Ministry of Education
The Republic of Ghana

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR THE CONSTRUCTION OF ADVANCED RESEARCH CENTER FOR INFECTIOUS DISEASES AT NOGUCHI MEMORIAL INSTITUTE FOR MEDICAL RESEARCH
IN
THE REPUBLIC OF GHANA

OCTOBER 2015

JAPAN INTERNATIONAL COOPERATION AGENCY

THE CONSORTIUM OF
NIHON SEKKEI, INC. AND FUJITA PLANNING CO., LTD.

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to consist of Nihon Sekkei, Inc. and Fujita Planning Co., Ltd.

The survey team held a series of discussions with the officials concerned of the Government of the Republic of Ghana, and conducted 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 Ghana for their close cooperation extended to the survey team.

October 2015

Takao Toda
Director General,
Human Development Department
Japan International Cooperation Agency

Summary

(1) Outline of the Country

The Republic of Ghana (hereinafter referred to as “Ghana”) got independent from Britain in 1957 and became the first independent state in Sub-Saharan Africa. Located in West Africa and bordered by Togo in the east, Burkina Faso in the north and Ivory Coast in the west, approximately 25.5 million people (2012, United Nations Fund for Population Activities) live in the land of 239,000m^2 (approximately 2/3 of Japan). The urban population accounts for 53%, concentrated in the southern area including Accra, the capital of Ghana, and Kumasi. The population consists of ethnic groups of Akan, Ga, Ewe and Dagomba among many others, and, as for religions, approximately 50% are Christian, 15% Muslim and other traditional religions which make Ghana a multi-ethnic and multi-religious country. Most of the territory is low-lying land along the Volta River. The climate is tropical rain forest in the southern area, and savanna in the northern area where it is clearly divided into the dry season and the rainy season. Concerning the Human Development Index which indicates the quality level of human life, Ghana is ranked 138 among 187 countries (0.573, 2014), classified as a medium human development country.

(2) Background

In order to achieve the Millennium Development Goals, the Ministry of Health of Ghana has established a development plan to take measures against infectious diseases and improve health care of mothers and infants under 5 years old. Another issue emerging due to the recent changes of the disease structure is non-communicable diseases.

Noguchi Memorial Institute for Medical Research (hereinafter referred to as “NMIMR”) was established in 1979 by Japan’s grant aid as a medical research center to perform researches, surveys and special examinations concerning those health issues as well as to develop human resources for researchers. The research capacity has been improved as a result of Japan’s grant aid and technical cooperation over the years, and it has grown to be an institute that can broadly and timely contribute to solve issues of infectious diseases in West Africa and the rest of the world. In cooperation with international organizations, government agencies, NGOs and universities, the institute is currently working on nutrition issues, cancer research and vaccine development in addition to research on major infectious diseases such as HIV/AIDS, malaria, tuberculosis and Neglected Tropical Diseases (NTD). Concerning the outbreak of Ebola hemorrhagic fever continuing since 2014, it has been diagnosing many suspicious cases as the only inspection institute in the country.

In order to cope with the increase of such activities, the staffs including research fellows was expanded rapidly, and is still growing at an annual average of 5%. Especially, the category of molecular biology is developing tremendously, and the demand is increasing. The number of interns invited for research on control of infectious diseases is also on the rise. On the other hand, the capacity of the existing facilities is not sufficient, which stands in the way of duties such as research, examination and diagnosis. The deterioration of facilities and equipment is also making it difficult to perform duties safely and effectively, which is causing concerns over research quality.

Under such situation, in order to further improve NMIMR’s capacity of research, examination and education, the government of Ghana has requested the government of Japan for grant aid concerning construction of an additional laboratory building and procurement of research equipment.

(3) Overview of Prepratory Survey and Contents of the Project

To respond to the aforementioned request, JICA determined to implement a Preparatory Survey (Basic Design) (hereinafter reffered to as “Preparatory Survey”) and send the Preparatory survey Team from March 9 to April, 2015.

NMIMR provides medical research education to graduate students at the University of Ghana. It not only holds nine departments including Virology and Parasitology departments, which conduct research in line with health challenges in the country, but also has a function as a diagnostic center on HIV drug resistance and a cancer research center.

Since its foundation in 1979 with Japan's grant aid, the department expanded the research capabilities over the years. And today, NMIMR is a leading research center that contributes to infectious disease issues in not only the West Africa region but the entire international community. For example, it is not only recognized as a referral laboratory on polio and Buruli ulcer by the World Health Organization (hereinafter referred to as "WHO"), but is also certified by WHO as the only diagnostic institute for Ebola hemorrhagic fever virus in the country, providing diagnostics for many suspected cases in the country as well as neighboring countries in the ongoing Ebola epidemic.
NMIMR has, however, faced a shortage of space to operate its research with a growing volume of education and research/testing activities in recent years. An additional facility is needed in order to meet the demand and expectation from both domestic and international communities.
Against this backdrop, the Project for Advanced Research Center for Infectious Diseases at Noguchi Memorial Institute for Medical Research (hereinafter referred to as "the Project") will be built as additional laboratories and enhance NMIMR of education and research/testing activities.

1) Construction of the Project

   The requirements of the Project were for nine departments, but three departments (Virology, Bacteriology and Immunology) are targeted at the improvement of a necessary research environment in addition to a growing volume of research. Because of Advanced Research Center for Infectious Diseases at Noguchi Memorial Institute for Medical Research will be constructed as specializing of research and training on pathogenic agents which are feared to outbreak in and out of the country in the future.

2) Construction of the New BSL-3 Laboratories

   With an increasingly advancement in research activities, it is currently difficult to perform research and experimental activities in the existing BSL-3 laboratory, which has space limitation and aging. Therefore, the construction of new BSL-3 Laboratories will be included in the Project.

3) Provision of Molecular Biology Laboratory

   The Common Molecular Biology laboratory (PCR laboratory) will be provided in order to make full and practical use of the same equipment owned by the targeted three departments.

4) Equipment Planning

   The necessary equipment will be planned in order to conduct experiments and research in NMIMR for the BSL-3 Laboratories, Virology, Bacteriology and Immunology departments and other relevant rooms.

5) Soft Component

   In an effort to manage and maintain the BSL-3 facility properly, building service workers departments and experimental at the biosafety and building service technology will be strengthened. While providing training in which they will use real equipment at the site, hands-on training will also be conducted for fumigation and technology to HEPA (exchange high efficiency particulate air) filters.

The goal is to enable NMIMR to contribute broadly to infectious diseases control in Africa and to improve the functions to deal with issues on health and education.
The following is the outline of the Project.

Responsible Agency	: The Ministry of Education
Implementing Agency	: University of Ghana/ NMIMR
Planned construction site	: NMIMR, Located in University of Ghana, Accra
Building structure	: Reinforced Concrete Structure

Outline of the Project

Structure of the Project		Details
Advanced Research Center (three-story, 4,597.50 m^2)		West wing, North wing (see below for details)
	West wing	Administration dept., Student/Internship/National service office, Professor room, Seminar room, Project room, Data processing unit room, Storage
	North wing	Laboratory, BSL-3 laboratory, BSL-3 administrative office, Washing room, Cold (freezer) room, Storage, Researcher/Research assistant/Technician office, Seminar room, Administration dept.
Water tower/Reservoir building (one-story, 40 m^2)		Elevated water tank space, Water reservoir room, Pump room
Sub-station (one-story, 77.65 m^2)		High tension volt room, Transformer room, Low tension volt room
Machine building (one-story, 196.23 m^2)		Generator room, Oil tank space (outside of the building), Workshop, Storage, WC, Pump room for septic tank
Septic tank building (one-story, 58.4 m^2)		Septic tank
Total 4,969.78 m^2		
Equipment		[BSL-3 laboratory]: Formaldehyde decontamination unit, Autoclave (A), Deep freezer (-80°C), Refrigerated centrifuge, Inverted microscope, CO2 incubator, etc. [Virology dept.]: Deep freezer (-80°C), Inverted microscope, Autoclave (B), Biosafety cabinet, Centrifuge (various type), Fluorescent microscope, Flow cytometry (A), etc. [Bacteriology dept.]: Freezer (-20°C), Refrigerated microcentrifuge, CO2 incubator, Deep freezer (-80°C), Refrigerated centrifuge (B), Biosafety cabinet, Fluorescent microscope, etc. [Immunology dept.]: Deep freezer (-80°C), Medical refrigerator, Refrigerated microcentrifuge, Clean bench, Fluorescent microscope, EliSpot reader, Flow cytometry (B), etc. [Common molecular biology laboratory]: Clean bench, PCR workstation, Thermal cycler, Real-time PCR, Electrophoresis apparatus, Gel imaging system, etc. [Washing room]: Autoclave (B), Ice maker, Dry hot oven, Water distiller, etc.
Soft Component		Properly Operating and Managing the BSL-3 Laboratory Facility Organization

(4) Implementation Schedule

The entire implementation of the Project consists of the following phase: Detail design: 4 months, Tender implementation: 3 months, Construction of facilities and procurement of equipment: 17 months.

The cost of works to be covered by the Ghanaian side has been confirmed by the Ministry of Education (hereinafter referred to as "MOE") of the Government of Ghana. The MOE pledged to secure the relevant budget based on the Minutes of Discussion (hereinafter referred to as "M/D").

(5) Project Evaluation

1) Relevance

The expected effects of the Project are as follows. It is judged that it is relevant to implement the Project by Japan's grant aid.

1. Beneficiaries of the Project and the Relevance of the Project Purpose

The Project aims at solving the issues of the health and educational sectors in Ghana and the rest of the world by reinforcing the functions of NMIMR. NMIMR plays the leading role in research, disease control, examination and diagnosis concerning different issues of infectious diseases, which is benefitting Ghana's entire population of 25.91 million (The State of the World's Children 2015, UNICEF). The institute is also functioning in the development of anti-AIDS drugs and malaria vaccine, diagnosis of Ebola virus disease inside and outside the country, WHO Emerging and Dangerous Pathogens Laboratory Network and as the regional reference laboratories for polio and Buruli ulcer, which means that establishing the Project will contribute to measures against the health issues in the West African sub-region and the rest of the world. Therefore, the number of indirect beneficiaries will amount to 765.2 million (The State of the World's Children 2015, UNICEF), the total population of the 7 countries in the West African sub-region. Recently, the threat of infectious diseases including Ebola hemorrhagic fever, avian influenza and MERS (Middle East Respiratory Syndrome) is an urgent international issue, and it is also urgent to strengthen the functions of NMIMR as the core of excellence in order to take countermeasures.

2. Consistency with the Health and Education Policies of Ghana

The "Health Sector Medium Term Development Plan 2014-2017" has 6 policy objectives. NMIMR is the base of research, disease control, examination and diagnosis on the 5th objectives "Enhance national capacity for the attainment of the health related MDGs and sustain the gains" and 6th objectives "Intensify prevention and control of non-communicable and other communicable diseases". The "Education Strategic Plan 2010-2020" has 8 goals focusing on science, mathematics and tertiary education in addition to basic education. NMIMR is directly and indirectly supporting part of the Goal 4 "Development of health, HIV/AIDS and Sexually Transmitted Infection(STI) in the curricular at all levels" as well as the Goal 5 "Improve quality of teaching and learning", Goal 6 "Promote science and technical education at all levels" and Goal 7 "Strengthen links between tertiary education and industry".

3. Consistency with the Assistance Policy of the Government of Japan

In the Country Assistance Program for Ghana, Japan prioritizes four issues: i.Agriculture, ii.Economic infrastructure (electric power, transportation), iii.Health and education of science and mathematics, and iv.Capacity development of government administration and financial management. In the health sector, while focusing on the reduction of mortality rate among mothers and infants, Japan is also providing an assistance in the sector of infectious diseases on a continuous basis, which is consistent with the assistance policy.

2) Effectiveness

The outputs expected from the Project and the outcomes to be achieved by the entire project can be described as follows. Quantitative indicators and qualitative indicators are suggested, while the benchmark year is 2014 or an average of several years, and the target year is 2021, 3 years after 2018 when the facilities will be completed.

1. Quantitative Effects

The quantitative indicators of the Project are proposed as mentioned below.

Outputs Expected from the Project

Indicators	Unit	Baseline		Goal(2021) (3 years after the Project Completion)[1]
		Year	Value	
Total number of interns within the three departments (Virology, Bacteriology, Immunology)	Person	average of 2012-2014	103.7 persons	135 persons
The percentage of foreign student interns	%	average of 2012-2014	9.3%	12%
Total number of research projects at the three departments (Virology, Bacteriology, Immunology)	Number	2014	31 projects	36 projects
Number of times people have accessed BSL-3 Laboratory per year	person	2014	1,005 times	1,307 times

In order to develop human resources for researchers, NMIMR accepts undergraduate and graduate school students in the faculty of medicine, health sciences and applied sciences as interns from inside and outside the country. The total number of interns is expected to be increased by establishment of the Project and procurement of advanced research equipment. As it will be the center of countermeasures against infectious diseases in the West African sub-region and interns from foreign countries will also increase, the percentage of foreign student interns is also included as an indicator.

The total number of research projects of the 3 departments to be transferred to the Project is incorporated because it is expected to be increased by reinforcement of the research functions and appropriate use of new equipment. As the number of users accessed BSL-3 Laboratory is linked with all of the four functions of NMIMR, users are expected to increase when the functions for reacting to emerging and re-emerging infectious diseases are improved. The achievement of the Project goals will be evaluated by these indicators.

The quantitative indicators of the entire project (including both Japan's grant aid project and the necessary input by the Ghanaian side) are proposed as follows.

[1] The target value was set by adding approximately 30% to the standard value referring to the grounds of setting the facility scale, except for the number of research projects, for which the target value was set by adding 15%, half of other target values (30%), taking into consideration the influence of the technical capacity of the researchers and the strategies of sponsors of research projects.

Outcomes to be Achieved by the Entire Project

Indicators	Unit	Baseline		Goal(2021) (3 years after the Project completion)[2]
		Year	Value	
Total number of research projects conducted at NMIMR	Number	2014	88 projects	101 projects
Increase in Research Project Overhead	Ghana Cedi	Average of 2012-2014	1,595,120 GHS	2,074,000 GHS
Number of diseases that NMIMR is recognized as a national/regional reference center	disease	2014	4 diseases (TB, Buruli Ulcer, Polio, Influenza)	5 diseases

The above mentioned indicators are intended to reinforce the functions of all of the 9 research departments of NMIMR. The Project includes the new BSL-3 Laboratory on the premises of NMIMR and partially procured equipment. When it is completed, 3 departments will be transferred to the Project. The remaining 6 research departments and the administrative department will continue to use the existing NMIMR facilities and take over the rooms which were used by those 3 departments in order to expand each department and improve the functions. Concerning the existing BSL-3 Laboratory, NMIMR will carry out partial renovation and use it as a hands-on-training facility to practice technical skills of the BSL-2 and BSL-3 Laboratory levels and acquire the maintenance skills. Moreover, the existing BSL-3 Laboratory will be reused for research in the case that the demand of examination and diagnosis is increased by an outbreak of a hazardous infectious disease impeding research and routine works at the new BSL-3 Laboratory. Therefore, it is expected to achieve the above mentioned outcomes by facilitating the Project on the part of NMIMR and effectively using the existing facilities.

2. Qualitative Effects

The qualitative effects expected from the implementation of the construction of the Project are mentioned below.

(a) Improvement of research quality conducted by Virology, Bacteriology and Immunology departments at NMIMR

In the existing facilities, experiment spaces, air-conditioning and ventilation were insufficient due to the expansion of research/testing activities and the staff. Because laboratories and offices were mixed together and refrigerators and freezers were placed out in the corridors, there were many factors that might deteriorate the quality and accuracy of research. In Advanced Research Center for Infectious Diseases, laboratories and offices will be divided, which will allow sufficient space for refrigerators and freezers. In addition to the laboratories exclusively used by each research department, common laboratories, training space and high-level equipment will be installed, which will greatly improve the research environment, and it is expected to improve the research quality of the 3 departments.

[2] The target value was set by adding approximately 30% to the standard value referring to the grounds of setting the facility scale, except for the number of research projects, for which the target value was set by adding 15%, half of other target values (30%), taking into consideration the influence of the technical capacity of the researchers and the strategies of sponsors of research projects.

(b) Increase in safety levels at the new BSL-3 Laboratory

The new BSL-3 Laboratory was designed considering the safety measures and response in case of an accident based on the WHO standards. Specifically:

- Installation of emergency showers and eye washers in the area
- Installation of hand wash basins near the entrance
- Installation of two safety cabinets, while there is only one in the existing BSL-3 Laboratory

Having two safety cabinets will improve the efficiency of processing samples, and enables to use one of them exclusively for samples infected by highly pathogenic viruses including Ebola.

(c) Increase in efficiency and accuracy of research in the molecular biology common laboratory

Research at the molecular level to analyze genetic information of pathogens is now common also among the 3 departments, and is becoming the mainstream in NMIMR. An experiment of molecular biology requires different rooms based on the processes: Master mix room, Pre PCR room, PCR room, 2nd PCR room, Genetic Analyzer room as well as equipment and tools in each process. Especially at the early stage of experiment, it is necessary to have a separate laboratory per sample in order to prevent contamination of reagent or sample. On the other hand, the highly advanced and expensive equipment must be shared in a PCR room or sequencing room. Advanced Research Center for Infectious Diseases will have a common molecular biology laboratory that enables to prevent contamination and share advanced equipment among the 3 departments, and it is expected to improve the efficiency and accuracy of research.

Based on above, it is judged relevance of the Project is high, and effectiveness is highly expected.

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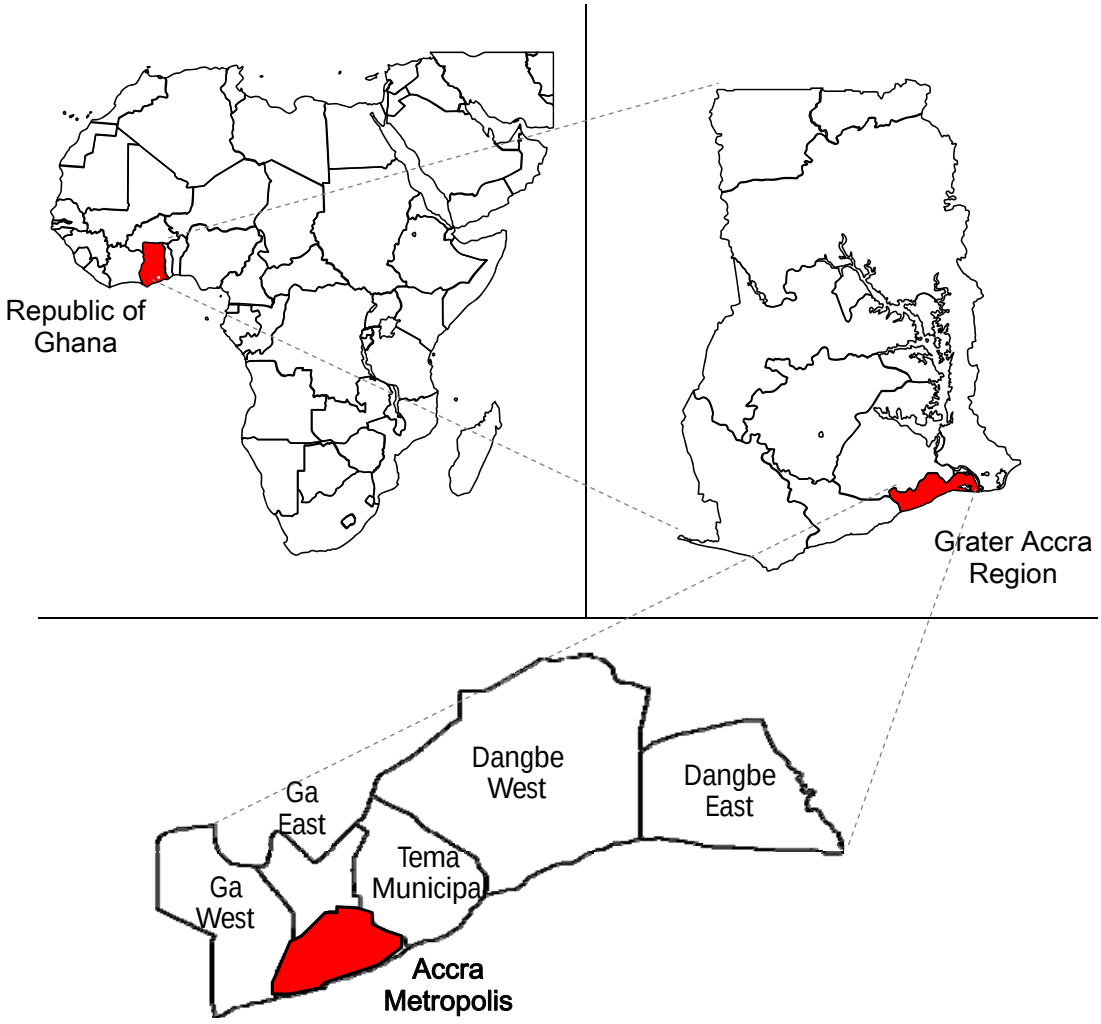
Location Map



Accra City

Construction Image

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ABBREVIATIONS

A/C	Air‐Conditioning
AHU	Air Handling Unit
A/P	Authorization to Pay
AIDS	Acquired Immunodeficiency Syndrome
AMED	Japan Agency for Medical Research and Development
ARCID	Advanced Research Center for Infectious Diseases
AVR	Automatic Voltage Regulator
B/A	Banking Arrangement
BS EN	British Standards/European Norm
BSL	Bio Safety Level
CAV	Constant Air Volume
CDC	Centers for Disease Control and Prevention
CHPS	Community-Based Health Planning and Services
DNA	Deoxyribonucleic Acid
EA	Exhaust Air
ESP	Education Strategic Plan
EU	European Union
GDP	Gross Domestic Product
GES	Ghana Education Service
GF	Ground Floor
GPRS	Ghana Poverty Reduction Strategy
GPRS-Ⅱ	Growth and Poverty Reduction Strategy
GSGDA	Ghana Shared Growth and Development Agenda
HEPA	High Efficiency Particulate Air
HIPC	Heavily Indebted Poor Countries Debt Initiative
HIV	Human Immunodeficiency Virus
HLA	Human Lymphocyte Antigen
HSMTDP	Health Sector Medium Term Development Plan
IP	Internet protocol
ITV	Industrial Television
J-GRID	Japan Initiative for Global Research Network on Infectious Diseases
JOCV	Japan Overseas Cooperation Volunteers
JST	Japan Science and Technology Agency
LAN	Local Area Network
LED	Light‐Emitting Diode
LP (gas)	Liquefied Petroleum (gas)
MDGs	Millennium Development Goals

MERS	Middle East respiratory syndrome
NAMRU-3	Naval Medical Research Unit 3
MTB	Main Terminal Board
NCTE	National Council for Tertiary Education
NGO	Non-Governmental Organization
NIH	National Institutes of Health
NMIMR	Noguchi Memorial Institute for Medical Research
NTD	Neglected tropical diseases
OA	Open Air
P3	Physical containment 3
PATH	Program for Appropriate Technology in Health
PCR	Polymerase Chain Reaction
PHC	Primary Health Care
PLOS-ONE	Public Library of Science One
RA	Return Air
Rm	Room
RNA	Ribonucleic Acid
ROTARIX	The vaccine which prevents a rotaviral infectious disease
SA	Supply Air
SATREPS	Science and Technology Research Partnership for Sustainable Development
SPF	Specific Pathogen Free
STI	Sexually Transmitted Infections
SWAPs	The Sector-Wide Approach
TB	Terminal Board
UHC	Universal Health Coverage
UPS	Uninterruptible Power Supply
VAV	Variable Air Volume
WACIPAC	West African Centre for International Parasite Control
WHO	World Health Organization

Chapter 1. Background of the Project

CHAPTER 1 BACKGROUND OF THE PROJECT

(1) Background

In order to achieve the Millennium Development Goals, the Ministry of Health of Ghana has established a development plan to take measures against infectious diseases and improve health care of mothers and infants under 5 years old. Another issue emerging due to the recent changes of the disease structure is non-communicable diseases.

Noguchi Memorial Institute for Medical Research (hereinafter referred to as "NMIMR") was established in 1979 by Japan's grant aid as a medical research center to perform researches, surveys and special examinations concerning those health issues as well as to develop human resources for researchers. The research capacity has been improved as a result of Japan's grant aid and technical cooperation over the years, and it has grown to be an institute that can broadly and timely contribute to solve issues of infectious diseases in West Africa and the rest of the world. In cooperation with international organizations, government agencies, NGOs and universities, the institute is currently working on nutrition issues, cancer research and vaccine development in addition to research on major infectious diseases such as HIV/AIDS, malaria, tuberculosis and Neglected Tropical Diseases (NTD). Concerning the outbreak of Ebola hemorrhagic fever continuing since 2014, it has been diagnosing many suspicious cases as the only inspection institute in the country.

In order to cope with the increase of such activities, the staffs including research fellows was expanded rapidly, and is still growing at an annual average of 5%. Especially, the category of molecular biology is developing tremendously, and the demand is increasing. The number of interns invited for research on control of infectious diseases is also on the rise. On the other hand, the capacity of the existing facilities is not sufficient, which stands in the way of duties such as research, examination and diagnosis. The deterioration of facilities and equipment is also making it difficult to perform duties safely and effectively, which is causing concerns over research quality.

Under such situation, in order to further improve NMIMR's capacity of research, examination and education, the government of Ghana has requested the government of Japan for grant aid concerning construction of an additional laboratory building and procurement of research equipment.

(2) General Outline of the Project Requested by the Ghanaian Side

Project Purpose	The Project is to play a leading role in tackling the ever expanding research and training needs of the country as well as the West African sub-region and to respond effectively to disease outbreaks, including highly pathogenic agents such as Ebola Hemorrhagic Fever Virus at NMIMR.
Project Outputs	The Advanced Research Center for Infectious Diseases at NMIMR will be newly constructed and research equipment will be procured.
Project Components	1. Facility Construction (Approximately 4,500m^2 including multi-purpose laboratories, specialized laboratories, meeting/seminar rooms, storages, cold rooms, offices, cafeteria, maintenance workshop, etc.) 2. Equipment (DNA sequencer, flow cytometer, mass spectrometer, incubators, ultra low freezers, etc.)

(3) Natural Condition

1) Wind

In Ghana, there are trade winds called "Harmattan," which are flown from the northwest and caused by desert dust and fiery winds in the Sahara during December to March.

2) Precipitation

There are dry season and rainy season in the country. Accra, which is located in the southern part of the country, goes through rainy season from April to June and dry season from December to April. In June, it can record up to a rainfall of 200 millimeters.

3) Temperature and Humidity

Accra belongs to tropical climate with the highs in 25 to 30 ^{o}C throughout the year. With an average daytime humidity of 90% or so, it is humid throughout the year. Its coolest month is in August, while it is the hottest in March.

Table 1-1 Weather Data in Accra

Item	Jan	Feb	Mar	Apl	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precipitation (mm)	15	37	73	82	145	193	49	16	40	80	38	18
Average humidity (%)	79	77	77	80	82	85	85	83	82	83	80	79
Average temperatur (^{o}C)	32	32	32	32	31	29	27	27	29	30	31	31

4) Sunlight

The city is located at 5^{0} 33' N. Therefore, it is necessary to consider countermeasures against heat caused by harsh sunlight, due to its high solar elevation and long hours of sunlight.

5) Disaster Records

Floods hit Accra City in July 1995, June 1997, June 2001, May 2010, November 2011 and June-July 2014. However, the University of Ghana is located on high ground in Accra City, and the Project site has no record of experiencing any flood, tsunami, typhoon or cyclone damage.

(4) Environmental and Social Considerations

Negative impacts of assistance for developing countries such as pollution can inflict tremendous damage on the global environment as well as the local residents. Therefore, it is necessary to study factors that could cause environmental impacts and take measures before executing the Project.

The possible factors of the planned facilities that could affect the surrounding environment are waste water which includes highly hazardous pathogens, waste which includes highly hazardous pathogens and exhaust which includes highly hazardous pathogens, including exhaust gas from private power generators.

1) Waste Water

In the Project, waste water including highly hazardous pathogens might be emitted from BSL-3 Laboratory. Therefore, waste water from autoclaves and hand wash basins is sterilized and treated at the wastewater treatment facility (septic tank) together with general waste water before being discharged to the existing waste water pipes outside the premises.

2) Solid Waste

Waste including highly hazardous pathogens generated at BSL-3 Laboratory is treated by autoclave before being disposed out of the laboratory. Therefore, waste from the relevant facilities is basically not infectious. However, as the possibility of infection cannot be totally excluded, it is treated in accordance with the same procedure to treat laboratory waste from the Noguchi Memorial Institute for Medical Research. Infectious waste from laboratories and animal facilities is collected, separated and incinerated at the existing incinerators.

3) Exhaust Air

In the Project, exhaust including highly hazardous pathogens is a factor of environmental pollution. However, it wouldn't cause any negative impact on the surrounding environment because exhaust including highly hazardous pathogens goes through High Efficiency Particulate Air (HEPA) filter for dust removal.

Chapter 2. Contents of the Project

CHAPTER 2 CONTENTS OF THE PROJECT

2-1 Basic Concept of the Project

(1) The Target of the Project

In Ghana, infectious diseases still make up over 75% of the most common diseases, and continued efforts against them as a critical issue. Moreover, the epidemic of Ebola hemorrhagic fever of West African region in 2014 became a major threat to mankind and had a huge impact on the world economy as well. Reinforcement of efforts against emerging and re-emerging infectious diseases is more than ever in demand.
"The Health Sector Medium-Term Development Plan (2014-2017)" in Ghana aims to strengthen the national control against malaria, tuberculosis and HIV/AIDS to achieve the MDGs and to strengthen prevention and control of the both infectious and non-infectious diseases as its policy objective. Furthermore, "the Educational Strategic Plan (2010-2012)" aims to improve the quality of education, to promote scientific and technological education, to enhance collaboration between higher education and industry, and to improve the educational curriculum that includes health issues (HIV/STI, etc.). In order to have a wide impact on infectious disease control in Africa, the Project aims to strengthen the countermeasure of infectious diseases in the West African district which respond to health and educational issues by building an advance research facility and equipping NMIMR with necessary research equipments.

(2) The Outline of the Project

NMIMR provides medical research education to graduate students at the University of Ghana. It not only holds nine departments including Virology and Parasitology departments which conduct research in line with health challenges in the country, but also has a function as a diagnostic center of HIV drug resistance and a cancer research center.
Since its foundation in 1979 with Japan's grant assistance, NMIMR and Japan has had a long history of both grant aid and technical cooperation which has strengthened NMIMR's research capabilities over the years. Today, NMIMR is a leading research center that contributes to infectious disease issues in not only the West Africa region but also the entire international community. For example, it is not only recognized as a referral laboratory on Polio and Buruli ulcer by WHO, but is also certified by WHO as the only diagnostic institute for Ebola hemorrhagic fever virus in the country, providing diagnostics for many suspected cases in the country as well as neighboring countries against the Ebola epidemic in 2014.
NMIMR has, however, faced a shortage of space to operate its research with a growing volume of education and research/testing activities in recent years. An additional facility is needed in order to meet the demand and the expectation from the both domestic and international communities.

Against this backdrop, the Project will not only build additional laboratories and enhance NMIMR's equipment in order to further increase its capabilities in education, research and testing, but will also provide a Soft Component for the Project to ensure the daily monitoring, maintenance, and the proper operational instruction.

Table 2-1 Outline of the Project

Structure of the Project	Details
Advanced Research Center (three-story, 4,597.50 m^2)	West wing, North wing (see below for details)
West wing	Administration dept., Student/Internship/National service office, Professor room, Seminar room, Project room, Data processing unit room, Storage
North wing	Laboratory, BSL-3 Laboratory, BSL-3 administrative office, Washing room, Cold (freezer) room, Storage, Researcher/Research assistant/Technician office, Seminar room, Administration dept.
Water Tower/Reservoir building (one-story, 40.00 m^2)	Elevated water tank space, Water reservoir room, Pump room
Sub-Station (one-story, 77.65 m^2)	High tension volt room, Transformer room, Low tension volt room
Machine Building (one-story, 196.23 m^2)	Generator room, Oil tank space (outside of the building), Workshop, Storage, WC, Pump room for septic tank
Septic Tank Building (one-story, 58.40 m^2)	Septic tank
Total 4,969.78 m^2	
Equipment	[BSL-3 Laboratory]: Formaldehyde decontamination unit, Autoclave (A), Deep freezer (-80°C), Refrigerated centrifuge, Inverted microscope, CO2 incubator, etc. [Virology dept.]: Deep freezer (-80°C), Inverted microscope, Autoclave (B), Biosafety cabinet, Centrifuge (various type), Fluorescent microscope, Flow cytometry (A), etc. [Bacteriology dept.]: Freezer (-20°C), Refrigerated microcentrifuge, CO2 incubator, Deep freezer (-80°C), Refrigerated centrifuge (B), Biosafety cabinet, Fluorescent microscope, etc. [Immunology dept.]: Deep freezer (-80°C), Medical refrigerator, Refrigerated microcentrifuge, Clean bench, Fluorescent microscope, EliSpot reader, Flow cytometry (B), etc. [Common molecular biology laboratory]: Clean bench, PCR workstation, Thermal cycler, Real-time PCR, Electrophoresis apparatus, Gel imaging system, etc. [Washing room]: Autoclave (B), Ice maker, Dry hot oven, Water distiller, etc.
Soft Component	Properly Operating and Managing the BSL-3 Laboratory Facility Organization

2-2 Outline Design of the Requested Japanese Assistance

2-2-1 Design Policy

(1) Basic Policy

1) Function as a Testing and Research Facility

In order to contribute measuring against infectious diseases in West Africa and the rest of the international community, the Project will develop Advanced Research Center for Infectious Diseases at NMIMR. It will be a facility with optimum specifications and scale which in turn will strengthen the function of NMIMR as a testing and research facility.

2) Construction of New BSL-3 Laboratories

With an increasing advancement in research activities, it is currently difficult to perform research and experimental activities in the existing BSL-3 Laboratory (hereinafter referred to as “P3 Laboratory”) which has space limitation and aging. Therefore, the construction of new BSL-3 Laboratories will be included in the Project.

3) Function as an Educational Institute

Appropriate research and training space for NMIMR will be secured to serve as an educational institution for researchers and students from within and outside of Ghana.

4) Setting of the Scale of the Planned Facilities

The scale of the facility will be set based on the trend of increase in the number of staff for the last five years from 2010 to 2015, with an anticipation of a similar increase in the number of staff from 2015 to 2020.

5) Number of Storey and Major Structure

In the Project, the building will mainly be two stories high, with a part of it as three stories. One elevator will be installed for persons with disabilities and transporting equipments. The building will be mainly made of reinforced concrete.

6) Infection Prevention Measures in the Facilities

In order to avoid in-house infection, bio-hazardous functions will be laid out as not to intersect with one another.

7) Environmental Consideration

The Project that will address prevention of environmental contamination in the surrounding facilities and neighboring areas will be drawn out.

8) Technical and Financial Sustainability

For the planning of facility and equipment, the planning will be kept within a scope that ensures technical and financial sustainability, based on the current operational capacities (number of building service workers, level of technology, financial strength, availability of consumables/replacement parts, etc.). Building materials will be selected in terms of robustness, maintenance-free nature, local availability, easy repair, exchange ability, etc.

9) Equipment Planning

In equipment planning, necessary equipment will be planned in order to conduct experiments and research currently conducted in NMIMR’s BSL-3 Laboratories, the Virology laboratory, the Bacteriology laboratory, Immunology laboratory and other relevant rooms.

10) Soft Component

In an effort to manage and maintain the BSL-3 facility properly, building service workers' understanding of the concept of biosafety and building service technology will be strengthened. A hands-on training with real equipment at the site will also be conducted for fumigation and technology to exchange High Efficiency Particulate Air (HEPA) filters.

(2) Natural Conditions

1) Temperature and Humidity

Accra belongs to tropical climate with the highs in 25 to 30 °C throughout the year. With an average daytime humidity of 90% or so, it is humid throughout the year. Its coolest month is August, while the hottest is March. Air conditioning will be installed in the laboratories and offices, but a pressurized air system will be installed for the entire building as a part of measures against Harmattan. This system will allow excess air to flow out through louvered doors and to keep the temperature along the corridors, at the intermediate temperature that is lower than the outside one.

2) Precipitation

There are dry season and rainy season in the country. Accra, which is located in the southern part of the country, goes through rainy season from April to June and dry season from December to April. A rainfall can record up to 200 millimeters in June. A secure rainwater piping will be selected in the same manner for the equivalent level of rainfall in Japan, when planning how to drain rainwater from roof inclination and roof surface.

3) Sunlight and Ultraviolet

The city is located at 5° 33' N. Therefore, it is necessary to consider countermeasures against heat caused by harsh sunlight, due to its high solar elevation and long hours of sunlight.

4) Wind

"Harmattan" is a trade wind in Ghana which flows from the northwest and caused by desert dust and fiery winds in the Sahara. Extra attention will be paid to the layout, openings, and specifications of machinery, in order to minimize the impact of the invasion of the desert dust on the facilities.

5) Seismic Load

The seismic design in Ghana is drawn according to "The Code for the Seismic Design of Concrete Structure (1990)". The calculation method used for the Code is similar to the calculation of horizontal load bearing capacity used in Japan. According to the Code, the design surface acceleration is $0.35g = 3.5m/sec^2$.

(3) Socioeconomic Conditions

Ghana's economy recorded an inflation rate around 20% each year in the early 2000s. In the late 2000s, the inflation rate gradually became moderate, while going through repeated volatile movements. According to the International Monetary Fund (IMF), the country's inflation rate went up to 6.70% in 2010, 7.68% in 2011, 7.07% in 2012 and 11.67% in 2013. IMF estimated that its inflation rate would become 15.49% in 2014, 12.20% in 2015 and 10.20% in 2016. Estimated price fluctuations from the calculation time (April 2015) will be integrated to the expected bidding time (August 2016) and reflect them in accumulated unit prices based on IMF's documents.

(4) Construction / Procurement Circumstances or Local Peculiarities/ Business Practices

There are many under construction buildings seen in Accra, the capital of the country. The city is under relatively good construction circumstances. It is expected that building material prices in Accra are likely to go up as a whole in the future being under the influence of international price

trend for an increase in raw material prices including oil and iron ore.
Foreign imported goods, such as reinforcing bars and tiles, are commonly available at building material shops in Accra. Considering their costs and maintenance after the facilities are built. These locally available products will be favored in principle for the procurement of general building materials.

(5) Utilization of Local Companies

In order to minimize building costs, the Project shall make a full use of local construction companies and local workers' capabilities by mainly using a general local construction method.

(6) Operation and Maintenance capabilities of the Implementing Agency

1) Facilities

The maintenance department is in charge of building service for the facilities. The maintenance department is organized under the administration department and has eleven workers in total, consisting of three electricians, four air-conditioning engineers, three water supply and waste engineers and an architect.
There are concerns over safety within the laboratory with a demonstrated mishandling in the laboratory management such as that HEPA filters in the P3 Laboratories were not exchanged for more than ten years. Therefore, it is needed not only to understand and operate the facility systems, but also to increase the level of the biosafety outline, fumigation technology, and technology to exchange HEPA filters, all of which are required to maintain safe BSL-3 Laboratories. It is necessary to provide technical training to engineers in charge of the areas. Response to the above will be done through the implementation of Soft Component scheme.

2) Equipment Planning

Maintenance for the existing equipment is provided through three ways: i) NMIMR's maintenance department, ii) Outsourcing and iii) Maintenance contracts with manufacturers, local agents, and the like. It is expected that the equipment, planned for procurement under the Project will be also maintained in similar ways. It is necessary to strengthen the maintenance system before the completion of the equipment procurement under the Project.
NMIMR's maintenance department is mainly responsible for maintenance for air conditioning and electrical equipment in the facilities. It does not clearly define technician's specializing in maintenance for equipment and the scope of their responsibilities. It is necessary to select personnel and technicians in charge of maintenance for equipment and to increase their technical level in the days to come.
When it comes to maintenance for equipment through outsourcing, outsourcing service including preventive maintenance will continue to be used. Moreover, smooth management and maintenance will continue to be conducted for advanced precision equipment, such as Flow cytometry and Real-time PCR, by engaging in maintenance contracts with manufacturers or selling agencies.

(7) Setting Standards of the Facilities and Equipment

1) Facility Planning

Currently, there are facilities that were built with the support from Japan and other countries on the NMIMR campus.

- NMIMR (Japanese Grant Aid in 1979): Basic medical research function as a research facility affiliated with the medical department of the university
- P3 Laboratory, Animal Laboratory and Conference Hall (Japanese Grant Aid in 1998): Strengthening of capacity for research on highly pathogenic agents, animal testing, meetings, etc.
- International Parasite Control Project (2004): West African Centre for International Parasite Control (WACIPAC)
- Others: Common laboratory in association with a Swiss company

As far as the offices and laboratories are concerned, facilities that can be the most cost-effective will be created by setting a satisfying grade to the specifications requested by individual departments referring to the structure and functional level, etc. of similar departments in NMIMR's existing facilities mentioned above and research laboratories of Korle-Bu Teaching Hospital affiliated with University of Ghana. In particular, BSL-3 Laboratories will be created to comply with WHO's standards and refer to the containerized BSL-3 Laboratory operated under the Ministry of Agriculture and Food, with the help of the government of Canada and to their BSL-3 Laboratories operating in other countries.

2) Equipment Planning

Required equipment will be planned for conducting experiments (diagnosis) and research that are now performed in the BSL-3 Laboratories and the three research departments that are going to be transferred from the existing main building to the facilities to be built under the Project. In setting the grade of equipment, the equipment that will be planned for are with specifications equivalent to those of the equipment currently used by NMIMR departments. Equipment that researchers and technicians can operate and maintain at their current technical level without difficulties will also be selected.

(8) Construction / Procurement method and Construction Period

1) Construction method

The architectural structure in the local area for its groundwork, pillars, and beams is constructed by reinforced concrete in general. Its walls are created with stacked concrete blocks within a structural frame. The Project will employ this local construction method in principle.

The proposed project site is large enough to construct facilities and secure a sufficient offset distance from the existing facilities. However, extra attention will be paid to take a construction method that will create less vibration and noise caused by construction work.

2) Procurement Method

Locally procured building materials will be used as much as possible in order to make maintenance easier after the completion of the facilities. Research equipment will be procured from Japan in principle, as most of the equipment is basic and easy to maintain. However, some of the equipment for laboratories requires manufacturers' agencies for maintenance service. Furthermore, procuring only Japanese products hampers competition in bidding and makes it difficult to ensure fair bidding. In order to avoid these circumstances, the procurement of products made in third countries will also be considered.

3) Construction Schedule

Some of the building materials used in the Project, such as interior materials, fittings, and pass boxes that are used in the rooms including BSL-3 Laboratories need to be ensured with a certain level of performance in airtightness. These building materials will be imported from third countries or Japan, as it is impossible to obtain them in the local area. Therefore, an appropriate process will be planned in the light of not only time required for manufacturing, but also transportation and customs procedures, when drawing up a construction schedule.

Furthermore, it is critical that Ghana's construction work to lay infrastructure should be carried out without any delay in line with Japan's construction schedule for smooth implementation of this construction project. Therefore, thorough explanation of Japan's construction schedule will be given to Ghana and have an agreement on the implementation schedule including Ghana's budgets for the construction work.

In the country, there is a clear division between dry season and rainy season. It can rain approximately 200 millimeters per month especially from April to June. Therefore, the construction schedule is expected to start after the rainy season in July and to complete the construction of structure consisting of earthmoving, foundation work, footing/underground beams and floor on the ground level before April when the rainy season starts again. Total of 17 months has been planned as an appropriate construction period.

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

2-2-2-1 Overview of the Project (Review of Requests)

(1) Transition of the Requests

NMIMR's activities and usage situation of the existing facilities will be investigated and issues will be sorted out in a field investigation. Initially proposed requests together with NMIMR will also be checked and reviewed in the light of the results of the investigation. Final proposed requests are as follows.

Table 2-2 Initial Requests and Final Proposed Requests

Initial Requests Dated February 7, 2014		Final Proposed Requests
Requesting departments		
Animal testing dept., Bacteriology dept., clinical research dept., electron microscopy/histology dept., epidemiology research dept., Immunology dept., Nutriology dept., Parasitology research dept., Virology dept.		Bacteriology dept. Immunology dept. Virology dept.
Facilities		
Multipurpose Laboratory (12) Specialized office Workshop/Maintenance	→	Office Laboratory Common laboratory BSL-3 Laboratory Common molecular biology laboratory (PCR laboratory)
Office (including Data processing unit room)	→	Office Head of department room Professor room Research fellow office/Research assistant office/technicians Data processing unit room
Meeting room/Seminar room Cafeteria	→	Seminar room Student/ Intern/ National service office
Storage/ Refrigerator (Freezer)	→	Storage Refrigerator/Freezer room Washing room Building services Workshop/Maintenance room Machine building (Generator room/Power receiving facilities, etc) Water supply facilities (Water tower・reservoir building) Wastewater treatment facility (Septic tank)
Total: approx. 4,500 m^2 three-story building	→	Main building (approx. 4,600m^2) Machine building (approx. 330 m^2) Water supply facilities (approx. 40 m^2) Total: approx. 4,970 m^2

Equipment		
DNA sequencer (1) Flow cytometry (1) Gas chromatography-mass spectrometry system (1) EliSpot reader (1) Incubator (4) Blood culture system (2) Biosafety cabinet (6) Deep freezer (5)	→	Table 2-3 See the list of final requested equipment

Soft Component		
Training for maintenance workers (3 times)	→	Technical training including BSL-3 facilities

(2) Requests Discussed in a Field Investigation

1) Confinement to the Requested Facilities

Although requests for nine departments were received, three departments (Virology, Bacteriology, and Immunology) will be focused since they need improvement of necessary research environment in addition to a growing volume of research. Because of this, facilities will be created to specialize in research and research training on pathogenic agents which are feared to outbreak in and out of the country in the future.

2) Construction of the Facilities

A draft plan attached to the requests stated nothing about the capacity and usage of individual rooms and their functions. Thus, it is necessary to come up with a plan sorting out details of experiments and staff in individual departments so that it can reflect an appropriate scale. A Student/ Internship/ National service office and a Seminar room will also be established in order to strengthen a training function in testing, research, and experiments for Ghana and the neighboring countries.

3) Addition of Relevant Facilities

・Development of BSL-3 Laboratories
Although P3 Laboratories has space limitation and aging, it is not realistic to shut them down for a long time during its refurbishment. Therefore, new BSL-3 Laboratories will be developed to create an effective and safe experiment environment.

・Development of a Common laboratory and campus infrastructure
Relevant rooms consisting of the Common Molecular Biology laboratory (PCR laboratory), Laboratories, Offices, and facility administration departments in individual departments are also developed in order to make full and practical use of the same equipment owned by the three requesting departments. At the same time, a Data processing unit room will be established to improve a network environment in the facilities.

・Addition of building service facilities
Generators, water supply facilities, and sewerage facilities will be set up in a separate building to eliminate the effects of vibration, noise, and water leakage and a workshop/maintenance room in charge of building service for them.

4) Research Equipment

In the field survey, equipment to be used in the “BSL-3 Laboratories,” the “Virology department,” the “Bacteriology department,” and the “Immunology department” was requested based on the facility planning. Much of the equipment provided through Grant Aid in 1979 and 1999 goes beyond its service life and gets older. For this reason, additional requests were made with equipment replacement.
The table below shows the final-request equipment, which was agreed through discussions in the field survey and described in the Minutes of Discussion signed between the survey team and Ghanaian side on March 27, 2015.

Table2-3 List of the Final Request Equipment

No.	Name of Equipment	Priority	Requested Q'ty
A. BSL-3 Laboratory (Common equipment for virology, bacteriology and immunology)			
1	Autoclave pass through type	A	2
2	Biosafety cabinet(A)	A	4
3	Pass box	A	2
4	Sink with decontamination tank	A	2
5	Formaldehyde decontamination unit (A)	B	1
6	Formaldehyde decontamination unit (B)	B	1
7	Biosafety type autoclave	A	2
8	Deep freezer (-80°C) (A)	A	2
9	Freezer (-20°C)	A	2
10	Medical refrigerator	A	2
11	Refrigerated centrifuge (A) *1	A	1
12	Refrigerated centrifuge (B) *2	B	1
13	Refrigerated microcentrifuge*1	A	1
14	Inverted microscope*1	B	1
15	CO2 incubator	A	2
16	Incubator(37°C)	B	2
17	Shaking water bath*1	A	1
*1 Equipment solely for virology experiments *2 Equipment solely for bacteriology experiments			
B. Virology Laboratory			
1	Portable pH meter	B	1
2	Electronic balance	A	3
3	Autoclave	B	4
4	Deep freezer (-80°C)	A	2
5	Binocular microscope	A	2
6	Refrigerated centrifuge (15/50ml)	B	3
7	CO2 Incubator	A	8
8	Incubator (37°C)	A	3
9	Inverted microscope	A	3
10	Biosafety cabinet (B)	A	6
11	Water bath	B	3
12	Microcentrifuge	A	1
13	Vortex mixer	B	3
14	Elisa system	A	2
15	Centrifuge (15/50ml)	A	2
16	Refrigerated microcentrifuge	A	2
17	Real-time PCR	B	2
18	Nanodrop	B	1
19	Medical refrigerator	A	4
20	Freezer (-20°C)	A	4
21	Clean bench	B	1
22	Freezer (-30°C)	A	4
23	Refrigerator/freezer	A	1
24	Refrigerated centrifuge (32 tubes)	A	2
25	Shaker	B	1
26	Ice maker	B	1
27	Vacuum dryer	B	1
28	Fluorescent microscope	A	1
29	Magnetic stirrer	A	2
30	Shaking water bath	B	2
31	Microwave oven	C	-
32	Ultracentrifuge	B	1
33	Flow cytometry	A	1
34	Immunoassay serological analyzer	B	1
35	Fully automated nucleic material extraction system	B	1
C. Bacteriology Laboratory			
1	Blood culture system	C	-
2	Autoclave	A	4
3	CO2 incubator	A	3
4	Refrigerated centrifuge(15/50ml)	B	2
5	Biosafety cabinet(B)	A	4
6	Refrigerated microcentrifuge	B	3
7	Electronic balance (A)	A	1
8	Electronic balance (B)	A	1
9	Electronic balance (C)	A	3
10	Colony counter	A	5
11	Incubator (37°C)	A	4
12	Incubator (22°C)	A	1
13	Incubator (44°C)	A	3
14	Medical refrigerator	A	4
15	Water bath	A	3
16	Centrifuge (15/50ml)	B	3
17	Shaker incubator	A	3
18	Clean bench	A	4
19	Vortex mixer	A	4
20	Freezer (-20°C)	B	4
21	Deep freezer (-80°C)	B	5
22	Sonicator	B	1
23	Desicator	B	1
24	Stomacher	B	1
25	Ice maker	A	1
26	Drying hot oven (B)	A	1
27	Binocular microscope	A	4
28	Digital coagulator	B	1
29	Twin incubator	B	1
30	Fluorescent microscope	A	1
31	Fume extractor	A	1

D. Immunology Laboratory			
1	Binocular microscope	A	4
2	Hotplate magnetic stirrer	A	2
3	Electronic balance	A	2
4	Centrifuge (15/50ml)	A	1
5	Refrigerated centrifuge (15/50ml)	B	2
6	Biosafety cabinet (B)	A	3
7	Elisa system	B	2
8	Fume extractor	A	1
9	Medical refrigerator	A	3
10	Refrigerator/freezer	B	4
11	EliSpot reader	B	1
12	Clean bench	A	1
13	Plate shaker	A	2
14	Vortex mixer	A	5
15	Flow cytometry	A	1
16	Autoclave	A	2
17	Shaking water bath	A	2
18	Microcentrifuge	B	3
19	pH meter	A	2
20	Inverted microscope	A	2
21	Fluorescent microscope	A	3
22	Radioactive cell harvesting device	C	-
23	Freezer (-20°C)	A	4
24	Freezer (-30°C)	A	4
25	Deep freezer (-80°C)	A	3
26	Dissecting microscope	A	1
27	Cell counter	B	1
28	Refrigerated microcentrifuge	B	1
29	Water bath	B	1
30	Micropipette	B	6
31	Sonicator	B	1
32	Chemical cabinet	B	2
33	Ultrasonic cleaner	B	1
34	Nitrogen tank	B	1
35	Confocal microscope	B	1
E. Clinical Pathology			
1	Gas chromatography mass spectrometry	C	—

F. Molecular Laboratory (PCR laboratory)			
(Pre-PCR laboratory)			
1	Medical refrigerator	A	3
2	Freezer (-20°C)	A	3
3	Refrigerated microcentrifuge	A	3
4	Vortex mixer	A	3
5	Timer	C	-
6	PCR workstation	B	3
7	Micropipette	A	6
8	Laminar flow biosafety cabinet	B	3
(PCR laboratory)			
1	Thermal cycler	B	4
2	Real-time PCR	B	2
3	Medical refrigerator	A	1
4	Micropipette	A	3
5	Laminar flow biosafety cabinet	A	1
(Post-PCR laboratory)			
1	Medical refrigerator	A	2
2	Freezer (-20°C)	A	2
3	Gel imaging system	A	2
4	Computer with network connection	B	1
5	Electrophoresis apparatus	A	10
6	Vortex mixer	A	3
7	Laminar flow biosafety cabinet	A	1
8	Refrigerated microcentrifuge	A	1
(Sample preparation)			
1	Sample homogenizer	A	2
2	Medical refrigerator	A	1
3	Freezer (-20°C)	A	1
4	Water bath	A	1
5	Heat block	A	2
6	Laminar flow biosafety cabinet	A	1
Sequencing (Common usage)			
1	DNA sequencer (next generation)	B	1
Washing room (Common usage)			
1	Drying hot oven (A)	A	3
2	Drying hot oven (B)	A	3
3	Water distiller	A	2
4	Washing machine	C	-
5	Drying machine	C	-
6	Automatic pipette washer	B	1

Priority A: Equipment that is essential for the Project
Priority B: Equipment that is necessary but further study in Japan is required
Priority C: Equipment that will be supplied by Ghanaian side whenever it deems necessary

The table below shows the items on the requested equipment above that are excluded from the Project (priority C) and the reason why they were excluded.

Table 2-4 Equipment Excluded from the Project

Equipment Excluded from the Project	Reason Why Excluded
Microwave oven, Timer, Washing machine, Drying machine	Easily able to be procured in the local area
Blood culture system	Already purchased by Ghanaian side
Radioactive cell harvesting device	Special facilities required to develop and use the equipment
Gas chromatography-mass spectrometry	Facility planning does not include Clinical Pathology Department

(3) Review of the Requests

1) Facility Planning

Review results with regard to the final requests from Ghana are as follows.

A. Validity of Construction of the Project

The laboratories and offices in the existing facilities are very small, compare to the trend in recent years. The number of researchers has increased by about five percent each year while research activities are on the rise. Therefore, the part of the laboratories has been used as a research space. Obviously, there are insufficient spaces. In addition, there has been an increase in the breakdown of equipment due to decreased safety and voltage fluctuations caused by aging facilities and equipment. This situation has caused troubles in consistent research and experiments.

For this reason, the construction of the Project is thought to be highly valid.

B. Validity of Concentration on the Targeted Departments

The initial proposed requests needed facilities which could be used by all the nine departments. However, it is not appropriate to separate the departments between the project and the existing facilities in terms of efficiency and safety.

The final requests focus on the three departments of “Virology,” “Bacteriology” and “Immunology.” As the scale of these departments expands, there has been an increasing need for developing an environment for advanced researches and experiments. Therefore, it is highly valid that the Project targets them.

The Virology and Bacteriology departments in the existing facilities have faced remarkable shortages of offices. Therefore, it is also highly valid to target them from a perspective of developing a safe environment for research and experiment training.

Table 2-5 Number of People and Area in the Existing Offices (as of the survey in 2015)

Department	No. of Current Researchers (persons)	Area of Existing Office (m^2)	Area of Existing Office per Researcher (m^2/person)	Typical Area of Office (m^2/person)
Virology	33	95	2.9	10.0
Bacteriology	30	95	3.2	
Immunology	24	163	6.8	

C. Validity of Addition of BSL-3 Laboratories

There is deterioration in the facilities including cracking and molding of floors and walls in the P3 Laboratory building, which was constructed in 1999. Furthermore, the building has not been in a situation to provide a safe environment for advanced experiments due to a shortage of space and biosafety cabinets, and insufficient hand-wash stations, etc.

NMIMR sometimes had to conduct laboratory diagnosis in the P3 laboratories as part of emergency response to public health threats. As this example shows, it is necessary to develop an environment which makes it possible to perform sudden testing as needed. It is not good to close down the P3 Laboratories for its refurbishment for a long time.

It is valid that BSL-3 Laboratories will be included in the facilities in the Project.

D. Validity of the Common Molecular Biology Laboratory (PCR laboratory)

A common field called Molecular Biology has been growing in recent years. In this field, the common analytical equipment is used by the three departments; Virology, Bacteriology and Immunology.

It is expected to carry out equipment planning which pays attention to space saving and economic efficiency by establishing a new common laboratory to perform such analytical work in NMIMR. Moreover, making a plan of establishing a common laboratory is expected for preventing cumbersome experiment management and contamination (contamination caused by experiments) ,and to improve the efficiency and the quality of the experiments more than making a plan of establishing a Common Molecular Biology laboratory in each general department.

2) Equipment Planning

Equipment required conducting experiments, research, and training of the facilities in the Project will be planned. In equipment planning, the equipment will be selected with emphases on the following points.

a) Equipment for BSL-3 Laboratory, Virology laboratory, Bacteriology laboratory, Immunology laboratory, Molecular Biology laboratory and a Washing room in accordance with the facility planning
b) The replacement and the addition of the existing equipment
c) Equipment which can be operated and used for the analyses at NMIMR’s current technical level
d) Equipment which can be maintained (including outsourcing maintenance services) and replacement parts, reagents, and consumables that can be procured without difficulties. As far as advanced precision equipment is concerned, it needs to be accompanied with maintenance contracts with manufacturers or agents.

The table below shows the review results of requested equipment based on the policies described above.

A. BSL-3 Laboratories

The review results of the requested equipment for the BSL-3 Laboratories (common in Virology, Bacteriology, and Immunology departments) are as follows.

Table 2-6 List of Review Results of Requested Equipment for the BSL-3 Laboratories

No.	Name of Equipment	Priority	Request-ed Q'ty	Plann-ed Q'ty	No.	Name of Equipment	Priority	Request-ed Q'ty	Plann-ed Q'ty
A-1	Autoclave pass through type	A	2	2	A-10	Medical refrigerator	A	2	2
A-2	Biosafety cabinet (A)	A	4	4	A-11	Refrigerated centrifuge (A)	A	1	1
A-3	Pass box	A	2	2	A-12	Refrigerated centrifuge (B)	B	1	1
A-4	Sink with decontamination tank	A	2	2	A-13	Refrigerated microcentrifuge	A	1	1
A-5	Formaldehyde decontamination unit (A)	B	1	1	A-14	Inverted microscope	B	1	1
A-6	Formaldehyde decontamination unit (B)	B	1	1	A-15	CO2 incubator	A	2	3
A-7	Biosafety type autoclave	A	2	4	A-16	Incubator (37°C)	B	2	1
A-8	Deep freezer (-80°C) (A)	A	2	2	A-17	Shaking water bath	A	1	1
A-9	Freezer (-20°C)	A	2	2					

Each of the two BSL-3 Laboratories (hereinafter referred to as laboratories) needs an Autoclave pass through type and a Pass box. Two Biosafety cabinets (A) are required for each laboratory in the light of work efficiency and safety in the laboratory. As "chemical tanks" will not be provided to the sink with decontamination tank, the name of the equipment will be changed to "Sinks for BSL-3 Laboratories" and they will be installed in each Laboratory.

The simplified decontamination unit procured in 1999 cannot be used for the project due to aging. Thus, the Project includes one Formaldehyde decontamination unit (A). In addition, a set of Formaldehyde decontamination unit (B) including Formaldehyde analytical equipment and Formaldehyde concentration measuring equipment that is necessary to decontaminate laboratories will be considered.

A total of four biosafety Autoclaves (A) are required to sterilize used infectious materials, etc. in laboratories and to sterilize protective clothing used in the same laboratories.

A Deep freezer (-80°C) (A), a Freezer (-20°C) and a Medical refrigerator will be considered in each BSL-3 Laboratory in order to store specimens, reagents, etc. The existing Freezers and other equipment, which can be used in the days to come, will be transferred to and used in BSL-2 laboratories of the new facility.

As far as requested refrigerated centrifuges (A) are concerned, a Tabletop ultracentrifuge which is more suitable for centrifuging virus specimens as alternative equipment will be considered. A refrigerated microcentrifuge for the Virus laboratory will be considered because the laboratory has been facing a shortage of it. Also, a refrigerated centrifuge (B) will be considered in the bacteria laboratory, which has been facing a shortage of it. The name of this equipment on the planned equipment list will be changed to Refrigerated centrifuge (A).

As the current CO2 incubators are becoming obsolete, two units will be included for the virus laboratory and one for the bacteriology laboratory in the project. The virus laboratory in the project also needs inverted microscopes, incubators (37°C) and shaking water baths. Therefore, one unit of each will be included in the Project.

Since the following four of the seventeen items described above are equipment attached to the buildings, they will be included in the facility planning.

Table 2-7 Equipment Included in the Facility Planning

No.	Name of Equipment	Q'ty
A-1	Autoclave pass through type	2
A-2	Biosafety cabinet (A)	4

No.	Name of Equipment	Q'ty
A-3	Pass box	2
A-4	Sink with decontamination tank	2

B. Virology Department

The review results of requested equipment for the Virology Department are as follows.

Table 2-8 List of Review Results of Requested Equipment for the Virology Department

No.	Name of Equipment	Priority	Request-ed Q'ty	Plann-ed Q'ty	No.	Name of Equipment	Priority	Request-ed Q'ty	Plann-ed Q'ty
B-1	Portable pH meter	B	1	1	B-19	Medical refrigerator	A	4	4
B-2	Electronic balance	A	3	3	B-20	Freezer (-20°C)	A	4	4
B-3	Autoclave	B	4	5	B-21	Clean bench	B	1	1
B-4	Deep freezer (-80°C)	A	2	2	B-22	Freezer (-30°C)	A	4	4
B-5	Binocular microscope	A	2	2	B-23	Refrigerator/freezer	A	1	1
B-6	Refrigerated centrifuge (15/50ml)	B	3	4	B-24	Refrigerated centrifuge (32 tubes)	A	2	0
B-7	CO2 incubator	A	8	8	B-25	Shaker	B	1	1
B-8	Incubator (37°C)	A	3	3	B-26	Ice maker	B	1	1
B-9	Inverted microscope	A	3	3	B-27	Vacuum dryer	B	1	0
B-10	Biosafety cabinet (B)	A	6	6	B-28	Fluorescent microscope	A	1	1
B-11	Water bath	B	3	3	B-29	Magnetic stirrer	A	2	2
B-12	Microcentrifuge	A	1	1	B-30	Shaking water bath	B	2	1
B-13	Vortex mixer	B	3	3	B3-2	Ultracentrifuge	B	1	0
B-14	Elisa system	A	2	2	B-33	Flow cytometry (A)	A	1	1
B-15	Centrifuge (15/50ml)	A	2	2	B-34	Immunoassay serological analyzer	B	1	0
B-16	Refrigerated microcentrifuge	A	2	2	B-35	Fully automated nucleic material extraction system	B	1	1
B-17	Real-time PCR	B	2	0	Add'l	Micropipette	—	—	6
B-18	Nanodrop	B	1	1					

NMIMR's planning assumes that media preparation will be made in the common Washing room which is going to be installed in the facility planning. For media preparation will be needed a Portable pH meter, three Electronic balances, a Clean bench and two Magnetic stirrers as common equipment. As the project also need an Ice maker to be shared by the three departments, an Ice maker will be installed in the washing room.

Although the project needs seven Autoclaves in total, two units of the existing ones can continue to be used in the project. Therefore, the Project includes five units.

Since two units of the existing six deep freezers (-80°C) have not been working well due to aging, they will be renewed. As far as Medical Refrigerators, freezers (-20°C) and Freezers (-30°C) are concerned, the project require higher quality equipment which digitally displays temperature. Therefore, four of each type of equipment will be considered. Refrigerators/freezers which digitally display temperature are also needed in BSL-2 Laboratories, thus, one unit will be included in the Project.

The project needs three Binocular microscopes. As the existing one can continue to be used, the Project includes two units. Although NMIMR's planning states that five inverted microscopes are needed, two of the existing ones can continue to be used. Thus, three units will be considered. Two of the current Fluorescent microscopes have also caused troubles due to aging, so the Project includes one unit.

Although the project needs six Refrigerated centrifuges (15/50ml), two of the existing ones can be transferred to and used in the project. Therefore, the Project includes four units. As there is a

shortage of Microcentrifuges for polio virus isolation, the Project includes one unit. Furthermore, two BSL-2 Laboratories need Centrifuges (15/50ml) and Refrigerated microcentrifuges. Thus, two units of each type will be included in each laboratory. When it comes to requested refrigerated centrifuges (32 tubes), the aforementioned refrigerated centrifuges (15/50ml) is considered to be able to substitute them. Therefore, they will be excluded from the Project. The replacement of Ultracentrifuge in the P3 Laboratories will not be considered in the Project, because the Tabletop ultracentrifuge mentioned above, which is going to be used for the BSL-3 Laboratories, can substitute it. In the case where Ultracentrifuges used in BSL-2 Laboratories will be needed, NMIMR is supposed to procure them.
Since the existing CO2 incubators and Incubators (37°C) have caused troubles due to aging, the Project consideres eight CO2 incubators and three Incubators (37°C).
The Project considers six Biosafety cabinets (B) based on the facility planning.
Although the project need six Water baths and six Vortex mixers, three of the existing Water baths and three of the existing Vortex mixers continue to be used. Therefore, the Project includes three for each. In addition, as Elisa systems (Microplate washers and Microplate readers) are also required, two sets of them will be considered.
Although the Molecular Biology laboratory, which is going to be planned in the facility planning, needs four Real-time PCRs, two of the existing ones can continue to be used. Therefore, the Project will include two units but they will be deleted from the equipment list above because they are included in the equipment list of Common Molecular Biology laboratory. Also, a Nanodrop in this laboratory will be included as common equipment.
The Project needs two Shakers and two Shaking water baths. As one of the existing Shakers and Shaking water baths can continue to be used, the Project includes one Shaker and one Shaking water baths.
It is understood that the Vacuum dryer is not as high priority for the Virology Department. Thus, it will be excluded from the Project. In the meantime, it seems to be difficult to operate and maintain the requested Immunoassay serological analyzers in the light of its purpose of use (clinical chemical analysis). NMIMR is going to have a review and procure equipment that is more suitable for NMIMR's purpose of use and more cost-efficient. The procurement will be made by NMIMR.
Since the existing Flow cytometry(A) has caused troubles in experiments and research due to aging, the Project considers one Flow cytometry (A) to be used in the project. Moreover, a Fully automated nucleic material extraction system provided by another donor has been exclusively used by the other project. This situation has limited access to the system. Therefore, the Project considers one whose specifications are similar to the existing one. With the construction of the project and procurement of equipment, there will be a shortage of Micropipettes. Then, a set of Micropipette in each laboratory (six sets in total) will be considered in the Project.

C. Bacteriology Department

The review results of requested equipment for the Bacteriology Department are as follows.

Table 2-9 List of Review Results of Requested Equipment for the Bacteriology Department

No.	Name of Equipment	Priority	Requested Q'ty	Planned Q'ty	No.	Name of Equipment	Priority	Requested Q'ty	Planned Q'ty
C-2	Autoclave	A	4	4	C-18	Clean bench	A	4	4
C-3	CO2 incubator	A	3	3	C-19	Vortex mixer	A	4	4
C-4	Refrigerated centrifuge (15/50ml)	B	2	2	C-20	Freezer (-20°C)	B	4	4
C-5	Biosafety cabinet (B)	A	4	4	C-21	Deep freezer (-80°C)	B	5	5
C-6	Refrigerated microcentrifuge	B	3	3	C-22	Sonicator	B	1	1
C-7	Electronic balance (A)	A	1	1	C-23	Desicator	B	1	1
C-8	Electronic balance (B)	A	1	1	C-24	Stomacher	B	1	1
C-9	Electronic balance (C)	A	3	3	C-25	Ice maker	A	1	0
C-10	Colony counter	A	5	5	C-26	Drying hot oven (B)	A	1	0
C-11	Incubator (37°C)	A	4	4	C-27	Binocular microscope	A	4	4
C-12	Incubator (22°C)	A	1	1	C-28	Digital coagulator	B	1	1
C-13	Incubator (44°C)	A	3	3	C-29	Twin incubator	B	1	0
C-14	Medical refrigerator	A	4	4	C-30	Fluorescent microscope	A	1	1
C-15	Water bath	A	3	3	C-31	Fume extractor	A	1	1
C-16	Centrifuge (15/50ml)	B	3	3	Add'l	Hotplate magnetic stirrer	—	—	1
C-17	Shaker incubator	A	3	3	Add'l	Micropipette	—	—	4

There are four laboratories (STI laboratory, Pathological laboratory, Food and Water laboratory and Environment Animal laboratory) in the Bacteriology Department. Each laboratory needs Autoclaves to sterilize infectious waste.

As CO2 incubators installed in 1999 cannot be transferred to and used in the project due to aging, one unit will be considered in each of the three laboratories, except the Environment Animal laboratory. Furthermore, the Project requires four Incubators (37°C), an Incubator (22°C) and three Incubators (44°C).

Although the Project needs three Refrigerated centrifuges (15/50ml), the existing one can continue to be used. Therefore, the Project considers two. Four Refrigerated microcentrifuges are also required, so the Project includes three and the existing one transferred to the project. A Centrifuge (15/50ml) procured in 1979 has been shared by all the departments. However, it cannot continue to be used in the project due to aging. The Project requires one for each of the STI laboratory, Pathological laboratory and Food and Water laboratory (three in total).

Four Biosafety cabinets (B) will be considered based on the facility planning. There is no Biosafety cabinet (B) which can be transferred to the project.

The project need Electronic balances of different specifications. Thus, an Electronic balance (A), an Electronic balance (B) and three Electronic balances (C) will be planned. Currently, there is only one Colony counter that can be transferred to the project. This situation has caused difficulties in training. Therefore, the Project includes five.

Each laboratory requires Medical refrigerators and Freezers (-20°C). The Project includes four for each type. NMIMR's planning expects that five Deep freezers (-80°C) will be needed in the future. Any of these Deep freezers can neither be transferred from the existing facilities nor continue to be used.

Each of the four laboratories needs a Clean bench to be used for media preparation. In the meantime, the four laboratories and the Media Preparation room require five Vortex mixers in total. However, the current one can continue to be used, so the Project includes four units.

As Stomachers, Desicators, Sonicators and Fume extractors cannot be used any longer due to aging. Thus, one for each type of the equipment will be planned. The Project needs two Digital coagulators, so the Project adds one.

When it comes to requested Ice makers and Dry hot ovens (B), they will be planned as common equipment in the Washing room and do not treat them as equipment solely for the Bacteriology Department. As far as Shaker incubators, NMIMR continues to use the existing one and it will not be considered in the Project.
Since the existing Binocular microscopes are aging, four units will be considered. The Project need microscopes for training. One of the four microscopes for training will be a Teaching microscope. At the same time, there is a shortage of Fluorescent microscopes. Thus, one unit for STI laboratory will be considered.
The Media Preparation room in the project requires Hotplate magnetic stirrers. Therefore, one unit will be included in the Project. It is expected that the Project will also be faced with a shortage of Micropipettes. Then, a set of Micropipette in each laboratory (four sets in total) will be considered in the Project.

D. Immunology Dept.

The review results of requested equipment for the Immunology Department are as follows.

Table 2-10 List of Review Results of Requested Equipment for the Immunology Department

No.	Name of Equipment	Priority	Requested Q'ty	Planned Q'ty	No.	Name of Equipment	Priority	Requested Q'ty	Planned Q'ty
D-1	Binocular microscope	A	4	4	D-18	Microcentrifuge	B	3	3
D-2	Hotplate magnetic stirrer	A	2	2	D-19	pH meter	A	2	2
D-3	Electronic balance	A	2	2	D-20	Inverted microscope	A	2	2
D-4	Centrifuge (15/50ml)	A	1	1	D-21	Fluorescent microscope	A	3	3
D-5	Refrigerated centrifuge (15/50ml)	B	2	2	D-23	Freezer (-20°C)	A	4	4
D-6	Biosafety cabinet (B)	A	3	3	D-24	Freezer (-30°C)	A	4	4
D-7	Elisa system	B	2	2	D-25	Deep freezer (-80°C)	A	3	3
D-8	Fume extractor	A	1	1	D-26	Dissecting microscope	A	1	1
D-9	Medical refrigerator	A	3	3	D-27	Cell counter	B	1	1
D-10	Refrigerator/freezer	B	4	4	D-28	Refrigerated microcentrifuge	B	1	1
D-11	EliSpot reader	B	1	1	D-29	Water bath	B	1	1
D-12	Clean bench	A	1	1	D-30	Micropipette	B	6	6
D-13	Plate shaker	A	2	2	D-31	Sonicator	B	1	1
D-14	Vortex mixer	A	5	5	D-32	Chemical cabinet	B	2	2
D-15	Flow cytometry	A	1	1	D-33	Ultrasonic cleaner	B	1	1
D-16	Autoclave	A	2	2	D-34	Nitrogen tank	B	1	1
D-17	Shaking water bath	A	2	2	D-35	Confocal microscope	B	1	0

Since different types of microscopes have caused troubles in experiments, research and training due to aging, the Project includes four Binocular microscopes, two Inverted microscopes, three Fluorescent microscopes and a Dissecting microscope. Requested Confocal microscope require technicians with considerable experiences and skills for their setup and maintenance. If technicians without sufficient experiences and skills used Confocal microscope in an incorrect way, they might suffer body damage including burn injury and retina damage by laser. In Ghana or the neighboring countries, there are no manufacturers having agencies which can provide sufficient support required after equipment is procured. Therefore, Confocal microscope will be excluded from the Project.
Although the project needs five Hotplate magnetic stirrers, three of the existing ones can continue to be used. Therefore, the Project includes two. As the existing Electronic balances are also aging, two units in total will be planned.
Since the current Centrifuges (15/50ml) and Refrigerated microcentrifuges have caused troubles in experiments and research due to aging, one unit for each type of the equipment will be planned. Also, two Refrigerated centrifuges (15/50ml) and three Microcentrifuges will be considered, because the existing ones are aging.
Although the Project needs five Biosafety cabinets (B), two of the existing ones can continue to be

used. Therefore, the Project includes three. As the Fume extractors procured in 1979 have not been working well due to aging, and one unit will be considered. In addition, the project need Clean benches, so one unit will be planned.
NMIMR's planning assumes that the project will need three sets of Elisa systems (Microplate washers and Microplate readers). However, a set of the existing one can continue to be used. Therefore, the Project considerers two sets. As the existing EliSpot readers and Flow cytometries have caused troubles in research due to aging, one unit for each type of the equipment will be replaced.
Five units are required for each of Medical refrigerators and Refrigerators/freezers. However, the existing two Medical refrigerators and one Refrigerator/freezer can continue to be used. Therefore, the Project considers three Medical refrigerators and four Refrigerators/freezers.
The existing Plate shakers, Autoclaves, Shaking water baths and pH meters used in the existing facilities are aging. Thus, two units for each type of the equipment will be considered. Although the Project also needs seven Vortex mixers, two of the current ones can be transferred and used. Therefore, the Project includes five units.
Six Freezers (-20°C) are required in the project. However, two of the existing ones can continue to be used. Therefore, four units will be planned. As there are no Freezers (-30°C) that can be transferred due to aging, four units will be included in the Project. Although six Deep freezers (-80°C) will be needed in the future, three of the existing ones can continue to be used, so it will be considered three units. At the same time, the Project plans Chemical cabinets that are short by two.
As there are shortages of Cell counters and Sonicators, it will be planed one for each. Although the project also need two Water baths and two Ultrasonic cleaners, one of the existing Water baths and one of the current Ultrasonic cleaners can be transferred and used, so it will be considered one unit for each.
Two Nitrogen tanks will be needed in the days to come. However, since the existing one can continue to be used, so the Project includes one. With the construction of the project there will also be a shortage of Micropipettes. Therefore, the Project plans six sets.

E. Common Molecular Biology laboratory (PCR Laboratory) (Common Equipment)

The review results of requested equipment for the Molecular Biology laboratory are as follows.

Table 2-11 List of Review Results of Requested Equipment for the Molecular Biology Laboratory

No.	Name of Equipment	Priority	Requested Q'ty	Planned Q'ty	No.	Name of Equipment	Priority	Requested Q'ty	Planned Q'ty
[F-1	Pre-PCR laboratory]				F-2-5	Laminar flow biosafety cabinet	A	1	1
F-1-1	Medical refrigerator	A	3	3	[F-3	Post-PCR laboratory]			
F-1-2	Freezer (-20°C)	A	3		F-3-1	Medical refrigerator	A	2	2
F-1-3	Refrigerated microcentrifuge	A	3	3	F-3-2	Freezer (-20°C)	A	2	
F-1-4	Vortex mixer	A	3	3	F-3-3	Gel imaging system	A	2	2
F-1-6	PCR workstation	B	3	3	F-3-4	Computer with network connection	B	1	0
F-1-7	Micropipette	A	6	6	F-3-5	Electrophoresis apparatus	A	10	6
F-1-8	Laminar flow biosafety cabinet	B	3	3	F-3-6	Vortex mixer	A	3	3
Add'l	Water bath	-	-	1	F-3-7	Laminar flow biosafety cabinet	A	1	1
Add'l	Heat block	-	-	2	F-3-8	Refrigerated microcentrifuge	A	1	1
[F-2	PCR laboratory]				Add'l	Electronic balance	-	-	1
F-2-1	Thermal cycler	B	4	4	Add'l	Autoclave	-	-	1
F-2-2	Real-time PCR	B	2	2	[F-5	Sequencing]			
F-2-3	Medical refrigerator	A	1	3	F-5	DNA sequencer (next generation)	B	1	0
F-2-4	Micropipette	A	3	3					

[F-1 Pre-PCR Laboratory]

When it comes to requested Medical refrigerators and Freezers (-20°C), it will be planned three "Refrigerators/freezers" as alternative equipment, in order to make more effective use of a space for their installment. The three units of Refrigerated microcentrifuges will be substituted by "Mini-microcentrifuges". The facility planning needs three Vortex mixers and three PCR workstations. Six sets of Micropipettes are also required in the light of work in the Pre-PCR laboratory. Although three Laminar flow biosafety cabinets are requested, the laboratory in question does not deal with infectious materials. Therefore, more appropriate three "Clean benches" as alternative equipment will be planned.

Furthermore, it is expected that the Pre-PCR laboratory will need a Water bath and two Heat blocks. Therefore, they will be considered in the Project.

[F-2 PCR Laboratory]

Although the project needs six Thermal cyclers, two of the existing ones can be transferred and used. Therefore, the Project considers four units. Four units of Real-time PCRs are required in the Project. However, two of the existing ones can be transferred and used, so the Project includes two units. As Medical refrigerators and Micropipette are needed, three Medical refrigerators and three sets of Micropipettes will be planned. As far as requested Laminar flow biosafety cabinets are concerned, they will be substituted by "PCR workstation" in line with the equipment used in the PCR laboratory in the existing facilities.

[F-3 Post-PCR Laboratory]

As far as requested Medical refrigerators and Freezers (-20°C) are concerned, they will be substituted by "Refrigerators/freezers", in order to make more effective use of a space for their installment. There is a need for Gel imaging systems, so two units will be planned. Although ten Electrophoresis apparatuses are requested, the Project considers two units for each department (Virology, Bacteriology and Immunology). Therefore, six units in total will be included in the Project. Three Vortex mixers will be planned as common equipment. A Laminar flow biosafety cabinet for Post-PCR laboratory is requested. However, the laboratory in question does not deal with infectious materials. Thus, a "Clean bench" that is more suitable as alternative equipment will be planned. Although a Refrigerated microcentrifuge is also requested, they will be substituted by "Mini-microcentrifuges" that are more appropriate for it. Besides the afore-mentioned equipment, it seems that Electronic balances and Autoclaves will be needed. Then, one unit for each type of equipment will be considered. When it comes to a requested Computer with network connection, it will be part of the facilities, so it will be excluded from the equipment list.

[F-4 Sample Preparation Room]

Equipment requested for the Sample preparation room based on the facility planning is as follows.

Table 2-12 List of Review Results of Requested Equipment for the Sample Preparation Room

No.	Name of Equipment	Priority	Requested Q'ty	Planned Q'ty	No.	Name of Equipment	Priority	Requested Q'ty	Planned Q'ty
[F-1	Pre-PCR laboratory 2nd Stage]				Add'l	PCR workstation	—	—	1
F-4-1	Sample homogenizer	A	2	1	Add'l	Mini-microcentrifuge	—	—	1
F-4-2	Medical refrigerator	A	1	1	Add'l	Micropipette	—	—	1
F-4-3	Freezer (-20°C)	A	1		[PCR laboratory 2nd Stage]				
F-4-4	Water bath	A	1	1	Add'l	Thermal cycler	—	—	2
F-4-5	Heat block	A	2	1	Add'l	Medical refrigerator	A	1	1
F-4-6	Clean bench	A	1	1	Add'l	PCR workstation	—	—	1
Add'l	Vortex mixer	—	—	1	Add'l	Micropipette	—	—	1

DNA sequencers (next generation) requested in [F-5 sequencing] are highly likely to be considered by another Japanese project. Therefore, it will be excluded from the Project.

F. Washing Room (Common Equipment)

The review results of requested equipment for the Washing room are as follows.

Table 2-13 List of Review Results of Requested Equipment for the Washing Room

No.	Name of Equipment	Priority	Requested Q'ty	Planned Q'ty	No.	Name of Equipment	Priority	Requested Q'ty	Planned Q'ty
G-1	Drying hot oven (A)	A	3	2	G-3	Water distiller	A	2	1
G-2	Drying hot oven (B)	A	3	2	G-6	Automatic pipette washer	B	1	2

As the large-capacity Dry hot ovens (A) and the small-capacity Dry hot ovens (B) procured in 1979 and 1999 are aging. So two units for each type will be planned as common equipment in the Washing room. In the same way, the Project requires two Water distillers. However, the current one can be transferred and used. Therefore, one unit will be included in the Project. The existing Automatic pipette washers are also aging, so two units (one unit in each washing room) will be considered in the Project.

The tables below show the list of planned equipment for the BSL-3 Laboratories and the each research departments based on what has been described above.

Table 2-14 BSL-3 Laboratory

No.	Name of Equipment	Q'ty	No.	Name of Equipment	Q'ty
A-5	Formaldehyde decontamination unit (A)	1	A-11	Tabletop ultracentrifuge	1
A-6	Formaldehyde decontamination unit (B)	1	A-12	Refrigerated centrifuge (A)	1
A-7	Autoclave (A)	4	A-13	Refrigerated microcentrifuge	1
A-8	Deep freezer (-80°C) (A)	2	A-14	Inverted microscope	1
A-9	Freezer (-20°C)	2	A-15	CO2 incubator	3
A-10	Medical refrigerator	2	A-16	Incubator (37°C)	1
			A-17	Shaking water bath	1

Table 2-15 Virology Department

No.	Name of Equipment	Q'ty	No.	Name of Equipment	Q'ty
B-1	Deep freezer (-80°C) (A)	1	B-14	Water bath	2
B-2	Freezer (-20°C)	4	B-15	Microcentrifuge	1
B-3	Medical refrigerator	4	B-16	Vortex mixer	3
B-4	Refrigerated microcentrifuge	2	B-17	Microplate washer	2
B-5	Inverted microscope	3	B-18	Microplate reader (A)	2
B-6	CO2 INCUBATOR	8	B-19	Centrifuge (15/50ml)	2
B-7	Incubator (37°C)	3	B-20	Freezer (-30°C)	4
B-8	Shaking water bath	2	B-21	Refrigerator/freezer	1
B-9	Autoclave (B)	3	B-22	Shaker	1
B-10	Deep freezer (-80°C) (B)	1	B-23	Fluorescent microscope	1
B-11	Binocular microscope	2	B-24	Flow cytometry (A)	1
B-12	Refrigerated centrifuge (B) (15/50ml)	4	B-25	Fully automated nucleic material extraction system	1
B-13	Biosafety cabinet (B)	6	B-26	Micropipette	6

Table 2-16 Bacteriology Department

No.	Name of Equipment	Q'ty
C-1	Freezer (-20°C)	4
C-2	Medical refrigerator	4
C-3	Refrigerated microcentrifuge	3
C-4	CO2 incubator	3
C-5	Incubator (37°C)	4
C-6	Electronic balance (B)	1
C-7	Electronic balance (C)	3
C-8	Autoclave (B)	4
C-9	Deep freezer (-80°C) (B)	5
C-10	Binocular microscope	3
C-11	Refrigerated centrifuge (B) (15/50ml)	2
C-12	Biosafety cabinet (B)	4
C-13	Water bath	3
C-14	Vortex mixer	4
C-15	Centrifuge (15/50ml)	3
C-16	Clean bench	4

No.	Name of Equipment	Q'ty
C-17	Fluorescent microscope	1
C-18	Electronic balance (A)	1
C-19	Colony counter	5
C-20	Incubator (22°C)	1
C-21	Incubator (44°C)	3
C-22	Shaking water bath	3
C-23	Sonicator	1
C-24	Desicator	1
C-25	Stomacher	1
C-26	Teaching microscope	1
C-27	Digital coagulator	1
C-28	Fume extractor	1
C-29	Hotplate magnetic stirrer	1
C-30	Micropipette	4

Table 2-17 Immunology Department

No.	Name of Equipment	Q'ty
D-1	Deep freezer (-80°C) (A)	3
D-2	Freezer (-20°C)	4
D-3	Medical refrigerator	3
D-4	Refrigerated microcentrifuge	1
D-5	Inverted microscope	2
D-6	Shaking water bath	2
D-7	Electronic balance(B)	2
D-8	Autoclave (B)	2
D-9	Binocular microscope	4
D-10	Refrigerated centrifuge (B) (15/50ml)	2
D-11	Biosafety cabinet (B)	3
D-12	Water bath	1
D-13	Microcentrifuge	3
D-14	Vortex mixer	5
D-15	Microplate washer	2
D-16	Microplate reader (A)	1
D-17	Centrifuge (15/50ml)	1

No.	Name of Equipment	Q'ty
D-18	Clean bench	1
D-19	Freezer (-30°C)	4
D-20	Refrigerator/freezer	4
D-21	Fluorescent microscope	3
D-22	Sonicator	1
D-23	Fume extractor	1
D-24	Hotplate magnetic stirrer	2
D-25	Microplate reader (B)	1
D-26	EliSpot reader	1
D-27	Plate shaker	2
D-28	Flow cytometry (B)	1
D-29	pH meter	2
D-30	Stereomicroscope	1
D-31	Cell counter	1
D3-2	Micropipette	6
D-33	Chemical cabinet	2
D-34	Ultrasonic cleaner	1
D-35	Nitrogen tank	1

Table 2-18 Common Molecular Biology Laboratory

No.	Name of Equipment	Q'ty
[Pre-PCR]		
F-1	Clean bench	3
F-2	Vortex mixer	3
F-3	Refrigerator/freezer	3
F-4	Micropipette	6
F-5	Mini-microcentrifuge	3
F-6	PCR workstation	3
F-7	Water bath	1
F-8	Heat block	2
[PCR]		
F-9	Medical refrigerator	3
F-10	Nanodrop	1
F-11	Micropipette	3
F-12	PCR workstation	1
F-13	Thermal cycler	4
F-14	Real-time PCR	2
[Post-PCR]		
F-15	Electronic balance (B)	1
F-16	Autoclave (B)	1
F-17	Clean bench	1

No.	Name of Equipment	Q'ty
F-18	Vortex mixer	3
F-19	Refrigerator/freezer	2
F-20	Mini-microcentrifuge	1
F-21	Gel imaging system	2
F-22	Electrophoresis apparatus	6
[Pre-PCR 2nd Stage]		
F-23	Clean bench	1
F-24	Water bath	1
F-25	Vortex mixer	1
F-26	Refrigerator/freezer	1
F-27	Micropipette	1
F-28	Mini-microcentrifuge	1
F-29	PCR workstation	1
F-30	Heat block	1
F-31	Sample homogenizer	1
[PCR 2nd Stage]		
F-32	Medical refrigerator	1
F-33	Micropipette	1
F-34	PCR workstation	1
F-35	Thermal cycler	2

Table 2-19 Washing Room

No.	Name of Equipment	Q'ty
G-1	Portable pH meter	1
G-2	Electronic balance (B)	2
G-3	Electronic balance (C)	1
G-4	Autoclave (B)	2
G-5	Water bath	1
G-6	Clean bench	1

No.	Name of Equipment	Q'ty
G-7	Ice maker	1
G-8	Magnetic stirrer	2
G-9	Drying hot oven (A)	2
G-10	Drying hot oven (B)	2
G-11	Water distiller	1
G-12	Automatic pipette washer	2

2-2-2-2 Layout Plan for Site and Facilities

(1) The Land and Current Usage

NMIMR is located in the southeastern part of large University of Ghana campus. The University is located on a hill in the northern part of Accra city, the capital. The University's Faculty of Medicine has a master plan called the "Medical Complex", and NMIMR is recognized as part of the plan. In the western part of NMIMR, a hospital is being constructed, which is funded by an Israeli fund.

NMIMR stands on a piece of land with a gentle downward slope toward the southeast. Its existing buildings are configured in a flat part of the land in the west. A proposed site of the Project is a vacant plot in the northeastern part of the NMIMR complex which has a slope whose height difference is approximately 5m.

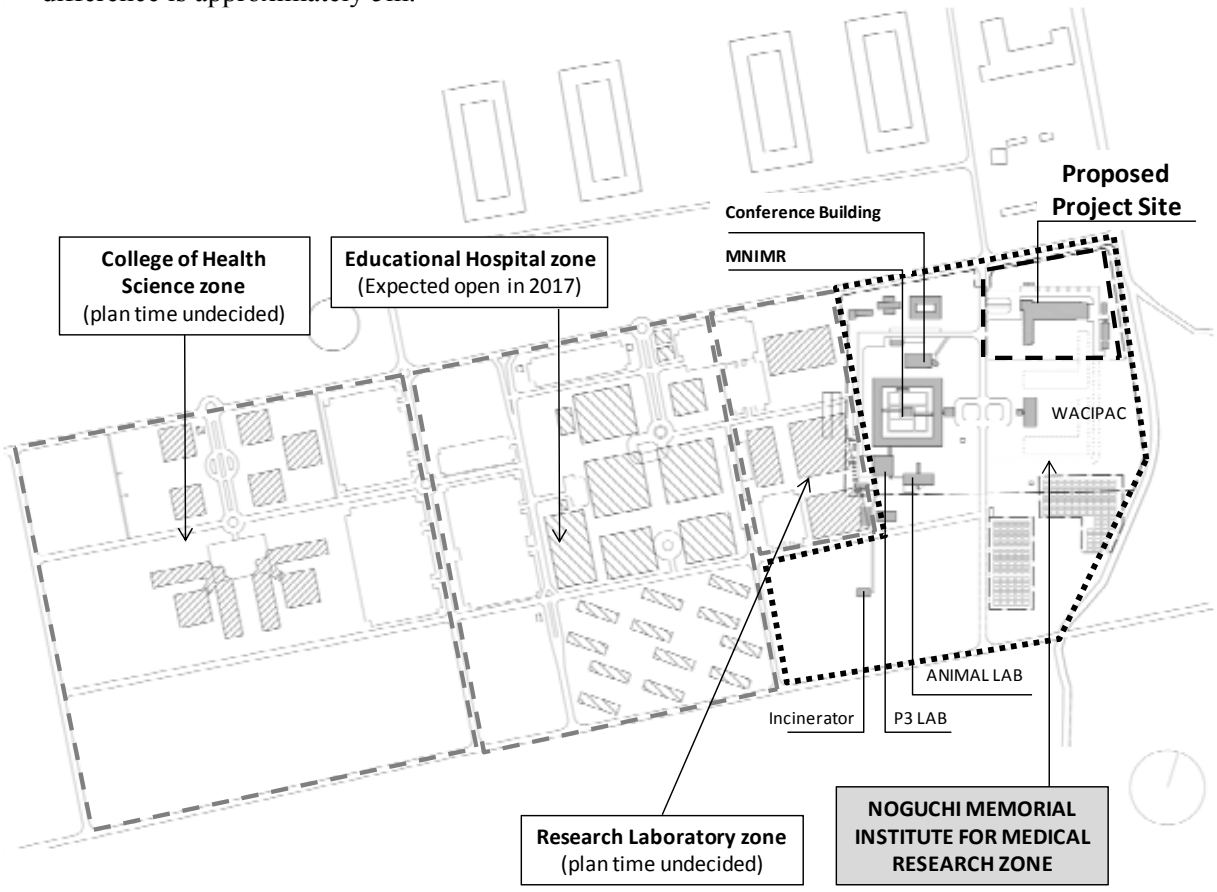


Figure 2-1 Proposed Project Site and Master Plan of College of Health Science

(2) Layout Plan

An L-shaped building will be employed based on the following considerations: visibility from the road in the north, which is the main route to approach the building from Accra city center; and for blending in with the existing scenery in the NMIMR complex. Also for aesthetic reasons, the L-shaped building and WACIPAC building walls will have the same setback line.

Water Tower is planned to be set up close to the existing city water pipe that supplies it the water, also, on the north side where the land base is higher. For the existing scenery, sub-station, a machine building, and a septic tank will be set up behind the building for noise, vibration, and the service flow.

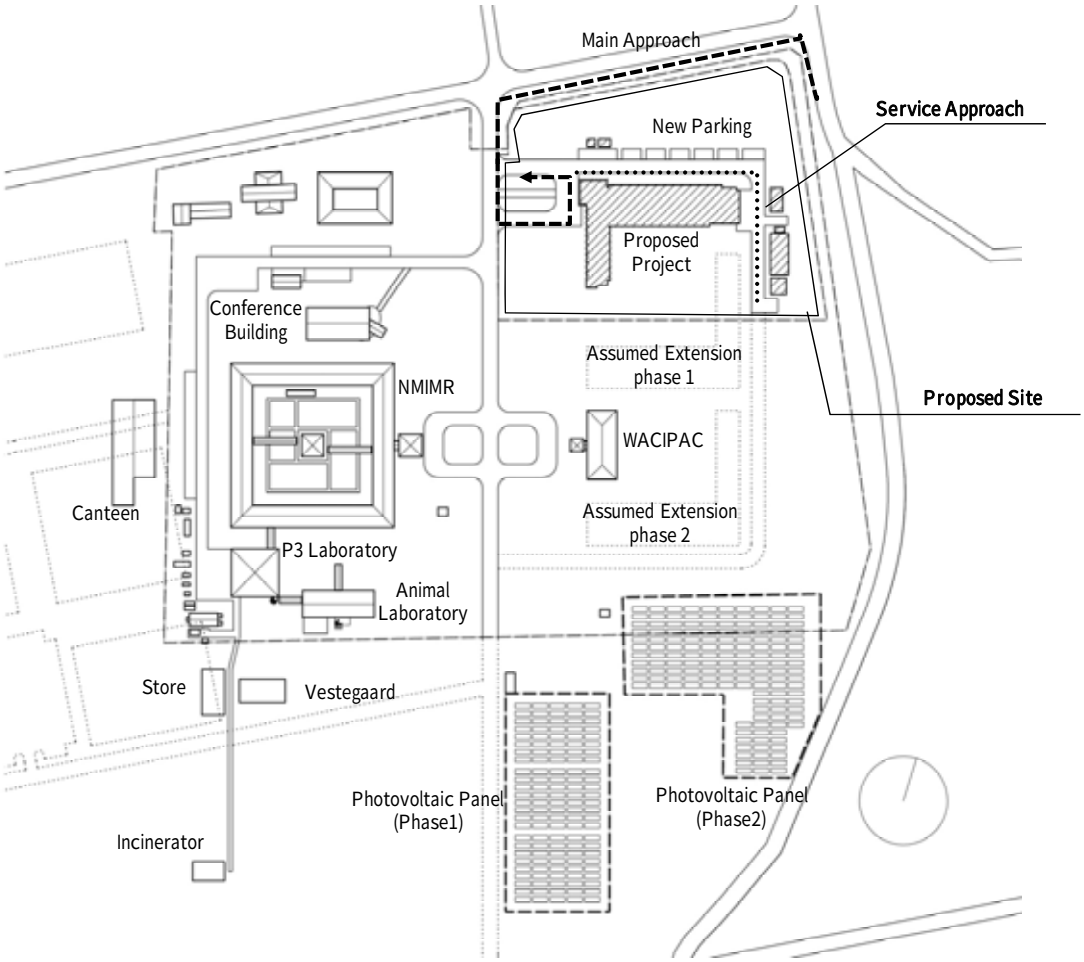


Figure 2-2 Facility Layout Plan in NMIMR

(3) Conditions Surrounding Construction Site and Current Infrastructure

1) Conditions surrounding construction site

According to our geotechnical survey, our proposed construction site has a downward slope from the northwest to the southeast with over 5m height difference. Under the northern side of the construction boundary, the city water pipe with a diameter of 900mmφ is buried. The University's administration department has instructed us not to build anything within 15m from the pipe. Therefore, sufficient distance from the pipe will be ensured.

2) Electric Power

Electric power will be supplied by Electricity Company of Ghana (ECG). It will be branched off from the 11kV main high-voltage cable on campus to the sub-station of the planned building. The required electric power for the Project is 400kVA.
The installation cost of extending electricity supply to the sub-station will be borne by Ghanaian side.

3) IP Phone

The optical fiber cable will be extended from an existing IP telephone apparatus in the main building to the Main Terminal Board (MTB) in the proposed building. A required number of extensions for the Project are approximately 100 lines.
The cost of extending the telephone line will be borne by Ghanaian side.

4) Water Supply

Water is supplied by Ghana Water Company (GWC). GWC provides the university water through the city water main pipe whose diameter of 100mmφ. A new pipe that is branched

out from the main one delivers water to the reservoir of the proposed facilities. The required retention of water per day for the Project is 30m^3.
The cost of installing a new water pipe connected to the reservoir will be borne by Ghanaian side.

5) Drainage

The drainage from the septic tank will be released into a drain pipe in diameter of 400mmφ. The university's pipe is installed along the road in the eastern side of the proposed building. Rainwater on site will be released into a U-shaped gutter installed along the same road.

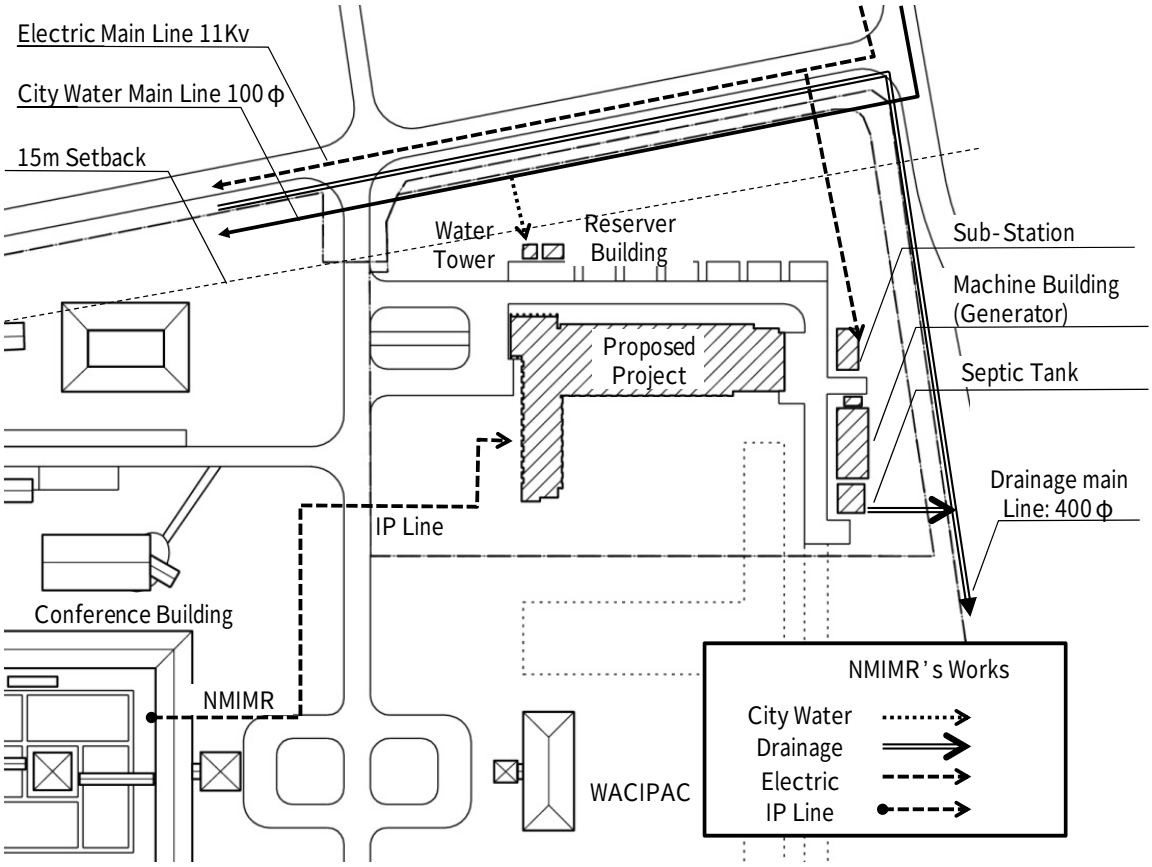


Figure 2-3 Infrastructure on Proposed Site

(4) Effective Use of Existing Buildings

Preparatory Survey has confirmed that the three departments scheduled to move to the proposed building are not the only ones with a problem of insufficient space for research and experiments. After the completion of this building to move three departments in, a large vacant space will be left in the existing buildings. In order to use this space effectively, the building will be renovated to meet the remaining departments' needs for space. The cost of renovation will be borne by Ghanaian side.

(5) Future Master Plans for NMIMR

A research complex is expected to be established by expanding in the locations indicated by the Assumed extension phase 1 and phase 2 on the figure 2-2 above; thereby it will be surrounding the courtyard following the example of existing NMIMR.

2-2-2-3 Architectural Plan

(1) Facility Composition

Our project plans to accommodate the following facilities:

Table 2-20 Project Facility

Wing/Floor	Facility	
	West Wing	North Wing
2FL	EV machine room	Machine room and BSL machine room
1FL Common Laboratory		Washing room 02; Freezer room 02; Cold room 02
Bacteriology	Head of department office; Professors' offices	Pathology lab; STI lab; Food water, and microorganism lab; Environment and animal lab; Bacteriology storage area; Media preparation room
Immunology	Head of department office; Professors' offices	-
Virology	Head of department office; Professors' offices	Virology lab; Virus isolation room (for influenza); Cell culture lab (for influenza); Virus isolation room (for polio); Cell culture lab (for polio); Virology storage area
Common Molecular Biology Laboratory (PCR room)	-	Master mix room; PCR rooms 1-2; PCR corridors 1-3; Pre PCR rooms 1-3; Post PCR room; Pre PCR room (the second stage); Genetic analyzer room
BSL-3 Laboratories		Administrative office; Reception; Corridors; Anterooms 1 & 2; Air lock rooms 1 & 2; BSL labs 1 & 2
Common Area	Project rooms, Other areas (Corridors, Elevator hall, Common storage, Air conditioning fan rooms)	Various areas (Corridors, Lounge area, Toilets, Common storage, Air conditioning fan rooms)
GFL Common Laboratory	-	Washing room 01; Freezer room 01; Cold room 01
Bacteriology	-	Bacteriology research assistant rooms; Bacteriology technician rooms; Bacteriology researcher rooms
Immunology	-	Immunology technician rooms; Serology storage; Serology lab; Cell culture lab; Parasite culture lab; Immunology instrument lab; Immunology research assistant rooms; Immunology researcher rooms
Virology	-	Virology technician rooms; Virology research assistant rooms; Virology researcher rooms
Common Area	Entrance hall; Administrative offices; Student rooms, Seminar rooms; Various areas (Corridors, Elevator hall, Common storage, Air conditioning fan rooms)	Seminar rooms and other areas (Corridors, Lounge, Toilets, Common storage, Air conditioning fan rooms)
Subsidiary Facilities	East Side ：Transformer sub-station; Generator rooms; Workshops; Septic tank	
	North Side ：Water tower, Water reservoir	

(2) Setting of Facility Scale

1) Faculty Office

In the Project, adequate research space is calculated by multiplying the floor area assigned to each academic position by the number of researchers.

(a) Increasing Tendency in the Researchers

Based on the trend that the number of researchers is increasing (124.2% increase in 6 years between 2010 and 2015), the number of researchers on campus in 2020; three years after the completion of the Project is estimated.

Space for laboratory will be determined based on a researcher survey regarding types of experiments and observation of the existing labs, along with a layout of required equipment.

Table 2-21 Increasing Trends in the Number of Researchers 1

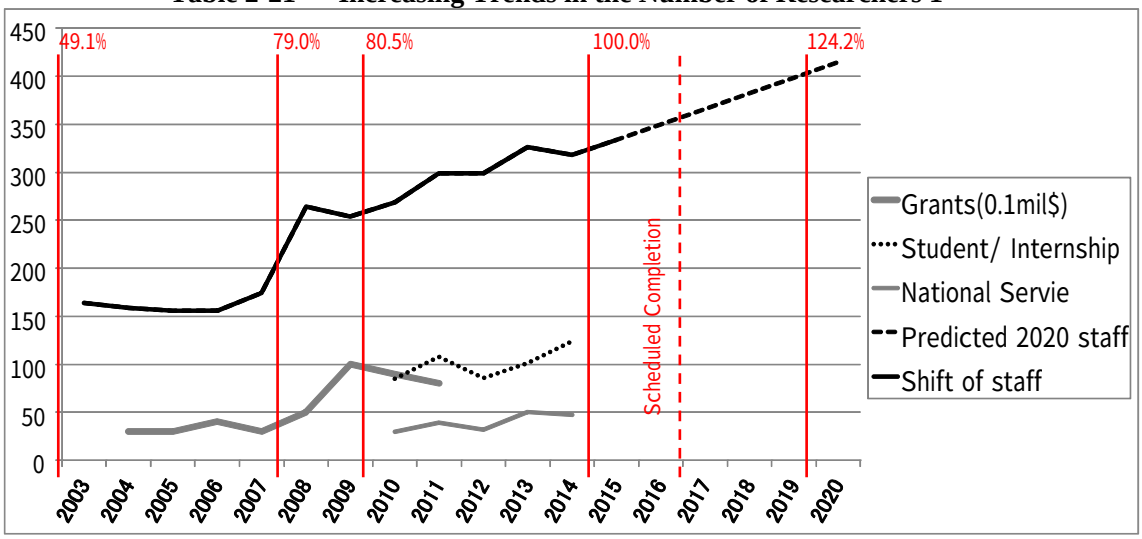


Table 2-22 Increasing Trends in the Number of Researchers 2

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Number of Researchers	269	299	299	326	318	334					415
Ratio of Increase (%)	100					124.2					
Increasing Tendency (%)						100					124.2

(b) Calculating the Scale of the Faculty Office

According to the statistics prepared by Japan's New Office Promotion Committee, a workspace is generally designed to be 10m^2 per person. The same standard will be applied to the faculty office. However, the said figure includes a common space. Therefore, a figure that will be adopted as our standard is 7m^2 per person. Then, a square measure for a person will be given according to his/her academic position, and each square measure will be multiplied by the estimated number of researchers for the year 2020 to calculate a total office area. A square measure given to the department head will be equivalent to the existing research space given to one researcher, which is 25m^2. For a research fellow, a 7m^2 area will be given; for a technician, a 5m^{2}area; and for a research assistant, a 4m^2 area. For students and interns, a 3m^2 area will be given per person, and this area will be shared by the three departments.

Table 2-23 Number of Researchers（as of March, 2015）

Department	Department head & Professor	Research Fellow	Technician	Research Assistant	Student & Others	Secretaries & Others	Total
Virology	1	9	2	21	7	6	46
Bacteriology	2	2	4	22	16	2	48
Immunology	2	5	5	12	5	1	30
Total	5	16	11	55	28	9	124

Table 2-24 Estimated Number of Researchers（as of year 2020）

Department	Department head & Professor	Research Fellow	Technician	Research Assistant	Student & Others	Secretaries & Others	Total
Virology	2	12	3	27	9	8	61
Bacteriology	3	3	5	28	20	3	62
Immunology	3	7	7	15	7	2	41
Total	8	22	15	70	36	13	164

Table 2-25 Estimated Office Space per Researcher (as of year 2020; m^2)

Department	Department head & Professor	Research Fellow	Technician	Research Assistant	Student & Others	Secretaries & Others	Total
Unit Area	25	7	5	4	3		
Virology	50	84	15	108	27	Included in the area allocated to the department head	284
Bacteriology	75	21	25	112	60		293
Immunology	75	49	35	60	21		240
Total	200	154	75	280	108		817

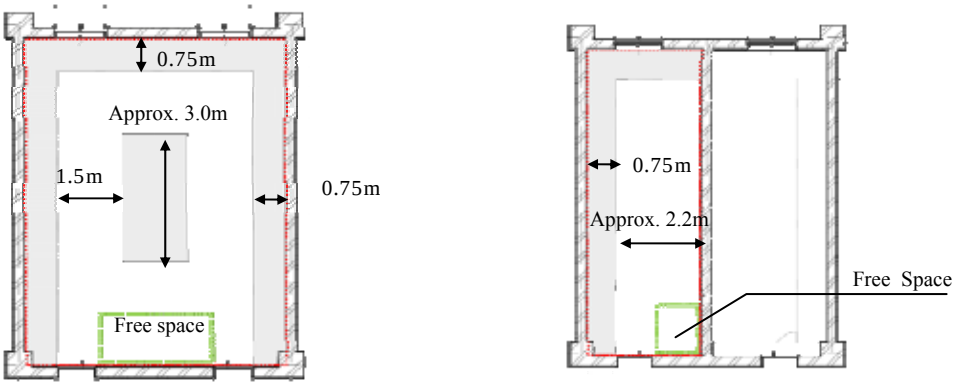
2) Laboratories

・ General Laboratory

A standard square measure unit of a laboratory will be determined based on the size of a lab table, a workspace and the like. According to contents of the research, scales, required equipment, etc., the standard unit will be modified; thereby laboratories will be designed suitable for each department.

In the Project, a laboratory island workbench is considered a standard unit. The standard unit of a laboratory has a total space of 6.4m × 8.0m, with a workbench of 1.5m in width in the center, a workspace of 1.5m in width, and the work table of 0.75m in depth against the walls.

Since required equipment and workspace will vary depending on the contents of research and experiments, to respond to any situation, a variety of standard unit will be available such as turning the standard unit into half of its size (3.2m × 8.0m).



Standard unit
6.4m × 8.0m (Approx. 51m^2)

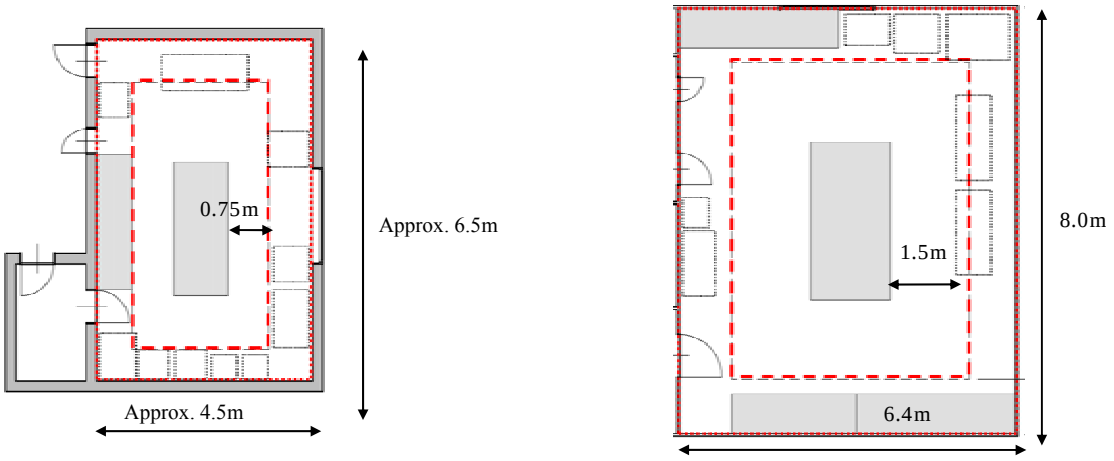
Half unit
3.2m × 8.0m (Approx. 26m^2)

Figure 2-4 Standard Unit for General Laboratory

・ BSL-3 Laboratory

The BSL-3 Laboratory is a facility designed for experiments and research. When a researcher handles a material which falls into one of the four categories of high-risk materials according to the Laboratory Biosafety Manual prepared by WHO, researcher must use the BSL-3 Laboratory. Such materials include pathogenic agents with high to medium potency. The BSL-3 Laboratory, therefore, has more stringent requirements than general laboratories, and more rigorous specifications apply to its research equipment. Such requirements include restricted access, air tightness, the autoclave, the biosafety cabinet, and the sophisticated air conditioning system.

The size of each BSL-3 Laboratory is to be approximately 8.0m x 6.4m. This size allows for a work space of 1.5m in both sides of a laboratory table, as well as a space for equipment like the biosafety cabinet and the work table around the walls, as shown in Figure2-5.



P3 Lab　　Proposed BSL-3 Lab in the Project

Figure 2-5　Proposed BSL-3 Laboratory

・ Molecular Biology Common Laboratory (PCR Room)

The Polymerase Chain Reaction Room (PCR Room) is a laboratory shared by the three departments. In this lab, the DNA extracted in an experiment conduced in the BSL-3 Laboratory or the general laboratory will be handled. By amplifying the DNA through polymerase chain reaction, reviews and further experiments will be conducted.

The PCR Room needs to be divided into sections to accommodate different experiments. Therefore, its standard unit size for one PCR Room should be three units combined.

The floor area of each type of rooms planned above is indicated in the Table 2-26 below.

Table 2-26 Area Table

ADVANCED TECHNOLOGY CENTER GFL		AREA(m2)
BACTERIOLOGY	BACTERIOLOGY RA-OFFICE	102.72
	BACTERIOLOGY RF-OFFICE	53.17
	BACTERIOLOGY TECH. OFFICE	25.68
IMMUNOLOGY	CELL CULTURE LAB	27.05
	IMMUNOLOGY RA-OFFICE	51.36
	IMMUNOLOGY RF-OFFICE	53.35
	IMMUNOLOGY TECH. OFFICE	25.68
	INSTRUMENT LAB	53.92
	PARASITE CULTURE LAB	26.96
	SEROLOGY LAB	51.36
	SEROLOGY STO.	25.68
VIROLOGY	ANTE-COLD RM. 01	16.75
	COLD RM. 01	15.84
	FREEZED RM. 01	15.75
	VIROLOGY RA-OFFICE	102.72
	VIROLOGY RF-OFFICE	77.04
	VIROLOGY TECH. OFFICE	25.68
COMMON SPACE	WASHING RM. 01	25.68
	ADMI. OFFICE	52.16
	DATA PROCESSING UNIT RM.	26.12
	LOUNGE 01	44.90
	SEMINAR RM. 01	51.36
	SEMINAR RM. 02	53.17
	STUDENT INTERNSHIP NATIONAL	102.72
	ENTRANCE PORCH	95.26
	ENTRANCE ANTEROOM	37.59
	ENTRANCE HALL	110.85
	PANTORY	16.76
	WC(HC)	5.72
	WC(M) 01	23.74
	WC(W) 01	22.47
	SK 01	1.28
	CORRIDOR 1	131.75
	CORRIDOR 2	67.67
	STAIRCASE 1	24.65
	STAIRCASE 2	29.49
	STAIRCASE 3	29.28
	STO. 01	7.90
	BALCONY (N_GF)	96.52
	BALCONY (S_GF)	88.20
	BALCONY (W_GF)	44.68
	CHAMBER RM1	2.10
	CHAMBER RM2	2.55
	EPS 1	3.80
	EPS 2	2.85
	EV	15.10
	FAN RM. 01	22.18
	FAN RM. 02	33.05
	PS	15.17
	PS	1.50
	PS	2.34
	PS	1.26
	GFL TOTAL	2,042.53

ADVANCED TECHNOLOGY CENTER 1FL		AREA(m2)
BACTERIOLOGY	BACTERIOLOGY STO.	25.68
	EMVIRO. ANIMAL LAB	25.68
	FOOD AND WATER LAB	51.36
	HEAD DEP. 02	25.68
	MEDIA PREPARATION RM.	25.68
	PATHOLOGICAL LAB	52.97
	PROF. RM. 02	25.68
	STI LAB	51.36
IMMUNOL	HEAD DEP. 01	25.68
	PROF. RM. 01	25.68
VIROLOGY	CELL CULTURE (INFULENZA)	27.49
	CELL CULTURE (POLIO)	27.67
	HEAD DEP. 03	25.68
	PROF. RM. 03	25.68
	VIROLOGY LAB 01	51.36
	VIROLOGY LAB 02	51.36
	VIROLOGY STO.	25.68
	VIRUS ISOLATION (INFLUENZA)	25.68
	VIRUS ISOLATION (POLIO)	25.68
BSL-3 LABO.	BSL-3 LAB 01	52.80
	BSL-3 LAB 02	52.80
	DESK	7.48
	CORRIDOR	25.11
	ANTE RM. 1	4.05
	ANTE RM. 2	4.05
	AIR LOCK RM. 1	4.91
	AIR LOCK RM. 2	4.91
	OFFICE	21.55
	AUTO CLAVE 01	4.46
	AUTO CLAVE 02	4.46
	MAINTENANCE	43.07
	BSL VOID	2.15
	BSL VOID	2.15
PCR LABO.	GENETIC ANALYZER RM.	8.00
	MASTER MIX RM.	19.26
	PCR RM. 1	32.10
	PCR RM. 2	6.05
	POST PCR RM.	27.00
	PRE PCR 01	5.82
	PRE PCR 02	5.76
	PRE PCR 03	7.68
	PRE PCR RM.	13.92
	PCR CORRIDOR 1	9.52
	PCR CORRIDOR 2	5.20
	PCR CORRIDOR 3	12.06
COMMON SPACE	ANTE-COLD RM. 02	20.99
	COLD RM. 02	12.16
	FREEZED RM. 02	13.02
	STO. 03	7.00
	WASHING RM. 02	27.49
	LOUNGE 02	45.78
	PROJECT RM.	51.36
	STO. 02	15.00
	HALL	71.79
	WC(M) 02	23.74
	WC(W) 02	22.47
	SK 02	1.28
	CORRIDOR 3	76.32
	CORRIDOR 4	112.38
	STAIRCASE 1	36.23
	STAIRCASE 2	28.70
	STAIRCASE 3	28.97
	BALCONY (N_1F)	96.52
	BALCONY (S_1F)	88.20
	BALCONY (W_1F)	44.68
	CHAMBER RM3	2.56
	CHAMBER RM4	2.10
	EPS3	3.80
	EPS4	2.99
	EV (30person) 2900x3450	15.10
	FAN RM. 03	23.56
	FAN RM. 04	22.18
	PS	1.50
	PS	2.34
	1FL TOTAL	1,908.26

MAIN BUILDING 2FL		AREA(m2)
	EV MR	16.80
	FILTER CHAMBER RM1	3.00
	LOFT	135.24
	MR	213.43
	FILTER CHAMBER RM2	6.30
	MR (BSL3)	230.60
	STAIRCASE 03	41.34
	2FL TOTAL	646.71

MAIN BUILDING AREA TOTAL	4,597.50

MACHINE TOWER/SUB STATION		AREA(m2)
SEPTIC TANK		58.40
MACHINE TOWER	WORKSHOP	63.70
	WC	5.12
	WC	4.04
	STO.	12.32
	GENERATOR RM	76.50
	CHAMBER RM	23.00
	BLOWER RM	11.55
SUB STATION	HTV PANEL	26.15
	LTV PANEL	26.30
	TRANSFORMER	25.20
	TOTAL	332.28

WATER SUPPLY		AREA(m2)
	WATER TOWER	16.00
	RESERVER	24.00
	TOTAL	40.00

TOTAL FLOOR AREA(m2)	4,969.78

(3) Floor Planning

1) Faculty Office and General Laboratory

The West Wing and the North Wing will be accessible through the entrance located in the northwest. The West Wing will have rooms to serve office works and administrative purposes. The North Wing will have rooms to serve experiment and research purposes. In this way, it will give a clear division of usage in this facility. In order to ensure safety for experiments, the office/administration zone and the laboratory zone will be completely separate.
Outdoor units for the air conditioning system will be placed to use the mechanical balcony for plumbing purposes. This arrangement will ensure the ease of building maintenance. In the mechanical balcony, louvers will be installed for sunlight shading as well as to prevent theft of expensive research equipment and bioterrorism.

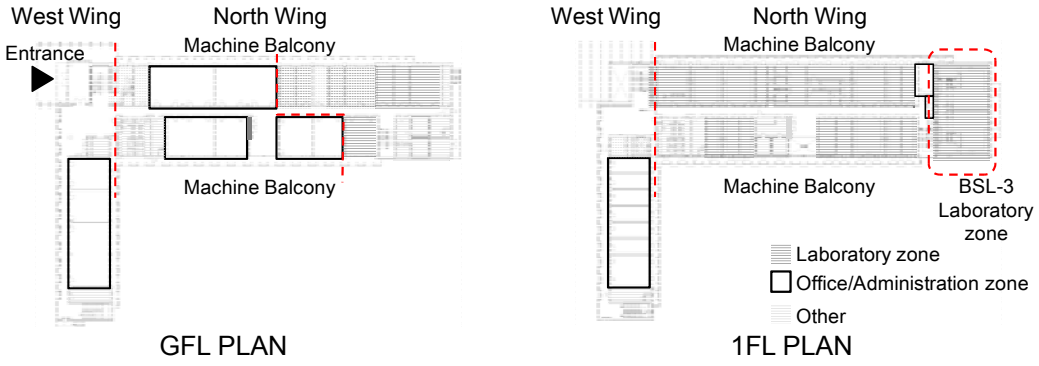


Figure 2-6 Split Between Research and Lab Sections

2) BSL-3 Laboratory

The BSL-3 Laboratory will be located in the back and east on the first floor of the North Wing not to prevent emergency evacuation from any rooms. Access to the BSL-3 Laboratory will be controlled by office and desk. This area of security check will be designated as the general area. The adjacent area will be designated as the laboratory area, and bio-security there will be ensured. Walls and ceilings in the laboratory area will be water resistant. For the ease of cleaning, steel panels will be used for the walls and ceilings, and the PVC sheet will be used as the flooring material. The ceiling height will be 2.7m, for the maximal functionality and economy.
Two BSL-3 Laboratories will be set up for two departments where its demand is the highest: One for virology and one for bacteriology.
Their maintenance will be easier by designing the machine room on the floor directly above, which specifically set for the BSL-3 laboratories.

Table 2-27 Access to the BSL-3 Laboratory

<table>
<tr><th>General area</th><th colspan="4">Laboratory area</th></tr>
<tr><td rowspan="2">(a) Office & Desk</td><td>(b) Corridor</td><td>(c) Anterooms 1 & 2</td><td>(d) Air-lock room 1 & 2</td><td>(e) BSL-3 Laboratories 1 & 2</td></tr>
<tr><td colspan="4">(f) Maintenance Space</td></tr>
</table>

(a) Office & Desk

Access to the BSL-3 Laboratories will be managed by the staff. The progress of experiments and the state of air conditioning will be monitored.

(b) Corridor

The laboratory area has the corridor in order to mark a clear boundary between the two areas with the two air tight doors. The autoclave is to be used to handle waste material after experiments, and the pass box is to be used to handle specimens and the like. There will be washrooms at or near the end of the corridor.

(c) Anteroom

In the anterooms, researchers put on protective clothes for experiments and make preparations for experiments. The door to the laboratory will automatically close. The

interlock system will be installed to prevent both doors from opening at the same time.

(d) Air-lock Room

Air-lock rooms will be provided in order to maintain the differential pressure between the anteroom and the BSL-3 Laboratory. Doors will automatically close, same as those of the anterooms. The interlock system will also be installed. An emergency shower system (or a chemical liquid for emergency shower system) will be installed for biohazard.

(e) BSL-3 Laboratory

The BSL-3 Laboratories will have a work table at the center. Each laboratory will be 6.4 m ×8.1m, based on an estimated working traffic line and a space required for two biosafety cabinets and other equipment. Near the entrance to the laboratory, a sink will be installed for hand-washing for disinfection. Windows will be installed for the staff to monitor the safety in the laboratory and visitors to observe a procedure.

(f) Maintenance Space

The corridor will be provided to maintain the air conditioning system and steel panels in the laboratory.

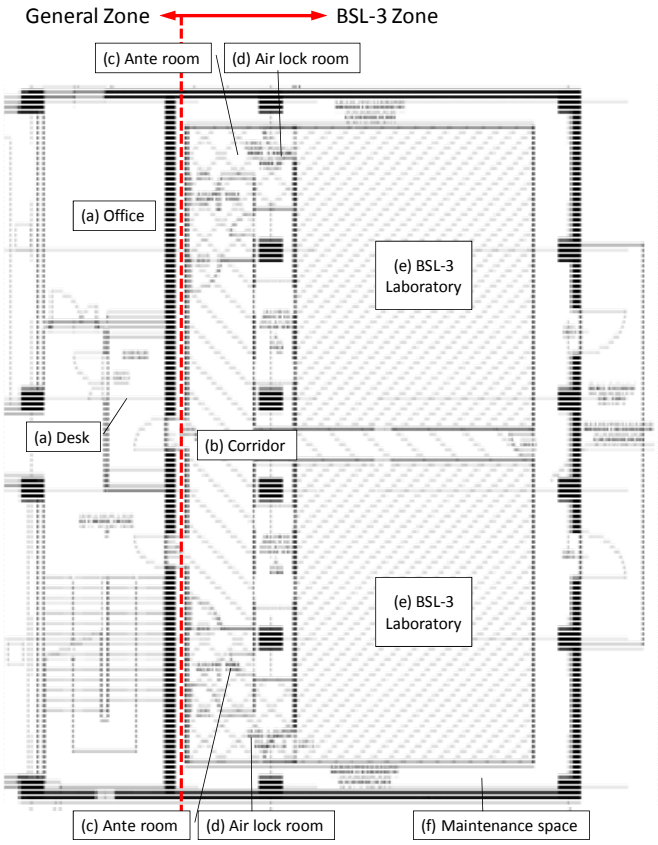


Figure 2-7 BSL-3 Laboratory Layout

3) Molecular Biology Common Laboratory (PCR Room)

On the north side of the first floor of the North Wing, the Polymerase Chain Reaction Room (PCR Room) will be planned.

Table 2-28 Experiment Sequence in PCR Room

i.	Master mix Room		
ii.	Pre PCR Room 1	Pre PCR Room 2	Pre PCR Room 3
iii.	PCR Room1		
iv.	a) Post PCR Room	b) Genetic Analyzer Room	c-1) Pre PCR Room (the second stage)
			c-2) PCR Room 2

The Molecular Biology Common Laboratory (PCR Room) will be shared by the three departments. Research equipment to be used at each department will be managed in Soft Component category. An experiment will flow in one way, and an electronic lock will be installed on the door to the corridor, thereby ensuring a smooth operation of an experiment and maintenance.

i. The Master mix room will be used exclusively for preparing the master mix in order to prevent any contamination. A DNA sample prepared by another laboratory will be handled via a pass box placed in the Corridor 1 by the PCR room, and delivered directly to the pre PCR room.

ii. The Pre PCR room will be used to mix a DNA sample and a primer prepared by the master mix. The pre PCR room will be provided for each of the three departments to prevent any contamination.

iii. In the PCR room, samples prepared in the pre PCR room will be used for experiments

iv. a) In the post PCR room, post PCR analyses by using the electrophoresis apparatus.
b) In the genetic analyzer room, a DNA sequencer is used for analyses.
c) In the Pre PCR room (the second stage) and the PCR room 2, PCR experiments will be conducted again. In the Post PCR room, their analyses will be done.

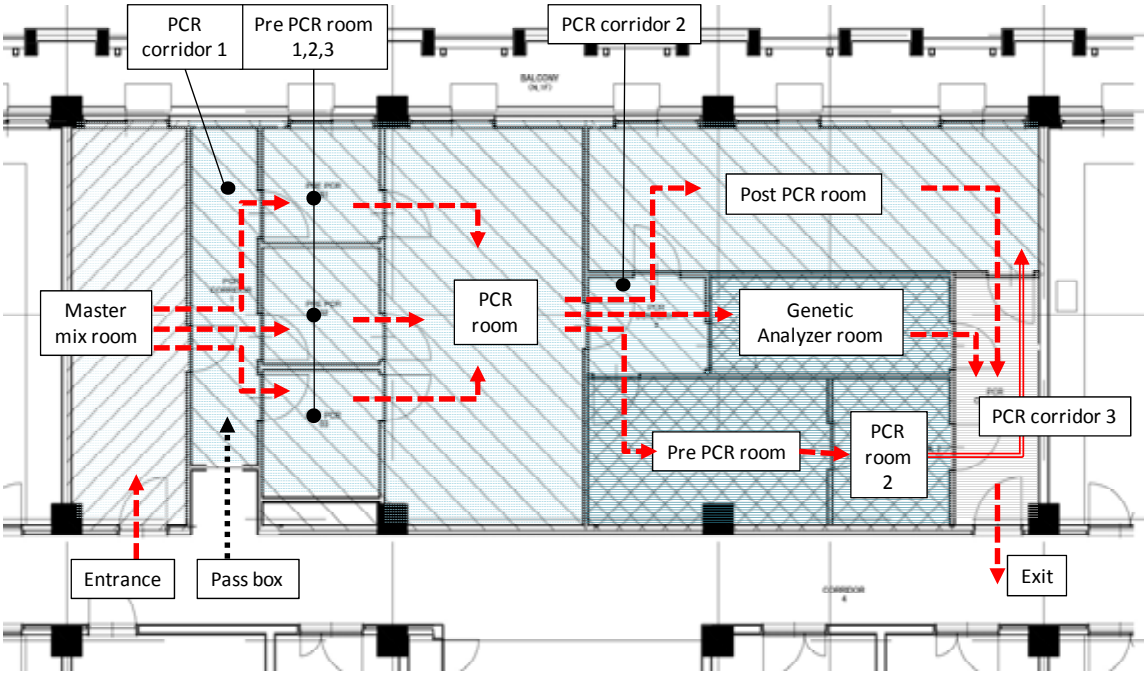


Figure 2-8 PCR Room Layout

(4) Section Plan

The standard floor height will be 4.0m. The standard ceiling height for rooms will be 2.7m. Above the ceiling will be secured for easy installation of pipes and the like. Above the ceiling, outdoor units for the air conditioning system used in the laboratories will be placed. Ventilation louver panels will be installed on the side where dirt and dust do not directly reach the panels so that the effect of the Harmattan will be minimized. The Project will ensure no leakage and sufficient draining gradient on the deck roof.

The section which houses the BSL-3 Laboratories will have the 5.0m floor height and the 2.7m ceiling height. By providing a large ceiling space, larger ducts for air supply and exhaust will be ensured to be installed. On the floor directly above the BSL-3 Laboratories, there will be a machine room dedicated to them.

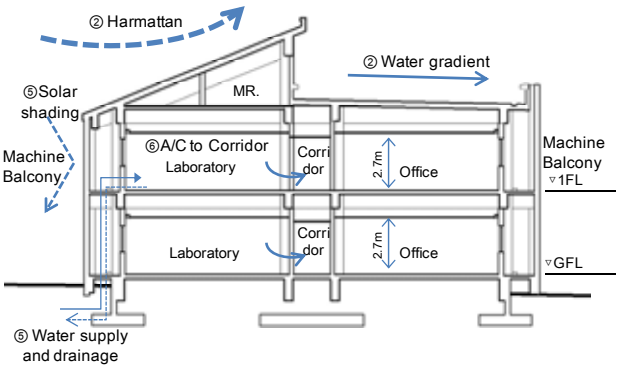


Figure 2-9
North Wing Section: Lab Area

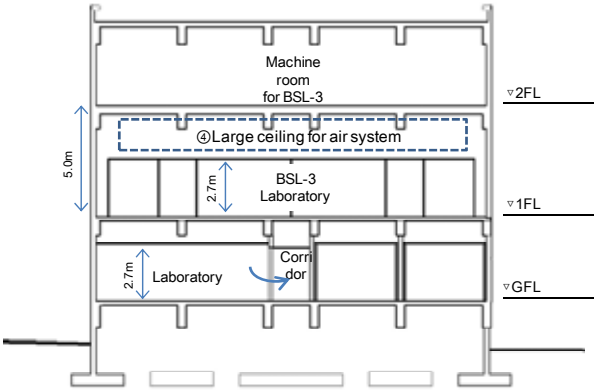


Figure 2-10
North Wing Section: BSL-3 Lab Area

(5) Subsidiary Buildings

Water Tower will be built on the highest point in the proposed site, where the main pipe for city water is installed. The Water Tower, along with a water receiver tank, will be on the northwest side of our proposed building, supplying water to the building. The tank will have the gravity water supply system. Therefore, it will be set up on a place 10m higher than the first floor of the main building. The sub-station and the machine building will be set up near the existing infrastructure, which is on the northeastern side of NMIMR. Each of the structures will have a pitched roof just like the main building, so that the new structures will fit in with existing ones in NMIMR. Any leakage on the roof will ensure to be avoided. The machine building will have a private power generator as well as a workshop where the maintenance staff can work. A septic tank will be set up in the lowest point in the Project's plan, which is in the southwest. After being treated properly, wastewater will be discharged into the main sewer pipe installed on the east side of NMIMR.

2-2-2-4 Structure Planning

(1) Outline of Structure Planning

The project is a two-story L-shaped building. The basic spans for the West Wing will be 6.4 m in Y direction and 8.0m in X direction. In the east and west sides of the building, cantilevered balconies with a length of 1.5m or 2.2m will be built.
The basic span for the North Wing will be 6.4m in X direction and 8.0m+2.4m+8.0m in Y direction. In the north and south sides of the building, cantilevered balconies with a length of 1.5m will be built.
Reinforced concrete structure will be used for the building structure to provide superior seismic resistance, wind resistance, durability, and shielding ability. Maximal freedom in floor planning will be ensured by adopting the rigid frame structure which would make any alterations in partition wall arrangements easier in future renovations. Reinforced concrete (RC) walls will be placed around the high bio-safety leveled or equivalent rooms by the architectural planning reason. RC walls including these will be used as structural walls (earthquake-resistant walls) which shall be properly placed to prevent torsion of the building. For inside partition walls and exterior walls of the building, concrete blocks walls (partially dry partition walls) will be used following the local standards and economic efficiency.
The building will be used for research purposes. In particular, a high bio-safety level is expected for laboratories. In this sense, it shall be a significant building with the same nationally designated security level as a hospital, fire station, or police office. Therefore, the importance factor of I=1.4 will be considered.

(2) Outline of Foundation Planning

The Project ground has a very dense sandy gravel layer below the surface layer, at about the mid-point of over the 40N value. The deeper dig, the larger the N value gets. Over 4m below the ground level, the N value indicates over 50. Spread foundation (direct foundation) will be adapted as the foundation plan due to the building scale.

(3) Outline of Structural Design

The Project will ensure that no long-term deleterious deformation will be caused by the fixed and live load in the vertical direction. It will also ensure that the building will not collapse nor crumble due to seismic and wind loads in the horizontal direction. Horizontal force used for stress analysis of the structural frame will be determined based on Ghana's Code. The calculation method defined in Japanese Standard will be adapted. In the calculation of horizontal load bearing capacity, it will be ensured that this building's capacity is well beyond the capacity that takes importance factor into account.

(4) Design Load

1) Fixed Load

The fixed load will be calculated based on the weight of structural and finishing materials, and fixtures for the building such as pipes and ducts.

2) Live Load

The live load will be determined based on the actual state of things or based on Ghana's Code for "The Seismic Design of Concrete Structure and BS EN 1991". The loads not mentioned in these two standards will be referred to Japanese Standard.

Table2-29 Live Loads in Major Rooms (N/m^2)

Room	Floor & Small Beam	Frame & Ground Work	Earthquake
Faculty office / Laboratory	3,900	2,600	1,600
Administration Office	2,900	2,100	1,100
Seminar Room	2,900	2,100	1,100

3) Wind Load

According to the wind record for Ghana and its surrounding areas, the peak wind speed has reached as high as 20m per second due to a seasonal wind called Harmattan, which occurs for several days in a year. With the wind speed of 20m per second, the design wind pressure comes to 800N/m^2 as calculated according to the Japanese Standard. This will be adopted as the design wind pressure for the structural frame.

4) Seismic Load

The seismic design in Ghana is drawn according to the Code for "The Seismic Design of Concrete Structure (1990)".

A) Design Seismic Load in Ghana

According to the Code, Ghana can be divided into four regions (Figure 2-11). Accra falls into Zone 3 and this makes the design surface acceleration 0.35g＝3.5m/sec^2. Considering "amplification factor" and "site coefficient" defined in the Code, the design seismic load will be 1.05g (= 0.35g×2.5×1.2), which is almost equivalent to 1.0g, the value used in the calculation of horizontal load bearing capacity in Japanese Standard.

B-1) Seismic Capacity in Ghana

According to the Code, the reciprocal of "structure behavior factor" K, 1/K, which is equivalent factor of Ds in Japanese Standard is defined to consider the seismic capacity in Ghana. In the case of a reinforced concrete structure, 1/K for each structural type will be as follows. They will be about 70% of Ds in Japanese Standard.

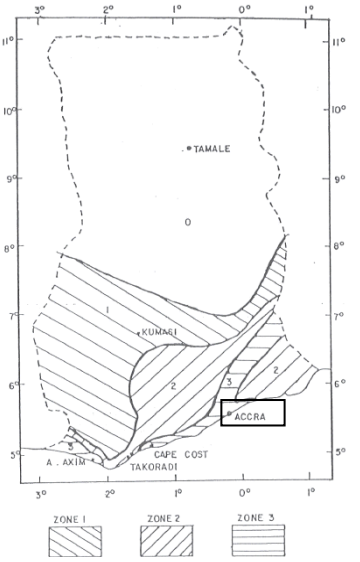
Rigid frame (without structural walls) :1/K= 0.20 (Ds= 0.3, in Japanese Standard)
Rigid frame with structural walls :1/K= 0.25 (Ds= 0.3~0.4, in Japanese Standard)

B-2) Considering the Importance Factor

According to the Code, the seismic capacity after taking into account of the importance factor I= 1.4 will be as follows. They will be equivalent to the Ds in Japanese Standard.

Rigid frame (without structural walls) :1/K×I= 0.20×1.4= 0.28 0.3
Rigid frame with structural walls :1/K×I= 0.25×1.4= 0.35 0.3~0.4

As a consequence, the seismic load in Ghana's Code is similar to the one in Japanese Standard and so is the seismic capacity after taking into account of the importance factor. Therefore, the calculation of horizontal load bearing capacity, according to Japanese Standard will be adopted for the design of the Project.



Seismic Zone	Assigned Horizontal Design Ground Acceleration:A g (Unit of gravityy)
0	0
1	0.15
2	0.25
3	0.35

The Global Seismic Hazard Assessment Program (GSHAP)

Figure 2-11 Seismic Zones

(5) Construction Material

1) Concrete

Ordinary concrete will be used. The designed strength will be C20 – C30 (20 – 30 N/mm^2). It should be noted that the local test piece is in a cubic form. Therefore, it should be translated into the strength in a cylinder form, and the Project will use that strength in the calculation. The mixing plan will be determined by mixing tests on site.

2) Reinforcing Bars

Deformed reinforcement; Mild Steel (fy=250N/mm^2) or High Yield Steel (fy=460N/mm^2) will be used.

2-2-2-5 Utility Plans (Electrical and Mechanical Systems)

(1) Electrical Equipment Design

1) Electrical Power Supply Facility

Electrical power will be supplied to proposed facilities via a transformer in a sub-station after being stepped down to 415V/200V. Power outage is frequently experienced on campus, and, in some periods, power outage is planned daily. Given that the Project includes laboratories of importance, two generators with 400kVA will be set up as a back-up energy source.
The AVRs (voltage stabilizers) will be placed for each load group. The UPS (Uninterruptible Power Supply) will be placed as an attachment to relevant equipment.

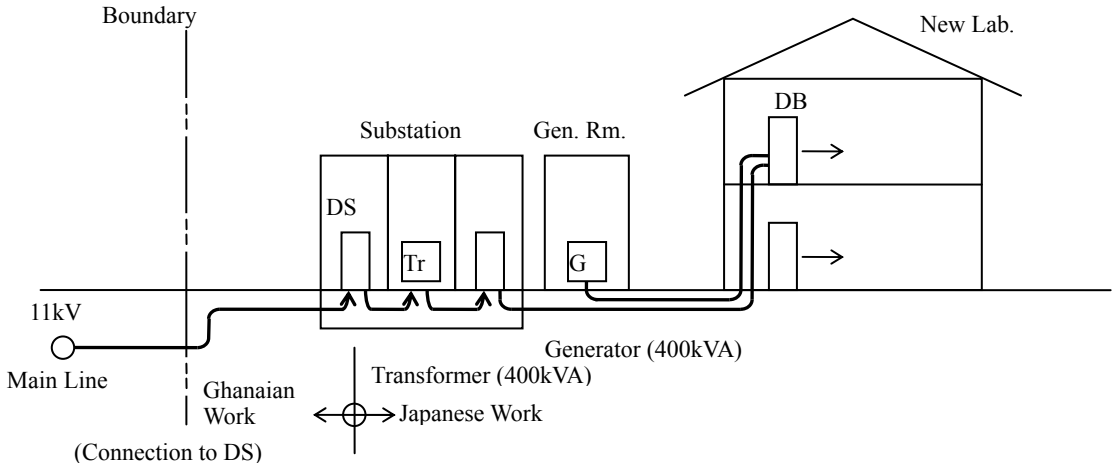


Figure 2-12 Outline of Electrical System

2) Lighting Fixture

Fluorescent light will be the major lighting fixture for the facilities. LED lighting will be used partially for the facilities.

3) IP Phone System

Telephone cables will be extended to each room from the Main Terminal Board (MTB). The cost of telephone sets will be borne by Ghanaian side.

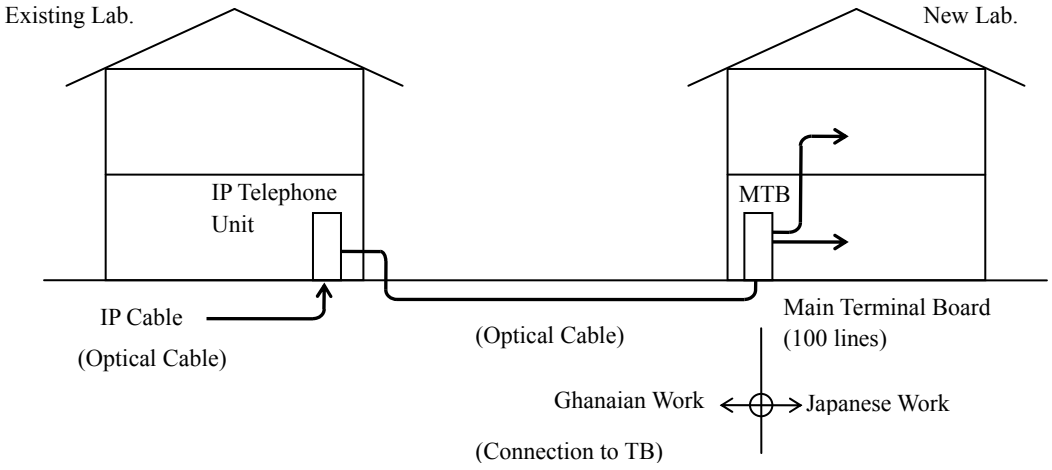


Figure 2-13 Outline of IP Telephone System

4) Public Address System

Public address system will be established for paging in the building or giving emergency evacuation instructions.

5) LAN Facility

The cable rack and pipes for the LAN will be installed as part of our project. The cost of equipment necessary for the wireless LAN and its wiring work will be borne by Ghanaian side.

6) Fire Alarm Facility

Push-button fire alarms will be installed as well as automatic fire alarms facility which will be activated by heat and smoke.

7) Television Facility

Television facility will be set up in seminar rooms and some others. The cost of television sets and their attachments as well as for their wiring work will be borne by Ghanaian side. Japanese side will bear the cost of piping work for wiring.

8) Lightning Protection & Earthing

Lightning conductors and earthing plates will be installed.

9) Security Facility

The same systems for management of enter and exit and monitoring as the system currently used in the existing facilities will be established. Japanese side will bear the cost of cable racks for security wiring and piping work. Ghanaian side will bear the cost of installing security equipment and wiring work.
The ITV system will be installed in the BSL-3 Laboratories.

10) Central Monitoring Facility

The operation of the facility, monitoring, and the alarm system will be managed on the central supervisory board.

(2) Mechanical Facility Design

1) Water Supply Facilities

City water will be received in a reservoir. The water will then be pumped into an elevated water tank, and distributed to each facility by the gravity water supply system. The capacity of the reservoir will be 60m^3, which will supply enough water for two days. The capacity of the elevated water tank will be 6m^3 for two-hour water supply.

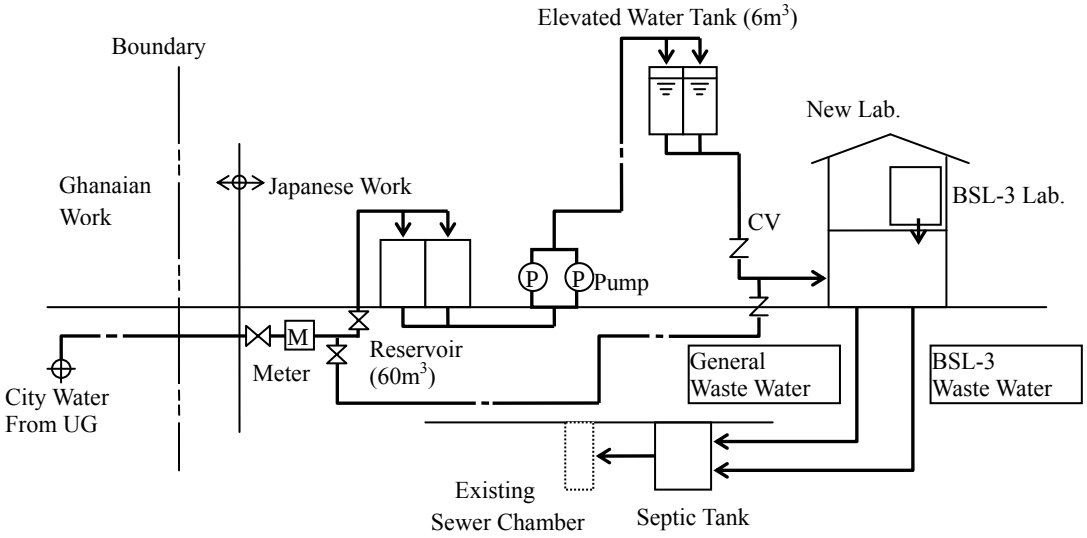


Figure 2-14 Outline of Water Supply & Drainage System

2) Drainage Facility

General wastewater will be treated in a septic tank and released into a nearby catch basin. Waste water from BSL-3 Laboratories will be first sterilized and then treated in a septic tank.

3) Sanitary Fixture Facility

The flush toilet bowls and urinals will be installed. In laboratories, chemical water faucets and emergency showers will be installed.

4) Special Gas Facility

Liquid propane gas will be supplied to laboratories by the centralized method. CO 2 gas will be supplied to laboratories requiring such gas by the centralized method.

5) Fire Fighting Facility

Indoor fire hydrants (hose reels) and fire extinguisher will be installed.

6) Waste Water Treatment Facility

In a septic tank, wastewater will be treated biologically. The volume of treated water will be 30 m^3 per day. The aim for the quality of discharged water is to have a 60ppm biological oxygen demand (BOD). Waste water discharged from the BSL-3 Laboratories will be first sterilized and then treated along with general waste water.

7) Air Conditioning Facility

i. General laboratories and offices

In order to hold back advancement of sand and dust caused by Harmattans into rooms, an air conditioning system which will slightly pressurize the rooms will be installed. The cassette-type or wall-mounted type of units will be installed individually. The duct-type

unit will be installed in some parts of the building. Mechanized ventilation system by air supply and discharge fans will be installed.

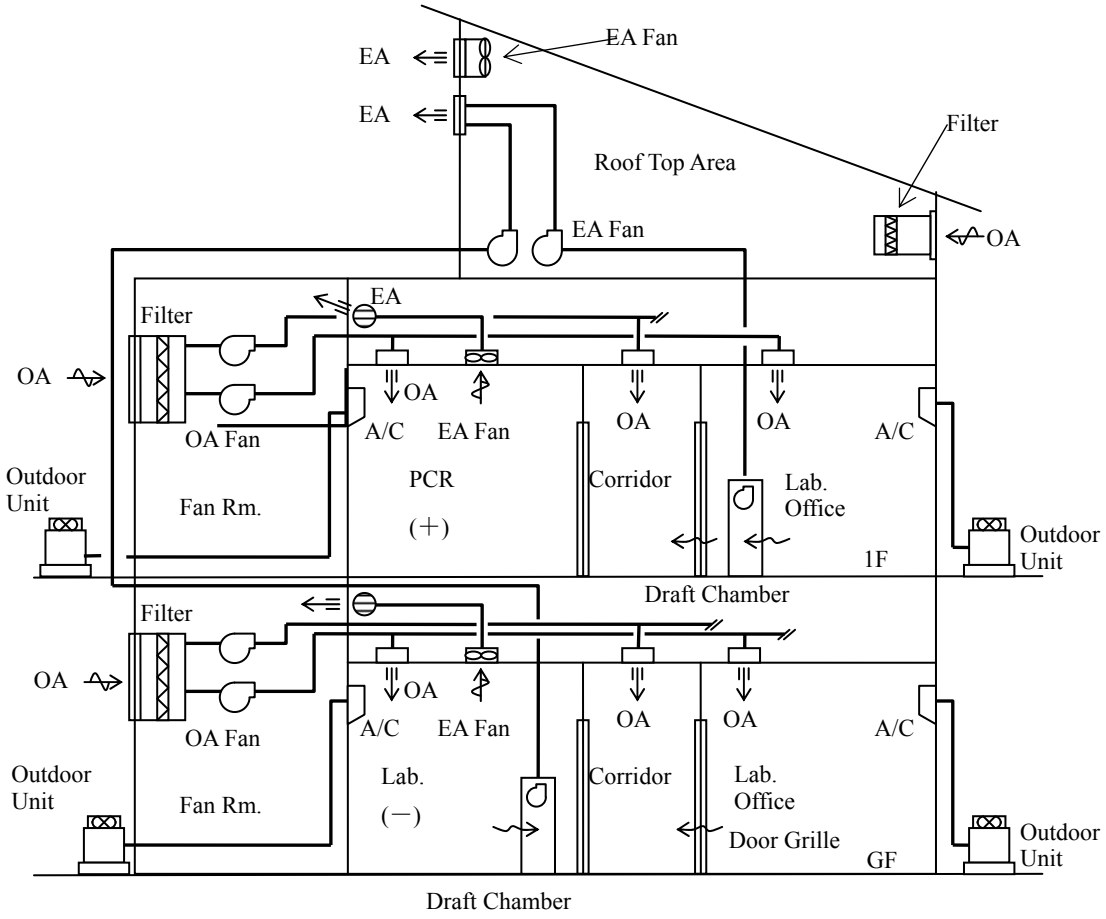


Figure 2-15 Air Conditioning System for General Laboratory

ii. BSL-3 Laboratory

An air conditioning system which will contain any biohazards by using air handling units energized by air-cooled chillers will be established. This system will maintain a negative pressure in a room. HEPA filter will be set on the outdoor side of the air supply and discharge ducts. In order to maintain the negative pressure, the system will need to adequately adjust the air volume. CAV, VAV, and barometric damper will be used for that purpose.

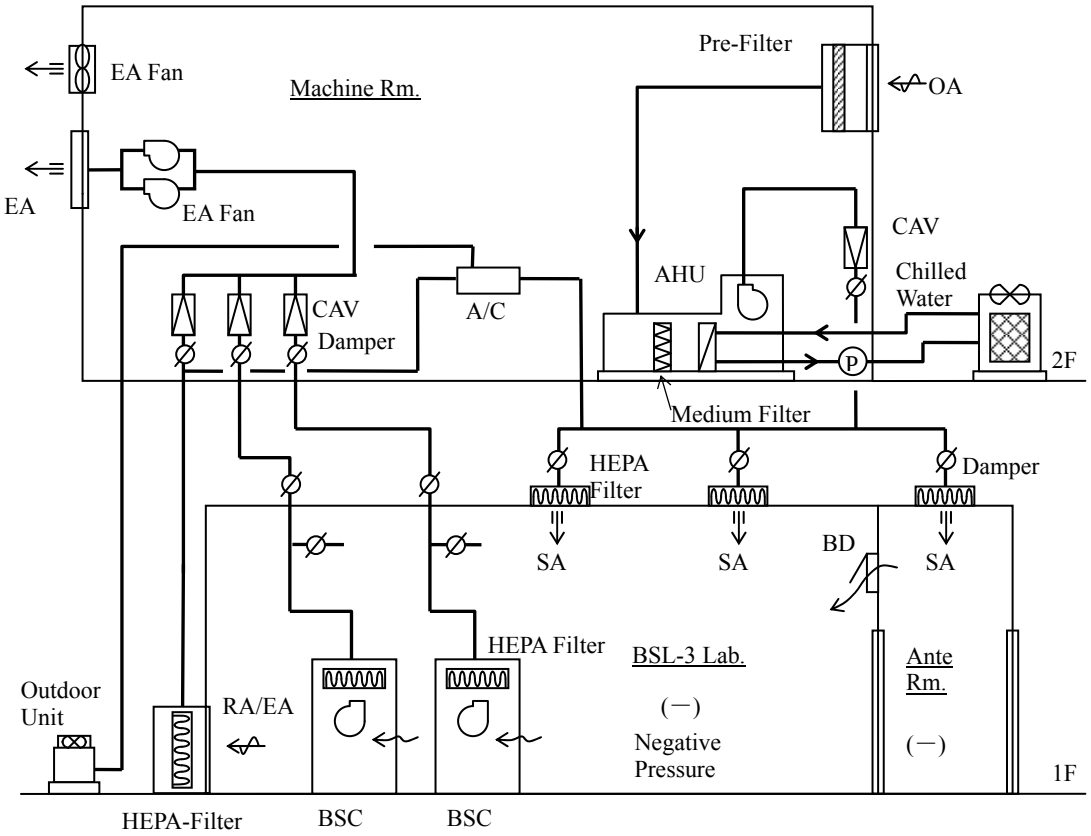


Figure 2-16 Outline of BSL-3 Laboratory A/C System

2-2-2-6 Construction Material Plan

(1) Exterior Finishing Material

1) Roof

Most of related facilities in University of Ghana have pitched roofs including NMIMR. The pitched roof is also adapted to this building to consider the prevention of leakage and integrating the existing scenery. The Project, however, has designed a flat roof with depth partially. If an entire building is covered by a pitched roof, the roof would be too big. In order to minimize cost and the construction schedule, flat roof will be applied where it does not affect the landscape of the university.

The durable metal roofing which was used for the P3 Laboratory Building and Conference Building will be adopted for the pitched roof. The flat roof will have locally common asphalt waterproofing and protect concrete with sufficient drainage slope.

2) Exterior Walls

Mainly, concrete blocks will be used and finished with setting bed mortar. This is commonly used as an exterior wall locally, and it is easy to maintain. Tiles will partially be used e.g. around the entrance for aesthetic reasons. A coating material that will respond to possible crazing will be selected in order to prevent deterioration of the building.

(2) Interior Finishing Material

1) Floor

Floors of the rooms for general use and laboratories in the existing buildings are finished with finish-in-place terrazzo. But floors of the Project will be tiled as renovated existing buildings to reduce construction time. PVC continuous sheets will be installed for the floors of the BSL-3 Laboratories to ensure good sanitation.

2) Interior Wall

Tiles, which can be easily wiped, will be used in WC, washing rooms, and other rooms that deal with water. Walls for general room will have coated mortar bed. Steel panels will be used for interior walls of the BSL-3 Laboratories to consider their requirements of sanitation, corrosion resistance, and air tightness. They will be procured from Japan to ensure the quality.

3) Ceiling

General rooms and laboratories will have grid system ceiling with rock wool acoustic ceiling panels. Steel panels will be used as their interior walls and for the ceiling of the BSL-3 Laboratories.

(3) Fittings

Aluminum fittings will be used for general external fittings from the weather ability point of view. Steel fittings will be used for general rooms for interior fittings.

Steel panel fittings will be used for the fittings of the BSL-3 Laboratories for sanitation, corrosion resistance, and durability.

Table 2-30 Finishing Material and Method of Construction

Part	Local Construction Method (including the existing structures)	Adopted Method of Construction	Reasons for the Choice
Roof	Pitched roof ・ With metal plates (same as the roof of the existing NMIMR main building)	Pitched roof ・ With metal plates	It is easy to maintain and its durability is high.
	Flat roof ・ With asphalt waterproofing	Flat roof ・ With asphalt waterproofing and protective concrete	It is easy to maintain. The protective concrete will enhance its durability.
Exterior wall	・ Mortar bed with a finishing coat ・ Tiled	・ Mortar bed with a finishing coat ・ Tiled	This is a common construction method local use. Therefore, local people are skilled with maintenance of the walls.
Floor	Tiled	Tiled	Tiles are locally used. They are relatively easy to maintain and clean.
Interior wall	・ Mortar bed with a finishing coat ・ Tiled	・ Mortar bed with a finishing coat ・ Tiled	This is a construction method used locally. Therefore, local people are skilled with maintenance of the walls.
Ceiling	Rock wool sound absorbing boards	・ Rock wool sound absorbing panels and calcium silicate boards	This is a common construction method local use. Therefore, local people are skilled with maintenance of the walls.
Fittings	Window	・ Aluminum windows	Aluminum windows are commonly available locally, and they are sufficient strong weather resistance.
	Door	・ Steel panel fittings	Steel panel fittings are durable, water resistant, and easy to handle. They will be used for the BSL-3 Laboratories, cold rooms, and freezed rooms.
		・ Light-weight steel fittings	Light-weight steel fittings are durable, water resistant, and easy to handle. They will be used for the PCR rooms.
		・ Steel fittings	Steel fittings are durable, water resistant, and easy to handle. They will be used for general laboratories, faculty offices and the like.
		・ Stainless steel fittings	Stainless steel fittings are durable and easy to clean. They will be used for the service entrance to the BSL-3 Laboratories.

(4) Equipment for the Facilities

Many of the equipment for the planned facilities have approximately 15 years of service life. It is quite short compared to the construction material. Therefore, the replacement material and equipment for the facilities after their completion should be available locally. However, the local equipment availability is limited, thus, Japan and third country will be the main sources of procurement.

The Project involves a research institution which includes the BSL-3 Laboratories. Activities conducted in the laboratories could affect people's lives. For this reason, material and equipment used for the Project must be chosen with their quality as the most important selection criterion.

General equipment will be procured from Japan or third country. Other equipment will be procured mainly from Japan for their improved quality, including the air conditioning system with an automatic control of air balance and pressure which is critical for the Project, and the security

monitoring system which ensures the security of the Project shall be planed after reviewing the cost, maintenance needs, and implementation records.
The table below shows research equipment that will be concerned in the Project.
The indicated equipment will be used in the BSL-3 Laboratories. Therefore, they will need to be fixed on the floor or the wall. They will also need to be connected to the air supply and exhaust system, water supply and drainage system, and/or electrical system. Therefore, the equipment installation should be discussed in our construction plan. It will be included in our construction work for arranging the construction time.

Table 2-31 Equipment Covered in the Project

No.	Equipment	Planned Quantity	Note
1	Autoclave pass through type	2	
2	Biosafety cabinet (A)	4	
3	Pass box	2	The pass box will be considered together with the autoclave pass through type.
4	Sink with decontamination tank	2	The name of the equipment will be changed to "Sink for BSL-3 Laboratories."

Specifications and intended use of the major built-in equipment are indicated below.

Table 2-32 Specifications and Intended Use of Major Built-in Equipment

Equipment No.	Name	Planned Quantity	Specifications	Intended Use and Other Remarks
1	Autoclave pass through type	2	Effective chamber dimensions: 500(W) ×500(H) ×900(D)mm approx. × 3units, 660(W) ×1,000(H) ×900(D)mm × 1unit Sterilization temp.: 105 to 135 ^{o}C Sterilization tank, boiler, compressor and stainless panel are included	This sterilizing system will be used to sterilize glassware and material used in the BSL-3 Laboratories.
2	Biosafety cabinet (A)	4	Class II Type B3 All exhaust type, Filter efficiency: 99.99% efficient for 0.3μm particle or better, External dimensions: 1,500(W)×800(D)×2,000(H)mm approx.	The biosafety cabinet will be used to handle infectious viruses and bacteria.
4	Sink for BSL-3 Laboratory	2	External dimensions: 1,000(W)×600(D)×950(H)mm approx. Sterilizing tank: Included Material: Stainless steel (SUS304)	The Sink will be used in the BSL-3 Laboratories to clean hands.

(5) Other Considerations

1) Termite Control

Floor slabs will be treated with termite prevention agents before it will be constructed. Wooden materials e.g. built-in furniture will also be treated with termite prevention agents.

2) Mold Control

The site has high humidity. Therefore, building material and coating that has anti-fungal agent function will be selected.

2-2-2-7 Equipment Plan

The specifications of the equipment planning to be procured for this research institution and its purpose is listed below.

Table 2-33 Equipment Planning

No.	Equipment	BSL-3 Lab	Virology	Bacteriology	Immunology	Molecular Biology Lab				Washing Room	Total Unit
						Pre-PCR	PCR	Post-PCR	PCR 2		
1	Biosafety cabinet		6	4	3						13
2	Formaldehyde decontamination unit (A)	1									1
3	Formaldehyde decontamination unit (B)	1									1
4	Autoclave (A)	4									4
5	Autoclave (B)		3	4	2			1		2	12
6	Deep freezer (-80°C) (A)	2	1		3						6
7	Deep freezer (-80°C) (A)		1	5							6
8	Freezer (-20°C)	2	4	4	4						14
9	Freezer (-30°C)		4		4						8
10	Medical refrigerator	2	4	4	3		3		1		17
11	Tabletop ultracentrifuge	1									1
12	Refrigerated centrifuge (A)	1									1
13	Refrigerated centrifuge (B)		4	2	2						8
14	Refrigerated microcentrifuge	1	2	3	1						7
15	Inverted microscope	1	3		2						6
16	CO2 Incubator	3	8	3							14
17	Incubator (22°C)			1							1
18	Incubator (37°C)	1	3	4							8
19	Incubator (44°C)			3							3
20	pH meter				2						2
21	Portable pH meter									1	1
22	Shaking water bath	1	1		2						4
23	Electronic balance (A)			1							1
24	Electronic balance (B)			1	2			1		2	6
25	Electronic balance (C)			3						1	4
26	Binocular microscope		2	3	4						9
27	Water bath		2	3	1	1			1	1	9
28	Microcentrifuge		1		3						4
29	Vortex mixer		3	4	5	3		3	1		19
30	Microplate washer		2		2						4
31	Microplate reader (A)		2		1						3
32	Microplate reader (B)				1						1
33	Centrifuge		2	3	1						6
34	Nanodrop						1				1
35	Clean bench			4	1	3		1	1	1	11
36	Refrigerator / freezer		1		4	3		2	1		11
37	Shaker		1								1
38	Ice maker									1	1
39	Fluorescent microscope		1	1	3						5
40	Magnetic stirrer									2	2
41	Flow cytometry (A)		1								1
42	Flow cytometry (B)				1						1
43	Fully automated nucleic material extraction system		1								1
44	Colony counter			5							5

No.	Equipment	BSL-3 Lab	Virology	Bacteriology	Immunology	Molecular Biology Lab				Washing Room	Total Unit
						Pre-PCR	PCR	Post-PCR	PCR 2		
45	Shaker incubator			3							3
46	Sonicator			1	1						2
47	Desicator			1							1
48	Stomacher			1							1
49	Teaching microscope			1							1
50	Digital coagulator			1							1
51	Fume extractor			1	1						2
52	Hotplate magnetic stirrer			1	2						3
53	EliSpot reader				1						1
54	Plate shaker				2						2
55	Dissecting microscope				1						1
56	Cell counter				1						1
57	Micropipette		6	4	6	6	3		2		27
58	Chemical cabinet				2						2
59	Ultrasonic cleaner				1						1
60	Nitrogen tank				1						1
61	Mini-microcentrifuge					3		1	1		5
62	PCR workstation					3	1		2		6
63	Thermal cycler						4		2		6
64	Real-time PCR						2				2
65	Gel imaging system							2			2
66	Electrophoresis apparatus							6			6
67	Sample homogenizer								1		1
68	Heat block					2			1		3
69	Drying hot oven (A)									2	2
70	Drying hot oven (B)									2	2
71	Water distiller									1	1
72	Automatic pipette washer									2	2

Table 2-34 Specifications and Intended Use of Equipment Planning

No.	Equipment	Q'ty	Specification	Intended Use and Other Remarks
1	Biosafety cabinet	13	Type: Class II Type A2 Filter efficiency: 99.99% efficient for 0.3μm particles External dimension: 1,500(W)×800(D)×2,000(H)mm approx.	The biosafety cabinet will be used to handle specimens, cells and the like used in experiments and research.
3	Formaldehyde decontamination unit (B)	1	Composition: Formaldehyde decontamination unit, Formaldehyde oxidation treatment unit, Densitometer for formaldehyde gas Effective capacity of fumigation: BSL-3 Laboratory room, 150m3 approx.	This unit will be used to disinfect the BSL-3 Laboratories.
4	Autoclave (A)	4	Type: For BSL-3 Laboratories Chamber capacity: 70L approx. Sterilization temp.: 105 to 135^{0}C approx.	This unit will be used to sterilize infectious material and protective clothes used in the BSL-3 Laboratories.
6	Deep freezer (-80℃)(A)	6	Type: Vertical Capacity: 500L approx. Temp. control: -50 to -86 ^{0}C approx.	The deep freezer will be used to store clinical specimens, samples and the like.
7	Deep freezer (-80℃)(B)	6	Type: Vertical Capacity: More than 690L Temp. control: -50 to -86^{0}C approx.	The deep freezer will be used to store clinical specimens, samples and the like.

No.	Equipment	Q'ty	Specification	Intended Use and Other Remarks
11	Tabletop Ultracentri-fuge	1	Max. speed: 150,000rpm approx. Max. x g: 1,000,000 xg approx Temp. control: 0 to 40 ^{0}C approx. Rotor: Biosafety type	This unit will be used for clinical specimens and samples to be centrifuged in the BSL-3 Laboratories handling viruses.
12	Refrigerated centrifuge (A)	1	Max. speed: 10,000rpm approx. Max. x g: 11,000 xg approx Temp. control: -9 to 40 ^{0}C approx. Rotor: Angle rotor, swing rotor, biosafety type	This unit will be used for clinical specimens and samples to be centrifuged.
23	Electronic balance (A)	1	Type: Single range, electronic balance Weighing capacity: 5g Minimum display: 1μg	The electronic balance will be used to measure, with precision, specimens and samples for experiments, analyses, and measurements.
32	Microplate reader (B)	1	Wave length range: Absorb. 230-1000nm approx., Fluor. 330-600nm approx. Accuracy: Less than 0.5% Measuring speed: 20 sec. for 96-well Data analysis software: Provided	The microplate reader will be used to separate, identify, and quantitatively analyze protein and nucleic acid.
34	Nanodrop	1	Type: Nanodrop Sample volume: Less than 0.5μL Wave length range: 200-840nm Accuracy: Less than 3% Printer: Built-in	The nanodrop will be used to measure protein and the like in the samples.
39	Fluorescent microscope	5	Magnification: 40x to 1,000x Objective lens: 5 pcs. Illumination system: Halogen lamp, mercury lamp Fluorescent filter: Blue, green etc.	The fluorescent microscope will be used to examine material through the fluorescent antibody technique.
41	Flow cytometry (A)	1	Measuring items: CD4 count, CD4%, CD8, CD3 Sample: Whole blood Detection speed: 60μL/min. Data analysis software: Included	The flow cytometry will be used to identify and discriminate types of cells, and to obtain their information with rapidity and precision.
42	Flow cytometry (B)	1	Type: For general cell detection Flow system: Fix flow cell type Optics: 2-laser, 6-color or more Data analysis software: Included	The flow cytometry will be used to identify and discriminate types of cells, and to obtain their information with rapidity and precision.
49	Teaching microscope	1	Type: Bright field, phase contrast Magnification: 40× to 1,000× Objective lens: More than 4pcs. Teaching heads: 1 main and 4-observer	The teaching microscope will be used to teach observation procedures using a microscope.
50	Digital Coagulator	1	Capacity: Culture tube 200pcs. Approx. Temp. range: 50 to 95 ^{0}C Timer, safety device: Equipped	The digital coagulator will be used to culture particular bacteria.
51	Fume extractor	2	Type: Exhaust outside the room Door: Glass Water tap, gas tap, electric outlet, fluorescent lamp: Provided External dimensions: 1,200(W) ×750(D) ×2,400(H)mm approx.	The fume extractor will be used to handle hazardous substances used in experiments.
53	EliSpot reader	1	Measurement method: EliSpot, fluorospot, etc. Measuring format: 96-well microplate, etc. Digital image: Camera Analyzing software: Included	The EliSpot reader will be used to capture digital images of protein and nucleic acid biopolymer which are being tested on the microplate, and to conduct structural analyses of the molecules.
56	Cell counter	1	Laser: Blur and red Sample tube: 1.5mL tube Detecting speed: 1 min./sample Analyzing software: included	The cell counter will be used to conduct cell analyses in immunology research.

No.	Equipment	Q'ty	Specification	Intended Use and Other Remarks
64	Real-time PCR	2	Composition: Main unit, data analysis system, software Sample volume: 96-well Measuring wave length: 470 to 500nm approx. Sample volume range: 25 to 100μL approx.	The real-time PCR will be used to multiply the DNA and analyze them quantitatively.
65	Gel imaging system	2	Composition: Main system, data processing hardware and software Illumination: Trans-UV, trans-white Imaging system: CCD camera Resolution: More than 1.2M pixels	The gel imaging system will be used to photograph and create images of post-electrophoresis dyed gel produced by the PCR.
71	Water distiller	1	Type: Fully automated type Purification method: Distillation and ion exchange Distilled water capacity: 5L/hour approx. Water softener: Included	The water distiller will be used to prepare distilled water required for experiments and research.

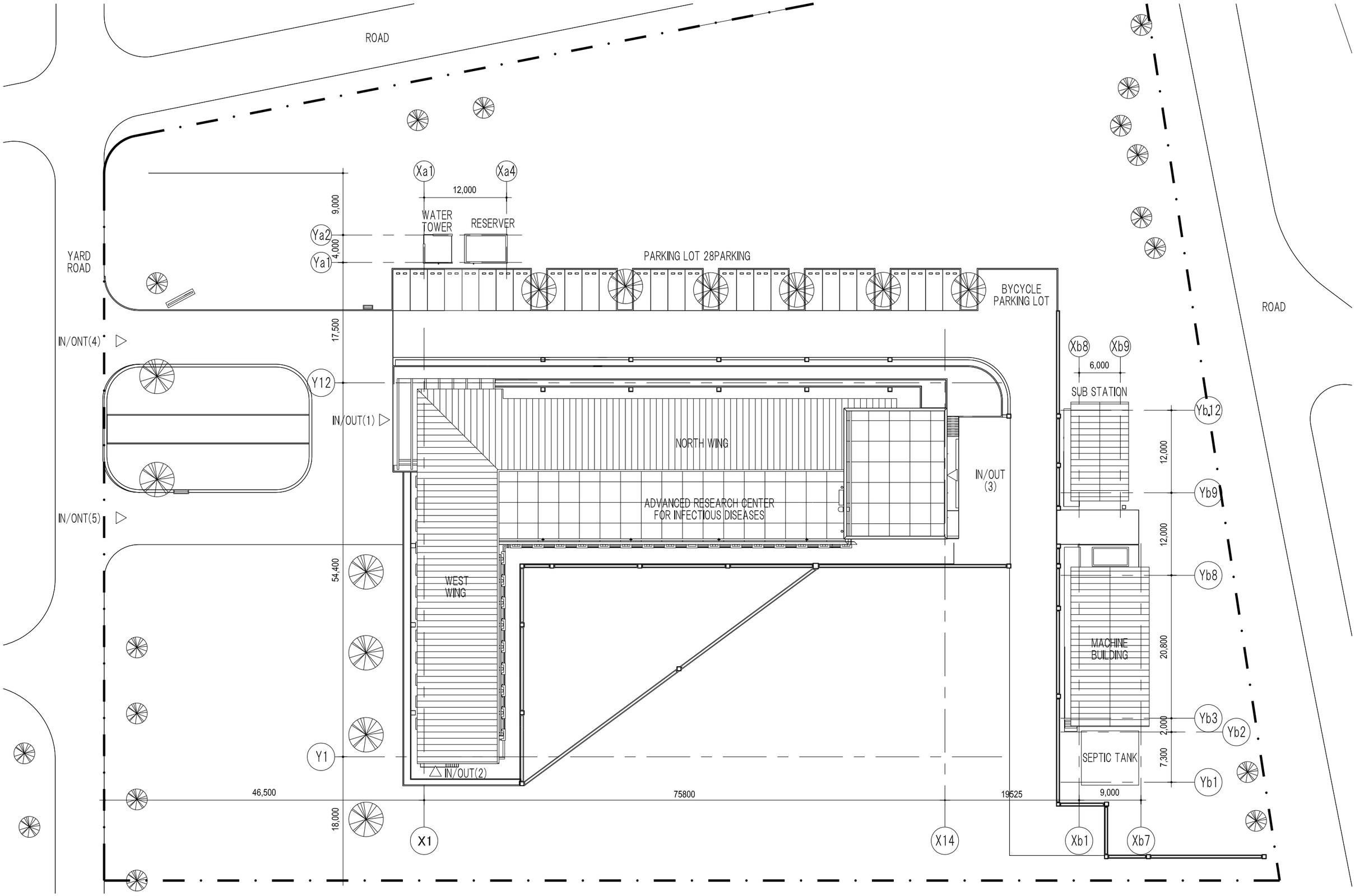
The equipment listed above includes a set of equipment that is easily affected by the voltage. Therefore, the uninterruptible power supply (UPS) will be attached to such equipment. They are deep freezers, freezers, refrigerator / freezers, fluorescent microscopes; flow cytometries; a fully automated nucleic material extraction system; an EliSpot reader; a cell counter; real-time PCRs; and gel imaging systems.

Many of the equipment procured for the Project will be similar to the equipment currently in use at the NMIMR. For this reason, the NMIMR intends to contract out their maintenance. Reagents and supplies required immediately after procuring and installing the equipment are the same ones currently used at laboratories in the NMIMR. Such reagents and supplies will be considered as part of the Project, for they will be required for our vendors to test operate the equipment and give training to the local staff on how to operate and maintain them. Other supplies, in principle, will be procured by the Ghanaian side. The expense to maintain the equipment will be budgeted by NMIMR. Spare parts of the proposed equipment will not be included in the Project with partial exception.

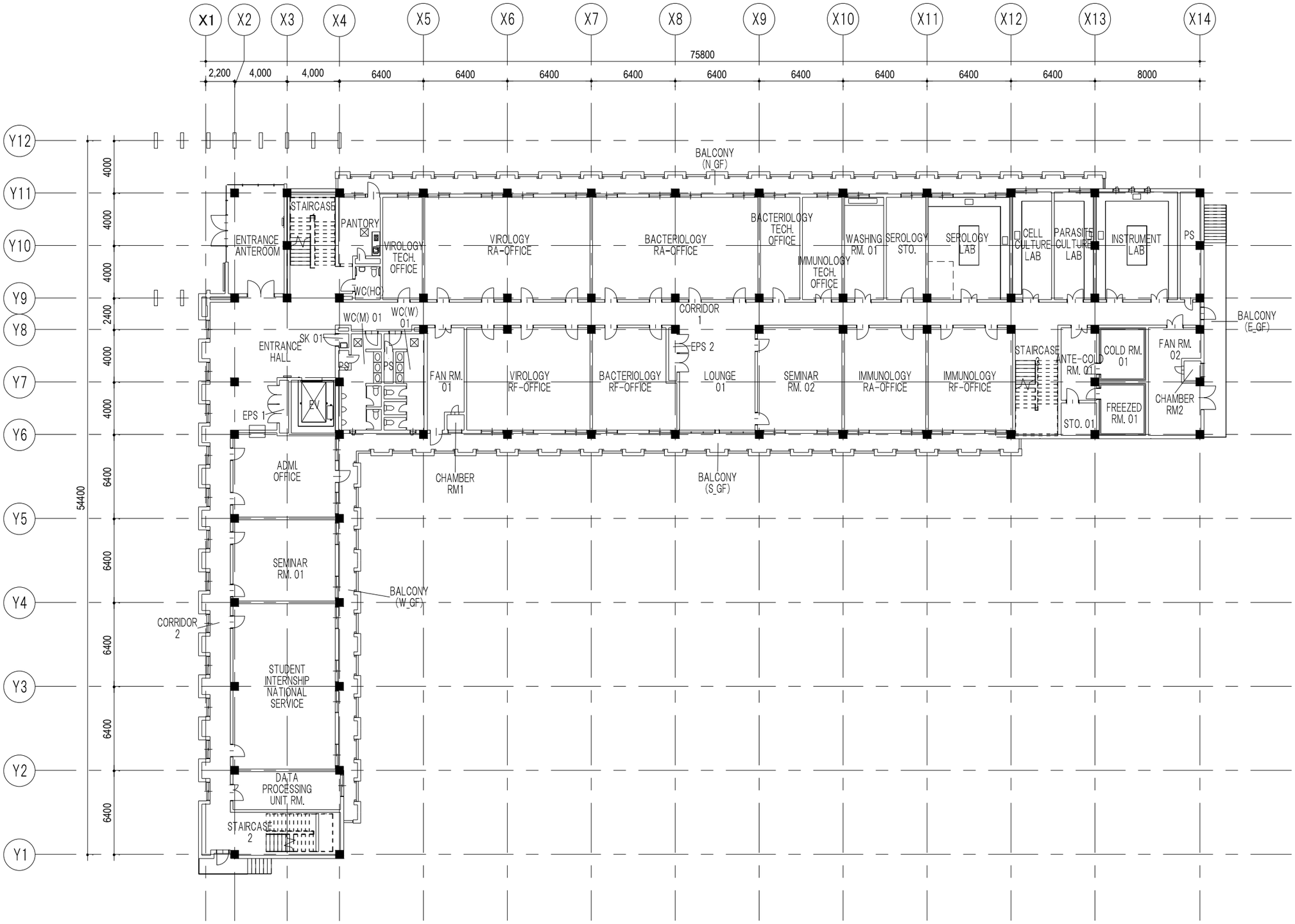
2-2-3 Outline Design Drawing

Table 2-35 List of Design Drawing

	Facility	Sheet	Scale
1	Site plan		1/500
2	Advanced Research Center for Infectious Diseases	GFL Plan	1/300
3		1FL Plan	1/300
4		2FL Plan	1/300
5		Roof Plan	1/300
6		Elevation 1	1/300
7		Elevation 2	1/300
8		Section	1/300
9	Sub-station, Machine building, Septic tank, Water tower	Plan, Section	1/200 1/300



	THE PROJECT FOR THE CONSTRUCTION OF ADVANCED RESEARCH CENTER	SITE PLAN	SHEET NO. -53-
			SCALE 1 : 500



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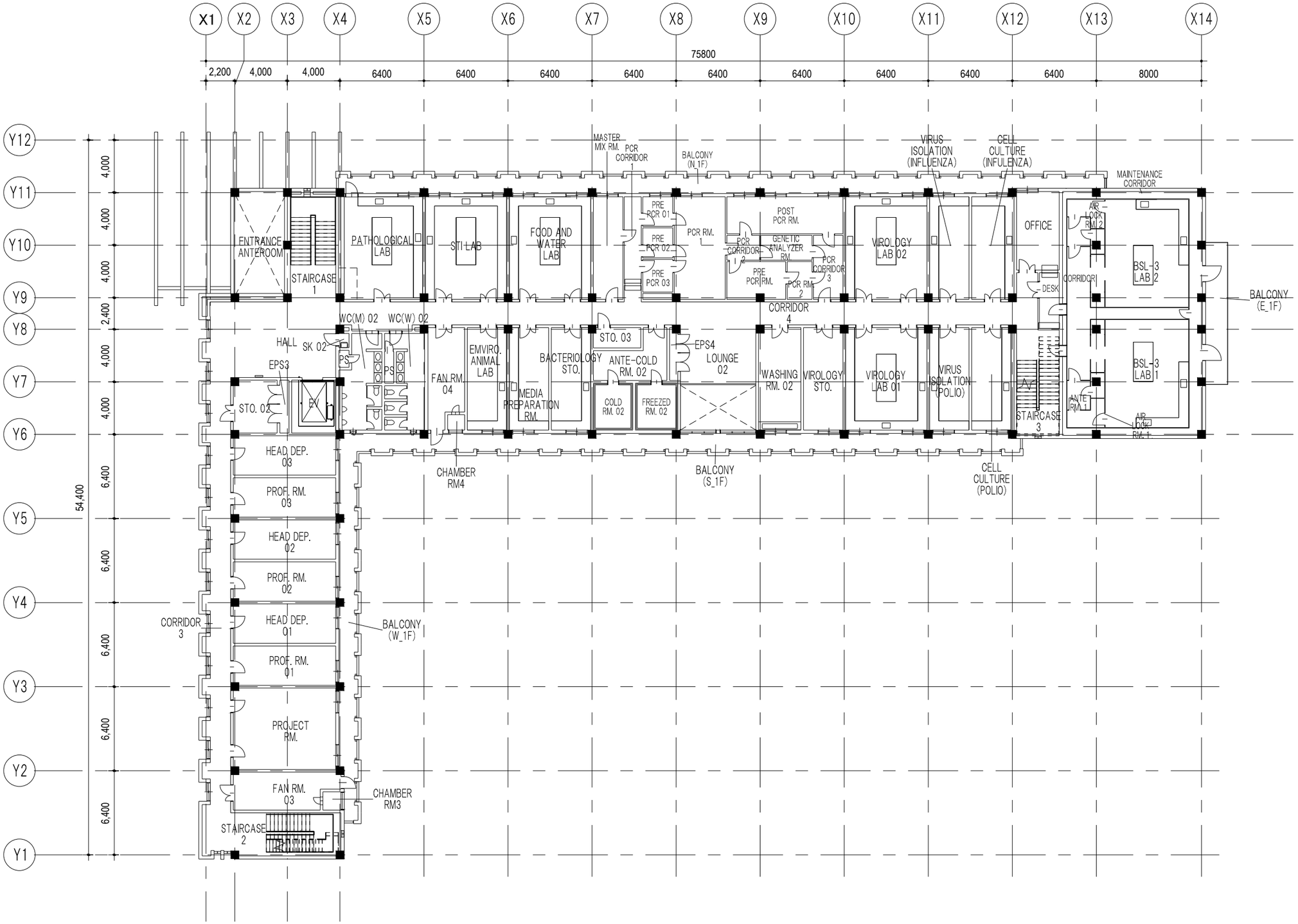
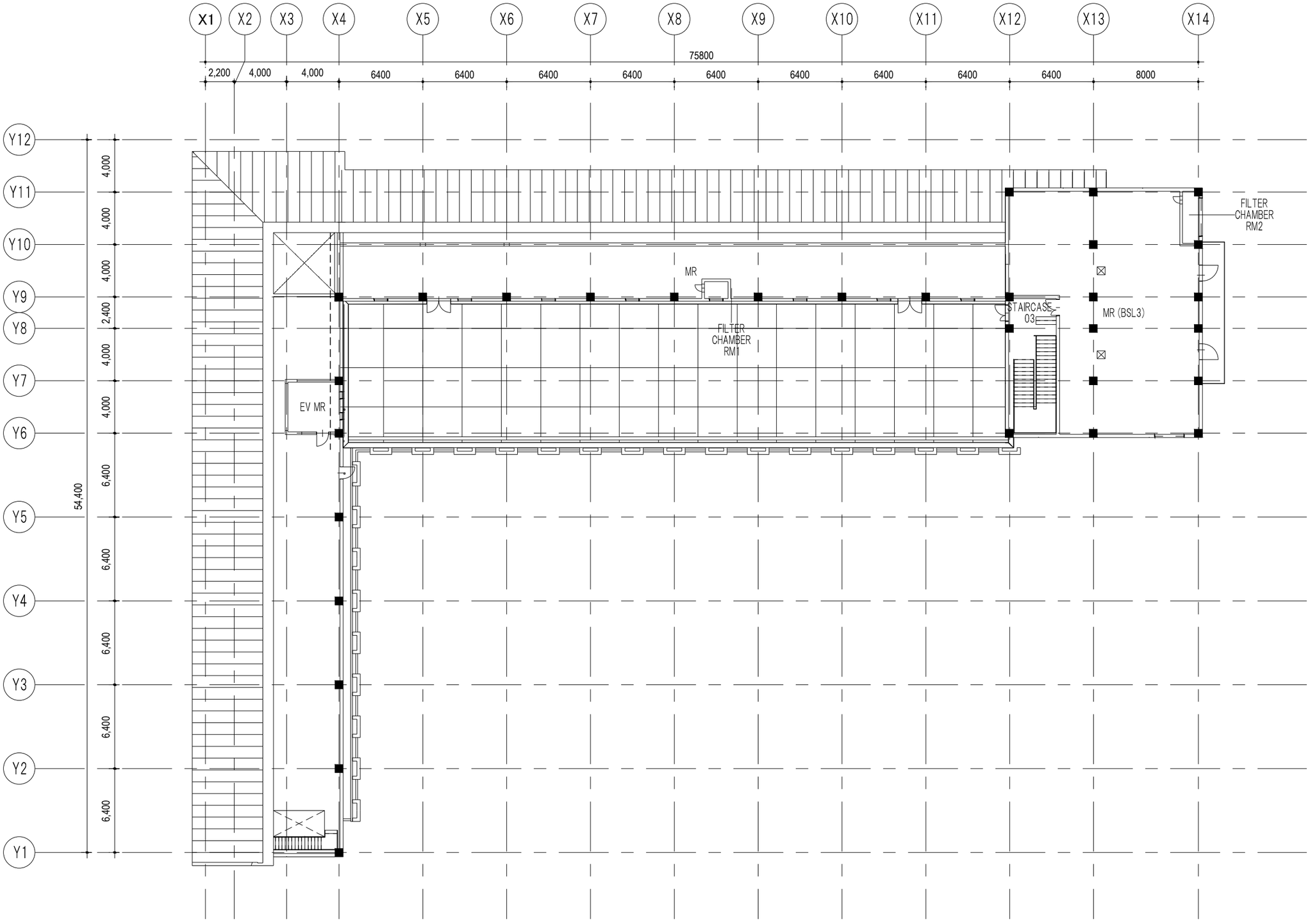
			SCALE 1 : 300



	THE PROJECT FOR THE CONSTRUCTION OF ADVANCED RESEARCH CENTER	1FL	SHEET NO. -57-
			SCALE 1 : 300



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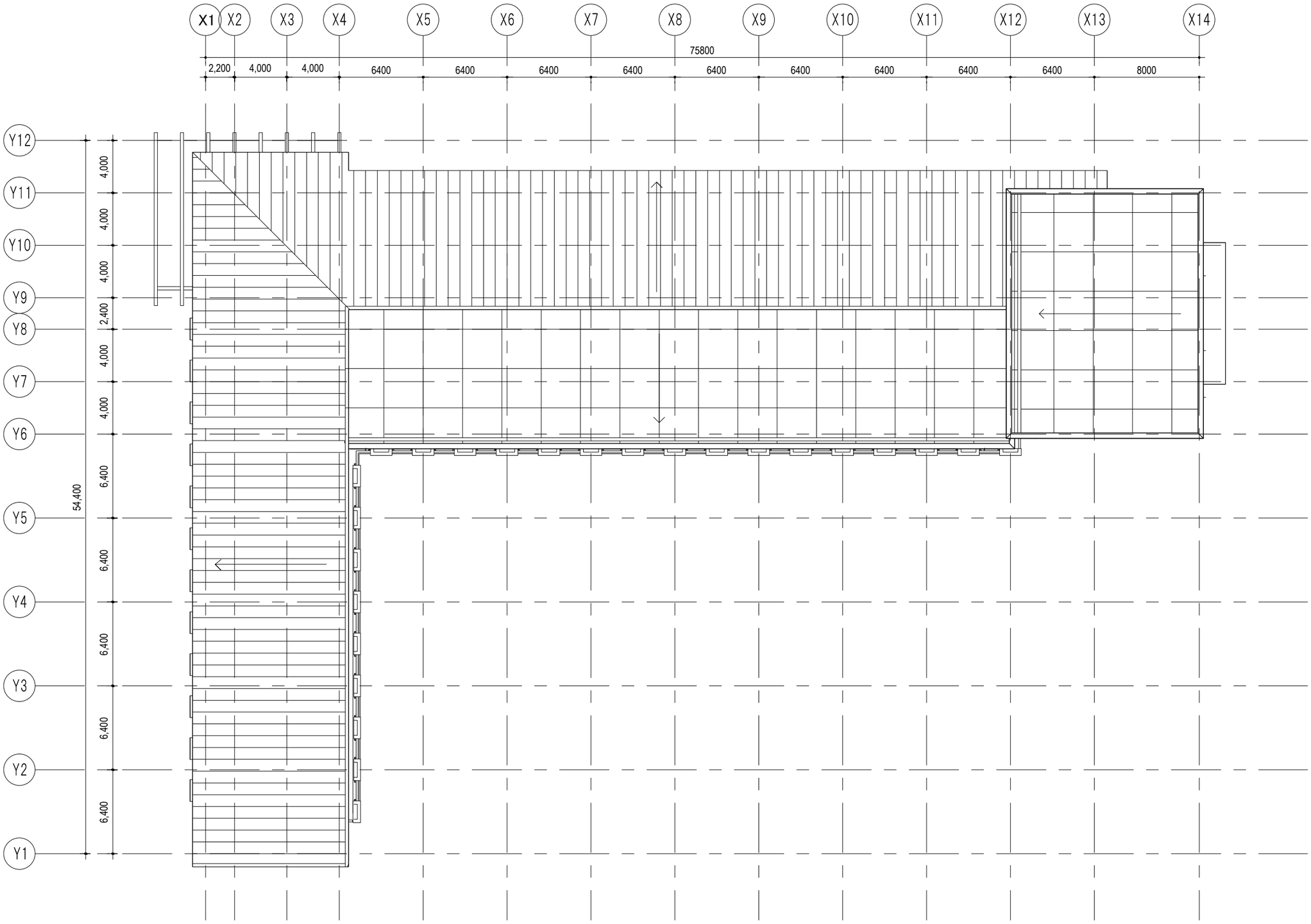
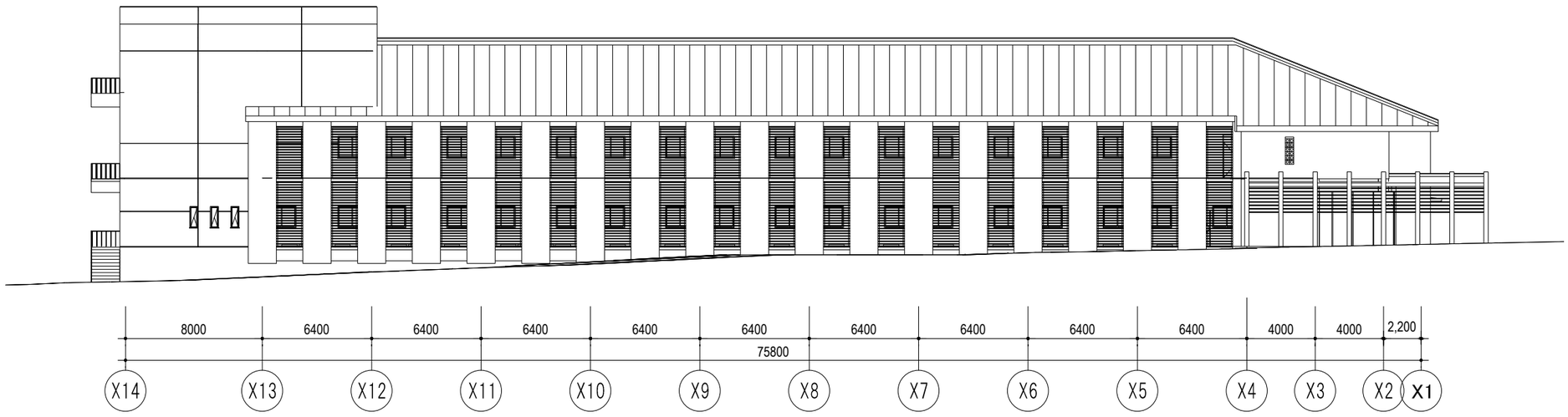
			SCALE 1 : 300

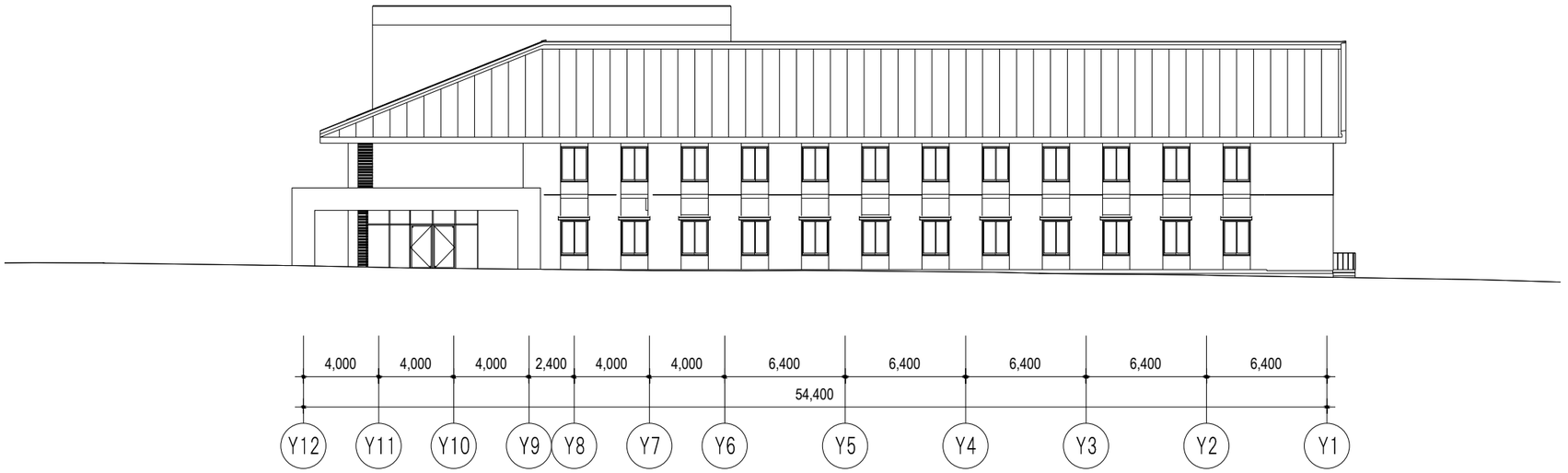


	THE PROJECT FOR THE CONSTRUCTION OF ADVANCED RESEARCH CENTER	ROOF	SHEET NO. -61-
			SCALE 1 : 300



1 NORTH ELEVATION

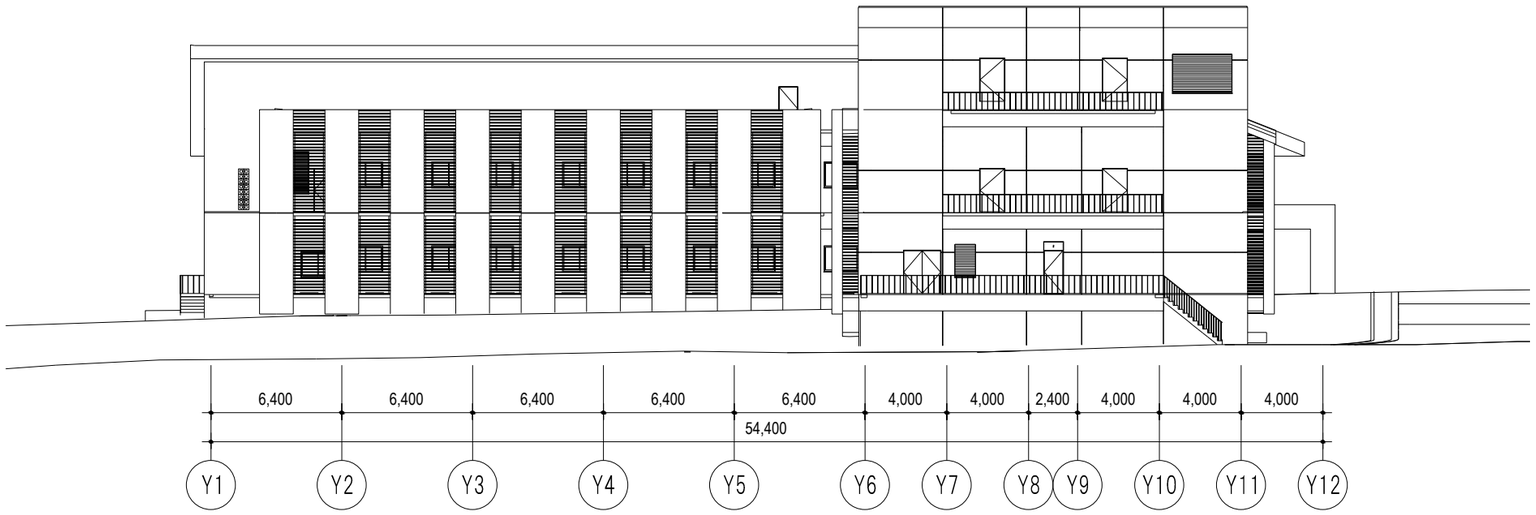
1 : 300



2 WEST ELEVATION

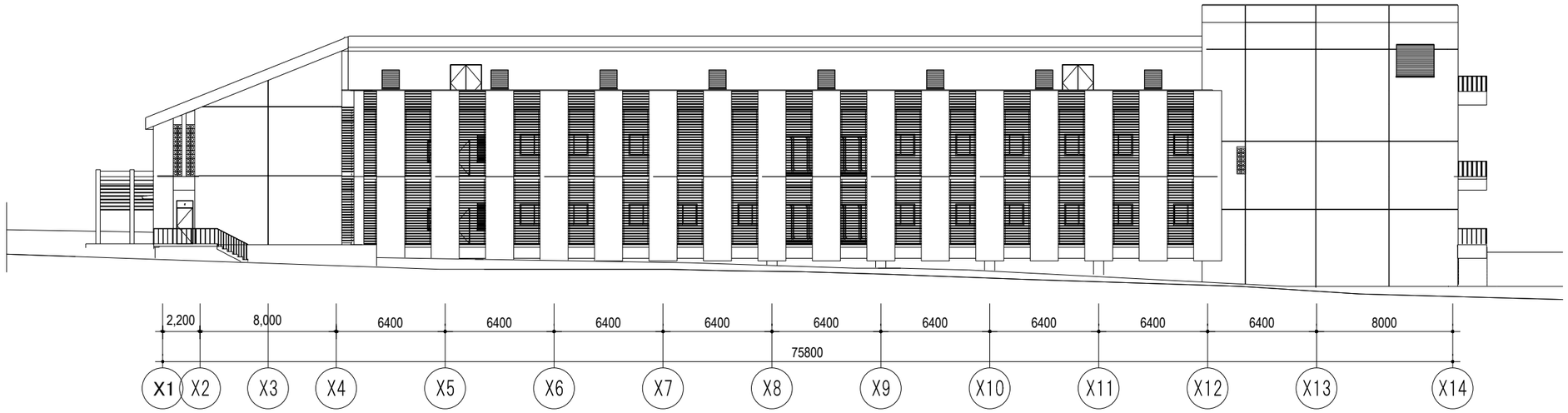
1 : 300

	THE PROJECT FOR THE CONSTRUCTION OF ADVANCED RESEARCH CENTER	ELEVATION 1	SHEET NO. -63-
			SCALE 1 : 300



2 EAST ELEVATION

1 : 300



1 SOUTH ELEVATION

1 : 300

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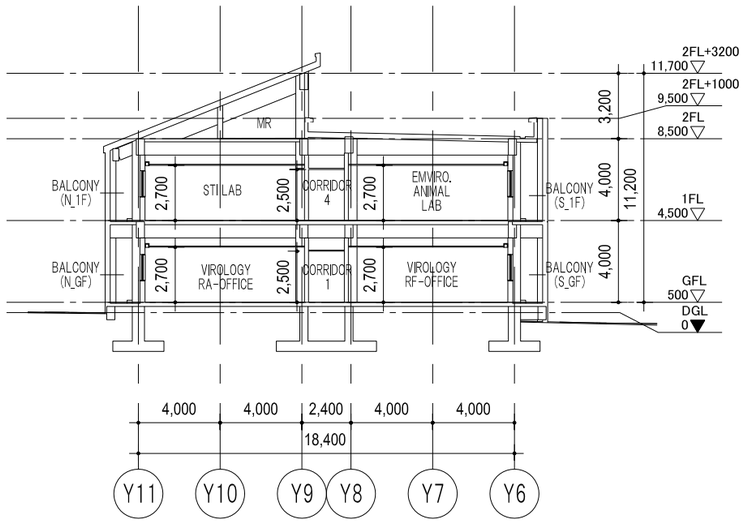
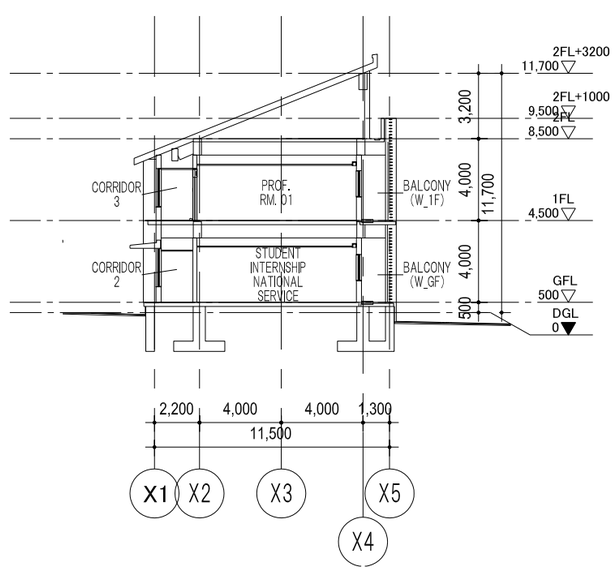
			SCALE 1 : 300



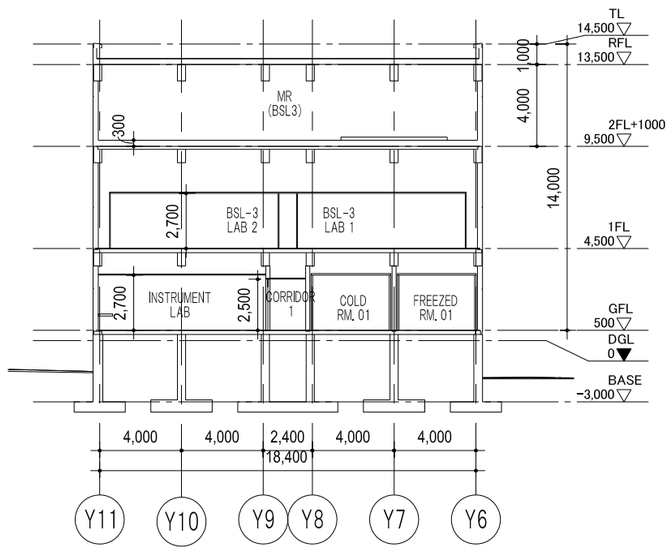
1 SECTION 1

1 : 300



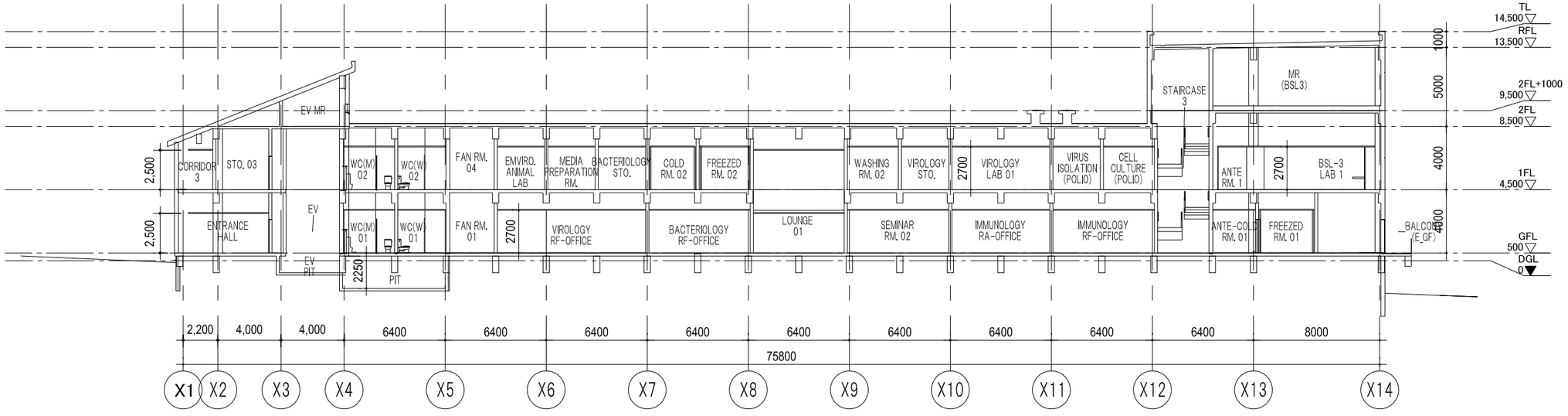
2 SECTION 2

1 : 300



3 SECTION 3

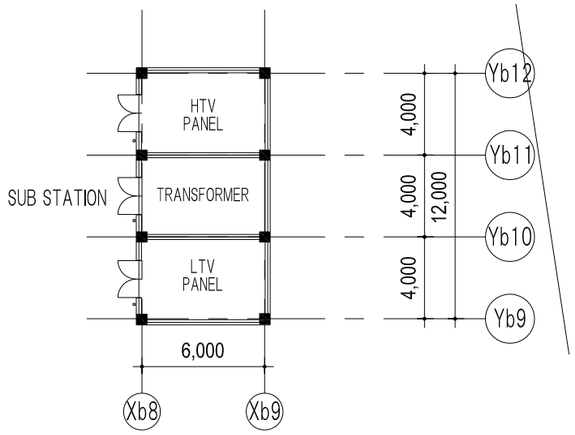
1 : 300

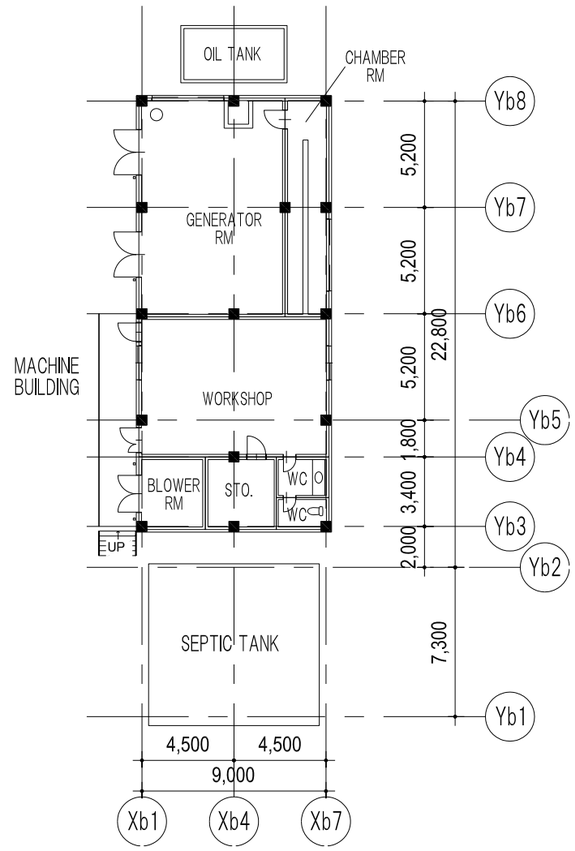


4 SECTION 4

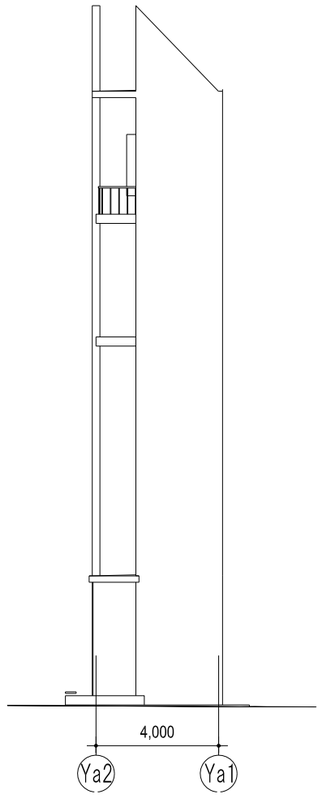
1 : 300

	THE PROJECT FOR THE CONSTRUCTION OF ADVANCED RESEARCH CENTER	SECTION	SHEET NO. -67-
			SCALE 1 : 300

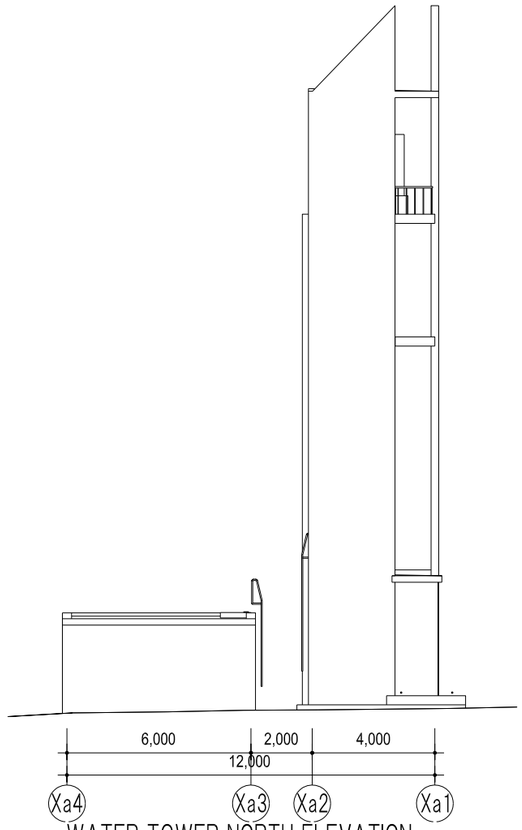




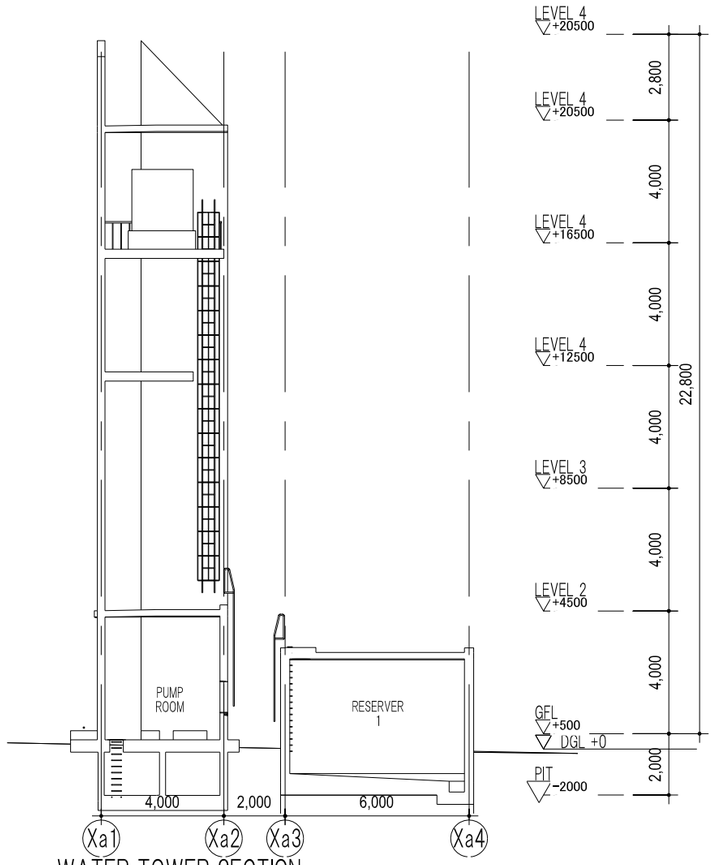
1 GFL (DL-1400)
1 : 300



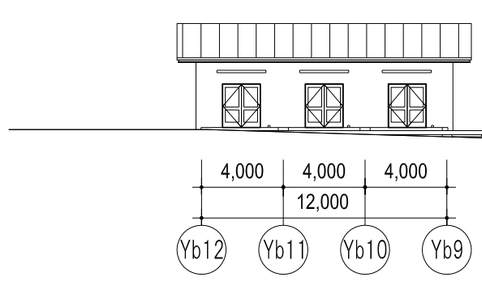
4 WATER TOWER WEST ELEVATION
1 : 200

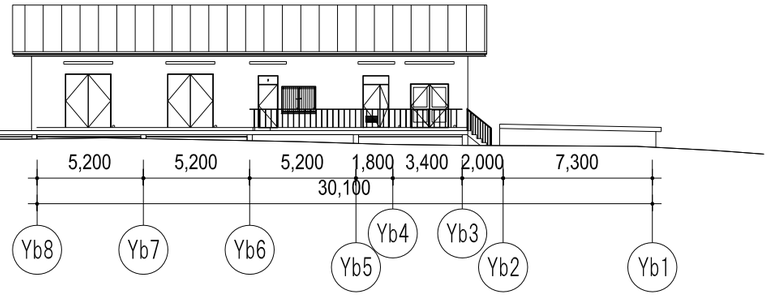


5 WATER TOWER NORTH ELEVATION
1 : 200

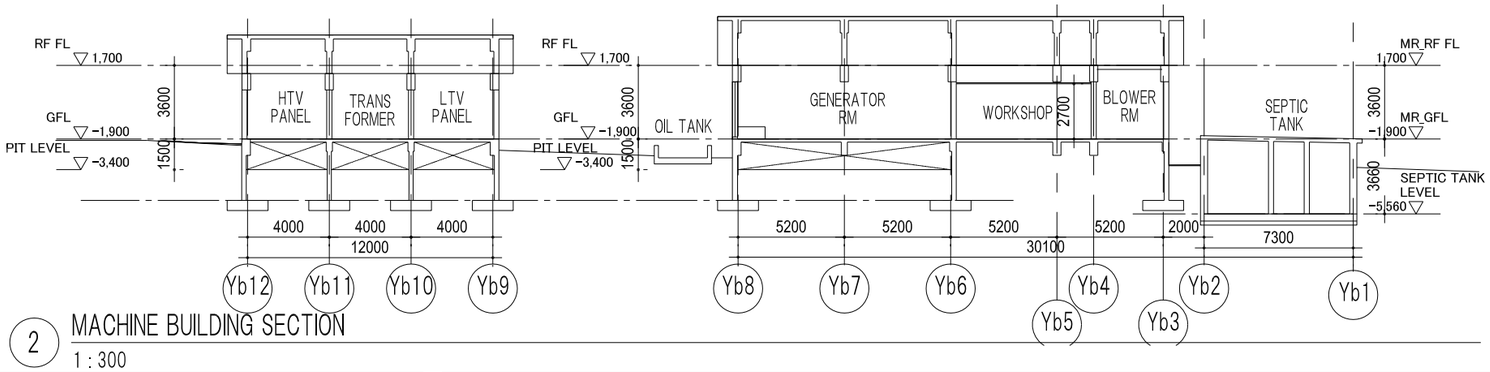


6 WATER TOWER SECTION
1 : 200





3 MACHINE BUILDING WEST ELEVATION
1 : 300



2 MACHINE BUILDING SECTION
1 : 300

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

(1) Implementation System

The Project will be carried out according to the grant aid system of the government of Japan with the cabinet approval of the government of Japan after the exchange notes (E/N) and the grant agreement (G/A) related to the Project are signed with Ghana.

The organizational body implementing the Project is University of Ghana, NMIMR and the responsible organization is Ministry of Education in Ghana.
NMIMR will conclude a consultant agreement and a construction / equipment contract for the project which include the Ghanaian side work.

The following figure shows the relations of all responsible and executing parties concerned in the Project to the Japanese contract signer.

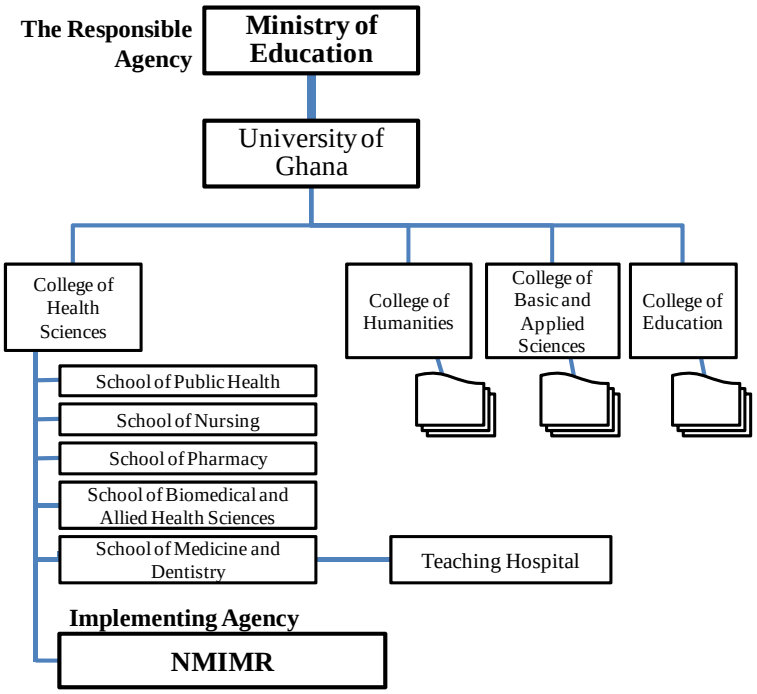


Figure 2-17 Project Implementation Structure

(2) Consultancy

After the exchange of notes and the grant agreement are signed, NMIMR will engage a consultant regarding the detailed design and the construction administration with a consultancy company of a Japanese corporate body. A consultant agreement document will be issued with the approval of JICA. To proceed with the Project smoothly, it is important to sign a consultant agreement promptly after concluding the grant agreement. Once the contract is made, the consultant will need to prepare bidding documents (detailed design drawings/specifications, etc.) based on the investigation report through consultation with NMIMR and obtain content confirmation from Ghana according to the aforementioned approval procedures. Bidding tasks and construction administration work will be carried out according to the bidding documents.

(3) Construction Work/Equipment Procurement Methods

There are two type of works for the project: i) Construction work to construct the facilities and ii) Equipment procurement for the procurement, installation, and trial runs of the medical equipment. The companies that each work task is given out to are restricted to Japanese corporate bodies with

a certain level qualification. Contractors will be selected by general competitive bidding that is restricted by the qualification.
NMIMR will close the main contract agreements with each of the contractor selected by bidding, to be in charge of the construction work. The equipment procurement and the contract documents are to be approved by the government of Japan. After this, the contractors are responsible for each part of the construction work and the equipment procurement, and will promptly initiate their work to accomplish the work according to the work construct document.

(4) Utilizing Local Construction Engineers and Dispatching of Japanese Technical Experts

There are several major construction companies in the city of Accra, but they all require technical advice from the main contractor (Japanese general contractor or large construction company). Therefore, the main contractor shall engage local construction engineers under the supervision of Japanese experts to receive detailed guidance in work process for the quality, and the safety control.
Furthermore, since the Project includes the construction of advanced research laboratory facility, as it is far advanced facility compare to the other research facilities, the high level of quality control of the construction is required. Japanese technical experts possessing relevant experience in the field shall be essential for technical advice and work execution management. Technical experts from Japan or otherwise shall be sought for the construction of highly specialized facility such as BSL-3 laboratory.

2-2-4-2 Implementation Conditions

(1) Temporary Work Plan

Based on the discussion meeting with NMIMR, temporary offices site shall be built for consultant, construction company, and sub-contractors, as well as material storage space combined with material processing areas, warehouses in the empty lot next to the Project.
The major construction materials will be supplied from the city of Accra or from nearby. The material of concrete, will be purchased from a ready-mix plant near the area or in the city of Accra, or produced on the construction site with butch plant.
The proposed project site is located on the University of Ghana campus premises and is in the close proximity to the existing NMIMR building. Since the regular research activities are conducted by NMIMR during the construction, special care should be paid such as construction traffic line in the premise, material carrying-in route and work yard, all to ensure work efficiency and safety. A security guard is required at entrances of NMIMR and surrounding facilities to prevent unauthorized entries to the construction areas, by the people related to the University or others. The traffic safety personnel shall be posted at all critical positions in and around the project site to prevent possible traffic obstructions and accidents caused by construction-related vehicles.

(2) Material Procurement

Main materials, with some exception, should be procured locally including surrounding areas of Accra since products imported from Europe, Southeast Asia, and China, with varied qualities and standards are circulated around Accra. All necessary materials needed for the ease burden of work to conduct building services and repairs after completion of the construction shall be procured locally as much as possible. However, the quality and the volume of supply should be thoroughly reviewed before the procurement to ensure not to negatively affect the construction process.

(3) Construction Method

Utilized materials / products that can be procured locally wherever possible to reduce the construction cost in the Project. In addition, in order to ensure local contractors can undertake the construction without any problems, the Project will avoid employing any particular kind of construction method.

(4) Notes on Legal Issues

In relation to construction permission, it was confirmed that NMIMR stands at the jurisdiction of the University of Ghana, Legon Region. Unlike the other construction in general public areas, no government permits are required for the construction, but only the permission issued from the University‘s Development Committee is expected.
In this particular project, the Ghanaian side had agreed that the consultant shall prepare design drawings in accordance to the Japan’s Building code, and have NMIMR submit them to the University‘s Development Committee for a review and screen toward issuing a building permit. They conform to the local laws issued by the government of Ghana covering anti-seismic, and refer to Japan’s laws in terms of the structural strength and other requirements.
It is also confirmed that the use of the proposed project site does not require special procedures for the reasons that the Project site is owned by the University.

2-2-4-3 Scope of Works

All ensuing construction work shall be executed under the responsibility of the both Ghanaian Ministry of Education and NMIMR. The scope of work for both parties concerned is listed below.

Table 2-36 The Scope of Work to be Covered by Both Sides

Japanese Side	Ghanaian Side
	Securing the proposed project site
	Building application and permits
	Ground clearing and levelling of the Project site 1) Removal of all structures in the site 2) Removal of all existing facilities in the site 3) Removal and land filling of existing electrical cables laid out in the site 4) Removal and land filling of existing telephone cables laid out in the site 5) Removal and land filling of existing water supply lines laid out in the site 6) Removal and land filling of existing drainage lines laid out in the site
	Construction of gates and fences surrounding the site
Construction of Roads 1) Yard roads inside the proposed site	Construction of Roads 1) Outside roads of the proposed site
Construction of building exteriors in the Project site 1) Pavement, outdoor lighting fixtures, rain water gutters, partial tree planting	Construction of building exteriors in the Project site 1) Tree planting
Construction of Buildings 1) Architectural work, including built-in furniture	Construction of Buildings 1) Architectural work
2) Electrical work Electric supply facility, lighting & electrical outlet facility, earthing facility, telephone facility (without telephone sets), paging facility, interphone facility, automatic fire alarm facility, Piping for common antenna television, PC network piping facility, central monitor system facility, Piping for security facility, ITV facility for BSL-3 Lab	2) Electrical work Installation of telephone sets, television sets and wiring work, installation of equipment for PC network and wiring work, installation of equipment for security facility and wiring work
3) Mechanical work Water supply facility, waste water facility, hot water supply facility, sanitary fixture facility, LP Gas facility, air conditioning facility, ventilation facility	3) Mechanical work

Japanese Side	Ghanaian Side
4) Special Work Generator facility, CO2 gas facility, waste water treatment facility, (septic tank)	4) Special work
Supply Facilities e.g. Electricity, telephone, water, waste water within the Project site. 1) Electricity a. Wiring work within the Project site b. Main circuit breaker, high-voltage transformer c. Incoming pipe line including manhole and hand hole, from the boundary line to the main circuit breaker 2) Water a. Water supply facility for the Project site from reservoir: reservoir, water tower, water supply to new buildings (including installation of water meter) 3) Waste water a. Waste water facility in the site 4) Telephone a. IP telephone conduit and cabling work beyond the target facility's terminal board 5) Equipment Work Procurement and installation of equipment included in the Equipment list of the Project 6) Other necessary infrastructure work 7) Furniture, apparatus a. Curtain rails, blackout curtains b. Office/laboratory furniture, built-in furniture	Supply Facilities e.g. Electricity, telephone, waste, waste water. 1) Electricity a. High-voltage incoming line to the building's main circuit breaker 2) Water a. City water Incoming line to reservoir 3) Waste water a. Drainage pipe work, including connecting pit, outside of the Project site 4) Telephone a. IP telephone incoming line to the target facility's terminal board 5) Equipment Work Transfer and installation of existing equipment. Procurement and installation of new equipment not included in the works of Japanese side 6) Other necessary infrastructure work 7) Furniture, apparatus a. Curtains, blinds b. Furniture in general

Important points to be observed in executing the Project is the process control of construction work, electric and equipment works, and installation work. All personnel involved should firstly study thoroughly the installation requirements of the equipment, and then adjust the installation process accordingly. Since the removal of existing buildings, infrastructure improvement, and landscaping is to be conducted by the Ghanaian side, work progress of both parties should be confirmed on a regular basis. The Ghanaian side has affirmed that infrastructure improvement work (electricity, water supply etc.) shall be finished in advance to make no delay of the construction schedule. Detailed discussion sessions should be held repeatedly, utilizing occasions to explain the design drawings to ensure smooth work process. Also temporary installation/connection to the existing buildings is needed before the actual work for infrastructure improvement starts.

2-2-4-4 Consultant Supervision

Japanese Consultancy Company shall conclude a consultant agreement with NMIMR, then prepare detailed design (such as tender documents), invite tenders for bidding, provide implementation of supervision and Soft Component of the Project.
The purpose of the supervision is to determine whether all construction work is conducted according to the design drawings, and to ensure the correct implementation of the construction agreement. During the period of construction, the consultant shall supervise work progress and maintain quality control by giving guidance, advice, and coordination. Types of supervision include the following tasks.

(1) Assistance in the Tendering and Award of the Contracts

To conduct the overall relevant tasks related to a tender notice to select contractors for construction work and equipment. The task includes, placing tender notice, accepting bid participation request forms, qualification of bidder, holding briefing meeting for interested bidders, distributing tender documents, receiving bid documents, evaluating bidding results. Once the bidders were chosen, it is implemented to advise and assist contractors in signing the contract agreements with NMIMR.

(2) Instruction/ Advice/ Coordination for Contractors

To review of construction process, construction plan, construction material procurement plan, equipment procurement/installation plan, etc., and give guidance, advice, coordination to contractors.

(3) Checking & Approval of Construction Drawings, Workshop Drawings, etc.

To check and approve all documents such as construction drawings, workshop drawings submitted by contractors. And add necessary instructions if any.

(4) Confirmation & Approval of Construction Materials and Equipment

To check if all construction materials that equipment contractors are to procure conform to the construction agreement documents before consenting.

(5) Construction Inspection

To inspect the manufacturer of construction material and equipment, attend as inspector at construction tests, and conduct tests to secure quality and performance when needed.

(6) Reporting Work Progress

To prepare a work progress report with a clear understanding of construction process and conditions at the construction site for all the relevant organizations in the both countries.

(7) Completion Inspection and Operation Test

To conduct complete inspection and trial operation of construction, related facilities, and equipment to check for the performance conformity specified in the construction contract documents. Submit the inspection report to NMIMR.

(8) Construction Supervision System

The consultant shall post a permanently-assigned on-site supervisor to achieve the aforementioned tasks. Depending on the pace of work progress, to dispatch technical engineers with relevant expertise to hold meetings, tests, guidance, and provide coordination/adjustments. At the same time, to assign engineer in charge to work from Japan for technical considerations and liaise with the construction site. Moreover submit reports to government of Japan agencies required information on work progress situation, payment process, delivery of completed project.

Below figure shows the Implementation of supervision organization.

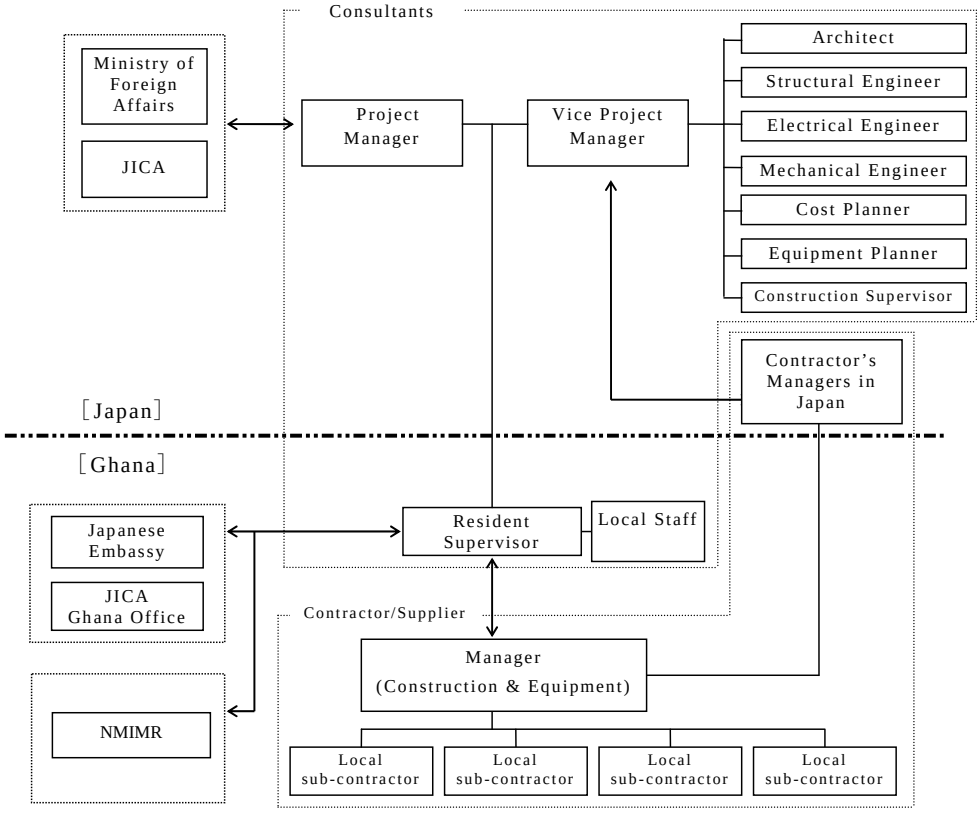


Figure 2-18 The Consultant's Supervision Organization

2-2-4-5 Quality Control Plan

(1) Concrete Work

Concrete quality control Plan shall be based on Japan's Public Buildings Construction Standards Manual (Public Buildings Association) and JASS5 (Architectural Institute of Japan), however, if needed, Ghana's quality control plan which is commonly employed within the country shall be used.

1) Mix Proportion Plan

Specified mix proportion shall be determined after trial mixings. Trial mixings shall be repeated until target slump value, air content, required air dried bulk density, and mix strength are satisfied.

2) Curing

Curing of test pieces shall employ underwater curing method at the work site. Temperature for curing should be close to that of surrounding building, etc. Collect trial pieces once on the day of placement and one for every 150m^3.

3) Strength Test

To confirm the mix strength, as a general rule, compression strength shall be measured after 28 days of placement. The third party agency, such as university laboratory, shall be used to reconfirm the test result.

4) Chloride Content

The measuring method commonly used in Japan to measure the amount of chloride will be employed to confirm the amount detected to falls below 0.30kg/m^3.

(2) Reinforcement Work

Quality control/inspection of the process and the assembling of the reinforced steel rod shall conform to the standards set by the Japan's Public Buildings Construction Standards Manual (Public Buildings Association) and JASS5 (Architectural Institute of Japan) however, if needed, Ghana's quality control plan which is commonly employed within the country shall be used.
The contractor shall submit to a bar arrangement inspection by the supervisor before placing concrete. Locations subject for inspection to be determined by the supervisor.

(3) Form Work

The quality control and the inspection of the form construction work shall conform to the standards set by the Japan's Public Buildings Construction Standards Manual (Public Buildings Association) and JASS5 (Architectural Institute of Japan), however, if needed, Ghana's quality control plan which is commonly employed within the country shall be used.
The contractor shall have the supervisor to inspect the space between sheathing board and the outermost reinforcement bar before placing concrete. Locations subject for inspection shall be determined by the supervisor.

(4) Inspection of Concrete Structures Finishing and Covering Depth

Inspection of concrete member's position and section size, surface finishing condition and uniformity, defective placement, covering depth of the structure shall be the subjects for the inspection shall be based on the Japan's Public Buildings Construction Standards Manual (Public Buildings Association) and JASS5 (Architectural Institute of Japan), however, if needed, Ghana's quality control plan which is commonly employed within the country shall be used. In the case where the inspection result for the structure's concrete finishing/covering depth does not conform to the relevant standards, the supervisor shall decide and issue instructions needed to comply.

(5) BSL-3 Laboratory

Sufficient capabilities to conform to the WHO biosafety standards shall be secured. In particular, steel panels, doors, air-conditioning ducts shall possess appropriate air tightness, and are structured capable of withstand air pressure differences. After the construction of the laboratory is finalized, leak tests (conforming to leak test standards) shall be conducted to verify air tightness and air pressure differences. Furthermore, exhaust performance for the laboratory should be secured.

2-2-4-6 Procurement Plan

(1) Procurement of Construction Material

Since this plan is designed for research facility, it is of upmost importance to procure sustainable and durable products which could provide sustaining performance for special facilities and equipment/apparatus, as well as ease of building service and cleaning, so that the performance of the facilities could be sufficiently exerted. Specific procurement policy is listed below.

1) Local Procurement

To ease the ensuing facility's repairs and building services after completion of construction, necessary equipment and materials shall be procured locally as much as possible, however, the material's quality and difficulty in obtaining needed quantity should be ascertained. Those imported materials locally available in Ghana markets shall be considered as "local goods" i.e., goods regularly available in local markets without importing them by yourself should be made to use as much as possible.
In view of the fact that products from Europe, Southeast Asia, China are distributed around Accra area with varying qualities and standards, it is perceivable all needed main materials, with some exceptions, could be procured locally and around the city of Accra. To facilitate the ease of building service and repairs, necessary materials should be procured locally;

however, quality and available volume should be ascertained so not to negatively affect the ongoing construction work.

2) Procurement through Import

Materials determined to be too difficult to procure locally, unmet-quality requirements, or unstable supply volume, shall be imported from Japan or third country. Under this circumstance, construction contractor should coordinate tasks with the Ghanaian side for import/customs clearance of goods as to facilitate smooth operation of tax exemption and other necessary procedures.
If the total costs (price of products plus packing/transport) of importing the similar materials from Japan or a third country are less expensive than that of locally procured goods, consider importing the materials.

3) Transport Plan

All materials imported from Japan or third country shall be transported by sea to the Port of Tema, Ghana. And from Tema to the construction site in Accra, they shall be transported by land. Tema is located about 30km east of Accra. Some equipment/materials may require special packing, so to withstand high humidity and temperature conditions as an impact.

4) Procurement Plan

Main construction equipment/materials to be procured shall be divided and listed into three groups: Local Procurement, Third Country Procurement, and Japan Procurement. Majority of main equipment/materials of electrical and mechanical equipment, with small exception, shall be imported from either Japan or third country.

Table 2-37 Main Construction Materials Procurement Plan

Type of Work	Equipment/Material Required	Order Destination			Remark
		Local	Japan	3rd Country	
Reinforcement	Portland Cement	○			
	Fine Aggregate	○			
	Rough Aggregate	○			
	Concrete	○			
	Heteromorphic reinforcing rod		○		Procurement from Japan is cheaper
	Forms	○			
Steel Frame	Steel Frames	○			
Masonry	Concrete Blocks	○			
Waterproofing	Silicone Sealant (around glasses, sashes)	○			
Plasterwork	Cement Mortar	○			
Tiling	Tiles	○			
Carpentry	Construction lumber	○			
Roofing &Gutter	Metal Roofing material	○			
Metal Construction	Lightweight ceiling, wall substrates	○			
	Decorative steel, hand rails	○			
	Aluminium ceiling access hole, hardware, grating, manhole covers	○			
	Aluminium louvers, EXP-J		○		To secure required quality
Metallic Fittings	Aluminium fittings		○		To secure required quality
	Steel fittings		○		To secure required quality
	Lightweight steel fittings		○		To secure required quality
	Stainless steel fittings		○		To secure required quality
	Fittings		○		To secure required quality

Type of Work	Equipment/Material Required	Order Destination			Remark
		Local	Japan	3rd Country	
Glassworks	Ordinary glasses	○			
	Glass blocks	○			
Painting	Interior painting	○			
	Exterior painting	○			
Interior Work	Steel panelling		○		To secure required quality
	Vinyl flooring sheets	○			
	Plaster boards	○			
	Asbestos sound absorbing system ceiling	○			
	Calcium silicate boards	○			
	PVC ceiling moulding	○			
Miscellaneous	Sinks	○			
	Hanging cabinets	○			
	Name plates for buildings & rooms, information boards/signs	○			
Electrical facility work	Wiring devices	○			Local procurement
	Lighting fixtures	○	○	○	Special items to come from Japan
	Boards		○		Unmet quality performance level
	Electric wires, cables	○	○		Special items to come from Japan
	Interphone system		○		Unmet quality performance level
	Public address system		○		ditto
	Fire alarm system	○	○	○	Special items to come from Japan
	Security		○	○	ditto
	Monitoring camera		○		ditto
	ITV		○		ditto
	Generators		○	○	Not available locally
Mechanical facility work	Air cooled chiller		○	○	Unmet quality performance level
	Air conditioning device		○		ditto
	Air conditioners		○	○	Not available locally
	Ventilators, extractors	○	○		Special items to come from Japan
	Blow-off ports, suction ports	○	○		ditto
	Filters		○	○	Not available locally
	Duct material	○			
	Pumps	○			
	Automatic control device		○		Unmet quality performance level
	Sanitary ceramics		○	○	Not available locally
	Fire extinguishing device		○	○	Not available locally
	Waste water treatment		○		Unmet quality performance level
	Piping material	○	○		Special items to come from Japan
	Heat insulating material		○	○	Not available locally

(2) Equipment Procurement Plan

1) Procurement Plan

All equipment included in the plan shall have appropriate maintenance to enable accurate and stable diagnostic results required by experiments and research. Such highly sensitive equipment as flow cytometry, real-time PCR must undergo periodical inspection, replacing and adjusting parts conducted by engineers with specialized experiences and knowledge, therefore, they must be procured through manufacturers who have local agents in Ghana, Africa, Middle East, or European countries.

Procurement of the equipment from third country shall be considered under circumstances where Japanese-product-specific procurement may result in improper competitive bidding, or may make maintenance difficult by not having a local agent. The following table shows the procurement of the major equipment from third countries.

Table 2-38 Major Sales Agents in Accra

Equipment	Japanese Make	3rd Country	Remarks
Biosafety cabinet, Deep freezer (-80^{0}C), Tabletop ultracentrifuge, Refrigerated centrifuge, Electronic balance, Microplate reader, Nanodrop, Fluorescent microscope, Flow cytometry, Teaching microscope, EliSpot reader, Cell counter, PCR workstation, Real-time PCR, Gel imaging system, Water distiller	○	○	To conduct proper competitive bidding
Formaldehyde decontamination unit, Autoclave, Digital coagulator, Fume extractor	○	—	Quality/ease of use, etc. is considered

2) Transportation Plan

Transportation routes for importing from Japan and third countries shall be similar to that for construction equipment/materials; transported by sea to the Port of Tema, Ghana, and from Tema to the Project site in Accra shall be transported by vehicles on land. The equipment to be procured locally or from local agents shall be transported to the Project site by vehicles. Special packing methods shall be employed for equipment which may result in function deterioration by impact, humidity or temperature during the transport.

Duration of transport may take approximately two months from/to the ports of Yokohama and Tema, and additional 0.5 month for customs clearance and local transport.

3) Installation of Equipment

In the installation plan, equipment which may be directly affected by construction and facility work is ice maker, fume extractor, and water distiller. Installation of other equipment not listed in the Table 3-39 should be coordinated largely with electric work, but it also needed to allow some time for assembly/trial operation/adjustment by technical experts and for operation instructions/analysis provided to researchers. Installation/adjustment of the equipment shall be conducted by engineers from equipment manufactures or agent. Incurring costs for installation are included in the Equipment Plan.

Table 2-39 Type of Work Needed for Equipment Installation

Equipment	QTY	Water Supply	Drain-age	Steam	Exhaust	Remark
Ice maker	1	○	○			
Fume extractor	2				○	
Water distiller	2	○	○			
Flow cytometry (A)	1					Main concern are related with electric work, but may require relatively longer time for installation, adjustment, training
Flow cytometry (B)	1					
EliSpot reader	1					
Cell counter	1					
Real-time PCR	2					

2-2-4-7 Operation Guidance Plan

(1) Initial Operation Instructions

Initial operation instructions for equipment shall be conducted by engineers/technicians dispatched by the supplier for NMIMR researchers and technicians. Instructions on all the equipment shall be given in principle, and they include operational and analytical method for highly sensitive equipment, explanations on handling and operating equipment, daily inspection, trouble shooting, periodical maintenance, etc.

(2) Operation Instructions Design

It is judged that no additional operational instructions are needed because of the fact that most equipment included in the procurement plan is either being replaced or supplementary to the existing equipment.

2-2-4-8 Soft Component Plan

(1) Background behind in Planning of Soft Component

The existing main research building, built in 1979 with centralized air-conditioning system has been replaced by the individual type air-conditioning system. Given the uncomplicated nature of the air-conditioning system, simple repairs and maintenance work were carried out by the NMIMR maintenance personnel. While more serious repairs were delegated to manufactures. It has been 15 years since the addition and operation of BSL-3 laboratory and animal laboratories, requiring biohazard type air-conditioning system to maintain laboratory rooms under negative pressure and running clean-room equivalent air-conditioning system.

This plan shall require even more rigid and sophisticated biohazard facility to ensure the safety of researchers and neighboring residents with the construction of the new BSL-3 laboratory. Maintaining negative pressure in the laboratory is the basic requirements of biohazard air-conditioning system, and it is essential to provide proper air balance and differential pressure in the laboratory. Personnel shall be retrained with the knowledge and skills to necessary operate and maintain the laboratory in order to improve their technical abilities. These skills and knowledge include proper operation to catch highly pathogenic agents through HEPA-filters and thoroughly sterilizing waste water.

Air conditioning method adopted in this plan uses chiller as a heat source to send chilled water to an air handling unit, and cooled air supply is distributed throughout the laboratory via the air ducts, while the room air is exhausted via the ventilator. Exhaust may contain highly pathogenic agents, therefore, high performance filter called HEPA filters should be installed to capture dust covered with highly pathogenic agents. Maintaining negative pressure in the laboratory requires well-balanced volumes of air supply and exhaust flow, so a CAV (Constant Air Volume) device, VAV (Variable Air Volume) device and BD (Barometric Damper) are needed. If the system fails to maintain the state of negative pressure, the system shall sound an alarm, at the same time, urgent measures shall be taken such as stopping operation of air-conditioners and operating only the ventilators to prevent any spread of highly pathogenic agents to the outside.
During the normal operation of the laboratory, this system shall be running automatically, however, it is required to switch to manual system in the area divided by predetermined air-conditioning zones during the after-hour work or during period of laboratory sterilization. A maintenance planning and scheduling process needs to be designed with the knowledge that machines and control system may fail at any given time. So the maintenance personnel are required to be able to cope with varying situations such as machine failures and emergency situations by manually switching to a back-up operation.

Currently 11 facility maintenance control persons are responsible for maintaining the entire NMIMR facilities and equipment, but many hours are now spent mostly on repair work. While 4 staff members out of 11 have completed a course on bio safety training program with the understanding of its theory as well as possessing some practical experiences in formaldehyde fumigation and HEPA filter replacement. In the next 2 years, it is expected that 3 staff members are to be retired and shall require the vacant positions be filled.
Intended trainees for the soft component training shall be the 8 maintenance control persons (except. the retirees) who would be directly responsible for NMIMR in 2 years' time. The breakdown of the 8 members' expertise is: 3 electricians, 3 air-conditioning technicians, and 2 for water supply/drainage work. NMIMR is aiming to recruit 1 additional member for each department.
In the maintenance section, there were 2 members trained in Japan (one of which is already resigned) and another who received a third-country training conducted in Sri Lanka. According to those who took training courses, most of the training programs were on handling hospital equipment and no BSL-3 programs.

Meanwhile, the fact that HEPA filters were finally replaced after 10 years of use instead of about 2 years has become an important safety concern.
These conditions make it necessary to enhance maintenance control technology capability of the maintenance personnel by having them go through training programs on bio safety theory, and then to properly manage and operate the BSL-3 laboratory.

(2) Soft Component Objectives

The following goal is stated to enable safe and efficient operation of the BSL-3 Laboratory which would be constructed by the support of grant aid.

Properly Operating and Managing the BSL-3 Laboratory Facility Organization

(3) Expected Achievements of Soft Component (Direct Effects)

At the end of Soft Component phase, the following 6 items shall be achieved as direct effect.

1. Understanding the BSL-3 Laboratory Facility System
2. Mastering the Operation of BSL-3 Laboratory Facility System
3. Maintenance Management of BSL-3 Laboratory Facility System
4. Understanding the Summary of Biosafety
5. Acquiring Skills for the Formaldehyde Fumigation
6. Acquiring Skills for the HEPA Filter Replacement

(4) Method of Ascertaining the Degree of Achievement

Refer to the table in below for items to determine the degree of implementation/accomplishing of Soft Component.

Table 2-40 Items to Determine of Achievements

Type of Training	Check Items
Understanding Laboratory Facility System	・Ability to understand the structure and flow of facility system. ・Ability to understand the function of facility system. ・Ability to understand the specifications applicable to BSL-2&3 Lab. ・Ability to understand the meaning of monitor and warning displays.
Operation of Laboratory Facility System	・Ability to conduct automatic-, systematic-, backup operations of facility system. ・Ability to switch operation of facility system to cope with emergency and failures. ・Ability to adequately determine facility system's required temperature, pressure, differential pressure, flow ratio. ・Ability to operate monitor and warning panels.
Maintenance Management of Laboratory Facility System	・Ability to conduct maintenance management. ・Ability to put together manuals and other documents. ・Ability to keep records of maintenance management documents. ・Ability to develop a maintenance management plan.
Understanding the Summary of Bio Safety	・Having a basic knowledge of microbiology. ・Ability to understand biohazard measure for laboratory.
Acquisition of Formaldehyde Fumigation Skills	・Ability to understand fundamentals of sterilization. ・Ability to acquire practical skills for formaldehyde fumigation.
Acquisition of HEPA Filter Replacement Skills	・Having a basic knowledge of HEPA filter function. ・Ability to acquire skills for HEPA filter replacement.

The training of understanding and operating, the maintenance of the system carries out technical guidance while making "instruction enforcement management table" every transfer technology item, and repeating on desk instruction and practice instruction. The result of the technology transfer can become a visual by judging "an acquisition level" as an evaluation of the acquisition technology every transfer technology item. The acquisition level judges a self-report with five level of follows by "an instruction enforcement management table" to a base. Judgments of performance will be performed two times, early stage of the first dispatch period and third dispatch. The aim level aims at the improvement of the lowest one rank after training attendance. Acquisition level is as follows.

Level A: Superior knowledge or appropriate operation and maintenance is possible
Level B: Some knowledge or tentative operation and maintenance is possible
Level C: Little knowledge or partial operation and maintenance is possible
Level D: Poor knowledge or operation and maintenance is not possible
Level E: No experience and no knowledge

(5) Soft Component Activities (Input Plan)

Since the Plan includes very sophisticated system including BSL-3 laboratory, mechanical and electrical facility engineers (Consultant A and B) with thorough understanding of the design contents shall be engaged from Japan. In addition, Japanese Experts (C and D) shall be dispatched to conduct training programs on bio safety summary, formaldehyde fumigation and HEPA filter replacement techniques. Commitment on the part of Ghana shall be the aforementioned NMIMR maintenance control personnel be the intended trainees.

Table 2-41 Soft Component Input Plan

Items	Japanese Side	Ghanaian Side	Duration
Understanding Facility System	Consultant A and B (Mechanical and Electrical Engineers)	NMIMR Maintenance Control Personnel	3.0 M/M for task performed at the Site; 2.8 M/M for task performed in Japan
Operation of Facility System			
Maintenance Management of Facility System			
Summary of Biosafety	Experts C and D		
Formaldehyde Fumigation Technique			
HEPA Filter Replacement Technique			

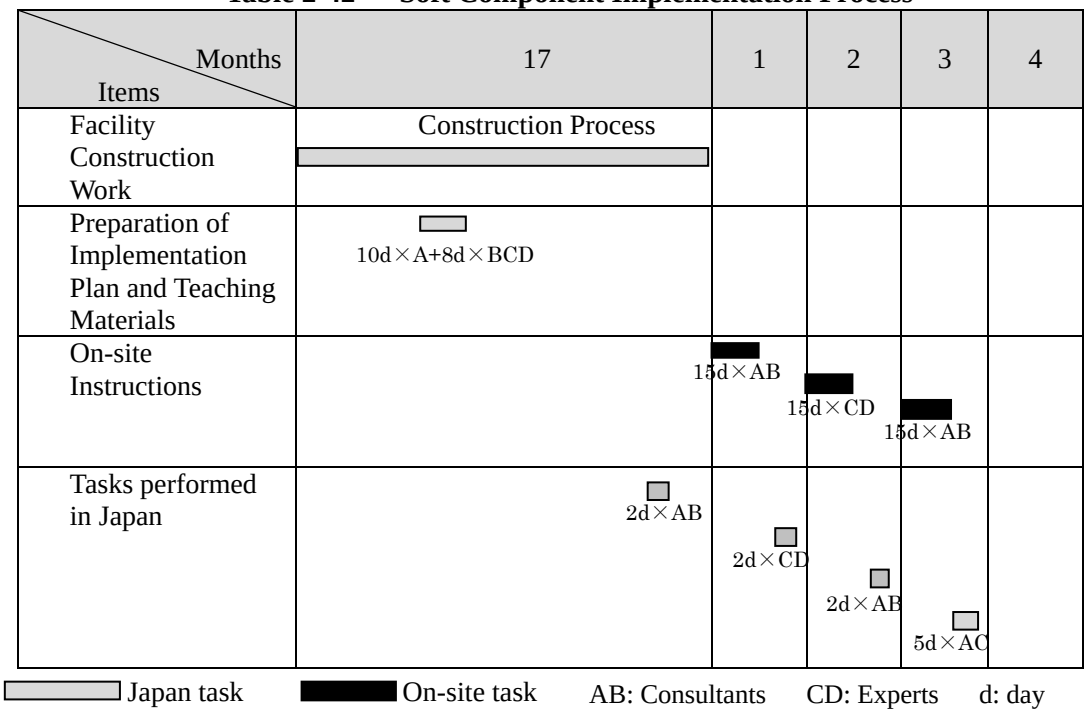
(6) Procurement Method for Soft Component Implementation Resource

The training for the Facility System as part of the Soft Component of this Plan mainly involves with technical instructions on operating and maintaining BSL-3 laboratory mechanical and electrical facilities. The rationale behind this is that the personnel to be considered for developing facility system of the Plan, should be the facility engineer who has been involved in the designing and administrating BSL-3 laboratory, therefore, it is most suitable to select and assign the mechanical and electrical consultant engineers (A and B).
Experts (C and D) hired for training courses conducted in Japan and for being dispatched to the Site shall be chosen from organizations such as JICA Technical Assistance Project team who has past experience conducting BSL-3 laboratory training programs in Japan.

(7) Soft Component Process

Training shall be conducted at facilities and venues in Japan or in the NMIMR compound, and the training shall be conducted 3M/M on site after the completion of the construction work.

Table 2-42 Soft Component Implementation Process



In the first on-site instructions, emphasis shall be placed on training the personnel to deepen their understanding the Design's facility system, and acquire the operation and maintenance control techniques of the system. The training plans 15-day dispatch by engineer A and B. Instructors shall use and utilize such available materials as design drawings, specifications, and brochures to deliver general explanation of the system, as well as use the Standard Operating Procedure (SOP) prepared while in Japan and manuals to aid in practical training programs. Equipment that are to be installed in the Project site, including chillers, air handling units, air-conditioners, pumps,

exhaust ventilators, HEPA filters, automatic-control system, and security system, shall be used in hands-on training program to aid better understanding the equipment and facility as a system as a whole. Special hands-on instructions shall be given to trainees enabling them to operate the system manually to cope with any situations, systematic or emergency, unable to run the system automatically. Adequate training on how to keep Daily Log to record system's temperatures, pressures, differential pressures, flow ratios of the system shall be conducted. Maintenance control trainings on how to replace or clean filters and to cope with equipment failure, or to procure replacement parts and nondurable parts shall be conducted also.
In the second on-site instructions, experts shall explain the bio safety theory, perform practical training on formaldehyde fumigation and HEPA filter replacement techniques. The training plans 15-day dispatch by experts C and D.
In the third on-site instruction, training of a daily record in line with practical operation such as measurement of temperature, pressure, differential pressure, the quantity of water of the system, the instruction on the maintenance side including the procurement method of drafting, replacement parts and the expendable supplies of the schedule plan will be performed. The training plans 15-day dispatch by engineer A and B.

(8) Achievements of Soft Component

A main achievement of the soft component is shown below.
These achievements are prepared in Japan mainly, but adjustment with the NMIMR side is necessary for a part including SOP, and a correction is necessary in Ghana.

Table 2-43 Soft Component Achievements

Goals	Outputs
Improving Maintenance Management Techniques	1. Soft Component Implementation Plan 2. Equipment Inventory, Operation/Maintenance Manuals 3. Daily Maintenance Inspection Manual, Recordings 4. Operation/Maintenance SOP for Air-Conditioning/Ventilation Systems and Bio Safety Cabinets, Validation/Calibration Implementation Plan, Reports 5. Inventory Control System 6. Data Control Manuals 7. Other Teaching Materials, Instruction Records, Video Recordings, etc. 8. Soft Component Progress Report, Result Report

(9) Obligation of Soft Component for Recipient Country

The Soft Component is carried out to secure the sustainability on the part of Ghanaian side, therefore, all trainings and instructions should be planed to encourage and promote voluntary activities of the Ghanaian side whenever possible. This requires the deep understanding and cooperation for the Soft Component from the Ghanaian's administrative and implementing organizations.
Specifically, responsible party at the NMIMR needs to understand and consider thoroughly of the Project's objectives and its implementation guidelines. As the overall figure responsible for maintenance of the facility, NMIMR Director and personnel in charge must continue to supervise on the facility maintenance both during and after completion of the soft component process. To this end, a regular reporting (approximately once a year) on the maintenance control situation of the site to the Chief Representative of JICA Ghana Office is recommended.

2-2-4-9 Implementation Schedule

Implementation schedule after the E/N is shown below. The content of the implementation schedule consists of 3 parts: (1) Detailed Design Work conducted by Consultant, (2) Tender, and (3) Construction Work by Contractor and Construction Administration Work by Consultant.

(1) Detailed Design Work

NMIMR and the Japanese consultant company shall engage a consultant contract agreement for the Project and then require approval of JICA. Consequently, the consultant shall prepare tender documents (detailed design work, bidding documents) based on the Preparatory Survey Report after discussing with NMIMR and require NMIMR's approval.
It will be expected to take 4 months for the preparation of tender documents.

(2) Tender Stage Work

Tender stage work will be expected to take 3 months for the preparation to hold bidding.

(3) Construction Work & Construction Supervision

After contracting construction agreements (construction/equipment procurement), the contractors shall undertake construction work. At the same time, the consultant shall start construction supervision.
It will be expected to take 17 months to complete the construction.

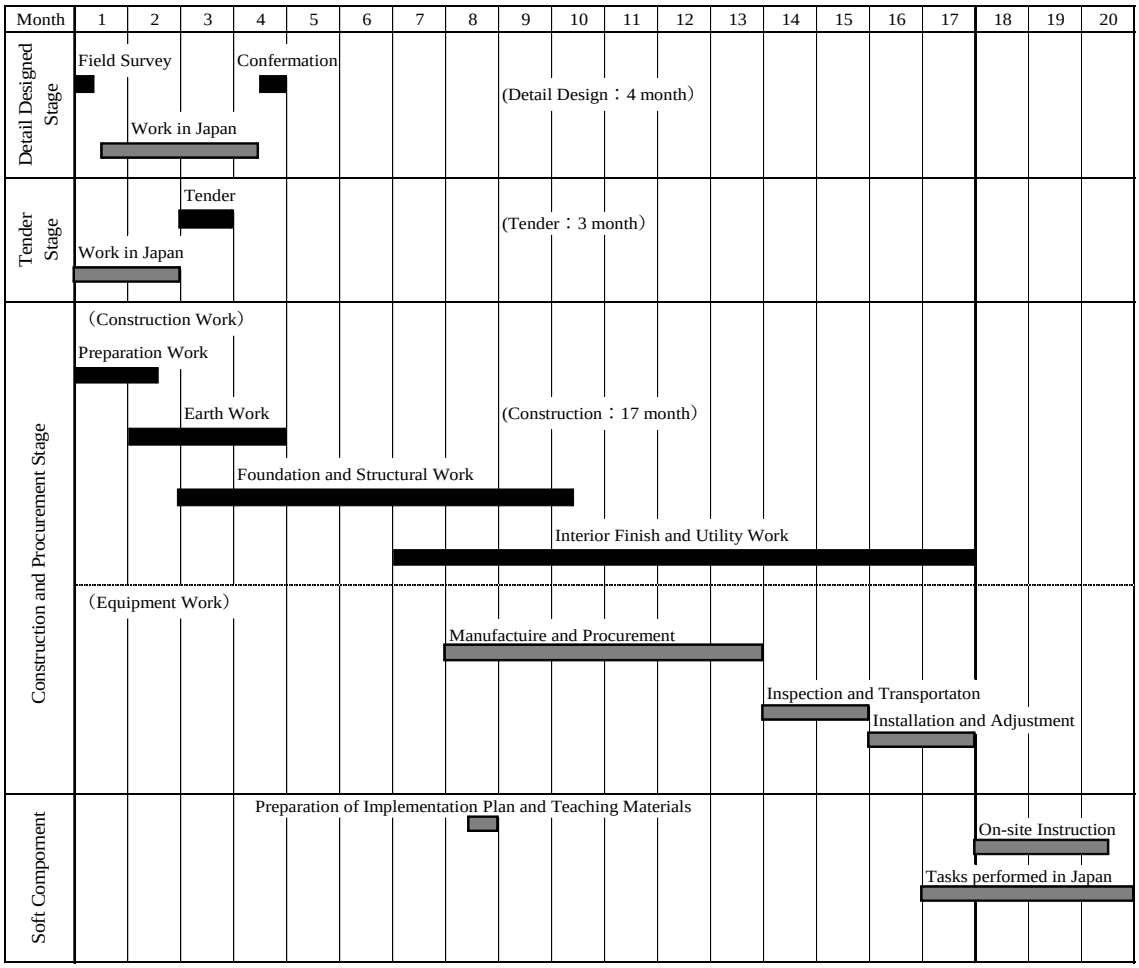


Figure 2-19 The Project's Implementation Schedule

2-3 Obligations of Recipient Country

(1) Input from Ghanaian side for the Project is indicated below:

1) To perform construction and to adjust the design that the Ghanaian side will be responsible for as aforementioned in the categories; construction and procurement.
2) To fully exempt tax regarding the Project.
3) To apply and acquire necessary permissions for planning and the Project construction etc.
4) To issue Banking Arrangement (B/A) and Authorization to Pay (P/A) issuance and associated transaction fees.
5) To grant quick landing, tax exemption and custom operation for the equipment at the port of arrival and prompt domestic transportation.
6) To arrange necessary entry and stay for the Japanese staff delivering the equipment and participating in the Project as contractually stipulated.
7) To give full domestic customs and tax exemption for the Japanese staff delivering equipment and participating in the Project as contractually stipulated.
8) To have budgetary steps for an effective operation and management of the facilities and equipment prepared by grant aid.
9) To install electricity, water, sewage line, and phone main line until the branch point.
10) To transfer and install the existing equipment that is assigned for the project.
11) To procure and install the equipment that is not included among Japan's responsibilities.
12) To purchase and install laboratory equipment except lab benches and necessary furniture for the office.

(2) Tax Exemption System

Japan's grant aid programs are extended in principle on condition of exemption of duties and taxes. It has been agreed that the Ministry of Education of the government of the Republic of Ghana takes necessary measures to concerned authorities to ensure that Japanese juridical persons, Japanese nationals, construction materials, equipment, etc. related to the project are exempted from various duties and taxes. The procedure for tax exemption is as shown in the figure below.

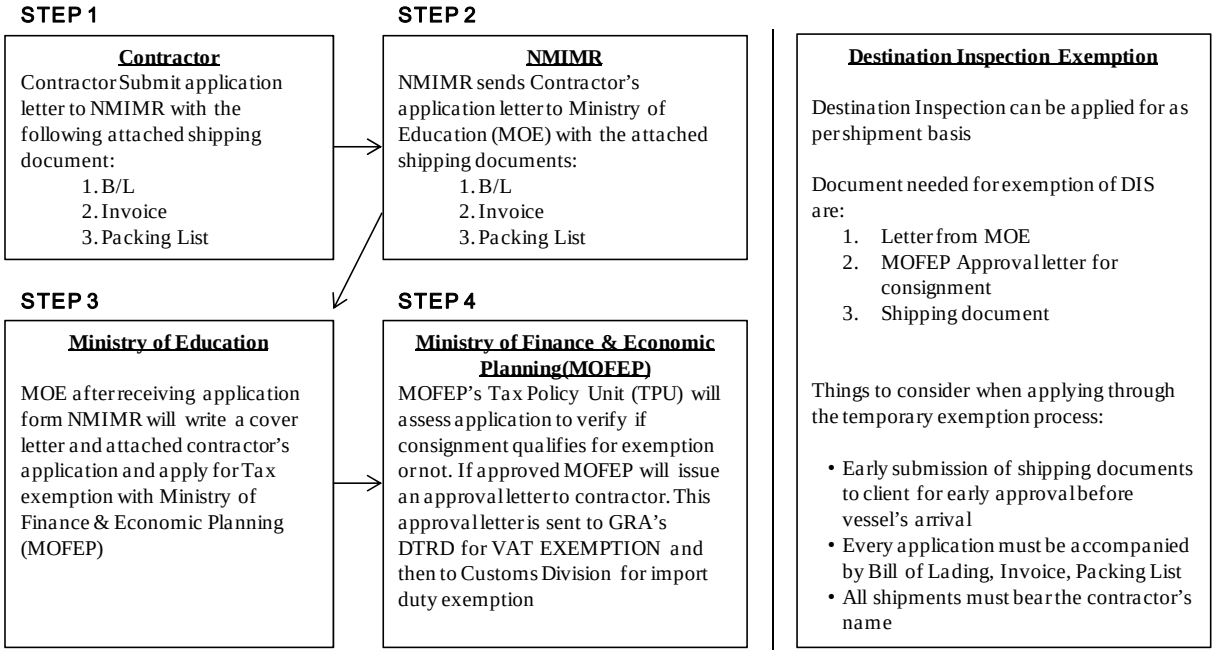


Figure 2-20 Tax Exemption Procedure Flow

2-4 Project Operation Plan

(1) Organization

The project will assemble three existing research departments. Therefore, the organizational structure will not change.

(2) Personnel Plan

NMIMR's future trajectory estimates 5% staff increase per year (including project staff, excluding interns and national service[1]). The past result shows 24% staff increases in five years, 2010 to 2015, and it matches the rate aforementioned (Refer to Figure 2-4 The Staff Number Change in The Past Ten Years). Therefore, by setting the 2015 staff number as 100%, the estimate of the staff increase in year 2020 will be 124%. This means there will be 119 staff members total in the 3 departments by year 2020. That is a 23–member increase compared with year of 2015. The detail is as follows:

Table 2-44 Staff Increase Estimate in the Discussed Three Departments

Department	Head/Prof.	Researcher	Assistant/ Technician	Others (Admin. etc)	Total
Staff Increase Estimate Year 2020	6	20	82	11	119
Staff Number Year 2015	5	16	66	9	96
Staff Increase EST (estimate 2020–Actual Number 2015)	1	4	16	2	23

Source: The Research Team

As stated above, about 23 staff members' increase is expected in the three departments of Virology Bacteriology, Immunology that are moving to the new research center. Those staff members can be categorized into full-time and project staff. Few increases are expected in full-time, who receive their salaries from the Ministry of Education. The majority of the increase is in project staff hired short-term and assigned to each project. Their salaries come from the budget for joint research projects with other donors and research institutions. Staff recruitment can be done without difficulty by choosing qualified applicants among NMIMR's interns, national service, or post-doctoral research scholarship recipients.

(3) Maintenance Plan

1) Facility

NMIMR's building service for facilities and equipment is managed by the NMIMR maintenance department. The department consists of 11 staff members in total. From year 2014, one person is in charge of architecture, two persons in electricity, four persons in air-conditioning, and three persons in water systems to provide the building service.

While frequent planned power outages have required many hours in power generator maintenance as their recent work. Their main work, however, is to respond to facilities or equipment malfunctions. Thus, it is difficult to conduct preventive maintenance on a daily or regular basis at present day.

Exiting P3 Laboratory and Animal Laboratory have had their HEPA filter unchanged for more than ten years. This fact gives a strong reason for adequate maintenance strategy reinforcement.

Installment of a BSL-3 Laboratory is part of the Project, and Ghana has requested staff training for enhancing the building service technical capability. We will consider provision of technical training through a grant aid "Soft Component Scheme".

[1] The graduate of higher education in Ghana is liable for social service during one year.

2） Equipment

Normally NMIMR's maintenance department is in charge of its equipment management and maintenance. The equipment that cannot be repaired by the technicians of maintenance department is taken care of by an outsourced maintenance company. Flow cytometry, automated blood culture systems, sequencers, and real time PCR are periodically maintained by the agencies that have annual maintenance contracts with each of the equipment providers. Necessary reagents and consumables for the equipment are regularly ordered by each department from domestic or international (e.g. UK) providers and received through NMIMR's Store department.

The maintenance of the equipment that will be procured through the Project will be done in the maintenance system described in below. Appointing one equipment maintenance manager and minimum two technicians will be needed for preventive maintenance and adequate repair. Also, NMIMR will offer those three technicians a technique improvement training given by a local engineer from the outsourced maintenance company.

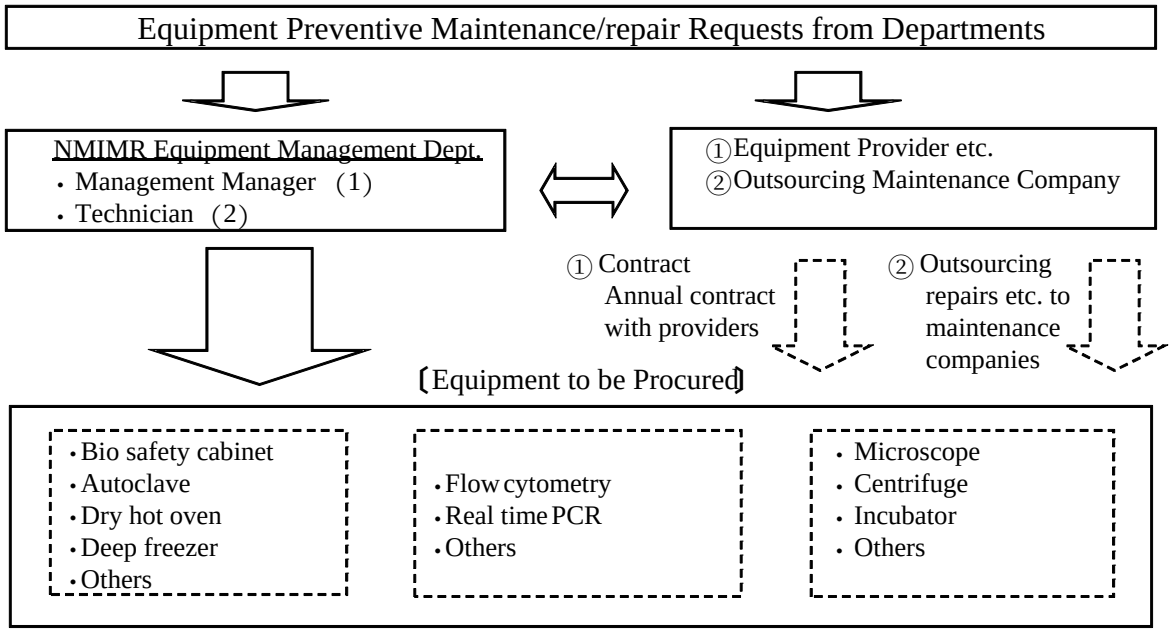


Figure 2-21 Equipment Management Organization

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

(1) Ghanaian responsible expenditure

Ghanaian responsible expenditure is below.

Table 2-45 Input and Expenditure of Ghana Side

Unit: GHS

Burden Contents		Expenses
1	Demolish of existing Gatehouse and trees	8,000
2	Construction of Gate and Fence around site	50,000
3	Connection of Electrical power	19,000
4	Connection of Water pipe	1,700
5	Installation of TV sets and related equipment and cabling	5,000
6	Installation of PC net work equipment and cabling	5,000
7	CCTV System	50,000
8	Access Control System (Card reader, Key)	48,000
9	Purchase of General Furniture, etc.	3,000
10	Connection of IP Telephone system to new facility, IP telephone set and cabling	127,300
11	Transfer and Installation of existing equipment, etc. to the new facility	3,000
12	Renovation of Existing Facility	-
	Total	320,000

Approx. 11.3million JPY

(2) Calculation conditions

1. Action date April, 2015
2. Currency rate 1USD＝120.15 JPY
3. Currency rate 1GHS＝35.44 JPY
4. Period of Construction: Detailed design and construction period are as stated in the Project execution plan.
5. Others: The Project will be done according to Grant Aid system determined by the Ministry of Foreign Affairs of Japan.

2-5-2 Operation and Maintenance Cost

(1) Operation and Maintenance Cost
Expenses needed for the Project building maintenance after the proposed project's completion is estimated as below.

Table 2-46 Projected Building Maintenance Expenditure

Unit: GHS

Item	First Year	Second Year and on	Note
① Electricity	208,000	208,000	
② Phone	0	0	
③ Water	27,000	27,000	
④ Liquid Propane gas	3,000	3,000	
⑤ CO2 gas	18,000	18,000	CO2 incubator
⑥ Diesel fuel	350,000	350,000	for power generator
⑦ Filter change	0	35,000	needed from a year after the Project completion
⑧ Building Maintenance	0	315,000	needed from a year after the Project completion
Subtotal	606,000 (21,477,000JPY)	956,000 (33,881,000JPY)	
⑨⑩⑪ Equipment-related	6,990	232,797	⑨Consumables, reagents ⑩Replacements ⑪Building Service Contract
Total	612,990	1,188,797	
Supplemental (10%)	61,299	118,929	
Grand total	674,289	1,307,677	

① Electricity …… 208,000 GHS/year.
Applicable electricity fee system to the proposed project according to Ghana electricity regulations is below.

Meter rate: 0.3 GHS/kWh (tax included)

The capacity of the transformer that will be installed for the proposed project is about 400kW, and projected average electricity use at the facility is 240kW, which is 60% of the contract capacity.
The formula is below.

Meter rate: 0.3 GHS/kWh×240kW×8h×30days×12months＝207.360 GHS/year.

Therefore, the annual electricity fee will be 207,360 → 208,000 GHS/year.

② Phone ……0
Since IP phone will be used, phone charge will not be occurred.

③ Water…… 27,000 GHS/year.
The applicable water fee system to proposed project according to Ghana water company regulations is below.

Base charge: none

Meter charge: 3 GHS/m3

The estimated water use in the proposed project is 30 m^3 per day.
The formula is below.
Meter rate: 3 GHS/m3×30m^3 p.d.×25days×12months＝27,000 GHS/year.
Therefore, the annual water fee will be 27,000 GHS/year.

④ Liquid Propane gas ……3,000 GHS/year.
In the Project, mainly liquid propane gas will be used for experiments. The daily use of the gas is estimated as 5kg.
Annual consumption

Liquid propane gas	5 kg p.d. ×25days×12months＝1,500 kg p.a.
Liquid propane gas fee	1.6 GHS/kg×1,500 kg p.a. ＝2,400 GHS/year.

Therefore, the annual liquid propane gas fee will be 2,400 to 3,000 GHS/year.

⑤ CO2 gas …… 18,000 GHS/year.
The gas that will be used in the proposed project is for CO2 incubator. The consumption of the gas is estimated as 2kg per day.
Annual consumption

CO2 gas	2 kg p.d. ×25days×12months＝600 kg p.a.
CO2 gas fee	30 GHS/kg×600 kg p.a.＝18,000 GHS/year.

Therefore, the annual CO2 gas fee will be 18,000 GHS/year.

⑥ Diesel fuel fee……350,000 GHS/year.
The calculation is done with an estimate of the emergency power generator fuel amount for planned outages of 4 months. The generator uses diesel fuel. The calculation is based on 100 ℓ/h (amount consumed for 400 kVA) and Diesel fuel price of 3.5 GHS/ℓ.

Annual fuel use	：100 ℓ/h×10 h p.d.×25days×4months＝100,000 ℓ p.a.
Annual fuel fee	：3.5 GHS/ℓ×100,000ℓ p.a.＝350,000 GHS/year.

Therefore, the annual diesel fuel fee will be 350,000 GHS/year.

⑦ Filter change…… 35,000 GHS/year.
HEPA filter will be installed for air-supply and exhaust in BSL-3 Laboratory. Each air-condition system will have pre-filter and medium efficiency filter.
Each filter change frequency is estimated as below. Pre-filter is regenerative, thus, has no need of change fees.
Replacement frequency：

Pre filter	Cleaning, twice p.m.
Med efficiency filter	Once p.a. (1,000 GHS each)
HEPA filter	1/2 p.a. (1,500 GHS each)

Annual filter-change fee

Med efficiency filter	1,000 GHS/unit ×20units p.a.＝20,000 GHS/year.
HEPA filter	1,500 GHS/unit ×10units p.a.＝15,000 GHS/year.

Therefore, the filter-change fee will be 35,000 GHS/year.
Note: Due to new equipment installation during construction, the fee occurs from the second year of operation.

⑧ The Building Maintenance Fee …… 315,000 GHS/year.
The facility of project has selected the interior materials of building for the easy maintenance. The general floors will be tiled finish, and the walls will be mortar with paint finish. The ceiling will be acoustic unit finish. The floor in BSL-3 Laboratory will be continuous PVC sheet, and its walls and ceiling will be steel panels.
The cost of building interior repair, electricity, air-supply and exhaust, and air conditioning is assumed to be around half or 1/3 of it in Japan. Therefore, the Projected maintenance fee is estimated to be 70 GHS/m^2 p.a.
Thus, the annual building maintenance fee will be 70 GHS/m^2 p.a.×4,500 m^2＝315,000 GHS/year. As ⑦, it is needed from the second year of the operation and thereafter.

⑨ Consumables, Replacements …… 1st year 6,990 GHS/year.
…… Following years 111,429 GHS/year.

【1】Expenses for consumable goods

1st year 6,990 GHS/year
Following years 13,980 GHS/year.

The NMIMR departments concerned need numerous amounts and types of consumables and reagents. The types of consumables etc. vary depending on research or frequency of use in each department. Consumables are covered by each project's management expenses, and they are apart from NMIMR's own management expenses. Therefore, the consumables that are used in research (e.g. centrifuge tubes) will not be discussed in this article. General consumables for the equipment that will be provided through the project will be mentioned under NMIMR's management expenditure. They are as follows:
In addition, consumables and reagents for 6 months are included in Equipment planning, so that expenses for consumable goods for the rest of six months in the 1st year are half of the following amount (6,990 GHS).

Table 2-47 Expenses for Consumable Goods

	Consumable Goods	No. of Equipment	JPY		US$		
			Unit Price	Total	Unit Price	Total	In JPY
Formaldehyde Decontamination Unit	Aluminum tray	1	30,000	30,000			
pH Meter	Standard solution	2	20,000	40,000			
Binocular Microscope	Immersion oil	9	1,500	13,500			
Fluorescent microscope	Immersion oil	5	10,000	50,000			
Teaching microscope	Immersion oil	1	1,500	1,500			
Gel imaging system	Printer color ink cartridge set	2			1,500	3,000	360,450
Subtotal①(JPY)				135,000			
Subtotal②(JPY)							360,450
Total①+②(JPY)							495,450
(GHS)							13,980

【2】Expenses for Replacements

From the second year and thereafter 97,943 GHS/year.

Regular replacements are as listed below. Equipment replacement frequency varies, therefore, the annual prices are based on the Projected frequencies.

Table 2-48 Fees for Replacements

	No. of Equipment	Replacement	JPY		Note
			Annual Price	Total	
Biosafety cabinet	13	HEPA Filter (air-supply)	77,000	1,001,000	HEPA filter will be replaced once in two years, others, annually
		HEPA Filter (exhaust)	47,000	611,000	
		Sterilization lamp	5,000	65,000	
Inverted Microscope	6	Halogen lamp	17,000	102,000	Changed annually
Binocular Microscope	9	Halogen lamp	3,400	30,600	Changed annually

	No. of Equipment	Replacement	JPY		Note
			Annual Price	Total	
Clean Bench	11	Circular HEPA Filter	30,000	330,000	HEPA filter will be replaced once in two years, others, annually
		HEPA Filter (exhaust)	13,000	143,000	
		Fluorescent lamp	5,000	55,000	
		Sterilization lamp	5,000	55,000	
Fluorescent Microscope	5	Halogen lamp	17,500	87,500	Replaced annually
		Mercury lamp	136,000	680,000	
Teaching Microscope	1	Halogen lamp	17,500	17,500	Replaced annually
PCR Workstation	6	Circular HEPA Filter	30,000	180,000	HEPA filter will be replaced once in two years, others, annually
		HEPA Filter (exhaust)	6,000	36,000	
		Fluorescent lamp	5,000	30,000	
		Sterilization lamp	5,000	30,000	
				Total(JPY)	3,453,600	
				(GHS)	97,449	

⑩ Maintenance Contract Fee----------2nd year and thereafter 121,368 GHS/year

The annual maintenance contract fees for the advanced research equipment are estimated as below:

Table 2-49 Annual Maintenance Contract Fee

	No. of Equipment	USD	EUR	JPY	In JPY
Realtime PCR	2	14,680.00			1,763,802
Elispot Reader	1		2,500.00		338,725
Flow cytometry(A)	1	3,300.00			396,495
Flow cytometry(B)	1	15,000.00			1,802,250
				Total(JPY)	4,301,272
				(GHS)	121,368

1EUR 135.49 JPY

Equipment Related ⑨＋⑩ Tota1st year ---------- 6,990 GHS/year.
Following years ----------232,797 GHS/year.

(2) NMIMR Projected Income and Expenditure

Below are NMIMR's year 2015 income and expenditure as well as those projected from the year of the new research center completion (2018) and the year that follows (2019). The estimation is based on NMIMR's budget and expenditure details in chapter 2 and Management and Building Maintenance Plan and Building Maintenance Expenses in chapter 3.

Table 2-50 NMIMR Projected Budget and Expenditure Unit：1,000GHS

Item	Result	Estimate		Note
	2015	2018	2019	
【Income】				
Government Budget (corresponds to staff salary)	7,558	8,875	9,363	5.5% of year 2015 budget is added per year, considering increased rates of governmental grants in the past four years (21.4%) and currency rate flux against USD.
Internal Income	2,817	3,947	4,417	11.9% of year 2015 budget is added per year, considering internal income for the past four years (46.6%) and currency rate flux against USD.
Projected Total Income (A) Yen equivalent (mil. JPY)	10,375 (367.7)	12,822 (454.4)	13,780 (488.4)	
【Expenditure】				
Staff salary	7,558	8,875	9,363	The same with the government budget
Management Expenses	851	999	1,054	The result from utility fees deducted from sales expenses. As the staff increase rate, 5% of year 2015 budget is added per year.
Utilities	400	638	638	The sum of electricity, phone, water, and gas fee. The estimate from aforementioned 'Table2-46 Projected Building Service Fees' is added to year 2015 budget amount.
Building Maintenance	160	160	475	Sum of building and facility maintenance. The estimate from aforementioned Table2-46 is added to year 2015 budget amount. The fee will occur from year 2019.
Facilities, A/C, Vehicle Maintenance	193	561	596	Sum of facilities, vehicle, air-conditioning maintenance. The estimate from aforementioned Table2-46 is added to year 2015 budget amount.
Equipment Maintenance	235	249	468	Sum of electronics, furniture, and equipment mentenance fee. The estimate from a forementioned "table 2-46" (7,000GHS for 2018, 233,000GHS for 2019) is added to year2015 budget amount.
Facility Investment	797	399	399	Procurement expenses for furniture, electronics, equipments, PC, and vehicle. For this grant aid, this expense is reduced greatly; 50% reduced from year 2015 budget amount.
Projected total Expenditure(B) Yen Equivalent (mil. JPY)	10,194 (361.3)	11,881 (421.1)	12,993 (460.5)	
Expense Difference (A－B) Yen Equivalent (mil. JPY)	181 (6.4)	941 (33.3)	787 (27.9)	Income still exceeds expenditure from year 2018 and on.

Source：The Research Team

The increase of the expected internal income such as research project overhead cost and examinations in addition to the government budget are shown above. That means even with original cost for the project deducted, there should be surplus about 941,000GHS (33.3 million JPY) in year 2018, and about 787,000GHS (27.9 million JPY). Moreover, NMIMR has management budget for each research project, which is not included in the income above, and total of 12.03 million USD (approx. 1,430 million JPY) was used in project staff salaries or expendable supplies, reagent charges, equipment maintenance in year 2014. Also, for the new research center with advanced research equipment installed, the increase of research project from year 2019 is expected.

Therefore, finances are not likely to inconvenience the facility and equipment management.

Chapter 3. Project Evaluation

CHAPTER 3 PROJECT EVALUATION

3-1 Preconditions

In order to promote the Project smoothly, it is important that necessary inputs by the Ghanaian side which was mentioned in "2-3 Obligations of Recipient Country" of Chapter 2 need to be conducted at the appropriate time before and during the construction works.

3-2 Necessary Inputs by Recipient Country

Advanced Research Center for Infectious Diseases will be established as part of NMIMR and some of equipment will be installed by the Project. In order to improve the functions of research, survey, special examination and development of human resources for researchers concerning health issues making use of those facilities, the Ghanaian side needs to take the following measures:

(1) Expansion of the Staff for Improving Advanced Research Center for Infectious Diseases

Around 23 more staff members will be employed in the 3 departments of Virology, Bacteriology and Immunology. Full-time employees apply through the University of Ghana to receive payment from the Ministry of Education. Because most of the employees are project members and paid from the budget allocated for joint research projects, the number of persons is adjusted in accordance with the period, scale and work volume of the research project. NMIMR needs to make a plan on necessary human resources and the number of persons before Advanced Research Center for Infectious Diseases is opened, and secure the budget on a priority basis in cooperation with the University of Ghana.

(2) Transfer of Equipment and Furniture from the Existing Facilities to Advanced Research Center for Infectious Diseases

Although the Project includes procurement of some equipment, the Ghanaian side will transfer and install the existing equipment, PCs and furniture that can be used continuously. NMIMR will transfer the existing equipment and furniture at its cost in order to start the operation of Advanced Research Center for Infectious Diseases promptly.

(3) Securing of Budget for Operation and Maintenance

The budget for operating and maintaining the facilities and equipment in the Project will be secured by NMIMR. Concerning the equipment especially requiring maintenance by specialized technicians, it is necessary to conclude a maintenance contract between NMIMR and a local distributor. In addition to the budget from the Ministry of Education, NMIMR has also the budget for research project consisting of its own revenue (project overheads, laboratory fees, animal sales, interest, etc.) and allocations from other donors and institutes. Moreover, the revenue is expected to be increased by more advanced research and special diagnosis of infectious diseases after Advanced Research Center for Infectious Diseases is opened. The management of Advanced Research Center for Infectious Diseases will be facilitated by the above mentioned budgets and revenue.

(4) Revision of BSL-3 Laboratory Guidelines and Implementation of Training

NMIMR will revise the existing BSL-3 Laboratory guidelines to reflect the incorporation of the new BSL-3 Laboratory. The Biosafety Committee will revise the guidelines and provide training for the users of the new BSL-3 Laboratory.

(5) Development of Human Resources for Researchers and Reinforcement of Intern Acceptance

NMIMR is the only institute in the country that can diagnose hemorrhagic fever viruses including Ebola. When Advanced Research Center for Infectious Diseases is established, the quality and quantity of research will be enhanced, and the demand as an educational institute for researchers and interns will increase. NMIMR is required to promote PR activities in cooperation with WHO,

other international organizations, NGOs and research institutes, increase the number of researchers and interns from foreign countries as well as Ghana, and improve the status as the core of excellence in the West African sub-region.

(6) Continuation and Development of Cooperation for Japan's Measures against Infectious Diseases

Since 1977 when it was constructed by Japan's grant aid, NMIMR has maintained cooperative relationships and executed many projects of Japan's technical cooperation over the years. There are many researchers who have experienced training in Japan, and "SATREPS (Science and Technology Research Partnership for Sustainable Development)" and "J-GRID (Japan Initiative for Global Research Network on Infectious Diseases)" has also been implemented in 2010-2015. Those projects are taken over under "AMED" (Japan Agency for Medical Research and Development) which was established in April 2015. There is also a possibility of JICA's technical cooperation in the future. NMIMR is expected to maintain and develop the cooperation with Japan in the future and remain as the research institute contributing to countermeasures against infectious diseases in the world.

(7) Maintenance Contract for Medical Equipment

It is required to engage maintenance contract for Flow Cytometry and Real-Time PCR to be procured in the Project. It is necessary to conduct periodical maintenance, spare parts replacement and adjustment by specialized technicians dispatched from manufacturers or local distributers in order to facilitate the equipment operation.

(8) Appropriate Equipment Maintenance

The equipment, which is not engaged a maintenance contract, required to conduct daily and periodical check by the maintenance department or outsourced maintenance companies based on the requirements of the equipment operation manual.

3-3 Important Assumptions

In order to realize and maintain the effect of the Project, the following assumptions need to be fulfilled.

(1) Continuation of the Development Plan in the Health and Educational Sectors

According to the "Health Sector Medium Term Development Plan 2014-2017", it is a policy objective to take measures against malaria, tuberculosis and HIV/AIDS and to prevent and control infectious diseases. The "Education Strategic Plan 2010-2020" focuses on reinforcement of science and technology and tertiary education in addition to basic education, and the salaries of the NMIMR staff are paid from the budget of the Ministry of Education. The cooperation framework of the Project has been constructed based on these priority plans, and continuous commitment to the infectious disease sector and tertiary education in Ghana is necessary for achieving the goals of the Project.

(2) Retainment of Four Functions in MNIMR

NMIMR has four functions: "High-level research and survey to deal with health issues", "Disease control", "Special examination and diagnosis" and "Development of human resources for researchers". The Project has been planned on the assumption that those four functions are effectively working. If any of them is not functioning, the personnel, the scale of the facilities and/or the budget plan might be adversely affected and the effects of the Project might be reduced.

(3) Continuation of BSL-3 Laboratory Operation

It is necessary to take measures to strictly prevent secondary infection to the users because BSL-3 Laboratory handles hazardous pathogens such as Ebola virus, HIV virus, Mycobacterium tuberculosis and Influenza virus which would cause severe diseases. Although there has been no

case of infection in the facilities reported in the past, the facilities would be forced to be terminated as well as researches in case that any infection is confirmed. It is necessary to make sure that BSL-3 Laboratory will be appropriately operated by the users and prevent infection in the facilities.

(4) Ghanaian Political Situation will keep without Significantly Deteriorated

Ghana is a model democratic country in Africa, and its politics and society are stable. However, the economic conditions have been deteriorated since 2013 due to the decline of crude oil prices, drastic wage increase of public workers and heavy debt, which is causing depreciation of Ghana cedi and a high inflation rate. As the oil export is recently expanding and the agricultural sector is expected to grow, the future perspective is optimistic unless the political and economic conditions deteriorate drastically.

3-4 Project Evaluation

3-4-1 Relevance

The expected effects of the Project are as follows. It is judged that it is relevant to implement the Project by Japan's grant aid.

(1) Beneficiaries of the Project and Relevance of the Project Purpose

The Project aims at solving the issues of the health and educational sectors in Ghana and the rest of the world by reinforcing the functions of NMIMR. NMIMR plays the leading role in research, disease control, examination and diagnosis concerning different issues of infectious diseases, which is benefitting Ghana's entire population of 25.91 million (The State of the World's Children 2015, UNICEF). The institute is also functioning in development of anti-AIDS drugs and malaria vaccine, diagnosis of Ebola virus disease inside and outside the country, WHO Emerging and Dangerous Pathogens Laboratory Network and as the regional reference laboratories for polio and Buruli ulcer, which means that establishing Advanced Research Center for Infectious Diseases will contribute to measures against health issues in the West African sub-region and the rest of the world. Therefore, the number of indirect beneficiaries will amount to 765.2 million (The State of the World's Children 2015, UNICEF), the total population of the 7 countries in the West African sub-region[2]. Recently, the threat of infectious diseases including Ebola hemorrhagic fever, avian influenza and MERS (Middle East Respiratory Syndrome) is an urgent international issue, and it is also urgent to strengthen the functions of NMIMR as the core of excellence in order to take countermeasures.

(2) Consistency with the Health and Education Policies of Ghana

The "Health Sector Medium Term Development Plan 2014-2017" has 6 policy objectives. NMIMR is the base of research, disease control, examination and diagnosis on the 5th objectives "Enhance national capacities for the attainment of the health related MDGs and sustain the gains" and 6th objectives "Intensify prevention and control of non-communicable and other communicable diseases". The "Education Strategic Plan 2010-2020" has 8 goals focusing on science, mathematics and tertiary education in addition to basic education. NMIMR is directly and indirectly supporting part of the Goal 4 "Development of health, HIV/AIDS and STI in the curricular at all levels" as well as the Goal 5 "Improve quality of teaching and learning", Goal 6 "Promote science and technical education at all levels" and Goal 7 "Strengthen links between tertiary education and industry".

(3) Consistency with the Assistance Policy of the Government of Japan

In the Official Development Assistance (ODA) Data Book for Ghana (2014), Japan prioritizes four issues: i). Agriculture, ii). Economic infrastructure (electric power, transportation), iii). Health and education of science and mathematics and iv). Capacity development of government

[2] Seven countries such as Togo, Benin, Burkina Faso, Liberia, Sierra Leone, Guinea and Cote d'Ivoire.

administration and financial management. In the health sector, while focusing on reduction of mortality rate among mothers and infants, government of Japan is also providing assistance in the sector of infectious diseases on a continuous basis, which is consistent with the assistance policy.

Thus, the Project is highly relevant from the viewpoint of human security, because it will contribute to health promotion of the entire population including the poverty people, mothers and children, stability of people's livelihood and solution of health issues centering on emerging and re-emerging infectious diseases.

3-4-2 Effectiveness

The outputs expected from the Project and the outcomes to be achieved by the entire project can be described as follows. Quantitative indicators and qualitative indicators are suggested, while the benchmark year is 2014 or an average of several years, and the target year is 2021, 3 years after 2018 when the facilities will be completed.

(1) Quantitative Effects

The quantitative indicators of the Project are proposed as mentioned below.

Table 3-1 Outputs Expected from the Project

Indicators	Unit	Baseline		Goal(2021) (3 years after the Project Completion)[3]
		year	Value	
Total number of interns within the three departments (Virology, Bacteriology, Immunology)	Person	average of 2012-2014	103.7 persons	135 persons
The percentage of foreign student interns	%	average of 2012-2014	9.3%	12%
Total number of research projects at the three departments (Virology, Bacteriology, Immunology)	Number	2014	31 projects	36 projects
Number of times people have accessed BSL-3 Laboratory per year	person	2014	1,005 times	1,307 times

In order to develop human resources for researchers, NMIMR accepts undergraduate and graduate school students in the faculty of medicine, health sciences and applied sciences as interns from inside and outside the country. The total number of interns is expected to be increased by establishment of Advanced Research Center for Infectious Diseases and procurement of advanced research equipment. As it will be the center of countermeasures against infectious diseases in the West African sub-region and interns from foreign countries will also increase, the percentage of foreign student interns is also included as an indicator.

The total number of research projects of the 3 departments to be transferred to Advanced Research Center for Infectious Diseases is incorporated because it is expected to be increased by reinforcement of the research functions and appropriate use of new equipment. As the number of users accessed BSL-3 Laboratory is linked with all of the four functions of NMIMR, users are

[3] The target value was set by adding approximately 30% to the standard value referring to the grounds of setting the facility scale, except for the number of research projects, for which the target value was set by adding 15%, half of other target values (30%), taking into consideration the influence of the technical capacity of the researchers and the strategies of sponsors of research projects.

expected to increase when the functions for reacting to emerging and re-emerging infectious diseases are improved. The achievement of the Project goals will be evaluated by these indicators.

The quantitative indicators of the entire project (including both Japan's gran aid project and necessary input by Ghanaian side) are proposed as follows.

Table 3-2 Outcomes to be Achieved by the Entire Project

Indicators	Unit	Baseline		Goal(2021) (3 years after the Project completion)[4]
		Year	Value	
Total number of research projects conducted at NMIMR	Number	2014	88 projects	101 projects
Increase in Research Project Overhead	Ghana Cedi	Average of 2012-2014	1,595,120 GHS	2,074,000 GHS
Number of diseases that NMIMR is recognized as a national/regional reference center	disease	2014	4 diseases (TB, Buruli Ulcer, Polio, Influenza)	5 diseases (following 4 diseases + new disease)

The above mentioned indicators are intended to reinforce the functions of all of the 9 research departments of NMIMR. The Project includes the new BSL-3 Laboratory on the premises of NMIMR and partially procured equipment. When it is completed, 3 departments will be transferred to Advanced Research Center for Infectious Diseases. The remaining 6 research departments and the administrative department will continue to use the existing NMIMR facilities and take over the rooms which were used by those 3 departments in order to expand each department and improve the functions. Concerning the P-3 Laboratory, NMIMR will carry out partial renovation and use it as a hands-on-training facility to practice technical skills of the BSL-2 and BSL-3 Laboratory levels and acquire the maintenance skills. Moreover, the P-3 Laboratory will be reused for research in case that the demand of examination and diagnosis is increased by an outbreak of a hazardous infectious disease impeding research and routine works at the new BSL-3 Laboratory. Therefore, it is expected to achieve the above mentioned outcomes by facilitating the Project on the part of NMIMR and effectively using the existing facilities.

(2) Qualitative Effects

The qualitative effects expected from the implementation of the Project are mentioned below.

1) Improvement of Research Quality Conducted by Virology, Bacteriology and Immunology Departments at NMIMR

In the existing facilities, experiment spaces, air-conditioning and ventilation were insufficient due to the expansion of work and the staff. Because laboratories and offices were mixed together and refrigerators and freezers were placed out in the corridors, there were many factors that might deteriorate the quality and accuracy of research. In Advanced Research Center for Infectious Diseases, laboratories and offices will be divided, which will allow sufficient space for refrigerators and freezers. In addition to the laboratories exclusively used by each research department, common laboratories, training space and high-level equipment will be installed, which will greatly improve the research environment, and it is expected to improve the research quality of the 3 departments.

2) Increase in Safety Levels at the New BSL-3 Laboratory

[4] The target value was set by adding approximately 30% to the standard value referring to the grounds of setting the facility scale, except for the number of research projects, for which the target value was set by adding 15%, half of other target values (30%), taking into consideration the influence of the technical capacity of the researchers and the strategies of sponsors of research projects.

The new BSL-3 Laboratory will be designed considering the safety measures and response in case of an accident based on the WHO standards. Specifically:

・Installation of emergency showers and eye washers in the area

・Installation of hand wash basins near the entrance

・Installation of two safety cabinets, while there is only one in the existing BSL-3 Laboratory

Having two safety cabinets will improve the efficiency of processing samples, and enables to use one of them exclusively for samples infected by highly pathogenic viruses including Ebola.

3) Increase in Efficiency and Accuracy of Research in the Molecular Biology Common Laboratory

Research at the molecular level to analyze genetic information of pathogens is now common also among the 3 departments, and is becoming the mainstream in NMIMR. An experiment of molecular biology requires different rooms based on the processes: Master mix room, PCR room, Genetic Analyzer room as well as equipment and tools per process. Especially at the early stage of experiment, it is necessary to have a separate laboratory per sample in order to prevent contamination of reagent or sample. On the other hand, the highly advanced and expensive equipment must be shared in a PCR room or sequencing room. The new Advanced Research Center for Infectious Diseases will have a common molecular biology laboratory that enables to prevent contamination and share advanced equipment among the 3 departments, and it is expected to improve the efficiency and accuracy of research.

Based on above, it is judged relevance of the Project is high, and effectiveness is highly expected.

Appendices

1. Member List of the Survey Team
2. Study Schedule
3. List of Parties Concerned in the Recipient Countries
4. Minutes of Discussion
5. Soft Component (Technical Assistance) Plan

1. Member List of the Survey Team

Preparatory Survey (March 9 to April 3, 2015)

No.	Name	Assignment title	Organization
1	Ms. Sonoko TAKAHASHI	Leader	Human Development Department, JICA
2	Dr. Shinsaku SAKURADA	Technical Adviser	National Center For Global Health And Medicine
3	Ms. Aya ISHIZUKA	Project Coordinator	Human Development Department, JICA
4	Mr. Masahiro IKAWA	Project Manager, Architectural Planner	Nihon Sekkei, Inc.
5	Ms. Makiko UEMURA	Vice Project Manager, Architectural Designer & Natural Condition	Nihon Sekkei, Inc.
6	Mr. Makoto SUZUKI	Equipment planner	Nihon Sekkei, Inc.
7	Mr. Naoki MIMURO	Medical Laboratory Research Surveyer	Fujita Planning, Co., Ltd.
8	Mr. Motohiro OKADA	Facilities Planner	Nihon Sekkei, Inc.
9	Ms. Maiko NAGASAWA	Equipment Procurement/Cost Planner	Fujita Planning, Co., Ltd.
10	Mr. Koji NISHIKAWA	Construction Procurement/Cost Planner	Nihon Sekkei, Inc.
11	Mr. Koji HIROSE	Architectural Planner-Assistant	Nihon Sekkei, Inc.
12	Mr. Jumpei SHIRAI	Architectural Designer - Assistant	Nihon Sekkei, Inc.

Explanation on Draft Report (September 6 to 12, 2015)

No.	Name	Assignment title	Organization
1	Ms. Sonoko TAKAHASHI	Leader	Human Development Department, JICA
2	Ms. Aya ISHIZUKA	Project Coordinator	Human Development Department, JICA
3	Mr. Masahiro IKAWA	Project Manager, Architectural Planner	Nihon Sekkei, Inc.
4	Ms. Makiko UEMURA	Vice Project Manager, Architectural Designer & Natural Condition	Nihon Sekkei, Inc.
5	Mr. Makoto SUZUKI	Equipment planner	Nihon Sekkei, Inc.

2. Study Schedule

Preparatory Survey (March 9 to April 3, 2015)

day			MEMBER	JICA MEMBERS			CONSULTANT MEMBERS								
				LEADER	TECHNICAL ADVISER	PROJECT COORDI-NATOR	PROJECT MANAGER & ARCHITECTURAL PLANNER	VICE PROJECT MANAGER /ARCHITECTURAL DESIGNER /NATURAL CONDITION	EQUIPMENT PLANNER	MEDICAL LABORATORY PLANNER	FACILITIES PLANNER	EQUIPMENT PROCUREMENT/ COST PLANNER	CONSTRUCTION PROCUREMENT/ COST PLANNER	ARCHITECTURAL PLANNER-ASSISTANT	ARCHITECTURAL DESIGNER - ASSISTANT
				(Ms.) SONOKO TAKAHASHI	(Dr.) SHINSAKU SAKURADA [M.D., Ph.D]	(Ms.) AYA ISHIZUKA	(Mr.) MASAHIRO IKAWA	(Ms.) MAKIKO UEMURA	(Mr.) MAKOTO SUZUKI	(Mr.) NAOKI MIMURO	(Mr.) MOTOHIRO OKADA	(Ms.) MAIKO NAGASAWA	(Mr.) KOJI NISHIKAWA	(Mr.) KOJI HIROSE	(Mr.) JUMPEI SHIRAI
1	9-Mar	M					dep. Tokyo								dep. Tokyo
2	10-Mar	TU					arr. Accra								arr. Accra
3	11-Mar	W					· Meeting at JICA office · NMIMR (Courtsey Call、meeting、explaining inception report)								Same as Architectural Designer
4	12-Mar	TH					· NMIMR(Servey and meeting) · Visiting University of Ghana Teaching Hosipital's construction site								Same as Architectural Designer
5	13-Mar	F					· NMIMR (Servey and meeting) · WHO (Courtsey Calll, meeting) · MOE(Courtsey call, meeting)			· WHO (Courtsey Calll, meeting) · MOE(Courtsey call, meeting)					Same as Architectural Designer
6	14-Mar	SA					Team Meeting								Team Meeting
7	15-Mar	SU			dep. Pakistan	dep. Tokyo	Team meeting				dep. Tokyo			dep. Tokyo	Team Meeting
8	16-Mar	M			arr. Accra NMIMR(Meeting)		· NMIMIR (Survey)				arr. Accra			arr. Accra NMIMR (Meeting)	Same as Architectural Designer
9	17-Mar	TU			NMIMR (Servey) University of Ghana (Courtsey Call, Meeting)					MNIMR (Survey) University of Ghana	NMIMR (Survey)			Same as Architectural Designer	Same as Architectural Designer
10	18-Mar	W			NMIMR (Servey) Ministrey of Food and Agriculture, Veterinary Service					NMIMR (Survey)	Same as Architectural Designer	· University of Ghana (Servey)		Same as Architectural Designer	Same as Architectural Designer
11	19-Mar	TH			NMIMR (Servey)					SATREPS (Interview) J-Grid (Interview)	Survey of Infrastructure	Servey on Agent		Same as Architectural Designer	Same as Architectural Designer
12	20-Mar	F			NMIMR (Servey)							Servey on Agent		Same as Architectural Designer	Same as Architectural Designer
13	21-Mar	SA			Team Meeting								dep. Tokyo		
14	22-Mar	SU		dep. Tokyo	Team Meeting								arr. Accra		
15	23-Mar	M		arr. Accra	· NMIMR (Meeting on Minutes of Discussions, Servey)			NMIMR	NMIMR (Discussion on Requested Equipment)	NMIMR (Meeting on Minutes of Discussions, Servey)	Suvey of Sub-contractor	Servey on Agent	Survey on construction	Same as Architectural Designer	Same as Architectural Designer
16	24-Mar	TU		NMIMR (Courtsey Call, Servey, Meeting)				· Interviewing local design studio · Meeting on Min'.	NMIMR (Meeting on Minutes of Discussions) NMIMR (Discussion on Equipment List)	SATRESP/J-Grid (Survey)	Related Facilities Visit	Servey on Agent	Survey on construction Interviewing local design studio	Same as Architectural Designer	Same as Architectural Designer
17	25-Mar	W		NMIMR (Meeting on Minutes of Discussions)					· NMIMR (Discussion on Equipment List)		University of Ghana (Technical Meeting)	Servey on Agent	Survey on construction	Same as Architectural Designer	Same as Architectural Designer
18	26-Mar	TH		· NMIMR (Meeting on Minutes of Discussions) · Report to EOJ				NMIMR/University of Ghana Request Esti-mate to Local Consultant	· NMIMR (Meeting on Minutes of Discussions) · NMIMR (Discussion on Equipment List)	· Report to EOJ	NMIMR (Technical Meeting)	Servey on Agent	Survey on construction	Same as Architectural Designer	Same as Architectural Designer
19	27-Mar	F		· NMIMR (Signing of Minutes of Discussions) · Report to JICA Office · dep. Accra			Working on Technical Memorandum		· NMIMR (Discussion on Equipment List)	· dep. Accra	NMIMR Technical Meeting	· NMIMR (Signing of Minutes of Discussions) · Servey on Agent	Survey on construction	· NMIMR signing minute · dep. Accra	Same as Architectural Designer
20	28-Mar	SA		arr. Tokyo	arr. Pakistan	arr. Tokyo	Team Meeting			arr. Tokyo	Team Meeting			arr. Tokyo	Team Meeting
21	29-Mar	SU					Working on Technical Memorandum				Working on Technical Memorandum	Survey	Working on Technical Memorandum		Team Meeting
22	30-Mar	M					Working on Technical Memorandum Meeting about Technical Memorandum	Receive Esti-mate from Local Consultant	Working on Technical Memorandum		To University of Ghana (Technical Meeting)	Servey on Agent	Survey on supply		Same as Project Manager
23	31-Mar	TU					Meeting about Technical Memorandum Contract with local consultant (soil, topogra-phy ...survey)		Discussion on Equipment Specifications		To NMIMR (Technical Meeting)	Servey on Agent	Survey on supply		Same as Project Manager
24	1-Apr	W					NMIMR (Signing on Technical Memorandum)		Discussion on Equipment Specifications		Survey of Supplyer	Servey on Agent	Survey on supply Survey on construction		Same as Project Manager
25	2-Apr	TH					Report to JICA Office dep. Accra		Discussion on Equipment Specifications		Report to JICA Office dep. Accra		Servey on supply		dep. Accra
26	3-Apr	F					arr. Tokyo				arr. Tokyo				arr. Tokyo

Explanation on Draft Report (September 6 to 12, 2015)

MEMBER / DAY			JICA MEMBERS		CONSULTANT MEMBERS		
			LEADER	PROJECT COORDI-NATOR	PROJECT MANAGER	Vice Project Manager, Architectural Designer & Natural Condition	EQUIPMENT PLANNER
			(Ms.) SONOKO TAKAHASHI	(Ms.) AYA ISHIZUKA	(Mr.) MASAHIRO IKAWA	(Ms.) MAKIKO UEMURA	(Mr.) MAKOTO SUZUKI
1	6-Sep	Sun	dep. Tokyo				
2	7-Sep	Mon	arr. Accra Visit to JICA GHANA OFFICE				
3	8-Sep	Tue	Courtesy Call on Director, NMIMR Meeting with NMIMR (Explanation of Draft Final Report)				
4	9-Sep	Wed	Courtesy Call on Vice-Chancellor, University of Ghana Meeting with NMIMR (the Minutes etc.)				
5	10-Sep	Thu	Debriefing to Chief Director, MOH/MOF/MOE Meeting with NMIMR (the Minutes etc.)				
6	11-Sep	Fri	Signing of the Minutes, Report to EOJ dep. Accra				
7	12-Sep	Sat	arr. Tokyo				

3. List of Parties Concerned in the Recipient Countries

NOGUCHI MEMORIAL INSTITUTE FOR MEDICAL RESEARCH

1	KWADWO KORAM	DIRECTOR	ADMINISTRATION
2	OKYERE BOATENG	INSTITUTE'S ADMINISTRATOR	ADMINISTRATION
3	GLADYS A-SEREBOO	ACCOUNTANT	ADMINISTRATION
4	GLORIA OBENG-BENEFO	PUBLIC RELATION OFFICER	ADMINISTRATION
5	KWABENA OWUSU BOATENG	IT ADMINISTRATOR	ADMINISTRATION
6	JOHN GAINSFORD	SENIOR ADMINISTRATIVE ASSISTANT	ADMINISTRATION
7	EMMANUEL NARTEY	HEAD	MAINTENANCE
8	E.O. LAMPTEY	CHIEF WORKS SUPT	MAINTENANCE
9	SAMUEL ADJEI	RESEARCH FELLOW	ANIMAL EXPERIMENTATION
10	GLORIA FOLSON	RESEARCH FELLOW, HEAD OF DEPARTMENT	NUTRITION
11	MICHAEL OFORI	ASSOCIATE PROFESSOR, HEAD OF DEPARTMENT	ELECTRON MICROSCOPY /HISTOPATHOLOGY
12	COLLLINS AHORLU	RESEARCH FELLOW, EAD OF DEPARTMENT	EPIDEMIOLOGY
13	REGINA APPIAH OPONG	HEAD OF DEPARTMENT	CLINICAL PATHOLOGY
14	WILLIAM ANYAN	RESEARCH FELLOW, ACTING HEAD	PARASITOLOGY
15	DZIEDZOM DE SOUZA	RESEARCH FELLOW,	PARASITOLOGY
16	SAMUEL DADZIE	RESEARCH FELLOW	PARASITOLOGY
17	BEN GYAN	ASSOCIATE PROFESSOR HEAD OF DEPARTMENT	IMMUNOLOGY
18	KWADWO A. KUSI	RESEARCH FELLOW	IMMUNOLOGY
19	BEN DJAN	H.O.D	IMMUNOLOGY
20	EMMANUEL KAKRA DICKSON	-	IMMUNOLOGY
21	DOROTHY YEBOAH-MANU	RESEARCH FELLOW, HEAD OF DEPARTMENT	BACTERIOLOGY
22	ANTHONY ABLORDEY	SNR RESEARCH FELLOW	BACTERIOLOGY
23	KWASI ADDO	ASSOCIATE PROFESSOR	BACTERIOLOGY
24	CHISTIAN BONSU	-	BACTERIOLOGY
25	WILLIAM AMPOFO	ASSOCIATE PROFESSOR, HEAD OF DEPARTMENT	VIROLOGY
26	JOHN ODOOM	RESEARCH FELLOW	VIROLOGY
27	JACOB BAROUR	SENIOR RESEARCH FELLOW	VIROLOGY
28	JAMES BRANDFUE	SENIOR RESEARCH FELLOW	VIROLOGY
29	KOFI BONNEY	RESEARCH FELLOW	VIROLOGY
30	EVELYN Y BONNEY	RESEARCH FELLOW	VIROLOGY
31	JACOB ARTHUR QUAM	TECHNOLOGIST	VIROLOGY
32	EIJI IDO	VISITING PROFESSOR	VIROLOGY
33	DANIEL O. AHANE-AMANQUANOR	DEPUTY DIRECTOR	PDMSD U.G

UNIVERSITY OF GHANA

1	ERNEST ARYEETEY	VICE CHANCELLOR	UNIVERSITY OF GHANA
2	AARON LAWSON	COORDINATOR	UNIVERSITY OF GHANA
3	DANIEL OTABI AHENE-AMANQWANOR	DEPUTY DIRECTOR, PHYSICAL DEVELOPMENT AND MUNICIPAL SERVICE DIRECTORATE (PDMSD)	UNIVERSITY OF GHANA
4	CHARLES A KOFINTI	DEPUTY DIRECTOR PHYSICAL DEVELOPMENT AND MUNICIPAL SERVICE DIRECTORATE	UNIVERSITY OF GHANA
5	TERKPER MICHAEL	HEAD OF ELECTRICAL SECTION	UNIVERSITY OF GHANA
6	RICHARD KWASHIE DIKENU	HEAD OF WATER SECTION	UNIVERSITY OF GHANA
7	MICHAEL OPARE ATUAH	EXECUTIVE SECRETARY COLLEGE OF HEALTH SCIENCES	UNIVERSITY OF GHANA MEDICAL SCHOOL
8	PHILIP AZUNDOW	DIRECTOR OF PHYSICAL	UNIVERSITY OF GHANA

WHO

1	DR. MAGDA ROBALO	REPRESENTATIVE	WHO GHANA OFFICE
2	DR. LAWSON AHADZIE	EPIDEMIOLOGIST	WHO GHANA OFFICE
3	DR. HENRY KYOBE BOSA	CONSULTANT	WHO GHANA OFFICE
4	MICHELLE THULKANAM	RISK COMMUNICATION & SOCIAL MOBILIZATION	WHO GHANA OFFICE
5	SALLY-ANN OHENE	DISEASE PREVENTION AND CONTROL	WHO GHANA OFFICE

MINISTRYS

1	ENOCH H. COBBINAH	CHIEF DIRECTOR	MINISTRY OF EDUCATION
2	ERNEST WESLEY OTO	HEAD, DEVELOPMENT PARTNER'S COORDINATION DIVISION	MINISTRY OF EDUCATION
3	BERNSRD XYENSU	PLANNING OFFICER	MINISTRY OF EDUCATION
4	JAMES JERRY ODDOYE	MICROBIOLOGIST	MINISTRY OF FOOD AND AGRICULTURE
5	SYLVESTER ANEMANA	CHIEF DIRECTOR	MINISTRY OF HEALTH
6	DANIEL DEGBOTSE	HEAD, MONITORING AND EVALUATION	MINISTRY OF HEALTH
7	EMMANUEL ODAME	POLICY ALALYST	MINISTRY OF HEALTH
8	JYA APPAIH	ADMINISTRATOR	MINISTRY OF HEALTH
9	KWADWO AWUA-PEASAH	Director, External Resource Mobilization (Bilateral) Division	MINISTRY OF FINANCE
10	EDWARD NYARKO OBIRI-YEBOAH	Japan desk	MINISTRY OF FINANCE

LAND SURVEYOR

1	BEVERLY N A OKAI	CIVIL STRUCTURE ENGINEER	CSENG CONSULTANT
2	PAA YOOKU YAWSON	CIVIL STRUCTURE ENGINEER	CSENG CONSULTANT

OTHER DONORS

1	KEN UGWU	SENIOR BIOCONTAINMENT SPECIALIST, BIOLOGICAL SECURITY	FOREIGN AFFAIRS, TRADE AND DEVELOPMENT CANADA
2	NATALY SPEARS	PROGRAM OFFICER, BIOLOGICAL AND CHEMICAL SECURITY, UNSCR1540	FOREIGN AFFAIRS, TRADE AND DEVELOPMENT CANADA

MINISTRY OF HEALTH, LABOUR AND WELFARE

1	KEIYA IIDA	ASSISTANT MINISTER	

EMBASSY OF JAPAN

1	KAORU YOSHIMURA	AMBASSADOR EXTRAORDINARY AND PLENIPOTENTIARY	EMBASSY OF JAPAN
2	SHIGERU UMETSU	DEPUTY CHIEF OF MISSION COUNSELOR	EMBASSY OF JAPAN
3	KENMEI SADAMOTO	FIRST SECRETARY	EMBASSY OF JAPAN
4	ETSUKO ITO	COORDINATOR FOR ECONOMIC COOPERATION	EMBASSY OF JAPAN

JICA GHANA OFFICE

1	TSUTOMU TANAKA	SENIOR REPRESENTATIVE	
2	AKIKO ITO	REPRESENTATIVE (HEALTH)	
3	MIYUKI TAN	PROJECT COORDINATOR	
4	TAKANORI HORI	JICA EXPART	SATREPS
5	MASANORI YAMAZAKI	REPRESENTATIVE(HEALTH)	

TOKYO MEDICAL AND DENTAL UNIVERSITY

1	EIJI IDO	PROFESSOR, VISITNG SCIENTIST OF DEPARTMENT OF VIROLOGY IN NMIMR	DEPARTMENT OF MOLECULAR VIROLOGY, TOKYO MEDICAL AND DENTAL UNIVERSITY

NATIONAL CENTER FOR GLOBAL HEALTH AND MEDICINE

1	SHIGEYUKI KANO	DIRECTOR, DEPARTMENT OF TROPICAL MEDICINE AND MALARIA PROFESSOR	NATIONAL CENTER FOR GLOBAL HEALTH AND MEDICINE GRADUATE SCHOOL OF COMPREHENSIVE HUMAN SCIENCES UNIVERSITY OF TSUKUBA
2	HIDECHIKA AKASHI	DIRECTOR, DEPARTMENT OF GLOBAL NETWORKING AND PARTNERSHIP, BUREAU OF INTERNATIONAL MEDICAL COOPERATION	NATIONAL CENTER FOR GLOBAL HEALTH AND MEDICINE

MINUTES OF DISCUSSIONS
ON THE PREPARATORY SURVEY
ON THE PROJECT FOR THE CONSTRUCTION OF ADVANCED RESEARCH CENTER FOR INFECTIOUS DISEASES AT NOGUCHI MEMORIAL INSTITUTE FOR MEDICAL RESEARCH
IN THE REPUBLIC OF GHANA

In response to a request from the Government of the Republic of Ghana (hereinafter referred to as "Ghana"), the Government of Japan decided to conduct a Preparatory Survey on the Project for the Construction of Advanced Research Center for Infectious Diseases at Noguchi Memorial Institute for Medical Research (hereinafter referred to as "the Project"), and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA") .

Accordingly, JICA sent a Preparatory Survey Team (hereinafter referred to as "the Team"), headed by Ms. Sonoko Takahashi, to Ghana and is scheduled to stay from 10th March to 2nd April, 2015.

The Team held discussions with the officials concerned from the Government of Ghana and conducted a field survey at the study area.

In the course of discussions and field survey, both parties confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare the Preparatory Survey Report.

Accra, 27th March, 2015

Ms. Sonoko Takahashi
Leader
Preparatory Survey Team
Japan International Cooperation Agency

Professor Kwadwo A. Koram
Director
Noguchi Memorial Institute for Medical Research
University of Ghana
The Republic of Ghana

ATTACHMENT

1. Objective of the Project

The objective of the Project is to construct advanced research center for infectious diseases at the Noguchi Memorial Institute for Medical Research, University of Ghana (hereinafter referred to as "NMIMR") in order to provide efficient and safe research and teaching environment and also to position NMIMR to play a leading role in tackling the ever expanding research and training needs of the country and the West African sub-region and in responding effectively to disease outbreaks, including highly pathogenic agents such as Ebola Hemorrhagic Fever Virus.

2. Project Site

The site of the Project will be on the grounds of the NMIMR. The location map of the Project site is shown in Annex-1.

3. Responsible and Implementing Agency

3-1. The Responsible Agency is the Ministry of Education.

3-2. The Implementing Agency is NMIMR.

Organization chart of NMIMR is shown in Annex-2.

4. Items Requested by the Government of Ghana

After discussions with the Team, the items described in Annex-3 (facilities) and Annex-4 (equipment) were finally requested by the Ghanaian side. JICA will assess the appropriateness of the request and will recommend to the Government of Japan for approval.

5. Japan's Grant Aid Scheme

5-1. The Ghanaian side understands the Japan's Grant Aid Scheme explained by the Team, as described in Annex-5.

5-2. The Ghanaian side will take the necessary measures, as described in Annex-6, for smooth implementation of the Project, as a condition for the Japanese Grant Aid to be implemented.

6. Schedule of the Study

6-1. The consultants will proceed to further studies in Ghana until 2nd April, 2015.

6-2. JICA will prepare the draft report in English and dispatch a mission in order to explain its contents in September, 2015.

6-3. In case that the contents of the report is accepted in principle by the Government of Ghana, JICA will complete the final report and send it to the Government of Ghana by December, 2015.

7. Key Functions of the New Facility of NMIMR

7-1. Both sides agreed that the new facility would serve as a diagnostic and surveillance center for emerging and re-emerging diseases in the sub-region. The diagnostic and surveillance capacity of the center will contribute to strengthening the health systems in the sub-region especially for post-Ebola crisis.

7-2. Both sides agreed that with the new facility, NMIMR would also serve as a medical research and training center for future scientists in the West Africa region. Scientists from the sub-region will be provided access to hands-on trainings and research opportunities. The provision of the new facility will allow NMIMR to utilize the existing laboratories for enhanced research training in infectious diseases. In this connection, Japanese side recommends that laboratories for training and those for research be separated in their usage to ensure efficiency. In addition, the existing Bio-Safety Level (BSL) III laboratory will be used in training researchers, laboratory technicians and maintenance staff on proper usage and maintenance of BSL III laboratories, which could include simulated experiments of highly pathogenic agents.

7-3. Both sides agreed to explore possibilities for assistance as necessary in increasing the technical capacity of the laboratory at NMIMR. This may include assistance to 1) ensure full and proper utilization of the new BSL III laboratory, 2) enhance the utilization of the existing BSL III laboratory, and 3) conduct training for existing and incoming staff, including researchers, laboratory technicians, and maintenance staff.

8. Other relevant issues

8-1. Budget Allocation

The Ghanaian side agreed to allocate budget and take necessary actions for the provision of new furniture as well as for the movement of existing furniture and equipment of the departments relocating to the new facility, as described in Annex-8.

8-2. Operation and Maintenance

The Ghanaian side agreed to allocate budget (operational and maintenance costs) and manpower (medical researchers and any other personnel) necessary for the proper and sustainable operation and maintenance of the facilities and the equipment to be provided under the Project.

8-2. Project Title

Both sides agreed that the name of the Project should be amended to "the Project for the Construction of Advanced Research Center for Infectious Diseases at Noguchi Memorial Institute for Medical Research" from "the Project for Provision of Additional Laboratory Space at Noguchi Memorial Institute of Medical Research," written in the original request.

8-3. Both sides agreed to the following architectural designing criteria of facility:

(1) The facility will be built with a purpose to be used as a medical research and training center as well as a diagnostic center, which are in line with the future visions of NMIMR as described in Annex-7;

(2) The new facility will include a provision of seminar rooms as well as office spaces for students, research fellows and professors as described in detail in Annex-3; and

(3) The new facility will include a provision of a new BSL I, II, and III laboratories, as well as a common molecular laboratory, as described in detail in Annex-3.

8-4. Both sides agreed to the following selection criteria of equipment:

(1) The equipment will be procured for the exclusive use of the facility mentioned in 8-3 (1) above.

(2) The equipment to be replenished and/or replaced from the existing ones will be prioritized.

(3) The basic laboratory equipment such as biosafety cabinets, laminar flow cabinets,

autoclaves, etc. will be prioritized, as described in detail in Annex-4.

9. Undertaking by the Ghanaian Side

Both sides agreed that provision of a new BSL III laboratory is crucial for the proposed relocating departments, which are bacteriology, virology, and immunology departments. NMIMR agreed to the following to ensure proper and safe usage of the laboratory that will ensure its sustainability:

(1) Allocate budget for continuous electrical power as well as routine maintenance of the facility and equipment.

(2) Train all existing and incoming staff on accurate and up-to-date knowledge of biosafety.

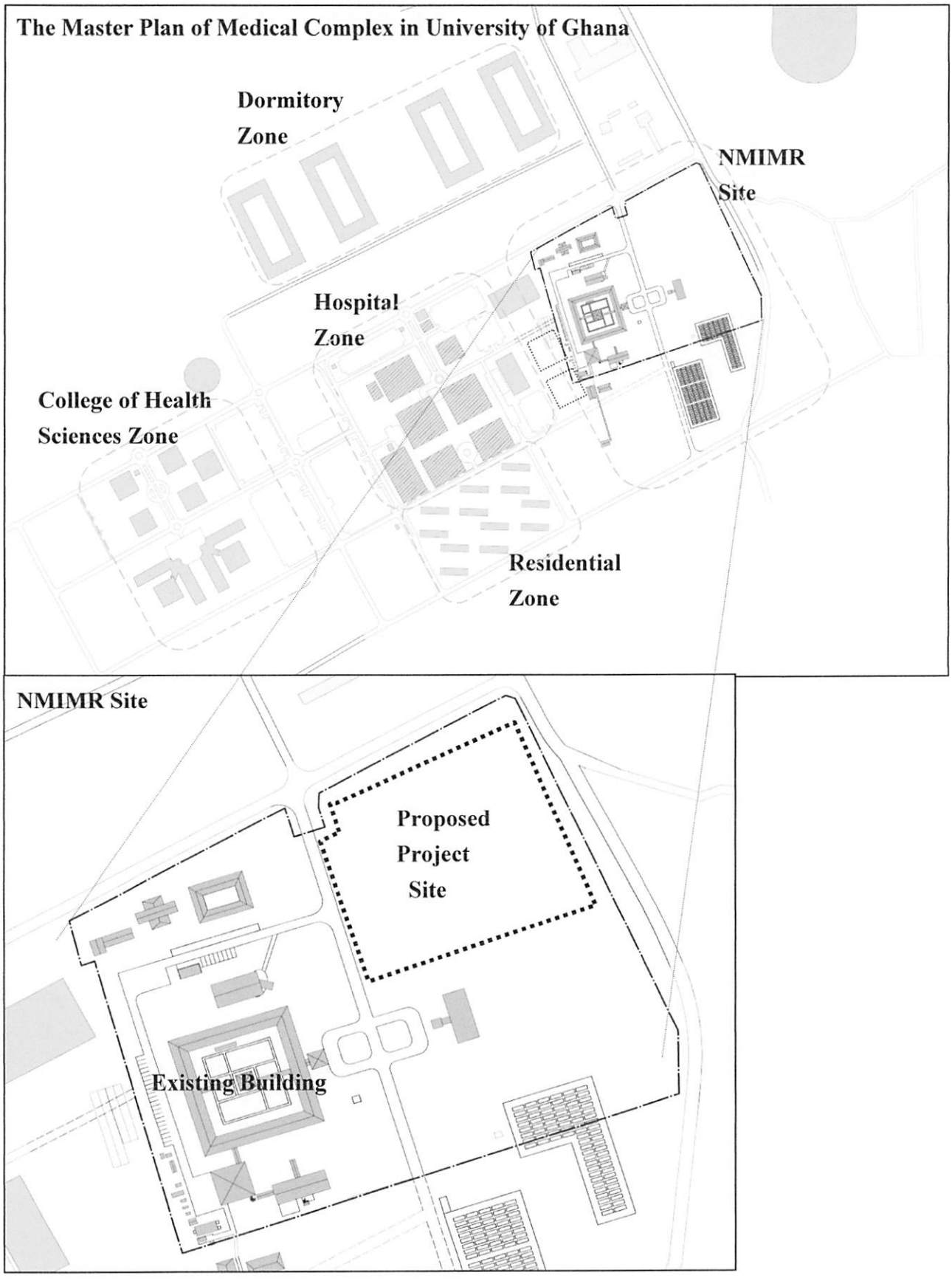
(3) Allocate budget for and renovate the existing BSL III laboratory following the completion of the Project.

10. Technical Assistance

The Ghanaian side requested technical assistance under the Japan's Grant Aid for basic training on facility maintenance of BSL III laboratory.

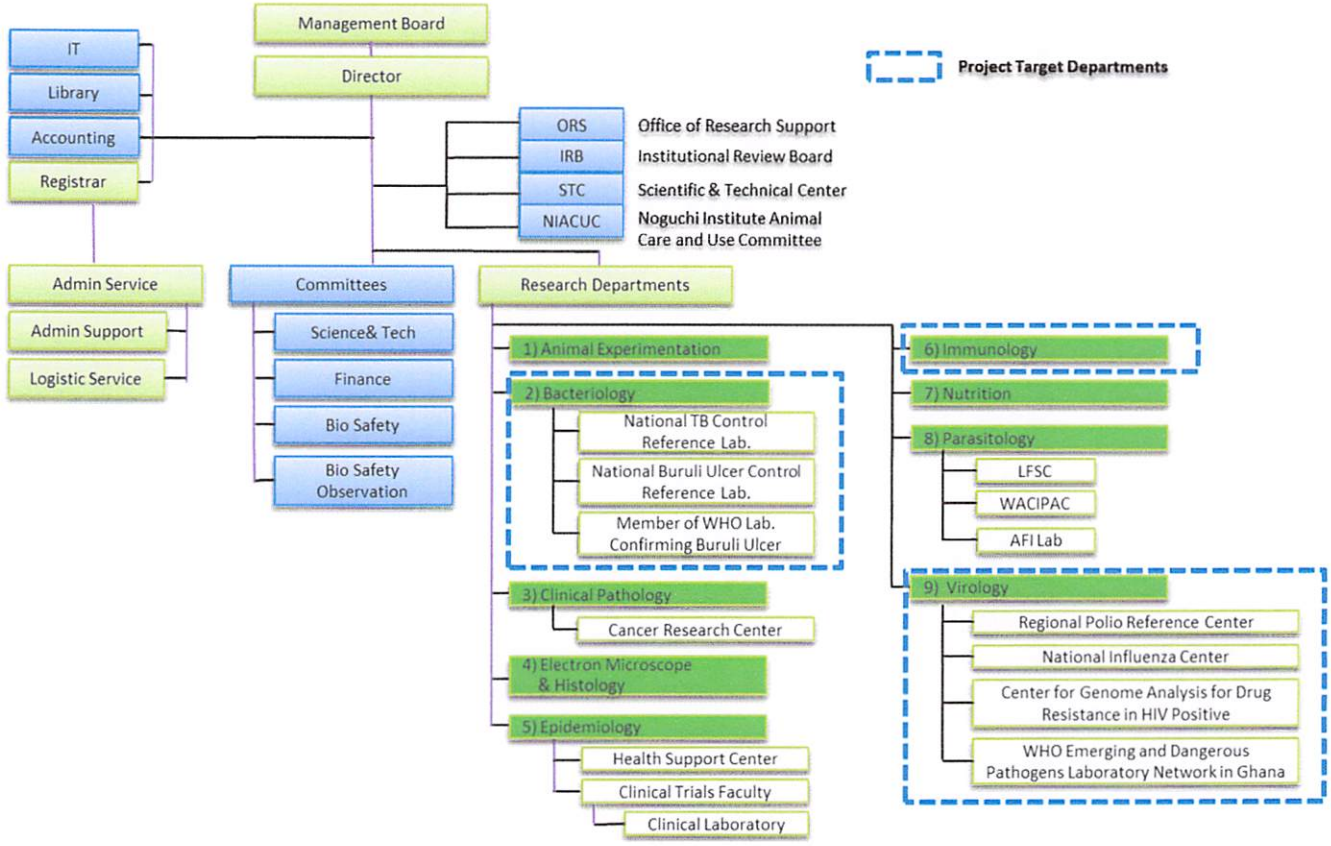
Annex-1	Location Map
Annex-2	Organization Chart of the NMIMR
Annex-3	Facility List
Annex-4	Equipment List
Annex-5	Japan's Grant Aid
Annex-6	Major Undertakings to be Taken by Each Government
Annex-7	Strategic Note on NMIMR's Future Plans
Annex-8	Schedule of the Project

Location Map



Annex-2

Organization Chart of the NMIMR



Facility List

	Research Depts		
	Bacteriology	Immunology	Virology
Laboratory			
Biosafety Level 1	A	A	A
Biosafety Level 2	A	A	A
Biosafety Level 3	A		
Common Molecular Laboratory	A		
Office			
for Professors	A	A	A
for Reserch Fellows / Reserch Assistants / Technicians	A	A	A
for Students (incl.Internship and National Service etc.)	A		
Seminar Room	A		
Storage	A		
Cold Room	A		
Washing Room	A		
Cafeteria (no kitchen)	B		
Building Services			
Data Processing Unit	A		
Maintenance Room / Workshop	A		
Generator	A		
Water Supply Facility	A		
Sewage Treatment System	A		

Note: A and B shows the priority level for the project.

Equipment List

Priority A: Equipment that is essential for the Project
Priority B: Equipment that is necessary but further study in Japan is required
Priority C: Equipment that will be supplied by Ghanaian whenever it deems necessary

Department/ Laboratory	No	Name of Equipment	Priority	Remarks
A. BSL-III Laboratory (Common equipment for Virology, Bacteriology and Immunology)	1	Autoclave pass through type	A	For virology and bacteriology
	2	Biosafety cabinet (A)	A	Idem
	3	Pass box	A	Idem
	4	Sink with decontamination tank	A	Idem
	5	Formaldehyde decontamination unit (A)	B	Common use
	6	Formaldehyde decontamination unit (B)	B	Idem
	7	Biosafety type autoclave	A	For virology and bacteriology
	8	Deep freezer (-80°C)	A	Idem
	9	Freezer (-20°C)	A	Idem
	10	Medical refrigerator	A	Idem
	11	Refrigerated centrifuge (A)	A	For virology
	12	Refrigerated centrifuge (B)	B	For bacteriology
	13	Refrigerated microcentrifuge	A	For virology
	14	Inverted microscope	B	Idem
	15	CO2 Incubator	A	For virology and bacteriology
	16	Incubator (37°C)	B	Idem
	17	Shaking water bath	A	For virology
B. Virology Laboratory	1	Potable pH meter	B	
	2	Electronic balance	A	
	3	Autoclave	B	
	4	Deep freezer (-80°C)	A	
	5	Binocular microscope	A	
	6	Refrigerated centrifuge (15/50ml)	B	
	7	CO2 Incubator	A	
	8	Incubator (37°C)	A	
	9	Inverted microscope	A	
	10	Biosafety cabinet (B)	A	
	11	Water bath	B	
	12	Microcentrifuge	A	
	13	Vortex mixer	B	
	14	Elisa system	A	
	15	Centrifuge (15/50ml)	A	
	16	Refrigerated microcentrifuge	A	
	17	Real Time PCR	B	
	18	Nanodrop	B	
	19	Medical refrigerator	A	
	20	Freezer (-20°C)	A	
	21	Clean bench	B	
	22	Freezer (-30°C)	A	
	23	Refrigerator/freezer	A	
	24	Refrigerated centrifuge (32 tubes)	A	
	25	Shaker	B	

Department/ Laboratory	No	Name of Equipment	Priority	Remarks
	26	Ice Maker	B	
	27	Vacuum dryer	B	
	28	Fluorescent microscope	A	
	29	Magnetic stirrer	A	
	30	Shaking water bath	B	
	31	Microwave oven	C	
	32	Ultracentrifuge	B	
	33	Flow cytometry	A	
	34	Immunoassay serological analyzer	B	
	35	Fully automated nucleic material extraction system	B	
C. Bacteriology Laboratory	1	Blood culture system	C	
	2	Autoclave	A	
	3	CO2 Incubator	A	
	4	Refrigerated centrifuge (15/50ml)	B	
	5	Biosafety cabinet (B)	A	
	6	Refrigerated microcentrifuge	B	
	7	Electronic balance (A)	A	
	8	Electronic balance (B)	A	
	9	Electronic balance (C)	A	
	10	Colony counter	A	
	11	Incubator (37°C)	A	
	12	Incubator (22°C)	A	
	13	Incubator (44°C)	A	
	14	Medical refrigerator	A	
	15	Water bath	A	
	16	Centrifuge (15/50ml)	B	
	17	Shaker incubator	A	
	18	Clean bench	A	
	19	Vortex mixer	A	
	20	Freezer (-20°C)	B	
	21	Deep Freezer (-80°C)	B	
	22	Sonicator	B	
	23	Desicator	B	
	24	Stomacher	B	
	25	Ice maker	A	
	26	Drying hot oven (B)	A	
	27	Binocular microscope	A	
	28	Digital coagulator	B	
	29	Twin Incubator	B	
	30	Fluorescent microscope	A	
	31	Fume extractor	A	
D. Immunology Laboratory	1	Binocular microscope	A	
	2	Hotplate magnetic stirrer	A	
	3	Electronic balance	A	
	4	Centrifuge (15/50ml)	A	
	5	Refrigerated centrifuge (15/50ml)	B	
	6	Biosafety cabinet (B)	A	
	7	Elisa system	B	
	8	Fume extractor	A	
	9	Medical refrigerator	A	
	10	Refrigerator/freezer	B	
	11	EliSpot reader	B	
	12	Clean bench	A	
	13	Plate shaker	A	
	14	Vortex mixer	A	

Department/ Laboratory	No	Name of Equipment	Priority	Remarks
	15	Flow cytometry	A	
	16	Autoclave	A	
	17	Shaking water bath	A	
	18	Microcentrifuge	B	
	19	pH meter	A	
	20	Inverted microscope	A	
	21	Fluorescent microscope	A	
	22	Radioactive cell harvesting device	C	
	23	Freezer (-20°C)	A	
	24	Freezer (-30°C)	A	
	25	Deep freezer (-80°C)	A	
	26	Dissecting microscope	A	
	27	Cell counter	B	
	28	Refrigerated microcentrifuge	B	
	29	Water bath	B	
	30	Micropipette	B	
	31	Sonicator	B	
	32	Chemical cabinet	B	
	33	Ultrasonic cleaner	B	
	34	Nitrogen tank	B	
	35	Confocal microscope	B	
E. Clinical Pathology	1	Gas chromatography mass spectrometry	C	
F. Molecular Laboratory (Pre-PCR Lab)	1	Medical refrigerator	A	
	2	Freezer (-20°C)	A	
	3	Refrigerated microcentrifuge	A	
	4	Vortex mixer	A	
	5	Timer	C	
	6	PCR Workstation	B	
	7	Micropipette	A	
	8	Laminar flow Biosafety Cabinet	B	
(PCR Lab)	1	Thermo Cycler	B	
	2	Real-Time PCR	B	
	3	Medical refrigerator	A	
	4	Micropipette	A	
	5	Laminar flow Biosafety Cabinet	A	
(Post PCR)	1	Medical refrigerator	A	
	2	Freezer (-20°C)	A	
	3	Gel Imaging system	A	
	4	Computer with network connection	B	
	5	Electrophoresis apparatus	A	
	6	Voltex mixer	A	
	7	Laminar flow Biosafety Cabinet	A	
	8	Refrigerated microcentrifuge	A	
(Sample Preparation)	1	Sample homogenizer	A	
	2	Medical refrigerator	A	
	3	Freezer (-20°C)	A	
	4	Water bath	A	
	5	Heat block	A	
	6	Laminar flow Biosafety Cabinet	A	
Sequencing (Common Usage)	1	DNA Sequencer (Next generation)	B	
Washing room (Common Usage)	1	Drying hot oven (A)	A	
	2	Drying hot oven (B)	A	
	3	Water distiller	A	

Department/ Laboratory	No	Name of Equipment	Priority	Remarks
	4	Washing machine	C	
	5	Drying machine	C	
	6	Automatic pipette washer	B	

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.

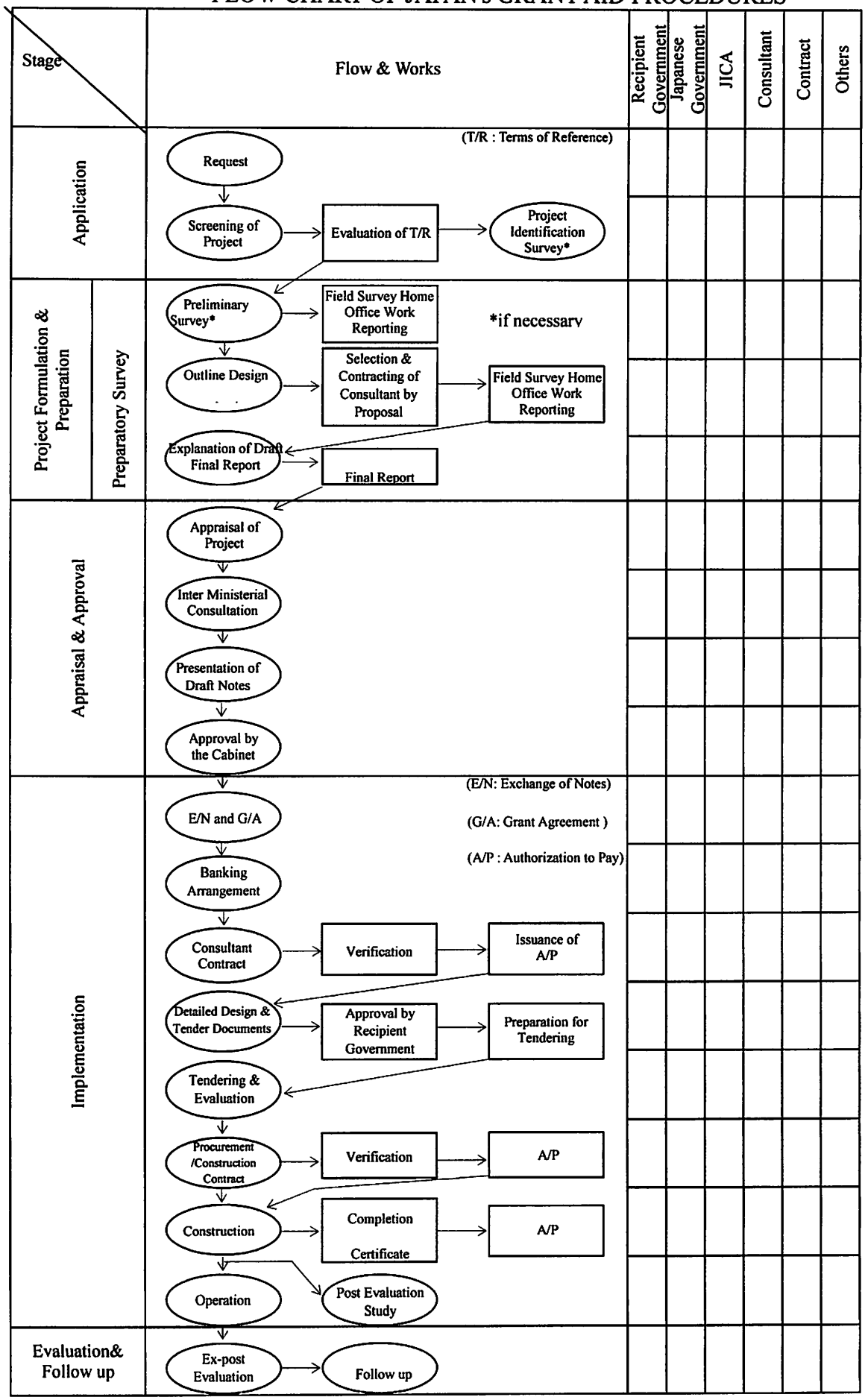
(9) Authorization to Pay (A/P)

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



Major Undertakings to be taken by Each Government (Facilities)

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	to secure a lot of land necessary for the implementation of the Project and to clear the site;		●
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		
	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 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)

Major Undertakings to be taken by Each Government (Equipment)

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	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	●	
2	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		●
3	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		●
4	To ensure that the Facilities and the products be maintained and used properly and effectively for the implementation of the Project		●
5	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		●
6	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		●
7	To give due environmental and social consideration in the implementation of the Project.		●

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

Strategic Directions of the NMIMR 2014 - 2019

Introduction

Over the past three decades and especially over the last decade and a half or so, the Noguchi Memorial Institute for Medical Research has largely lived up to the expectation of the founding fathers by carving a niche for herself in the area of infectious diseases research, training of middle level personnel and provision of lab facilities for graduate training in biomedical research and also provision high end diagnostic capabilities in support of health services in the country and beyond. This is evidenced from the many centres that have been established, e.g WACIPAC, LFCSC, NIC, Regional Lab for Polio Eradication etc. These centres have arisen out of the work of the excellent and competent scientists that have contributed to this advancement. The Institute has reached a point in its history that requires a re-orientation and re-positioning of itself to continue to be relevant to the provision of health care in the country and beyond. As a part of the University, the generation of new knowledge will continue to be paramount in its activities. However, the new knowledge should be developed to inure to the benefit of the population in the areas of preventive and curative strategies for prevailing diseases. The time has come for the Institute to examine itself, consolidate those activities that it has been doing well in and re-position itself to play even more significant roles in the development of the University and the nation at large.

The strategic directions are to be predicated on the following broad objectives;

- Restructure the Institute for greater efficiency
- Consolidate and strengthen the work of the Institute
- Position the Institute for long term growth
- Encourage new areas of research, such as product development (e.g. development of field applicable diagnostic tools, novel therapeutic agents for the treatment of infectious diseases, vaccines etc.) to promote growth;

The new 600-bed UG Teaching hospital being constructed next door to the Institute offers huge resources for expanded clinical research. Thee Institute will position itself to fully exploit these resources for the development of a strong clinical research programme that encompasses also clinical trials, genomics, bioinformatics etc. through enhanced lab spaces (an application has been made to JICA for a grant aid to expand the laboratories), recruitment of specialty scientists and involvement of physicians in basic science research.

The basic building blocks for the achievement of these objectives are in place, although significant challenges remain. To place the Institute on a firm footing for the next decade or so it is planned to undertake the following activities;

Consolidation and Strengthening of work of NMIMR

- Complete the establishment of Quality Unit and institute wide quality improvement scheme
    - Complete ISO certification for LF lab
- Establish the Data Management Unit including the Bio informatics unit
- Strengthen the maintenance unit to be able to take care of routine maintenance needs in the Institute, such as replacement of old and worn out parts on plant and machinery.
- Refurbishment of laboratories
- Institute a review of the Institute to inform on needed restructuring for greater efficiency

Positioning the Institute for long term growth

- Reorientation to achieve the objectives /mission of the Institute vis a vis working to improve the health of the nation
- Strengthen work on non communicable diseases in collaboration with other stakeholders such as the Non Communicable Disease Control Unit of the Ghana Health Service to address the increasing problem of NCDs in the country
- Establish collaborations within and outside the University to enhance the drug development program with a focus on plant medicines.
- Establish a product development program to cover field applicable diagnostic tools for infectious diseases, drugs from herbal medicines and vaccines.
- Establish major research clusters or programs with emphasis on contributing directly and indirectly to the improvement of health in the country.
- Complete discussions and establish a College wide research program for medical students interested in obtaining the dual MB, ChB/PhD program at the University.

Consolidation of current gains and improving the efficiency of work in the Institute.- Institutional or Core Facilities

Establish a strong Quality Management Unit in the Institute to cover all aspects of the Institute's work (next 12 months).

- Work on establishing these will continue as part of the re-organization and quality improvement for enhanced efficiency. The work on Institute wide Quality Management Scheme will be completed and the laboratory accreditation for the various laboratories will

be obtained, starting with the Lymphatic Filariasis laboratory in the current department of Parasitology.

- The Quality Management Scheme will encompass all aspects of work at the Institute including supporting activities such as the maintenance unit, transport section etc.
- The Quality Unit will be established as strong unit with oversight responsibility for maintaining quality throughout the workings of the Institute.
- The quality improvement will include a review and revision of all operational policies and guidelines on such activities as transport, sample storage, etc and revise those that need revision.
- Data management unit will be expanded with additional qualified staff to assist with data analysis and improved publications from the Institute.
- Establishment of a core molecular biology suite for the Institute to enhance efficiency in the conduct of research.

Positioning the Institute for long term growth

The huge resources that the 600-bed UG Teaching hospital offer will be exploited for establishing a strong program in clinical research at the Institute. It is my vision to position the Institute to exploit this fully, through enhanced lab spaces (application made to JICA for a grant aid for the provision of an advanced research laboratory), recruitment of specialty scientists and development of a clinical research programme that encompasses also clinical trials, genomics, bioinformatics etc.

- Reorientation to achieve the objectives /mission of the Institute in the new drive of the University to being a research university and also contributing to the general improvement of the health of the nation
- Strengthen work on non communicable diseases in collaboration with other stakeholders such as the Non Communicable Disease Control Unit of the Ghana Health Service to address the increasing problem of NCDs in the country. To build upon the collaborations begun with the Department of Biochemistry, Cell and Molecular Biology to include other schools /departments in developing programs on non communicable diseases, eg. The Department of Chemistry in the work on plant medicines to develop a drug development program in the University.
- Continue the process of engaging alumni, especially those in the diaspora, to partner in the work of the Institute as well as source for funds for research programs
- The collaborations established with JICA and others such as PATH, GVBH and other academic institutions will be strengthened to ensure that the diagnostic centre is brought into

being. Will liaise with the Institute of Applied Science and Technology to take on some of these early collaborations and develop them for industrial engagement.

- Establish major research clusters or programs with emphasis on contributing directly and indirectly to the improvement of health in the country.
- Establish a program on clinical research to take advantage of the opportunities offered by the establishment of the UG Teaching Hospital.

Operations – Finance, Administration and Human Resources

- Diversify the funding base of the Institute to ensure sustainability. Pursue relentlessly the provision of core funding to the Institute (besides provision of salaries).
- To improve the conduct of commissioned research in the Institute
- Establish a strong clinical services laboratory at the Institute with emphasis on high end clinical tests such as immunological tests etc.
- Research clusters to plan for and obtain large collaborative grants /contracts

Training

- Continue the current Post Doctoral training program as the flagship training program in the Institute (Will apply for grants to support this scheme)
- Work with the other institutes in the CHS to establish a college wide program for the dual MB, ChB /PhD training to ensure the supply of personnel interested in medical research
- Expand into the area of provision of short term hands on training at the bench for young researchers
- Establish the middle level manpower training /certification for MOH/GHS in the area of modern diagnostic assays for infectious diseases

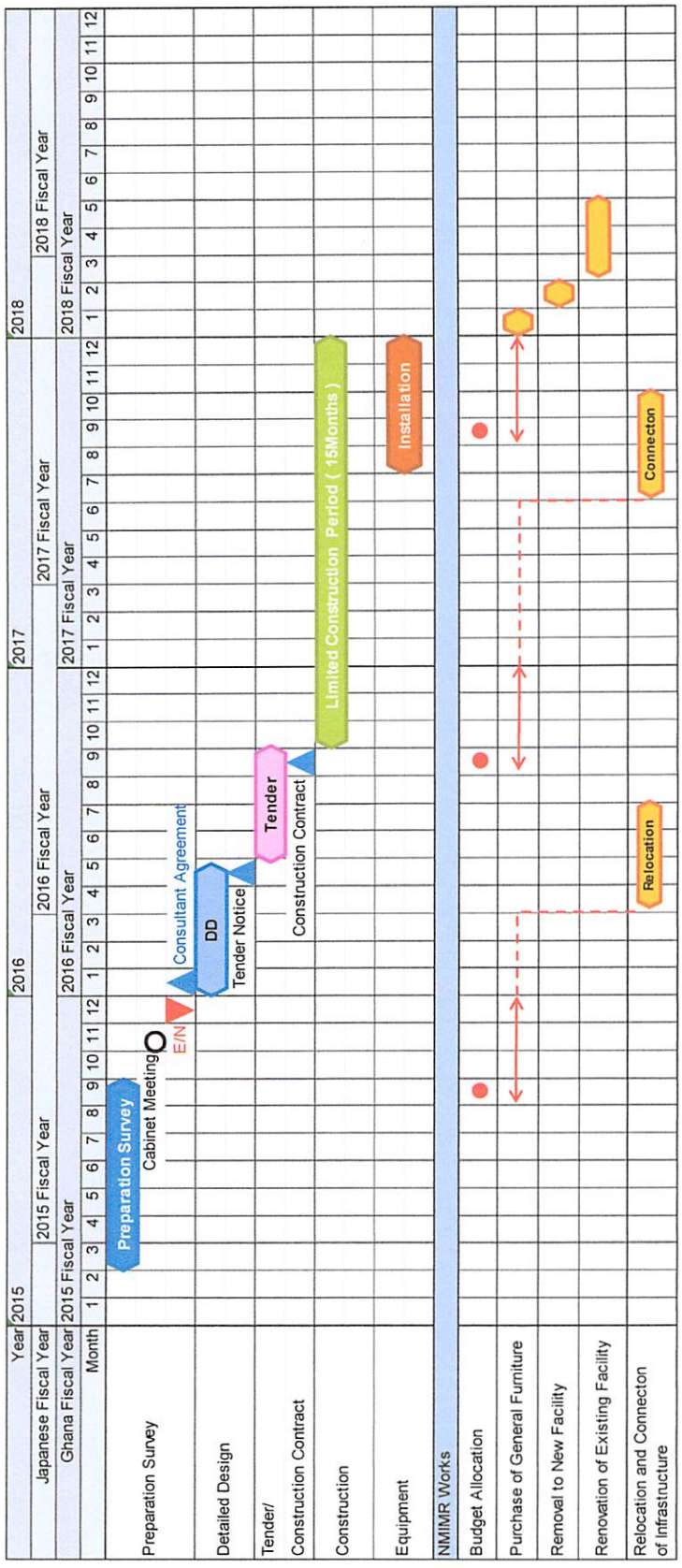
Projections

Staff expansion

- To be able to undertake the expected expansion in research that is envisioned, the Institute will grow the staff strength at an average annual increase of about 5%. Emphasis will be put on recruiting new fellows with interest /expertise in the proposed areas of work targeted for expansion. In the short to medium term this should increase the numbers of senior members increase from 38 to around 50.
  - Work with the MOH/GHS to second interested physicians to the Institute to work alongside the scientists

Annex-8

Schedule of the Project



MINUTES OF DISCUSSIONS

ON THE PREPARATORY SURVEY

ON THE PROJECT FOR THE CONSTRUCTION OF ADVANCED RESEARCH CENTER FOR INFECTIOUS DISEASES AT NOGUCHI MEMORIAL INSTITUTE FOR MEDICAL RESEARCH

IN THE REPUBLIC OF GHANA

(EXPLANATION ON DRAFT PREPARATORY SURVEY REPORT)

On the basis of the discussions and field survey in the Republic of Ghana (hereinafter referred to as "Ghana") in March 2015, 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 (hereinafter referred to as "the Draft Report") on the Project for the Construction of Advanced Research Center for Infectious Diseases at Noguchi Memorial Institute for Medical Research (hereinafter referred to as "the Project").

In order to explain the Draft Report and to consult with the concerned officials of the Government of Ghana on its contents, JICA sent the Preparatory Survey Team for the Explanation of the Draft Report (hereinafter referred to as "the Team") to Ghana, headed by Ms. Sonoko Takahashi, Deputy Director, Health Team 2, Human Development Department, JICA, and is scheduled to stay in the country from 7th to11th September, 2015.

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

Accra, 11th September, 2015

Ms. Sonoko Takahashi
Leader
Preparatory Survey Team for the Explanation of the Draft Report
Japan International Cooperation Agency
Japan

Professor Kwadwo A. Koram
Director
Noguchi Memorial Institute for Medical Research
University of Ghana
The Republic of Ghana

Mr. Enoch H. Cobbinah
Chief Director
Ministry of Education
The Republic of Ghana

Mr. Kwadwo Awua-Peasah
Director
External Resource Mobilization (Bilateral) Division
Ministry of Finance
The Republic of Ghana

ATTACHMENT

1. Objective of the Project

   The objective of the Project is to construct the Advanced Research Center for Infectious Diseases at Noguchi Memorial Institute for Medical Research, University of Ghana (hereinafter referred to as "NMIMR") in order to provide an efficient and safe research and teaching environment for the staff and students of NMIMR. The Project will position NMIMR to play a leading role in tackling the ever expanding research and training needs of the country as well as the West African sub-region and to respond effectively to disease outbreaks, including highly pathogenic agents such as Ebola Hemorrhagic Fever Virus.

2. Title of the Preparatory Survey

   Both sides confirmed the title of the Preparatory Survey as "the Preparatory Survey on the Project for the Construction of Advanced Research Center for Infectious Diseases at Noguchi Memorial Institute for Medical Research." The title reflects the agreed amendment of the project title, as recorded in the Minutes of Discussions dated 27th March 2015.

3. Project Site

   Both sides confirmed that the site of the Project is on the grounds of NMIMR, as 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 the Ministry of Education, which would be the agency to supervise the executing agency.

   4-2. The executing agency is the University of Ghana / NMIMR. The executing agency should coordinate with all the relevant agencies to ensure smooth implementation of the Project and ensure that the undertakings are implemented by the relevant agencies properly and on time. The organization chart of NMIMR is shown in Annex 2.

5. Contents of the Draft Report

   After the explanation of the contents of the Draft Report by the Team, both sides agreed to its contents.

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.

The Team explained to the Ghanaian side that the rough estimate of the Project Cost described in Annex 3 includes the contingency, however, the final Project Cost including the contingency described in Exchange of Notes (E/N) would be appraised by the Government of Japan. The contingency would cover the additional cost against natural disaster, unexpected natural conditions, etc.

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. Japanese Grant Scheme

The Ghanaian side understands the Japanese Grant Scheme and its procedures as described in Annexes 4, 5, and 6, and necessary measures to be taken by the Government of Ghana.

9. Project Implementation Schedule

The Team explained to the Ghanaian side that the expected implementation schedule is as per attached in Annex 7.

10. Expected outcomes and Indicators

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

10-1. Quantitative Effect

Indicators	Baseline		Goal (2021)
	year	value	
Total number of research projects at the three departments (Virology, Bacteriology, Immunology)	2014	31 projects	36 projects
Yearly average number of interns within the three departments (Virology, Bacteriology, Immunology)	average of 2012 - 2014	103.7 persons	135 persons
Percentage of foreign student interns	average of 2012 - 2014	9.3%	12%
Number of times people have accessed BSL-3 Laboratory per year	2014	1,005 times	1,307 times

10-2. Qualitative Effect

- Improvement of the quality of research conducted by the Virology, Bacteriology and Immunology departments at NMIMR
- Increase in safety level at the new BSL-3 laboratory
- Increase in efficiency and accuracy of research with the installment of molecular biology common laboratory room

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

Considering the sustainable operation and maintenance of the BSL-3 laboratory, technical assistance for strengthening the maintenance capacity and deepening the understanding of biosafety is planned to be provided under the Project. The Ghanaian side confirmed that it will assign necessary number of competent and appropriate staff as described in the Draft Report.

12. Undertakings by Both Sides

Both sides confirmed the undertakings described in Annex 8. The Ghanaian side assured to take necessary measures, including the allocation of the necessary budget, as preconditions for the implementation of the Project. It was further agreed that the costs are indicative at the Outline Design level. More accurate costs will be calculated and updated at the Detailed Design stage. The contents of Annex 8 will

also be an Attachment to the Grant Agreement.

13. Monitoring during the Implementation

The Project will be monitored every 3 months by the executing agency using the Project Monitoring Report (PMR), as per attached in Annex 9.

14. Ex-Post Evaluation

JICA will conduct ex-post evaluation three (3) years after the project completion with respect to five evaluation criteria (Relevance, Effectiveness, Efficiency, Impact, Sustainability) of the Project. Result of the evaluation will be publicized. The Ghanaian side is requested to provide necessary information.

15. Schedule of the Study

JICA will complete the Final Report of the Preparatory Survey and send it to the Ghanaian side around December 2015.

16. Environmental and Social Considerations

The project is likely to have minimal adverse impact on the environment under the 'JICA Guidelines for Environmental and Social Considerations (April 2010)'.

17. Other Relevant Issues

17-1. Operation and Maintenance of the Facilities and Equipment

The Team explained the importance of operation and maintenance of the facilities and equipment under the Project considering that proper asset management is necessary to secure the life-span of the facilities and equipment and to reduce its maintenance cost. The Ghanaian side should secure enough staff and budget necessary for appropriate operation and maintenance of the facilities and equipment. The annual operation and maintenance costs are estimated and shown in Annex 8.

17-2. 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.

List of Annexes:

Annex 1 Location Map
Annex 2 Organization Chart of NMIMR
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Annex 8 Major Undertakings by Each Government
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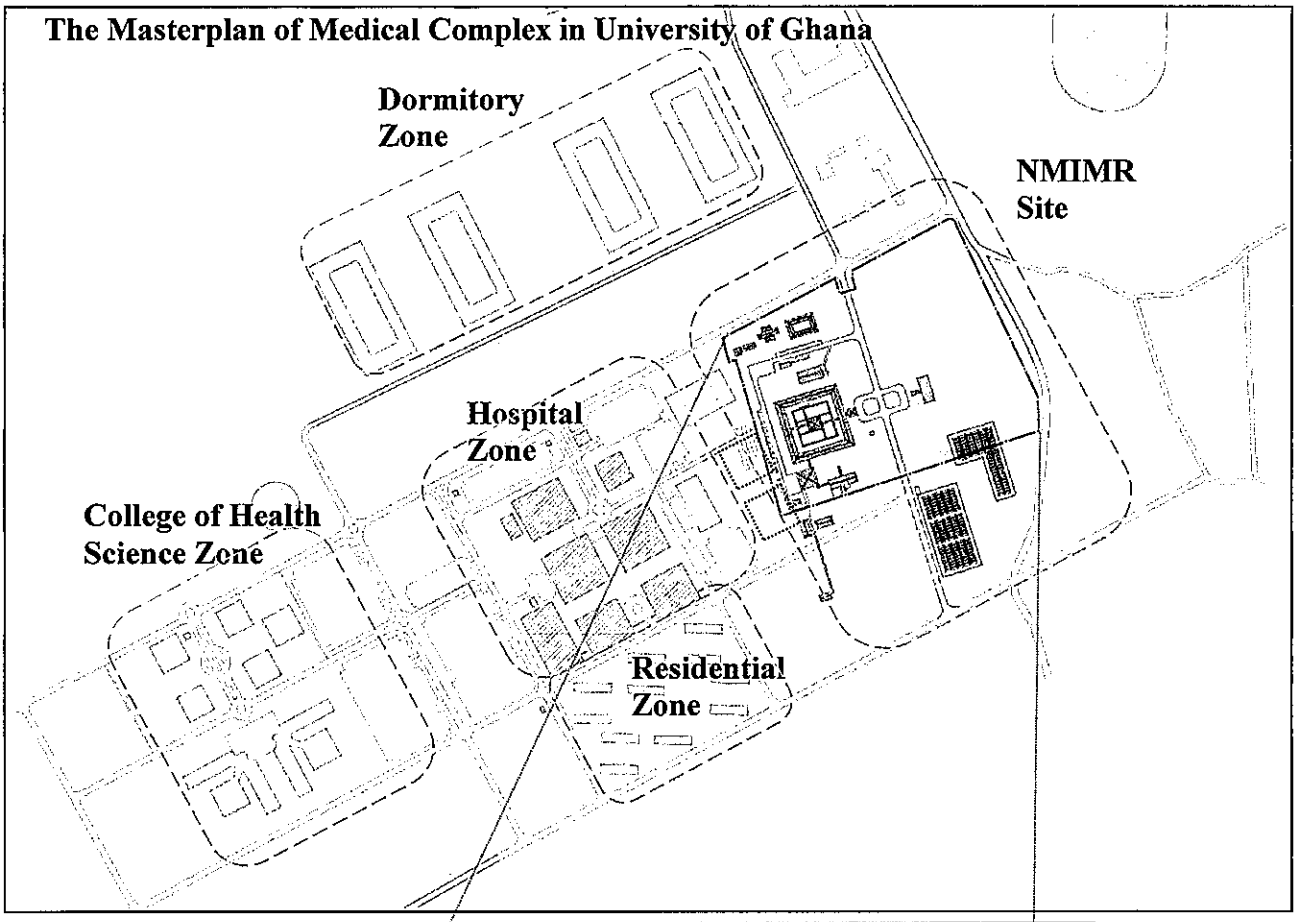
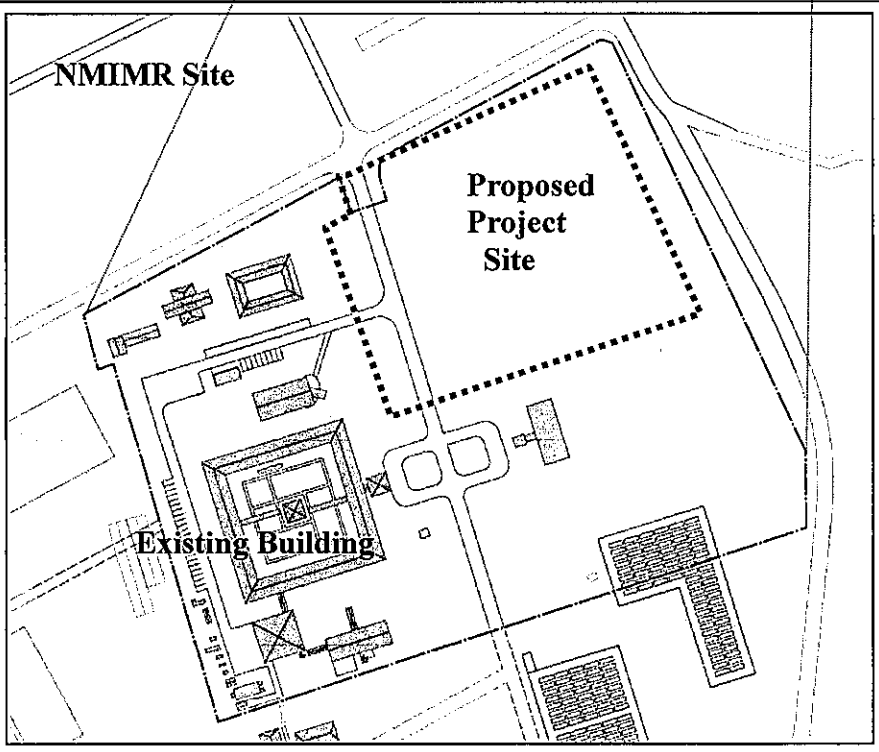
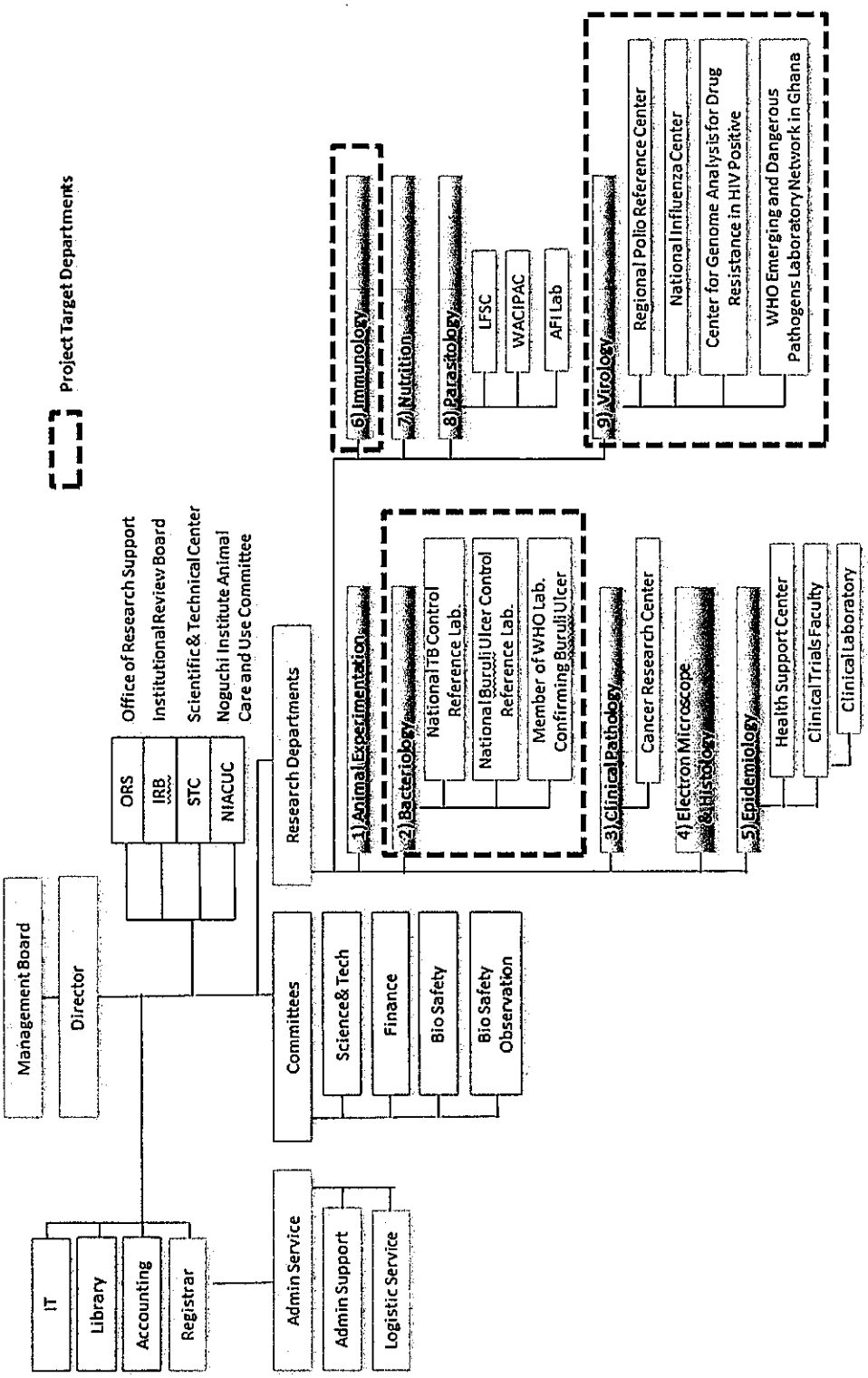
ANNEX 1: LOCATION MAP





ANNEX 2: ORGANIZATION CHART OF NMIMR



ANNEX 4: JAPANESE GRANT

The Japanese Grant (hereinafter referred to as the "Grant") 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 is not supplied through the donation of materials as such.
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 Japanese Grant for Projects for construction of facilities, purchase of equipment, etc.

1. Grant Procedures

The Grant 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 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 an 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 project. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant 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) 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. Japanese Grant 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, in accordance with the E/N, 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 Grant, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. The Grant may be used for the purchase of the products or services of a third country, if necessary, taking into account the quality, competitiveness and economic rationality of products and services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals", in principle.

(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 by the Government of the Recipient Country

In the implementation of the Grant Project, the recipient country is required to undertake such necessary measures as Annex 8. 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 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, to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Grant.

(7) "Export and Re-export"

The products purchased under the Grant 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 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) Environmental and Social Considerations

The Government of the recipient country must carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the recipient country and JICA Guidelines for Environmental and Social Consideration (April, 2010) .

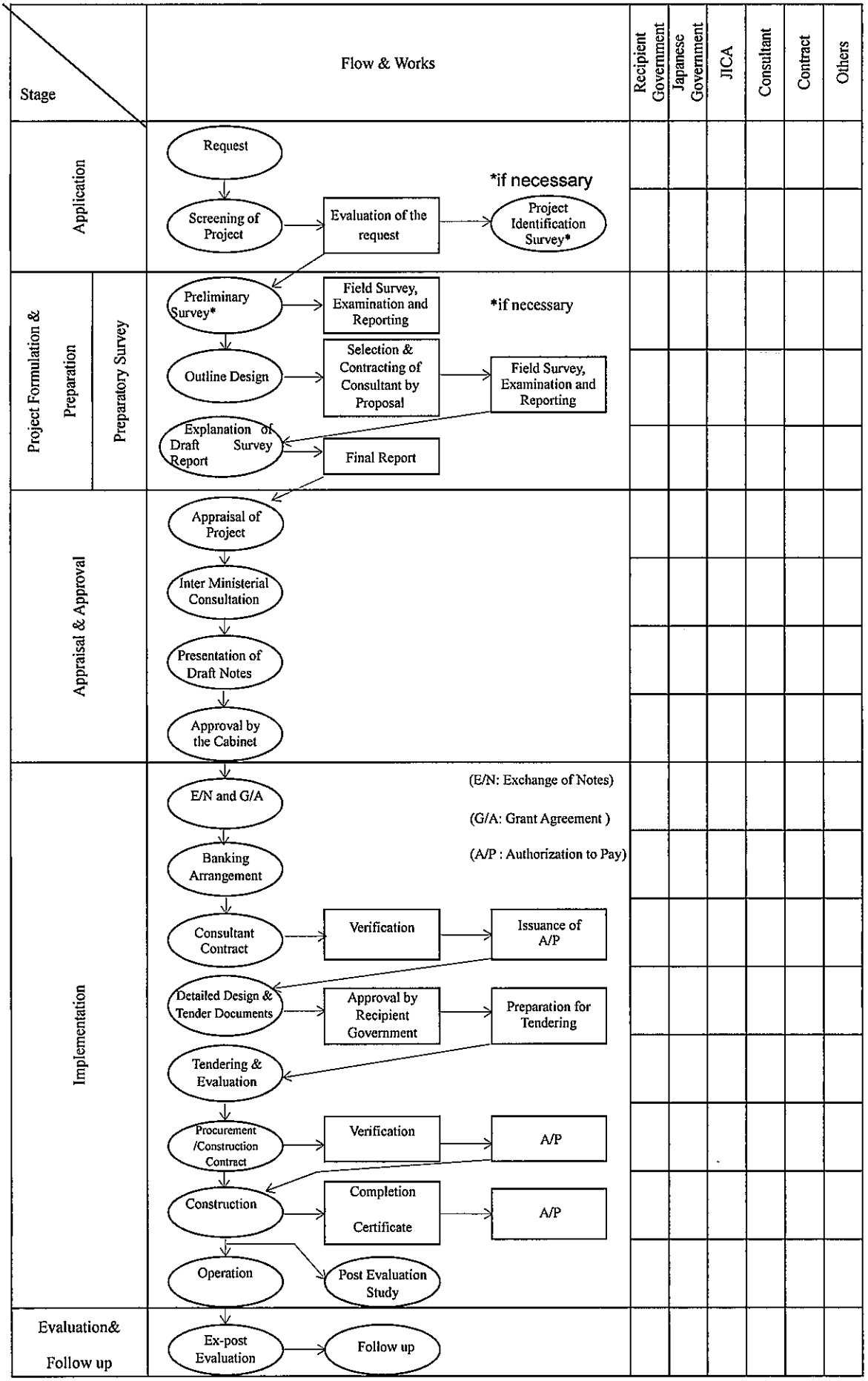
(11) Monitoring

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).

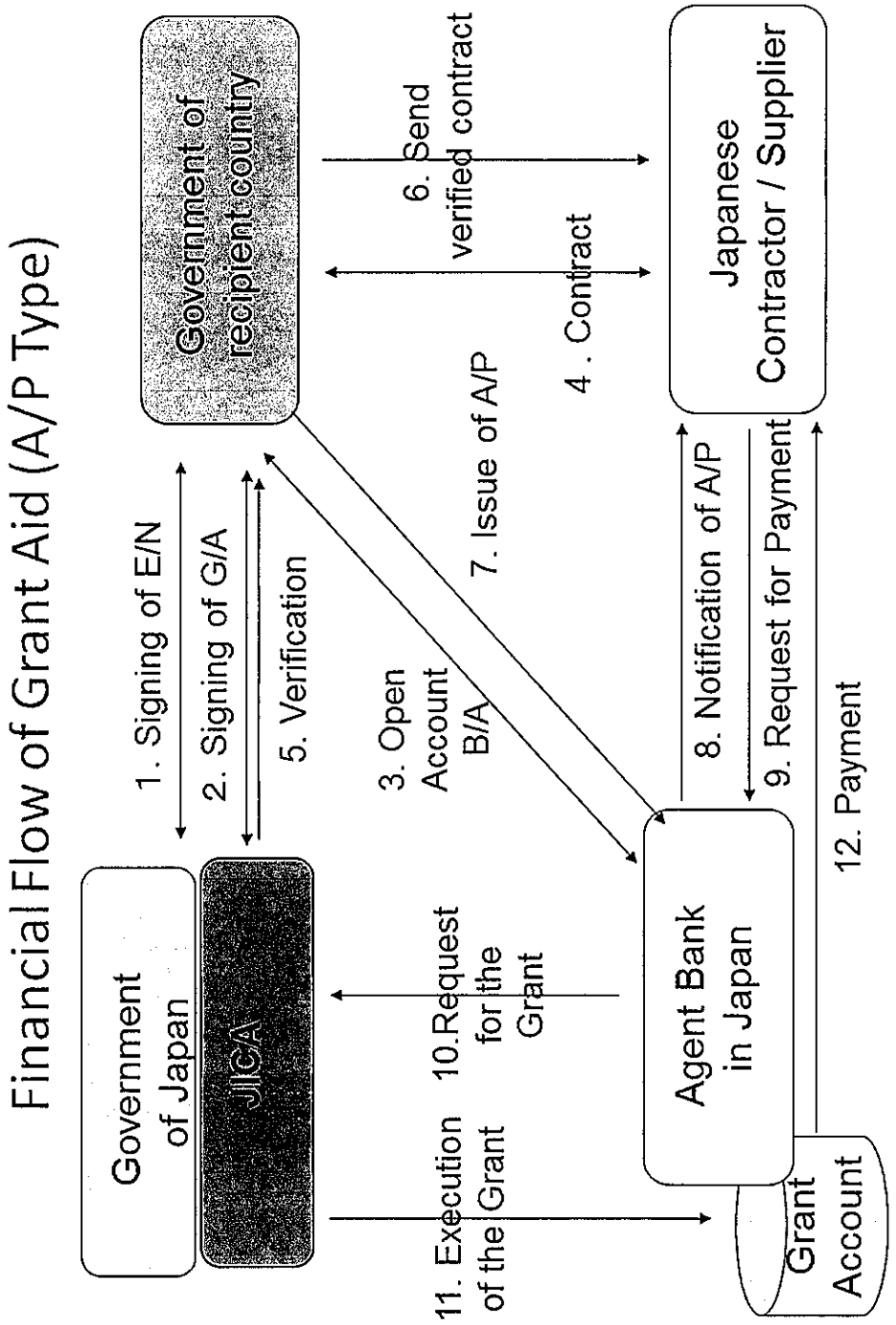
(12) Safety Measures

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

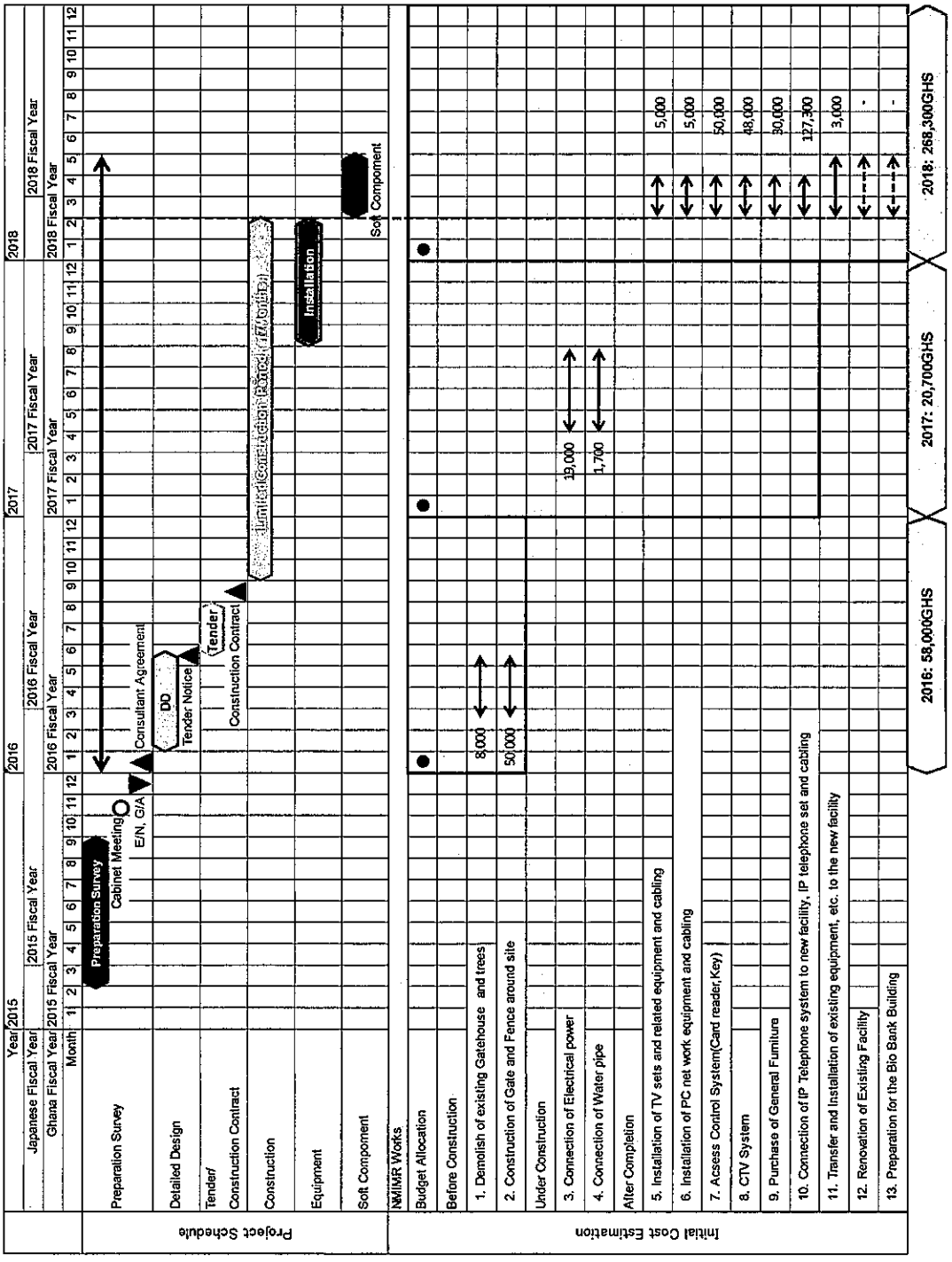
ANNEX 5: FLOW CHART OF JAPANESE GRANT PROCEDURES



ANNEX 6: FINANCIAL FLOW OF JAPANESE GRANT



ANNEX 7: PROJECT IMPLEMENTATION SCHEDULE



ANNEX 8: MAJOR UNDERTAKINGS BY EACH GOVERNMENT

MAJOR UNDERTAKINGS TO BE COVERED BY THE RECIPIENT GOVERNMENT

1. Before the Tender

NO	Items	Deadline	In charge	Cost (GHS)	Ref.
1	To open Bank Account (Banking Arrangement (B/A))	within 1 month after G/A	MOF	0	
2	To secure the land necessary for the implementation of the Project	before notice of the tender document	NMIMR		
3	To obtain the planning, zoning, building permit	N/A			
4	To clear, level and reclaim the Project site	before notice of the tender document	NMIMR		

2. During the Project Implementation

NO	Items	Deadline	In charge	Cost (GHS)	Ref.
1	To bear the following commissions to a bank of Japan for the banking services based upon the B/A				
	1) Advising commission of A/P	within 1 month after the singing of the contract	MOF	15,000yen	
	2) Payment commission for A/P	every payment	MOF	0.1% of Project Cost (about 2 million yen)	
2	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country				
	1) Tax exemption and customs clearance of the products at the port of disembarkation	during the Project	NMIMR		
	2) Internal transportation from the port of disembarkation to the project site	during the Project	Japan		
3	To accord Japanese nationals and/or physical persons of third countries 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	NMIMR		
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	NMIMR		
5	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for construction of the facilities as well as for the transportation and installation of the equipment	during the Project	NMIMR		
6	To construct access roads				
	1) Outside the site	N/A			
7	To provide facilities for the distribution of electricity, water supply, drainage and other incidental facilities				
	1) Demolish of existing gatehouse and trees	before start of the construction	NMIMR	8,000	
	2) Construction of gate and fence around site	before start of the construction	NMIMR	50,000	
	3) Connection of electrical power	6 months before completion of the construction	NMIMR	19,000	
	4) Connection of water pipe	6 months before completion of the construction	NMIMR	1,700	

3. After the Project

NO	Items	Deadline	In charge	Cost (GHS)	Ref.
1	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid 1) Allocation of maintenance cost 2) Operation and maintenance structure 3) Routine check/Periodic inspection	After completion of the construction	NMIMR	612,990 (first year) 1,188,797 (second year and on)	
2	To provide facilities for the distribution of electricity, water supply, drainage and other incidental facilities				
	1) Installation of TV sets and related equipment and cabling	After completion of the construction	NMIMR	5,000	
	2) Installation of PC net work equipment and cabling	After completion of the construction	NMIMR	5,000	
	3) Access Control System(Card reader, Key)	After completion of the construction	NMIMR	50,000	
	4) CTV System	After completion of the construction	NMIMR	48,000	
	5) Purchase of General Furniture	After completion of the construction	NMIMR	30,000	
	6) Connection of IP Telephone system to new facility, IP telephone set and cabling	After completion of the construction	NMIMR	127,300	
	7) Transfer and installation of existing equipment, etc. to the new facility	After completion of the construction	NMIMR	3,000	
	8) Renovation of Existing Facility	After completion of the construction	NMIMR	TBC	
	9) Preparation for the Bio Bank Building	After completion of the construction	NMIMR	TBC	

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

Annex 8

MAJOR UNDERTAKINGS TO BE COVERED BY THE JAPANESE GRANT

No	Items	Deadline	Cost Estimated (Million Japanese Yen)*	
I	To construct the facilities			
	- Improvement of roads			
	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 provide 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 provide equipment with installation and commissioning			
3	To implement detailed design, tender support and construction supervision (Consultant)			
4	Soft Component (Technical assistance)			
5	Contingencies			
	Total			

*: The cost estimates are provisional. This is subject to the approval of the Government of Japan.

Project Monitoring Report
on
Project Name
Grant Agreement No. XXXXXXX
20XX, Month

Organization Information

1) Authority (Signer of the G/A)	_____ Person in Charge _____ (Division) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____
Executing Agency	_____ Person in Charge _____ (Division) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____
Line Agency	_____ Person in Charge _____ (Division) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____

Outline of Grant Agreement:

Source of Finance	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____
Project Title	
E/N	Signed date: Duration:
G/A	Signed date: Duration:

1: Project Description

1-1 Project Objective

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.

1-3 Effectiveness and the indicators

- Effectiveness by the project

Quantitative Effect (Operation and Effect indicators)		
Indicators	Original (Yr)	Target (Yr)
Qualitative Effect		

2: Project Implementation

2-1 Project Scope

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

Location	**Original:** *(M/D)* **Attachment(s):Map**	**Actual:** *(PMR)* **Attachment(s):Map**

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

Items	Original	Actual
(M/D)	*(M/D)*	*(PMR)*

'Soft component' shall be included in 'Items'.		Please state not only the most updated sc hedule but also other past revisions chron ologically.

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	
【M/D】	*(M/D)*		*(PMR)* As of (Date of Revision)
'Soft component' shall be stated in the column of 'Items'.			Please state not only the most updated schedule but also other past revisions chronologically.
Project Completion Date*			

*Project Completion was defined as _____ 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 Facilities (or Equipment)	'Soft component' shall be included in 'Items'.			Please state not only the most updated schedule but also other past revisions chronologically.
Consulting Services	- Detailed design -Procurement Management -Construction Supervision			
Total				

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

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

Items	Cost (Million USD)

	Original	Actual	Original	Actual
				Please state not only the most updated schedule but also other past revisions chronologically.
Total				

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar = (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)*
Actual, if changed: *(PMR)*

2-6 Environmental and Social Impacts

- The results of environmental monitoring as attached in Attachment 5 in accordance with Schedule 4 of the Grant Agreement.

- The results of social monitoring as attached in Attachment 5 in accordance with Schedule 4 of the Grant Agreement.
- Information on the disclosed results of environmental and social monitoring to local stakeholders, whenever applicable.

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)*
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)*

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.	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):
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. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (Final Report Only)

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)
-
-
-

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%)	

5. Soft Component (Technical Assistance) Plan

Soft Component Plan

(1) Background behind in Planning of Soft Component

The existing main research building, built in 1979 with centralized air-conditioning system has been replaced by the individual type air-conditioning system. Given the uncomplicated nature of the air-conditioning system, simple repairs and maintenance work were carried out by the NMIMR maintenance personnel. While more serious repairs were delegated to manufactures. It has been 15 years since the addition and operation of BSL-3 laboratory and animal laboratories, requiring biohazard type air-conditioning system to maintain laboratory rooms under negative pressure and running clean-room equivalent air-conditioning system.

This plan shall require even more rigid and sophisticated biohazard facility to ensure the safety of researchers and neighboring residents with the construction of the new BSL-3 laboratory. Maintaining negative pressure in the laboratory is the basic requirements of biohazard air-conditioning system, and it is essential to provide proper air balance and differential pressure in the laboratory. Personnel shall be retrained with the knowledge and skills to necessary operate and maintain the laboratory in order to improve their technical abilities. These skills and knowledge include proper operation to catch highly pathogenic agents through HEPA-filters and thoroughly sterilizing waste water.

Air conditioning method adopted in this plan uses chiller as a heat source to send chilled water to an air handling unit, and cooled air supply is distributed throughout the laboratory via the air ducts, while the room air is exhausted via the ventilator. Exhaust may contain highly pathogenic agents, therefore, high performance filter called HEPA filters should be installed to capture dust covered with highly pathogenic agents. Maintaining negative pressure in the laboratory requires well-balanced volumes of air supply and exhaust flow, so a CAV (Constant Air Volume) device, VAV (Variable Air Volume) device and BD (Barometric Damper) are needed. If the system fails to maintain the state of negative pressure, the system shall sound an alarm, at the same time, urgent measures shall be taken such as stopping operation of air-conditioners and operating only the ventilators to prevent any spread of highly pathogenic agents to the outside.

During the normal operation of the laboratory, this system shall be running automatically, however, it is required to switch to manual system in the area divided by predetermined air-conditioning zones during the after-hour work or during period of laboratory sterilization. A maintenance planning and scheduling process needs to be designed with the knowledge that machines and control system may fail at any

given time. So the maintenance personnel are required to be able to cope with varying situations such as machine failures and emergency situations by manually switching to a back-up operation.

Currently 11 facility maintenance control persons are responsible for maintaining the entire NMIMR facilities and equipment, but many hours are now spent mostly on repair work. While 4 staff members out of 11 have completed a course on bio safety training program with the understanding of its theory as well as possessing some practical experiences in formaldehyde fumigation and HEPA filter replacement. In the next 2 years, it is expected that 3 staff members are to be retired and shall require the vacant positions be filled.

Intended trainees for the soft component training shall be the 8 maintenance control persons (except. the retirees) who would be directly responsible for NMIMR in 2 years' time. The breakdown of the 8 members' expertise is: 3 electricians, 3 air-conditioning technicians, and 2 for water supply/drainage work. NMIMR is aiming to recruit 1 additional member for each department.

In the maintenance section, there were 2 members trained in Japan (one of which is already resigned) and another who received a third-country training conducted in Sri Lanka. According to those who took training courses, most of the training programs were on handling hospital equipment and no BSL-3 programs.

Meanwhile, the fact that HEPA filters were finally replaced after 10 years of use instead of about 2 years has become an important safety concern.

These conditions make it necessary to enhance maintenance control technology capability of the maintenance personnel by having them go through training programs on bio safety theory, and then to properly manage and operate the BSL-3 laboratory.

(2) Soft Component Objectives

The following goal is stated to enable safe and efficient operation of the BSL-3 Laboratory which would be constructed by the support of grant aid.

Properly Operating and Managing the BSL-3 Laboratory Facility Organization

(3) Expected Achievements of Soft Component (Direct Effects)

At the end of Soft Component phase, the following 6 items shall be achieved as direct effect.

1. Understanding the BSL-3 Laboratory Facility System
2. Mastering the Operation of BSL-3 Laboratory Facility System
3. Maintenance Management of BSL-3 Laboratory Facility System
4. Understanding the Summary of Biosafety

5. Acquiring Skills for the Formaldehyde Fumigation
6. Acquiring Skills for the HEPA Filter Replacement

(4) Method of Ascertaining the Degree of Achievement

Refer to the table in below for items to determine the degree of implementation/ accomplishing of Soft Component.

Items to Determine of Achievements

Type of Training	Check Items
Understanding Laboratory Facility System	・Ability to understand the structure and flow of facility system. ・Ability to understand the function of facility system. ・Ability to understand the specifications applicable to BSL-2&3 Lab. ・Ability to understand the meaning of monitor and warning displays.
Operation of Laboratory Facility System	・Ability to conduct automatic-, systematic-, backup operations of facility system. ・Ability to switch operation of facility system to cope with emergency and failures. ・Ability to adequately determine facility system's required temperature, pressure, differential pressure, flow ratio. ・Ability to operate monitor and warning panels.
Maintenance Management of Laboratory Facility System	・Ability to conduct maintenance management. ・Ability to put together manuals and other documents. ・Ability to keep records of maintenance management documents. ・Ability to develop a maintenance management plan.
Understanding the Summary of Bio Safety	・Having a basic knowledge of microbiology. ・Ability to understand biohazard measure for laboratory.
Acquisition of Formaldehyde Fumigation Skills	・Ability to understand fundamentals of sterilization. ・Ability to acquire practical skills for formaldehyde fumigation.
Acquisition of HEPA Filter Replacement Skills	・Having a basic knowledge of HEPA filter function. ・Ability to acquire skills for HEPA filter replacement.

The training of understanding and operating, the maintenance of the system carries out technical guidance while making "instruction enforcement management table" every transfer technology item, and repeating on desk instruction and practice instruction. The result of the technology transfer can become a visual by judging "an acquisition level" as an evaluation of the acquisition technology every transfer technology item. The acquisition level judges a self-report with five level of follows by "an instruction enforcement management table" to a base. Judgments of performance will be performed two times, early stage of the first dispatch period and third dispatch. The aim level aims at the improvement of the lowest one rank after training attendance. Acquisition level is as follows.

Level A: Superior knowledge or appropriate operation and maintenance is possible
Level B: Some knowledge or tentative operation and maintenance is possible

Level C: Little knowledge or partial operation and maintenance is possible
Level D: Poor knowledge or operation and maintenance is not possible
Level E: No experience and no knowledge

(5) Soft Component Activities (Input Plan)

Since the Plan includes very sophisticated system including BSL-3 laboratory, mechanical and electrical facility engineers (Consultant A and B) with thorough understanding of the design contents shall be engaged from Japan. In addition, Japanese Experts (C and D) shall be dispatched to conduct training programs on bio safety summary, formaldehyde fumigation and HEPA filter replacement techniques. Commitment on the part of Ghana shall be the aforementioned NMIMR maintenance control personnel be the intended trainees.

Soft Component Input Plan

<table>
<tr><th>Items</th><th>Japanese Side</th><th>Ghanaian Side</th><th>Duration</th></tr>
<tr><td>Understanding Facility System</td><td rowspan="3">Consultant A and B (Mechanical and Electrical Engineers)</td><td rowspan="6">NMIMR Maintenance Control Personnel</td><td rowspan="6">3.0 M/M for task performed at the Site; 2.8 M/M for task performed in Japan</td></tr>
<tr><td>Operation of Facility System</td></tr>
<tr><td>Maintenance Management of Facility System</td></tr>
<tr><td>Summary of Biosafety</td><td rowspan="3">Experts C and D</td></tr>
<tr><td>Formaldehyde Fumigation Technique</td></tr>
<tr><td>HEPA Filter Replacement Technique</td></tr>
</table>

(6) Procurement Method for Soft Component Implementation Resource

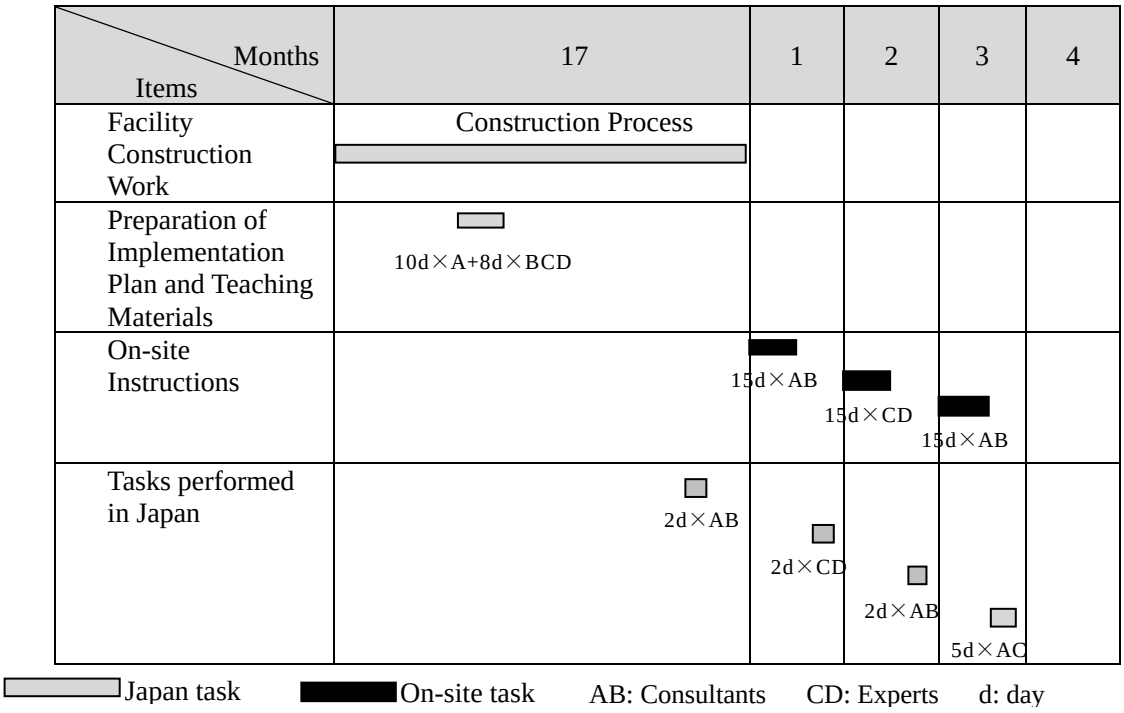
The training for the Facility System as part of the Soft Component of this Plan mainly involves with technical instructions on operating and maintaining BSL-3 laboratory mechanical and electrical facilities. The rationale behind this is that the personnel to be considered for developing facility system of the Plan, should be the facility engineer who has been involved in the designing and administrating BSL-3 laboratory, therefore, it is most suitable to select and assign the mechanical and electrical consultant engineers (A and B).

Experts (C and D) hired for training courses conducted in Japan and for being dispatched to the Site shall be chosen from organizations such as JICA Technical Assistance Project team who has past experience conducting BSL-3 laboratory training programs in Japan.

(7) Soft Component Process

Training shall be conducted at facilities and venues in Japan or in the NMIMR compound, and the training shall be conducted 3M/M on site after the completion of the construction work.

Soft Component Implementation Process



In the first on-site instructions, emphasis shall be placed on training the personnel to deepen their understanding the Design's facility system, and acquire the operation and maintenance control techniques of the system. The training plans 15-day dispatch by engineer A and B. Instructors shall use and utilize such available materials as design drawings, specifications, and brochures to deliver general explanation of the system, as well as use the Standard Operating Procedure (SOP) prepared while in Japan and manuals to aid in practical training programs. Equipment that are to be installed in the Project site, including chillers, air handling units, air-conditioners, pumps, exhaust ventilators, HEPA filters, automatic-control system, and security system, shall be used in hands-on training program to aid better understanding the equipment and facility as a system as a whole. Special hands-on instructions shall be given to trainees enabling them to operate the system manually to cope with any situations, systematic or emergency, unable to run the system automatically. Adequate training on how to keep Daily Log to record system's temperatures, pressures, differential pressures, flow ratios of the system shall be conducted. Maintenance control trainings on how to replace or clean filters and to cope with equipment failure, or to procure replacement parts and nondurable parts shall be conducted also.

In the second on-site instructions, experts shall explain the bio safety theory, perform practical training on formaldehyde fumigation and HEPA filter replacement techniques. The training plans 15-day dispatch by experts C and D.

In the third on-site instruction, training of a daily record in line with practical operation such as measurement of temperature, pressure, differential pressure, the quantity of water of the system, the instruction on the maintenance side including the procurement method of drafting, replacement parts

and the expendable supplies of the schedule plan will be performed. The training plans 15-day dispatch by engineer A and B.

(8) Achievements of Soft Component

A main achievement of the soft component is shown below.
These achievements are prepared in Japan mainly, but adjustment with the NMIMR side is necessary for a part including SOP, and a correction is necessary in Ghana.

Soft Component Achievements

Goals	Outputs
Improving Maintenance Management Techniques	1. Soft Component Implementation Plan 2. Equipment Inventory, Operation/Maintenance Manuals 3. Daily Maintenance Inspection Manual, Recordings 4. Operation/Maintenance SOP for Air-Conditioning/Ventilation Systems and Bio Safety Cabinets, Validation/Calibration Implementation Plan, Reports 5. Inventory Control System 6. Data Control Manuals 7. Other Teaching Materials, Instruction Records, Video Recordings, etc. 8. Soft Component Progress Report, Result Report

(9) Obligation of Soft Component for Recipient Country

The Soft Component is carried out to secure the sustainability on the part of Ghanaian side, therefore, all trainings and instructions should be planed to encourage and promote voluntary activities of the Ghanaian side whenever possible. This requires the deep understanding and cooperation for the Soft Component from the Ghanaian's administrative and implementing organizations.
Specifically, responsible party at the NMIMR needs to understand and consider thoroughly of the Project's objectives and its implementation guidelines. As the overall figure responsible for maintenance of the facility, NMIMR Director and personnel in charge must continue to supervise on the facility maintenance both during and after completion of the soft component process. To this end, a regular reporting (approximately once a year) on the maintenance control situation of the site to the Chief Representative of JICA Ghana Office is recommended.