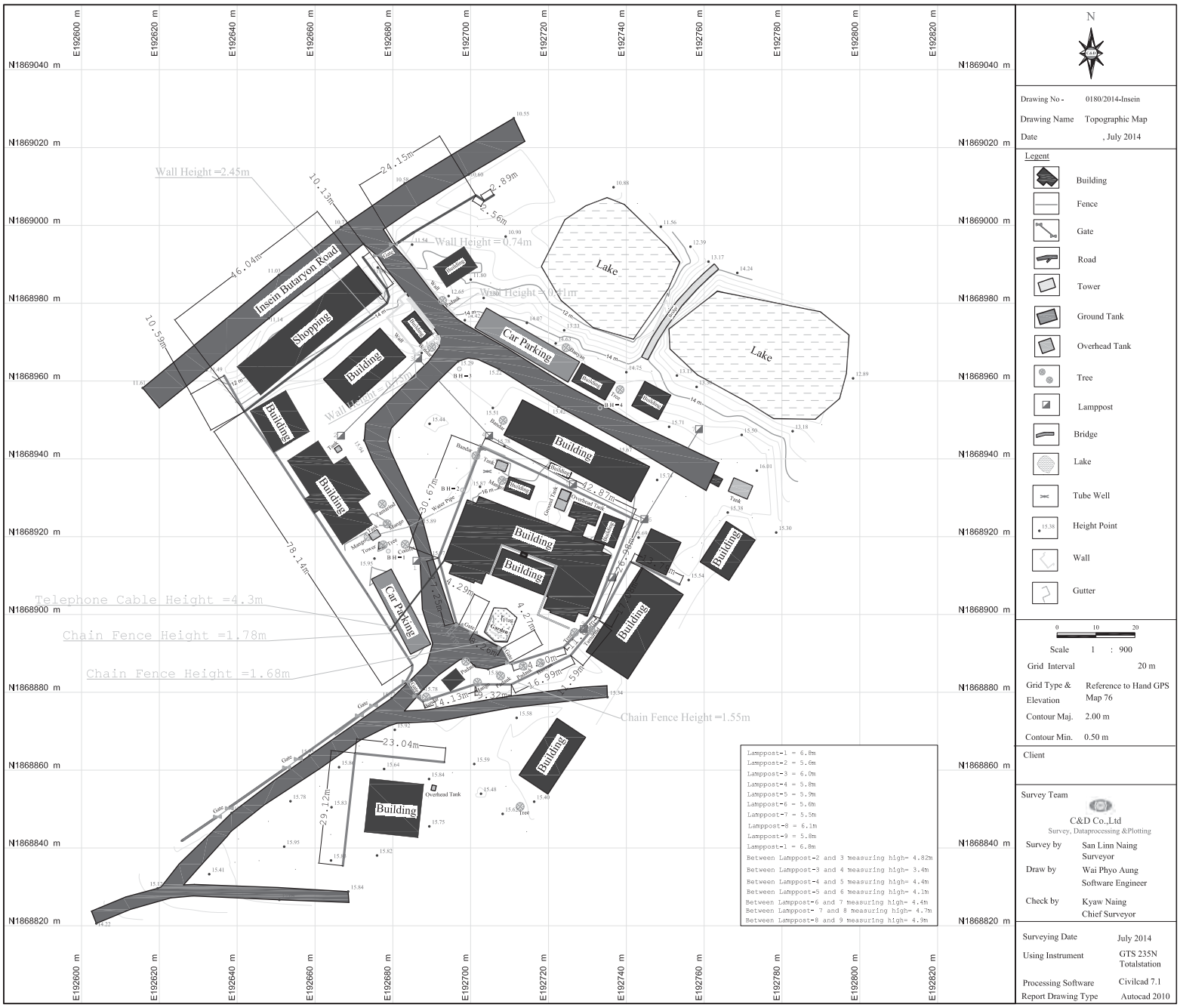
6. References

6. References

No.	Name	Type	Publisher(Year of Publsh)
1.	MANUAL OF ASEAN STANDAEDS FOR ANIMAL VACCINES	SOFT COPY	ASEAN Cooperation in Food, Agriculture and Forestry（1998）
2.	MANUAL OF ASEAN RULES AND PROCEDURES FOR THE REGISTRATION OF ANIMAL VACCINES	SOFT COPY	ASEAN Cooperation in Food, Agriculture and Forestry（1998）
3.	MAUNUAL OF ASEAN STANDARDS FOR GOOD MANUFACTURING PRACTICES (GMP) FOR ANIMAL VACCINES	SOFT COPY	ASEAN Cooperation in Food, Agriculture and Forestry（1998）
4.	THE NATIONAL DRUG LAW	SOFT COPY	The Government ofTheRepublic of The union of Myanmar（1992）
5.	NATIONAL FOOT AND MOUTH DISEASE PLAN OF MYANMAR (DRAFT)	SOFT COPY	Livestock Breeding and Veterinary Department（2014）
6.	PROTOCOL FOR THE MANUFACTURE OF FMD VACCINE	SOFT COPY	UNKNOWN（UNKNOWN）
7.	CLIMATE DATA（Yangon Kaba-Aye Station）	SOFT COPY	DEPARTMENT OF METEOROLOGY AND HYDROLOGY（2014）
8.	VETERINARY MEDICAL PLANT LAYOUT PLAN	SOFT COPY	Livestock Breeding and Veterinary Department (UNKNOWN)
9.	Report on BUREAU OF VETERINARY BIOLOGICS	SOFT COPY	Bureau of Veterinary Biologics（2014）
10.	Report on REGIONAL REFERENCELABORATORY FOR FMD IN SOUTH EAST ASIA	SOFT COPY	REGIONAL REFERENCELABORATORY FOR FMD IN SOUTH EAST ASIA（2014）

7. Other Relevant Data

7-1 Topographic Survey



Location of Boring Points

The locations, levels and coordinates of investigation points of boring points were designated by the client. The locations of boreholes are presented in Figure - 2.3.

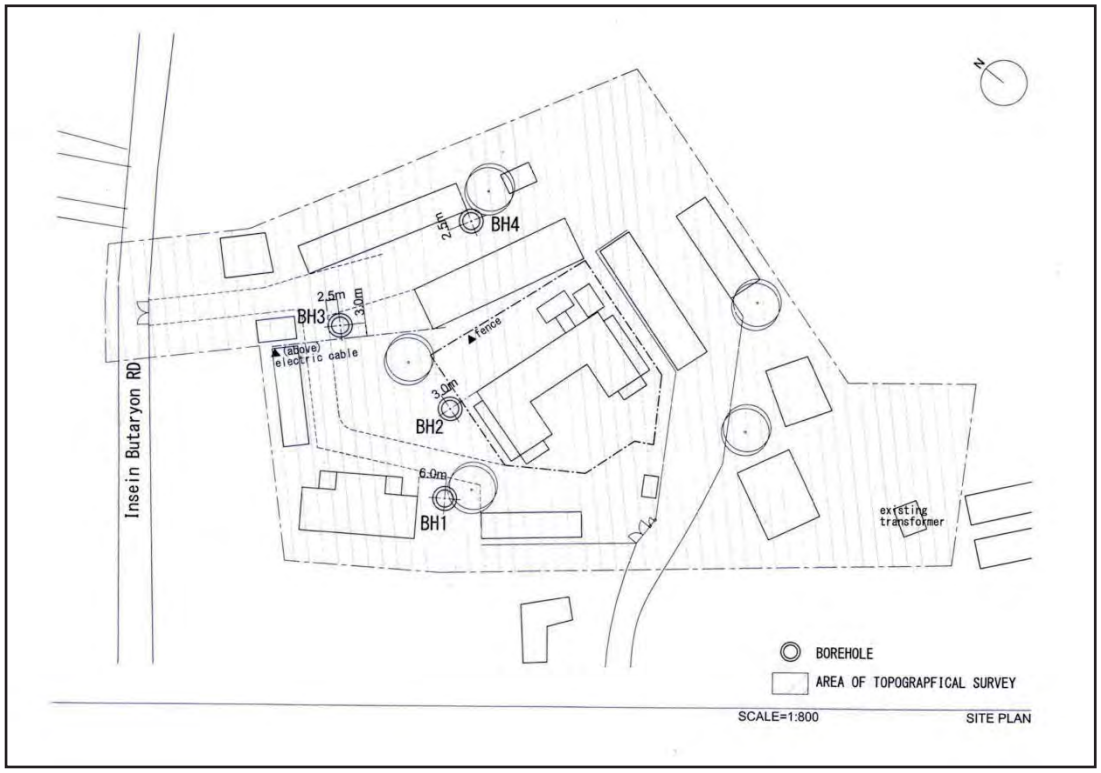


Figure - 2.3 : Plan Map of Investigation Boring Points

Table - 2.2 : Coordinates of Borehole Points

BH No.	N	E	Elevation
BH-1	16°53'10.3"	96°06'44"	natural GL
BH-2	16°53' 11.0"	96° 06' 44.0"	natural GL
BH-3	16°53' 11.7"	96° 06' 44.0"	natural GL
BH-4	16°53' 11.5"	96° 06' 45.3"	natural GL

7-2 Geological Survey

BORE HOLE No. **BH -1**

B O R I N G L O G (FOR DESIGN PARAMETERS CONSIDERATION)

Sheet No. 1 OF 1

PROJECT NAME : SI Works for the Improvement of Foot and Mouth Disease Control in Myanmar
BORING EQUIPMENT : XY-130
DATE : 7/07/14 ~ 8/07/14

LOCATION : Compound of the Livestock Breeding and Veterinary Department, Insein TSP.
BORING METHOD : Rotary Drilling Method
LOGGED BY : Nay Min Zaw

GROUND LEVEL : Existing Ground Level
ORIENTATION : Vertical
CLIENT: YAMASHITA SEKKEI INC.

COORDINATE : N:16°53'10.3", E: 96°06'44"
DEPTH : 20.45 m
GROUND WATER LEVEL : 7.0 m

SCALE (m)	ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	DIAGRAM	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
1					Reddish brown			Top soil layer, CLAY (Back filled soil).
2	-2.00	2.00	2.00					
3	-3.00	3.00	1.00		Yellowish brown	Stiff	Fat CLAY-I	Stiff, Yellowish brown, high plasticity, Fat CLAY-I.
4					Yellowish brown	Medium dense	Clayey SAND	Medium dense, Yellowish brown, fine to coarse grained sand, Clayey SAND.
5	-5.00	5.00	2.00					
6								
7								
8								
9					Yellowish brown	Medium dense	Silty SAND	Medium dense, Yellowish brown, Fine to coarse grained sand, Silty SAND.
10								
11								
12								
13	-13.00	13.00	8.00					
14	-14.00	14.00	1.00		Yellowish gray	Hard	Lean CLAY	Hard, Yellowish gray, Low plasticity, Lean CLAY.
15								
16								
17					Yellowish brown	Medium dense to dense	Silty SAND	Medium dense to dense, Yellowish brown, Fine to coarse grained sand, Silty SAND.
18								
19								
20	-20.45	20.45	6.45					
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DATE & DEPTH (m)	CASING (DEPTH (m) & DIAMETER (mm))	WATER DEPTH (m)
	3.0 φ110	
		7.0
11.00 7/07/14		
20.45 8/07/14		

STANDARD PENETRATION TEST
TEST METHOD (ASTM D 1586-99)

DEPTH GL - (m)	N-Value (Blows / 30cm)
1.0	2/30
2.0	11/30
3.0	30/30
4.0	11/30
5.0	16/30
6.0	20/30
7.0	16/30
8.0	23/30
9.0	24/30
10.0	21/30
11.0	18/30
12.0	19/30
13.0	35/30
14.0	23/30
15.0	23/30
16.0	35/30
17.0	34/30
18.0	37/30
19.0	43/30
20.0	44/30

CURVE OF BLOW ●
N-Value (Blows / 30cm)
0 20 40 60 80 100

SAMPLING

SAMPLE (Type & No.)	DEPTH GL - (m)
	0.45
SPT-1	1.0
	1.45
SPT-2	2.0
	2.45
UD-1	3.0
	3.45
SPT-3	4.0
	4.45
SPT-4	5.0
	5.45
SPT-5	6.0
	6.45
SPT-6	7.0
	7.45
SPT-7	8.0
	8.45
SPT-8	9.0
	9.45
SPT-9	10.0
	10.45
SPT-10	11.0
	11.45
SPT-11	12.0
	12.45
SPT-12	13.0
	13.45
SPT-13	14.0
	14.45
SPT-14	15.0
	15.45
SPT-15	16.0
	16.45
SPT-16	17.0
	17.45
SPT-17	18.0
	18.45
SPT-18	19.0
	19.45
SPT-19	20.0
	20.45
	21.0
	21.45
	22.0
	22.45
	23.0
	23.45
	24.0
	24.45
	25.0
	25.45
	26.0
	26.45
	27.0
	27.45
	28.0
	28.45
	29.0
	29.45
	30.0
	30.45

TCR (%) | SCR (%) | RQD (%)

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value (mean)	Consistency	SPT N-Value (mean)
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	11 - 30	Firm	5 - 8
Dense	31 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- P-1: Disturbed sample (SPT sample)
- U D T-1: Undisturbed Sample (Piston sampler)
- U D D-1: Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core lost)
- W-1: Water sample

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

Geo-friends Engineering & construction Co.,Ltd.
Tel : 951-561431, 959-420107757
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service@geo-friends.com

Revision No.	Rev-0
Revision Date	22/07/14
Site Geogolist :	Nay Min Zaw
Operator :	Myo Zaw Oo
Checked by :	May Thu

BORE HOLE No. **BH -2**

B O R I N G L O G (FOR DESIGN PARAMETERS CONSIDERATION)

Sheet No. 1 OF 1

PROJECT NAME : SI Works for the Improvement of Foot and Mouth Disease Control in Myanmar
BORING EQUIPMENT : XY-130 DATE : 9/07/14 ~ 10/07/14
LOCATION : Compound of the Livestock Breeding and Veterinary Department, Insein TSP.
BORING METHOD : Rotary Drilling Method LOGGED BY : Yar Zar Myint
GROUND LEVEL : Existing Ground Level
ORIENTATION : Vertical
CLIENT: YAMASHITA SEKKEI INC.
COORDINATE : N:16°53' 11.0", E: 96° 06' 44.0" DEPTH : 20.45 m
GROUND WATER LEVEL : 7.0 m

SCALE (m)	ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	DIAGRAM	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION	DATE & DEPTH (m)	CASING (DEPTH (m) & DIAMETER (mm))	WATER DEPTH (m)
1	-1.00	1.00	1.00					Top soil layer, CLAY.			
2	-2.00	2.00	1.00		Yellowish brown	Firm	Sandy SILT	Firm, Yellowish brown spotted light gray, high plasticity, Sandy SILT.			
3										3.0	
4										ϕ110	
5											
6											
7					Yellowish brown	Loose to medium dense	Silty SAND	Loose to medium dense, Yellowish brown spotted light gray, Fine to medium grained sand, Silty SAND.			7.0
8											
9											
10											
11									11.00 9/07/14		
12	-12.00	12.00	10.00								
13											
14					Bluish gray	Hard	Fat CLAY-II	Hard, Bluish gray, High plasticity, Fat CLAY-II.			
15											
16											
17	-17.00	17.00	5.00								
18											
19					Bluish gray	Hard	Sandy Lean CLAY	Hard, Bluish gray, Fine to medium grained sand, Sandy Lean CLAY.			
20	-20.45	20.45	3.45						20.45 10/07/14		
21											
22											
23											
24											
25											
26											
27											
28											
29											
30	-30.45	30.45	22.45						30.45 6/02/14		

STANDARD PENETRATION TEST
TEST METHOD (ASTM D 1586-99)

DEPTH GL - (m)	N-Value (Blows / 30cm)
1.0	8/30
2.0	7/30
3.0	9/30
4.0	16/30
5.0	18/30
6.0	20/30
7.0	21/30
8.0	23/30
9.0	23/30
10.0	25/30
11.0	18/30
12.0	39/30
13.0	37/30
14.0	55/30
15.0	54/30
16.0	59/30
17.0	53/30
18.0	56/30
19.0	56/30
20.0	57/30

CURVE OF BLOW ●
N-Value (Blows / 30cm)
0 20 40 60 80 100

SAMPLING

SAMPLE (Type & No.)	DEPTH GL - (m)
SPT-1	1.0
SPT-2	2.0
SPT-3	3.0
SPT-4	4.0
SPT-5	5.0
SPT-6	6.0
SPT-7	7.0
SPT-8	8.0
SPT-9	9.0
SPT-10	10.0
SPT-11	11.0
SPT-12	12.0
SPT-13	13.0
SPT-14	14.0
SPT-15	15.0
SPT-16	16.0
SPT-17	17.0
SPT-18	18.0
SPT-19	19.0
SPT-20	20.0

TCR (%) | SCR (%) | RQD (%)

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value (mean)	Consistency	SPT N-Value (mean)
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	11 - 30	Firm	5 - 8
Dense	31 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- P-1 Disturbed sample (SPT sample)
- U-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core lost)
- W-1 Water sample

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

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Revision No.	Rev-0
Revision Date	22/07/14
Site Geogolist :	Yar Zar Myint
Operator :	Myo Zaw Oo
Checked by :	May Thu

7-2 Geological Survey

BORE HOLE No. **BH -3**

B O R I N G L O G (FOR DESIGN PARAMETERS CONSIDERATION)

Sheet No. 1 OF 1

PROJECT NAME : SI Works for the Improvement of Foot and Mouth Disease Control in Myanmar
LOCATION : Compound of the Livestock Breeding and Veterinary Department, Insein TSP.
GROUND LEVEL : Existing Ground Level
COORDINATE : N:16°53' 11.7", E: 96° 06' 44.0" DEPTH : 20.45 m

BORING EQUIPMENT : XY-130 DATE : 11/07/14 ~ 12/07/14
BORING METHOD : Rotary Drilling Method LOGGED BY : Yar Zar Myint
ORIENTATION : Vertical
GROUND WATER LEVEL : 6.5 m

CLIENT: YAMASHITA SEKKEI INC.

SCALE (m)	ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	DIAGRAM	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
1	-1.00	1.00	1.00					Top soil layer, Sandy CLAY (Backfilled soil)
2	-2.00	2.00	1.00		Reddish brown	Loose	Clayey SAND	Loose, Reddish brown mottled light gray, fine to coarse grained sand, Clayey SAND.
3								
4								
5								
6								
7								
8								
9								
10								
11					Yellowish brown	Loose to dense	Silty SAND	Loose to dense, Yellowish brown mottled light gray, Fine to coarse grained sand, Silty SAND.
12								
13								
14								
15								
16								
17								
18								
19	-19.00	19.00	17.00					
20	-20.45	20.45	2.45		Bluish gray	Hard	Fat CLAY-II	Hard, Bluish gray, Low plasticity, Fat CLAY-II.
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DATE & DEPTH (m)	CASING (DEPTH (m) & DIAMETER (mm))	WATER DEPTH (m)
5.00 11/07/14	3.0 ϕ110	6.5
20.45 12/07/14		

STANDARD PENETRATION TEST
TEST METHOD (ASTM D 1586-99)

DEPTH GL - (m)	N-Value (Blows / 30cm)
1.0	6/30
2.0	5/30
3.0	9/30
4.0	7/30
5.0	16/30
6.0	12/30
7.0	17/30
8.0	24/30
9.0	22/30
10.0	27/30
11.0	30/30
12.0	31/30
13.0	19/30
14.0	25/30
15.0	31/30
16.0	34/30
17.0	31/30
18.0	32/30
19.0	54/30
20.0	41/11

CURVE OF BLOW ●
N-Value (Blows / 30cm)
0 20 40 60 80 100

SAMPLING

SAMPLE (Type & No.)	DEPTH GL - (m)	TCR (%)	SCR (%)	RQD (%)
SPT-1	0.45 – 1.0 – 1.45			
SPT-2	2.0 – 2.45			
SPT-3	3.0 – 3.45			
SPT-4	4.0 – 4.45			
SPT-5	5.0 – 5.45			
SPT-6	6.0 – 6.45			
SPT-7	7.0 – 7.45			
SPT-8	8.0 – 8.45			
SPT-9	9.0 – 9.45			
SPT-10	10.0 – 10.45			
SPT-11	11.0 – 11.45			
SPT-12	12.0 – 12.45			
SPT-13	13.0 – 13.45			
SPT-14	14.0 – 14.45			
SPT-15	15.0 – 15.45			
SPT-16	16.0 – 16.45			
SPT-17	17.0 – 17.45			
SPT-18	18.0 – 18.45			
SPT-19	19.0 – 19.45			
SPT-20	20.0 – 20.45			
	21.0 – 21.45			
	22.0 – 22.45			
	23.0 – 23.45			
	24.0 – 24.45			
	25.0 – 25.45			
	26.0 – 26.45			
	27.0 – 27.45			
	28.0 – 28.45			
	29.0 – 29.45			
	30.0 – 30.45			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value (mean)	Consistency	SPT N-Value (mean)
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	11 - 30	Firm	5 - 8
Dense	31 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- P-I: Disturbed sample (SPT sample)
- T-I: Undisturbed Sample (Piston sampler)
- D-I: Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core lost)
- W-I: Water sample

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

Geo-friends Engineering & construction Co.,Ltd.
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Revision No.	Rev-0
Revision Date	25/07/14
Site Geogolist :	Yar Zar Myint
Operator :	Myo Zaw Oo
Checked by :	May Thu

BORE HOLE No. **BH -4**

B O R I N G L O G (FOR DESIGN PARAMETERS CONSIDERATION)

Sheet No. 1 OF 1

PROJECT NAME : SI Works for the Improvement of Foot and Mouth Disease Control in Myanmar
LOCATION : Compound of the Livestock Breeding and Veterinary Department, Insein TSP.
GROUND LEVEL : Existing Ground Level
COORDINATE : N:16°53' 11.5", E: 96° 06' 45.3" DEPTH : 20.45 m

BORING EQUIPMENT : XY-130
BORING METHOD : Rotary Drilling Method
ORIENTATION : Vertical
GROUND WATER LEVEL : 4.0 m

DATE : 14/07/14 ~ 15/07/14
LOGGED BY : Yar Zar Myint

CLIENT: YAMASHITA SEKKEI INC.

SCALE (m)	ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	DIAGRAM	COLOUR	RELATIVE DENSITY (ωp) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION	DATE & DEPTH (m)	CASING (DEPTH (m) & DIAMETER (mm))	WATER DEPTH (m)
1	-1.00	1.00	1.00					Top soil layer, Sandy CLAY.			
2					Reddish brown	Loose to medium dense	Clayey SAND	Loose to medium dense, Reddish brown, Low plasticity, Fine to coarse grained sand, Clayey SAND.			
3	-3.00	3.00	2.00							3.0	
4	-4.00	4.00	1.00		Reddish brown	Very stiff	Sandy Lean CLAY	Very stiff, Reddish brown, Low plasticity, Fine to coarse grained sand, Sandy Lean CLAY.		ϕ110	
5	-5.00	5.00	1.00		Reddish brown	Firm	Sandy Fat CLAY	Firm, Reddish brown, High plasticity, Sandy Fat CLAY.			4.0
6					Bluish gray	Firm to very stiff	Fat CLAY-I	Firm to very stiff, Reddish brown and bluish gray, High plasticity, Fat CLAY-I.			
7	-7.00	7.00	2.00								
8					Reddish brown	Loose to medium dense	Silty SAND	Loose to medium dense, Reddish brown and yellowish brown, Fine to coarse grained sand, Silty SAND.			
9					Yellowish brown						
10	-10.00	10.00	3.00								
11					Yellowish gray	Very stiff to hard	Lean CLAY	Very stiff to hard, Yellowish brown mottled light gray, Low plasticity, Lean CLAY.			
12									12.00 14/07/14		
13					Yellowish brown						
14											
15					Yellowish gray						
16											
17											
18					Bluish gray						
19											
20	-20.45	20.45	2.50						20.45 15/07/14		
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											

STANDARD PENETRATION TEST
TEST METHOD (ASTM D 1586-99)

DEPTH GL - (m)	N-Value (Blows / 30cm)
1.0	7/30
2.0	14/30
3.0	16/30
4.0	7/30
5.0	30/30
6.0	16/30
7.0	10/30
8.0	10/30
9.0	20/30
10.0	28/30
11.0	55/24
12.0	60/20
13.0	56/15
14.0	60/15
15.0	64/15
16.0	62/13.5
17.0	60/13
18.0	60/13
19.0	62/15
20.0	63/18

CURVE OF BLOW ●
N-Value (Blows / 30cm)
0 20 40 60 80 100

SAMPLING

SAMPLE (Type & No.)	DEPTH GL - (m)
SPT-1	1.0
SPT-2	2.0
SPT-3	3.0
SPT-4	4.0
UD-1	5.0
SPT-5	6.0
SPT-6	7.0
SPT-7	8.0
SPT-8	9.0
SPT-9	10.0
SPT-10	11.0
SPT-11	12.0
SPT-12	13.0
SPT-13	14.0
SPT-14	15.0
SPT-15	16.0
SPT-16	17.0
SPT-17	18.0
SPT-18	19.0
SPT-19	20.0

TCR (%) | SCR (%) | RQD (%)

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value (mean)	Consistency	SPT N-Value (mean)
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	11 - 30	Firm	5 - 8
Dense	31 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- P-1: Disturbed sample (SPT sample)
- T-1: Undisturbed Sample (Piston sampler)
- D-1: Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core lost)
- W-1: Water sample

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

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Revision No.	Rev-0
Revision Date	25/07/14
Site Geogolist :	Yar Zar Myint
Operator :	Myo Zaw Oo
Checked by :	May Thu

7-3 Water Quality Test

The Government of the Republic of the Union of Myanmar
Ministry of Agriculture and Irrigation
Irrigation Department
Survey and Investigation Branch
Soil Survey Section
Soil and Water Analytical Laboratory

ANALYTICAL DATA FOR WATER SAMPLE

Location-YCDC ရိုးဖြူ (City Water) Date :27.6.2014

No	Ions	Symbol	Units	Results
1	Color	–		Absent
2	Turbidity	Turb	NTU	6
3	pH	pH	–	7.35
4	Tatol Hardness	TH	mg/l	72
5	Calcium	Ca^{++}	mg/l	20.84
6	Magnesium	Mg^{++}	mg/l	4.88
7	Sodium	Na^{+}	mg/l	33.1
8	Sulphate	$SO_4^{=}$	mg/l	89.34
9	Chloride	Cl^{-}	mg/l	47.87
10	Total Dissolved Solids	TDS	mg/l	188.16
11	Aluminium	Al	ppm	0.00
12	Iron	Fe	ppm	0.01
13	Arsenic	As	ppb	0.290
14	Cadmium	Cd	ppb	0.011
15	Chromium	Cr	ppb	0.000
16	Copper	Cu	ppb	18.623
17	Lead	Pb	ppb	0.000
18	Manganese	Mn	ppb	0.059
19	Mercury	Hg	ppb	0.003
20	Zinc	Zn	ppb	0.000

(May Aye Lwin)
Staff Officer (Laboratory)
Soil and Water Laboratory
Survey and Investigation Branch
Irrigation Department

7-3 Water Quality Test

The Government of the Republic of the Union of Myanmar
Ministry of Agriculture and Irrigation
Irrigation Department
Survey and Investigation Branch
Soil Survey Section
Soil and Water Analytical Laboratory

ANALYTICAL DATA FOR WATER SAMPLE

Location-ဆေးဝါးစက်ရုံ, Tube Well ,Factory (Existing Tube Well) Date :27.6.2014

No	Ions	Symbol	Units	Results
1	Color	–		Absent
2	Turbidity	Turb	NTU	6
3	pH	pH	–	7.35
4	Tatol Hardness	TH	mg/l	218
5	Calcium	Ca^{++}	mg/l	52.91
6	Magnesium	Mg^{++}	mg/l	20.98
7	Sodium	Na^{+}	mg/l	14.5
8	Sulphate	$SO_4^{=}$	mg/l	33.14
9	Chloride	Cl^{-}	mg/l	10.64
10	Total Dissolved Solids	TDS	mg/l	384.64
11	Aluminium	Al	ppm	0.00
12	Iron	Fe	ppm	0.02
13	Arsenic	As	ppb	0.607
14	Cadmium	Cd	ppb	0.209
15	Chromium	Cr	ppb	25.418
16	Copper	Cu	ppb	0.000
17	Lead	Pb	ppb	0.000
18	Manganese	Mn	ppb	0.130
19	Mercury	Hg	ppb	0.034
20	Zinc	Zn	ppb	0.000

(May Aye Lwin)
Staff Officer (Laboratory)
Soil and Water Laboratory
Survey and Investigation Branch
Irrigation Department

7-3 Water Quality Test

ISO TECH LABORATORY
Laboratory Technical Consultant: U Saw Christopher Maung
B.Sc Engg: (Civil), Dip S.E (Delft) Lecturer of YIT (Retd), Consultant (Y.C.D.C), LWSE 001.
Former Member (UNICEF, Water quality monitoring & Surveillance Myanmar)

ISO 9001:2008 Cert. No.688283

WTL-RE-001
Issue Date - 01-12-2012
Effective Date - 01-12-2012
Issue No - 1.0/Page 1 of 1

W0614 281

WATER QUALITY TEST RESULTS FORM

Client	Mandalay Technology
Nature of Water	Y.C.D.C Water (Point - B) (City Water)
Location	Yangon
Date and Time of collection	18.6.2014
Date and Time of arrival at Laboratory	19.6.2014
Date and Time of commencing examination	21.6.2014
Date and Time of completing	23.6.2014

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)		°C	
Fluoride (F)	0.3	mg/l	1.5 mg/l
Lead (as Pb)		µg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate ($N.NO_3$)	0.7	mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)	Nil	mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature: Hein

Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by

Signature: Phyo

Name: Phyo Myint Oo
B.E (Chemical)
Technical Officer
ISO TECH Laboratory

7-3 Water Quality Test

ISO TECH LABORATORY
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W0614 279

WATER QUALITY TEST RESULTS FORM

Client: Mandalay Technology

Nature of Water: Tube Well Water (Point - B) **(Existing Tube Well)**

Location: Yangon

Date and Time of collection: 18.6.2014

Date and Time of arrival at Laboratory: 19.6.2014

Date and Time of commencing examination: 21.6.2014

Date and Time of completing: 23.6.2014

Results of Water Analysis

			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)		°C	
Fluoride (F)	0.5	mg/l	1.5 mg/l
Lead (as Pb)		µg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate ($N.NO_3$)	1.5	mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)		mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)		mg/l	
Cyanide (CN)	Nil	mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by

Signature: Heinu

Name: Zaw Hein Oo
B.Sc (Chemistry)
Chemist
ISO TECH Laboratory

Approved by

Signature: Phyo

Name: Phyo Myint Oo
B.E (Chemical)
Technical Officer
ISO TECH Laboratory

Final Requested Equipment List after Evaluation

Category	Original No.	Final No.	Equipment Name	Requested Quantity	Planned Quantity※1	Priority	(New/Renewal/Addition)	Evaluation Criteria(○、△、×)											Overall Evaluation	Remarks
								Basis of qualification					Basis of omission							
								①	②	③	④	⑤	I	II	III	IV	V	VI		
Vaccine manufacturing control equipment	PM-01	PM-01	Personal Computer	12	16	A	New	○	○	○	○	○							○	Include 4 units for diagnosis
	PM-02	PM-02	Color Laser Printer	2	2	A	New	○	○	○	○	○							○	
	PM-03	PM-03	Laser Printer	6	6	A	New	○	○	○	○	○							○	
	PM-04	PM-04	PC Desk	12	12	A	New	○	○	○	○	○							○	
	PM-05	PM-01	Printer Rack	6	Co	A	New	○	○	○	○	○							○	
	PM-06	PM-01,02,03	Toner	12	Co	A	New	○	○	○	○	○							○	Combined to each printer
		PM-05	Projector		1															
		PM-06	Screen		1															
Equipment for facility	UT-01		Boiler	2	Fa	A	Renewal	○	○	○	○	○							○	Changed as facility portion's equipment
	UT-02		Chiller unit	2	Fa	A	New	○	○	○	○	○							○	Changed as facility portion's equipment
	UT-03		LPG Gas System	2	Fa	A	New	○	○	○	○	○							○	Changed as facility portion's equipment
	UT-04		Purified water production / supply facility	1	Fa	A	New	○	○	○	○	○							○	Changed as facility portion's equipment
	UT-05		Pure steam generator	1	Fa	A	Renewal	○	○	○	○	○							○	Changed as facility portion's equipment
	UT-06		Oil-free screw compressor unit	2	Fa	A	New	○	○	○	○	○							○	Changed as facility portion's equipment
	UT-07		CIP unit	1	Fa	A	New	○	△	○	○	○							○	Changed as facility portion's equipment
	UT-08		SIP station	2	Fa	A	New	○	△	○	○	○							○	Changed as facility portion's equipment
	UT-09		Wastewater inactivation facilities	1	Fa	A	New	○	△	○	○	○	○						×	
	UT-10		Wastewater treatment facilities	1	Fa	A	New	○	△	○	○	○	○						×	
Equipment for sterilization	UT-11		Autoclave (Large)	5	Fa	A	New	○	○	○	○	○							○	
		UT-17	Autoclave (Floor Standing)		4		New	○	○	○	○	○							○	
			Autoclave (Desktop)		De		New	○	○	○	○	○							○	Can be replaced by Autoclave (Floor Standing)
	UT-12	UT-12	Hot Air Sterilizer	3	2	A	New	○	○	○	○	○							×	Can be replaced by Desktop Autoclave
	UT-13		Generator	2	Fa	A	New	○	○	○	○	○	○						×	Changed as facility portion's equipment
	UT-14		Translator	1	Fa	A	New	○	○	○	○	○	○						×	Changed as facility portion's equipment
	UT-15	UT-15	Washing Machine	1	2	-	New	○	○	○	○	○							○	Added after analysis in Japan
	UT-16	UT-16	Tumble Dryer	1	2	-	New	○	○	○	○	○							○	Added after analysis in Japan
Equipment for cultivation process of cell and virus	PT-01		Media Preparation Tank	2	Fa	A	Renewal	○	○	○	○	○							○	Changed as facility portion's equipment
	PT-02	MS-11	Media Filtration Unit	6	1	A	Renewal	○	○	○	○	○							○	
	PT-03		Aluminum Hydroxide Gel Tank	1	Fa	B	New	○	○	○	○	○							○	Changed as facility portion's equipment
	PT-04		Chloroform Treatment Tank	1	Fa	A	Renewal	○	○	○	○	○							○	Changed as facility portion's equipment
	PT-05		Inactivation Tank	2	Fa	A	Renewal	○	○	○	○	○							○	Changed as facility portion's equipment
	PT-06		Oil Type Vaccine Production Tank	1	Fa	C	New	△	○	○	○	○			○	○			×	
	PT-07		Mixing Tank	2	Fa	A	Renewal	○	○	○	○	○							○	Changed as facility portion's equipment
	PT-08		Reservoir Tank	3	Fa	B	Renewal	○	○	○	○	○							○	Changed as facility portion's equipment
	PT-09		Storage Tank	2	Fa	A	Renewal	○	○	○	○	○							○	Changed as facility portion's equipment
	PT-10	PT-10	Inverted Microscope with Camera	3	3	A	Renewal	○	○	○	○	○							○	
	PT-11	PT-11	Roller Apparatus	8	2	A	Renewal	○	○	○	○	○							○	
	PT-12	PT-12	Roller Bottle	300	300	A	Renewal	○	○	○	○	○							○	
	PT-13	PT-13	Roller Bottle Cap	500	500	A	Renewal	○	○	○	○	○							○	
	PT-14	PT-14	Centrifuge for Cell Production	2	2	A	Renewal	○	○	○	○	○							○	
	PT-15	PT-15	Clean Bench A	2	2	A	Renewal	○	○	○	○	△							○	
	PT-16	PT-16	Vacuum Pump	7	7	A	New	○	○	○	○	○							○	
	PT-17	PT-16	Waste Suction Unit	7	Co	A	New	○	○	○	○	○							○	Combined to PT-16
	PT-18		Lamina Air Flow Booth	2	Fa	A	Renewal	○	○	○	○	○							○	
	PT-19		Gas Burner	9	De	A	New	○	○	○	○	○					○		×	Combined as a composition of Gas Torch
	PT-20	PT-20	Gas Torch	9	6	A	New	○	○	○	○	○							○	
	PT-21	PT-21	CO2 Incubator	4	4	A	New	○	○	○	○	○							○	
	PT-22		Incubation Room	2	Fa	A	New	○	○	○	○	○	○						×	
	PT-23	MS-12,13	Capping System, Filling Nozzle	4	1	A	New	○	○	○	○	△							○	
Equipment for virus purification	PT-24	MS-11	Media Filtration Unit	1	Co	A	Renewal	○	○	○	○	○							○	Combined as a composition of Media filtration unit
	PT-25	PT-25	Ultra Centrifuge	2	2	A	New	○	△	○	○	△							○	
	PT-26	PT-25	Ultra Centrifuge	2	Co	A	New	○	○	○	○	○					○		×	Combined as a composition of Ultra Centrifuge

Final Requested Equipment List after Evaluation

Category	Original No.	Final No.	Equipment Name	Requested Quantity	Planned Quantity※1	Priority	(New/Renewal/Addition)	Evaluation Criteria(○、△、×)											Overall Evaluation	Remarks
								Basis of qualification					Basis of omission							
								①	②	③	④	⑤	I	II	III	IV	V	VI		
	PT-27	PT-27	Refrigerated Centrifuge	2	3	A	Renewal	○	○	○	○	○							○	
	PT-28	PT-28	Bottles for Centrifuge	50	150	A	New	○	○	○	○	○							○	
	PT-29	PT-29	Tubing Pump	4	4	A	New	○	○	○	○	○							○	
	PT-30	PT-30	Silicone Tube for Tubing Pump	12	12	A	New	○	○	○	○	○							○	
	PT-31	PT-31	Biosafety Cabinet	4	5	A	New	○	○	○	○	○							○	
	PT-33	PT-33-1	Electric Balance A	2	1	A	Renewal	○	○	○	○	○							○	
		PT-33-2	Electric Balance B		3		Renewal	○	○	○	○	○							○	
	PT-34	PT-34	EC meter	2	3	A	New	○	○	○	○	○							○	
	PT-35	PT-35	pH meter	4	3	A	Renewal	○	○	○	○	○							○	
Equipment for vaccine filling and storage	ST-01		Cold Room	3	Fa	A	Renewal	○	○	○	○	○							○	Changed as facility portion's equipment
	ST-02	ST-02	Freezer (Portrait Type)	3	3	A	New	○	○	○	○	○							○	
	ST-03	ST-03	Deep Freezer	2	3	A	Renewal	○	○	○	○	○							○	
	ST-04	ST-04	2 Doors Refrigerator	6	5	A	Renewal	○	○	○	○	○							○	
	ST-05	DS-46-7,8,9	Steel Shelf	9	11	A	New	○	○	○	○	○							○	
Other equipment required for vaccine manufacturing	MS-01	MS-01	Glass Ware Set for Vaccine Production	1	1	A	Renewal	○	○	○	○	○							○	
	MS-02	MS-02	Tool Set for Vaccine Production	1	1	A	New	○	○	○	○	○							○	
	MS-03	MS-02	Hemacytometers	20	Co	A	New	○	○	○	○	○							○	
	MS-04	MS-04-1~6	Working Table	12	14	A	New	○	○	○	○	○							○	
	MS-05	MS-05	Silicon Hose Set	5	5	A	New	○	○	○	○	○							○	
	MS-06	MS-06	Temperature Data Logger	8	8	A	New	○	○	○	○	○							○	
	MS-07	MS-07	Surface Thermometer	2	2	A	New	○	○	○	○	○							○	
	MS-08	MS-08	Trolley	10	10	A	New	○	○	○	○	○							○	
		MS-04-7,8	Laboratory Table		3															
Equipment for Diagnosis	DS-01	DS-01	Real-Time PCR System	1	2	B	New	○	△	○	△	○					○		○	
	DS-02	DS-49	DNA Sequencer	1	1	B	New	○	△	○	△	○					○		×	Has deleted because of high-technique during first analysis in Japan, but replaned in final decision.
	DS-03		Electrocataphoresis Apparatus	4	De	B	New	○	△	○	△	○					○		×	Deleted because can be replaced by Real-time PCR
	DS-04		Ultraviolet Irradiation Apparatus for Electrocataphoresis	4	De	B	New	○	△	○	△	○					○		×	Deleted because can be replaced by Real-time PCR
	DS-05		Camera for Record	4	De	B	New	○	△	○	△	○					○		×	Deleted because can be replaced by Real-time PCR
	DS-06	DS-01	PC for Real-Time PCR System	5	Co	B	Renewal	○	○	○	○	○							○	Combined as a composition of DS-01 Real-time PCR
	DS-07	DS-07	Microplate Shaker	2	2	A	Renewal	○	○	○	○	○							○	
	DS-08	DS-07	Microplate Incubator	2	Co	A	Renewal	○	○	○	○	○					○		×	DS-07Microplate shaker has the function of incubator
	DS-09	DS-09	Microplate Washer	2	2	A	New	○	○	○	○	○							○	
	DS-10	DS-10	Microplate Reader	2	2	A	Renewal	○	○	○	○	○							○	
	DS-11	DS-10	PC for Microplate Reader	2	Co	A	New	○	○	○	○	○							○	Combined as a composition of DS-10Microplate Reader
	DS-12		High-speed Centrifuge	2	De	B	New	×	○	○	○	○				○	○		×	
	DS-13	DS-13	Low-Speed Centrifuge	2	2	A	Renewal	○	○	○	○	○							○	
	DS-14	DS-14	Micro Centrifuge	3	3	A	Renewal	○	○	○	○	○							○	
	DS-15		Ultra Centrifuge	1	De	B	New	×	×	○	○	×			○	○		○	×	
	DS-16	DS-16	Magnetic Stirrer (Big)	5	2	A	Renewal	○	○	○	○	○							○	
			Magnetic Stirrer (Small)		Co	A	Renewal	○	○	○	○	○							○	Combined in MS-02Tool Set for Vaccine Production
	DS-17	DS-17	Ultra--Low Temperature Freezer	2	2	A	New	○	○	○	○	○							○	
	DS-18	DS-18	Freezer (Chest Type)	2	2	A	Renewal	○	○	○	○	○							○	
	DS-19	ST-04	2 Doors Refrigerator	7	5	A	Renewal	○	○	○	○	○							○	
	DS-20	DS-20	Liquid Nitrogen Tank	2	2	A	Renewal	○	○	○	○	○							○	
	DS-21	DS-21	CO2 Incubator C	2	2	A	Renewal	○	○	○	○	○							○	
	DS-22	DS-22	Single Channel Micropipette Set	20	4	A	Renewal	○	○	○	○	○							○	
	DS-23	DS-23	Multi Channel Micropipette Set	4	4	A	Renewal	○	○	○	○	○							○	
	DS-24	PT-20	Gas Torch	2	2	A	New	○	○	○	○	○							○	Same with PT-20 Gas Torch
	DS-25	PT-36-1,2	Constant Temperature Water Bath	4	3	A	Renewal	○	○	○	○	○							○	
	DS-26	DS-26	Water Distillizer	1	1	A	New	○	○	○	○	○							○	
	DS-27	DS-27	Inverted Microscope	2	2	A	Renewal	○	○	○	○	○							○	

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								Basis of qualification					Basis of omission							
								①	②	③	④	⑤	I	II	III	IV	V	VI		
	DS-28	PT-33-2	Electric Balance	2	2	A	Renewal	○	○	○	○	○							○	
	DS-29	DS-29	Analytical Balance	2	2	B	New	○	○	○	○	○							○	
	DS-30	UT-17	Autoclave (Floor Standing)	2	2	A	Renewal	○	○	○	○	○							○	
	DS-31	UT-12	Hot Air Sterilizer	2	2	A	New	○	○	○	○	○							○	
	DS-32	UT-17	Drum for sterilizer	10	Co	A	New	○	○	○	○	○					○		○	Combined as a composition of Autoclave (Floor Standing)
	DS-33	DS-33	Dry Oven	2	2	A	Renewal	○	○	○	○	○							○	
	DS-34	DS-34	Spectrophotometer	2	2	A	New	○	○	○	○	○							○	
	DS-35	PT-31	Biosafety Cabinet	1	1	A	Renewal	○	○	○	○	○							○	
	DS-36	DS-36	Biosafety Cabinet	1	1	A	New	○	○	○	○	○							○	
	DS-37		Ice Making Machine	1	De	C	New	×	○	○	○	○				○	○		×	
	DS-38	PT-35	pH meter	2	2	A	Renewal	○	○	○	○	○							○	
	DS-39	DS-39	Touch mixer	5	5	A	Renewal	○	○	○	○	○							○	
	DS-40	MS-03	Hemacytometers	20	20	B	New	○	○	○	○	○							○	
	DS-41	DS-41	Aspirator	2	2	A	New	○	○	○	○	○							○	
	DS-42	DS-42	Viral Titration Kit	2	1	A	New	○	○	○	○	○							○	
	DS-43	DS-43	Glass Ware Set for Diagnosis	1	1	A	Renewal	○	○	○	○	○							○	
	DS-44	DS-44	Tool Set for Diagnosis	1	1	A	New	○	○	○	○	○							○	
	DS-45	DS-45-1,2	Laboratory Table	4	2	A	New	○	○	○	○	○							○	
	DS-46	DS-47	Stool	17	17	A	New	○	○	○	○	○							○	
	DS-47	DS-46-7,8,9	Steel Shelf	1	21	A	New	○	○	○	○	○							○	
	DS-48	DS-48	Reagent Set	1	1	A	New	○	○	○	○	○							○	

※1

Co:The item which is combined as a composition of other item

Fa:The item which changes to construction portion

De:The item which is not procured in this project

The basis of the qualification of the requested equipment

【Basis of qualification】

① Consistency with vaccine production plan and epidemic prevention for foot-and-mouth disease in Myanmar

② Consistency with the local technology level

③ Slow technology obsolescence and long duration of the market value

④ Those that dose not require expensive consumables frequently

⑤ Those which maintenance is possible by local technician

【Basis of omission】

I Those that should be procured by the facility portion

II Equipment currently available or overlap with the other equipment

III Those that is difficult with on site maintenance because of the technical or cost problem

IV Those assumed to be low cost-effectiveness because of frequency of use

V Those overlap with other requested equipment or can be replaced by other equipment

VI Those require significant facility repair or other budget issues

【Priority of the equipment】

A The equipment which is confirmed the necessary and applicability in this project.

B The equipment which is desirable to include this project, but considered to be needed father analysis in Japan

C The equipment outside of the scope of this project or alternatives are available